# LOW-CARBON, CLIMATE-RESILIENT ECO-VILLAGE DEVELOPMENT IN SOUTH ASIA

inseda

IDEA

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**Objective:**

The overall objective of the Eco-Village Development intervention is to achieve an improved standard of living for climate-vulnerable rural communities in South Asia by integration of local sustainable solutions that contribute to climate change mitigation, adaptation, and resilience building. With this intervention, the partners are rolling out a concept for village-based, local, low-carbon development in four South Asian countries: the **Eco-Village Development (EVD) concept**. This concept is a prosperous and proven development concept that the partners developed and have the competence to scale-up, through eight years of cooperation, and much longer individual experiences.

**Target groups**:

Poor, marginal, and climate-vulnerable people in villages in Bangladesh, India, Nepal, and Sri Lanka. They are receiving training, necessary information and support to implement solutions that lower greenhouse gas emissions to improve their living standards and livelihood. With a wider implementation of the concept in new areas and on new levels, the project is reaching out to foster development in poor, rural areas. To maximise results, local activities are combined with capacity building to involve more actors (MFIs, SHGs, corporate sector, CSOs), and with advocacy to increase political support nationally, as well as internationally, by presenting it at the United Nations level on Climate and Sustainable Development.

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Nepal VDP meeting at Dhungkharka.
**Photo:** CRT Nepal

# 1 ECO-VILLAGE DEVELOPMENT (EVD) - INTRODUCTION

### Fast Development and Still Poverty

South Asia has experienced a period with robust economic growth rate of over 5% per year on average over the last decade,[1] but also with crisis periods with lower growth such as the COVID-19 crisis in 2020-2021. The growth has translated into declining poverty and impressive improvements in human development. Despite this, the South Asian region is home to many of the developing world's poor.

Climate change makes the situation grimmer as by the 2050s. The consequences of climate change are decreasing cultivation area of high-yielding wheat by 50% due to heat stress in the Indo-Gangetic plains and similarly reduce yields of rice. Climate change will also trigger natural disasters like additional storms, unseasonal rain, droughts, as well as lead to glacier melt affecting Bangladesh, Nepal and India, and sea level rise affecting coastal areas. South Asia may have contributed little to the current climate change shocks and events, but $CO_2$ emissions from fossil fuels are rising in the region, and overuse of biomass in parts of the region contributes to local resource exhaustion as well as to the global warming phenomena.

### Energy Access Challenges

Access to clean, affordable energy is one of the key inputs to lifting people out of poverty. Along with economic growth, the South Asian region has witnessed rapid growth in energy consumption. Still, 79 million people across the region have no access to electricity while many others have weak electricity access and 712 million have no access to clean cooking.[2] In addition, many of those that used LPG for clean cooking in 2020 can possibly no longer afford it due to a sharp increase in fossil fuel prices.

### Need for Low-Carbon Pathway

The combined development and climate challenges can be met by increasing energy efficiency and increased use of renewable energy, resulting in lower emissions and increased available energy. Solar energy, sustainable consumption of biomass and local use of hydro-power are local solutions that can contribute to both clean energy access and poverty reduction throughout the region. They can be key parts of comprehensive, development-oriented decarbonization strategies that are inexpensive and acknowledge local needs.

### Focus on Local Organisation

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 a large part of the population. When the larger potential is considered, the South Asian region, with its millions of villages, has immense potential for the diffusion of village development concepts. Furthermore, some of these people are the most vulnerable to climate change in the region. Many villages are ill-equipped to cope with the rapidly evolving impacts of climate change on their land and livelihoods.

1 Source: data.worldbank.dk
2 https://trackingsdg7.esmap.org/results)

# 1

The key to success for any development project is the active participation of local communities, sub-communities, and rural households. To facilitate this broad-based participation, community members must be engaged, trained, and provided with skills and later updates.

## Eco-Village Development (EVD) Concept and Solutions

There have already been large successes in implementing small-scale, energy-efficient Renewable Energy Technology (RET) solutions in different South Asian countries that can be modified and replicated across the region. For instance, Integrated Development Association (IDEA) in Sri Lanka has been active in disseminating improved cookstoves (ICSs) to improve the biomass combustion of traditional technologies and reduce biomass use with the result that 300,000 ICSs are sold every year in Sri Lanka. In Bangladesh, Grameen Shakti has disseminated more than 1.8 million solar home systems, providing basic electricity and light to millions of people and small businesses. In Nepal, the Centre for Rural Technology (CRT/N) has promoted and implemented micro-hydro systems with the direct involvement of the beneficiary community, through the formation of a consumer society. In India, Integrated Sustainable Energy and Ecological Development Association (INSEDA) has been designing and implementing both household-size and small industrial-size biogas plants.

For over a decade, the RETs have been combined with other local development and livelihood solutions at the village level in the Eco-Village Development concept, where villagers are planning their future development and realising their plans with local, sustainable solutions. The concept has been tested and found viable in different regions in Bangladesh, India, Nepal, and Sri Lanka as a way to speed up clean energy access and improve livelihood.

The EVD bottom-up approach to problem-solving honours the cultural practices and traditions of the communities, contributing to acceptance by the community members. 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 civil society organisations (CSOs) as well as national and state governments.

EVD contributes to 14 out of 17 sustainable development goals (SDGs), as explained below.

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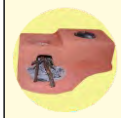
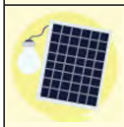
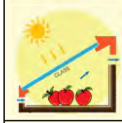
## EVD projects contributing to 14 SDGs out of 17

| | |
|---|---|
| 1 NO POVERTY | **Poverty Reduction - Helps Increase in Income** - solar dried produce and products grown using solar poly-greenhouse, kitchen garden, and from making bamboo products etc. |
| 2 ZERO HUNGER | **Reduction in hunger -** availability of improved **quality of produce** - vegetables and fruits from kitchen garden. |
| 3 GOOD HEALTH AND WELL-BEING | **Good health** because of clean kitchen, **reduced indoor and outdoor pollution,** drudgery reduction, increased income and nutrition food IHME estimates 1.6 m deaths/year, WHO - 4.3 m |
| 4 QUALITY EDUCATION | Helps in **skill development of women and farmers** |
| 5 GENDER EQUALITY | **Gender: focus on women, participation in planning, income generation and implementation, Reduces drudgery of women in fuelwood collection, cooking etc.** |
| 6 CLEAN WATER AND SANITATION | Availability of **clean water** because of roof water harvesting unit and sanitation because of biogas and composting |
| 7 AFFORDABLE AND CLEAN ENERGY | **Clean Energy** is central to EVD concept through improved cookstove, biogas, solar home system, etc. Reduces use of firewood - 1 million tons of wood is used every day for cooking. |

| | |
|---|---|
| 8 DECENT WORK AND ECONOMIC GROWTH | Helps in **economic growth** through income generation activities. |
| 10 REDUCED INEQUALITIES | The project focuses on **reducing inequality** and involves most vulnerable population. |
| 12 RESPONSIBLE CONSUMPTION AND PRODUCTION | **Responsible production** through **organic manure, soil and water conservation** fruits/fuel and fodder tree plantation, **improved soil health.** |
| 13 CLIMATE ACTION | **Climate action –** mitigation, adaptation, reduction in **movement in forest areas** (wood collection), **carbon sequestration,** GHG reduction, **climate resilience.** |
| 15 LIFE ON LAND | **Climate action -** mitigation, adaptation, reduction in **movement in forest area** (wood collection), **carbon sequestration, GHG** reduction, **climate resilience.** |
| 16 PEACE, JUSTICE AND STRONG INSTITUTIONS | The concept involves **responsive, inclusive, participatory and representative decision-making at all levels.** |
| 17 PARTNERSHIPS FOR THE GOALS | **Work in partnership: participatory planning, project partnership in 4 countries.** |

Specifically, EVD contributes to climate change mitigation and adaptation, as explained below -

| | EVD Solution | Mitigation Impact | Adaptation Impact |
|---|---|---|---|
|  | Improved Cookstoves (ICS) | In households: GHG and black-carbon emissions from cooking are reduced by 1-3 tons $CO_2$ -equivalents ($CO_2e$) per family per year. | |
| | | In village and household industries, GHG and black carbon emissions are reduced significantly. | |
|  | Household Biogas Plants | GHG and black carbon emissions from cooking and agriculture are reduced by 1-4 tons $CO_2e$ per family per year. | Soil improvement |
|  | Solar Lighting | Use in homes reduces $CO_2$ emissions from kerosene and other non-solar light sources by roughly 0.34 tons per family per year. | Provides light during cyclones |
|  | Solar or hydro micro- and mini-grids | Typical reduces $CO_2$ emissions from uses of electricity and/or of diesel engines by 0.7 tons per family per year. | |
|  | Solar Dryers | Typically reduces $CO_2$ emissions by 1.4-3 tons per year when solar drying replaces electric or fossil-fuelled dryers. | Preservation of food in changing weather |
|  | Organic Farming, Gardening, Composting | Organic practices replace GHG-producing N-fertiliser, increase soil carbon, which reduces $CO_2$ emissions from agriculture.<br>It is difficult to quantify emission reductions. | Improve soil for moisture retention. Crop rotation gives more stable yield in changing climate |

# 1

## Main Parts of Eco-Village Development

To work on development at the village level, one has to start with an inclusive village development planning that empowers the villagers to decide their way forward. Then comes the implementation of the plan with the prioritised solutions for cooking, electricity, gardening, access to water, etc. Here, the EVD combines demonstration models with microfinance and contributions from the villagers, for instance involving Village Savings and Loan Associations (VSLAs). To this is added a social enterprise model to increase the income of the villagers with new and/or better organised activities.

## Scaling up Eco-Village Development

While the Eco-Village Development (EVD) concept is now developed and tested in several places throughout South Asia, the next step is to get it integrated in local and national policies. Our analysis shows that it fits well into national development and climate plans, allowing more synergy between the development objective of poverty reduction and the climate objectives of reducing emissions and developing climate resilience at the village level. With EVD there is no conflict between climate action, sustainable development, and climate action in villages, where sustained energy access is an issue. By including EVD in national and local climate plans, the climate plans will also be development and poverty-reduction plans. This is also the case for National Determined Contributions (NDCs) to the global Paris Agreement for climate action. Likewise, EVD is also well suited to be part of Sustainable Development Goals (SDGs) and implementation plans to reach the SDG targets by 2030.

In addition to local and national climate and development plans, it is also important to have EVD in focus internationally, to have international attention and climate financing directed towards the local solutions, where they give the most benefits, both as climate solutions and as development solutions to reduce poverty.

## Supporters of Eco-Village Development

Eco-Village Development (EVD) is promoted by civil society organisations in the CSO networks International Network for Sustainable Energy (INFORSE) and Climate Action Network South Asia (CANSA), with key national implementers and promoters in four countries:

In Bangladesh: Grameen Shakti

In India: Integrated Sustainable Energy & Ecological Development Association (INSEDA)

In Nepal: Centre for Rural Technology, Nepal (CRT/N)

In Sri Lanka: Integrated Development Association (IDEA)

The support of the NGO Cooperation Projects on Eco-Village Development in South Asia is organised by DIB, Denmark.

The partners have developed the concept and are promoting it since 2015 through demonstration, implementation, publications, videos, webinars, and an online database (see Chapter 6).

# 2 THE ECO-VILLAGE DEVELOPMENT SOLUTIONS

Eco-Village Development (EVD) involves implementation at the village level of appropriate, inexpensive, renewable energy and other local solutions that can combine climate change adaptation and mitigation with development.

The starting point for EVD implementation is village development planning for selection of the right solutions and approaches for each village. The solutions include household-sized biogas plants, improved smokeless cookstoves, hayboxes, Solar Home Systems (SHS), solar street lights, solar lanterns, solar water pumps for drinking/irrigation, improved water mills to generate electric power, solar dryers as well as kitchen gardening, rooftop-water harvesting, water-lifting technologies like hydraulic ram pumps, and other solutions. This chapter gives a short overview of the main EVD solutions. More detailed information can be found in the Online Database of the EVD Solutions, and the "Socio-Technical Manual for Training of Trainers Manual on Participatory Planning, Technology, and Knowledge Transfer of Eco-Village Development" published in English, Hindi, Nepali, Bengali, and Sinhala (see Chapter 6).

### Village Development Planning

For successful village development, it is important to use participatory methods for development of village development plans (VDPs) that can guide the implementation of EVD solutions to match the community needs. The planning is mostly done using the Participatory Rural Appraisal (PRA) approach, which can be appropriately modified based on the local situation. It is important that there is equal focus on inclusivity and gender aspects in the participatory assessment and planning process. As part of the PRA, one of the tools used with success involves the villagers making maps of their existing village and a so-called "dream village".

### Household Biogas Plants

Biogas is a source of renewable cooking fuel, while the anaerobic digestion process of cattle dung, kitchen waste, etc. also provides clean organic manure in the form of biogas slurry. Under the EVD programme, plants with a capacity as small as one cubic metre of gas per day are being constructed, in addition to larger plants.

The degassed biogas sludge is very useful in agriculture as an organic fertiliser. It consists of ingredients that are very rich in nitrogen content and is a good source of nutrients for plants. Biogas plants reduce greenhouse gas emissions, especially methane, which is 28 times more potent than carbon dioxide, and provide fertiliser for improved farming and gardening.

### Improved Cookstoves (ICSs)

The ICSs burn firewood cleaner and more efficiently than traditional fires, reducing the amount of carbon emissions as well as firewood. The chimney or chimney hood also keep the kitchen smoke-free, thereby preventing respiratory illnesses in particular for women and children. Several models are available, made of mud/clay, burnt clay, metal, or a combination.

The 2-pot Anagi stove is a very successful model of ICS in Sri Lanka. Training was provided for potters, which has contributed to the successful commercialization of the stove. It is fully commercialised now, with over 300,000 stoves being produced annually. In India, ICSs with chimneys are popular, but still millions use traditional fires (chulhas, etc.). In Nepal, despite the promotion of higher tier cookstoves, the fuelwood reliant consumers in the hilly region prefer mud-based improved cookstoves, whereas those in the mountain region opt for metallic ICS that meets their dual-end services: cooking and space heating.

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### Improved Large-Scale Biomass Stoves

Many rural cottage industries involved in food processing use inefficient conventional stoves and practices. With the introduction of efficient large-scale biomass stoves, firewood consumption is reduced significantly, cutting cost and emissions at the same time, while helping to strengthen and sustain rural enterprises, cottage industries and livelihoods.

### Retained Heat Cookers / hayboxes

Retained Heat Cooker (RHC) is an insulated bag designed to reduce the amount of fuel required to cook food. Instead of being placed on a stove for the entire duration, food is heated to a boiling temperature and then transferred to the RHC. Because of the insulation the cooking process continues without additional heat or fuel. 40-70 % energy can be saved using an RHC, depending on the type of meal.

### Solar Electricity

Solar photovoltaic (PV) panel-powered homes in off-grid areas are a staple solution for increasing energy access. The system provides light, and can operate a TV, radio, and power smaller appliances, and charge mobiles. The price of solar PV systems has dropped substantially in recent years, and LED lights need less energy compared to older lamps, so the same PV panel can power more lights or appliances than earlier. Smaller solar LED lanterns are also available, which can be also powered by their own solar PV panel, in addition to light, the new version also provides mobile charging. Bangladesh has installed nearly 6 million units of Solar Home Systems (SHSs) which has created access to electricity for 14% (20 million people) of the total population.

PV powered street lights are lighting dark streets at night, and enabling safety, especially for women and girls.

### Improved Water Mill for Power

This technology helps generate off-grid electricity for mountainous regions and in countries like Nepal, where there are plenty of water resources and a tradition of constructing water mills. It is a valuable source of power for domestic use as well as for energy-using micro-enterprises. It provides $CO_2$-free power.

### 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-integration and sanitation. Hydram technology can be manufactured locally, providing more local employment and ensuring local spare-part availability.

### 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

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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.

### Compost-Making Baskets

Compost baskets can be made out of loosely woven bamboo. They work with natural compost 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 metres of land, enough for a good-sized kitchen garden.

### Rainwater harvesting, water tanks from bamboo-cement and other material

Rainwater harvesting from roofs is useful for small-scale irrigation, cleaning, and, with filtering, even drinking water. This can be a collection of water from the roof combined with a tank. Bamboo reinforced cement tank is a sustainable and cheap solution for a rainwater tank. Bamboo is cheap and bamboo weaving of the structure of a tank can be an income generating activity for women. In India, INSEDA has designed bamboo cement tanks from 1000 to 5000 litres. Water tanks are also available in other materials, which can be advantageous as they are readymade, but expensive, in materials like plastic (polyethylene), galvanised steel, and fibreglass. Tanks made from prefabricated concrete sewage ring elements have also proved to be a cheap option made by IDEA in Sri Lanka.

### Solar Powered Water Pumps

The water pumps powered by PV panels are a climate-friendly option instead of diesel pumps. The energy needed comes from the sun and there is no fuel cost. A solar-powered water pump enables irrigation and cultivation in remote off-grid areas and significantly contributes to food security and livelihood improvement. Similarly, it can ensure clean drinking water. It reduces the amount of labour and time that is needed to irrigate the crops. It requires less labour and maintenance compared to fossil fuel pumps.

### Greenhouses

Poly-greenhouses and the smaller polytunnels are typically made from locally available bamboo and covered with UV polythene sheets. They trap the solar heating, allowing fruits and vegetables to be grown at colder periods of the year. They also protect growing plants from hard rain, frost, snow, hail, and gales and therefore enable more autumn, winter and early spring crops to be grown.

### Domestic Solar Dryers

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

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construction costs. The models are often equipped with a small solar-cell powered ventilator to increase efficiency.

### Solar Cookers and Ovens - Water Purifying

Solar cookers concentrate solar rays at the cooking pot with the help of reflecting mirrors or metal sheets. The trapped solar thermal heat prepares the food. There are different sizes of household and community models. The main types are solar parabolic reflector cookers and solar ovens. The solar ovens use an insulated box to retain heat. Besides cooking, the solar ovens can be used to purify water. This is beneficial for areas where obtaining safe drinking water is a problem. The solar cookers only function when there is sunshine, and it takes longer to cook than other ways of cooking. They are used as an additional option in remote areas, where there is shortage of fuelwood.

### Other Solutions

In different EVD implementations, a number of other solutions are included, including water ponds, mushroom farming, drip-irrigation, tree-planting, biomass-dryers, trees with high value, kitchen improvement, chimney hoods, efficient electric cooking, and others.


Biogas


Hydraulic Ram Pump


Solar Powered Water Pumps


Improved Cookstoves (ICSs)


Retained Heat Cookers


Greenhouses


Improved Water Mill for Power

**THE ECO-VILLAGE DEVELOPMENT SOLUTIONS**


Domestic Solar Dryers


Solar Electricity


Compost-Making Baskets


Other Solutions (Drip-Irrigation)


Improved two-pot Biomass Stoves


Rainwater harvesting, water tanks from bamboo-cement and other material


Organic Farming and Kitchen Gardening

# 3 CHALLENGES AND GAPS IN IMPLEMENTATION OF LOCAL SOLUTIONS

Impacts of climate change on poor and vulnerable communities affects their lives and livelihoods in a decisive manner. With limited resources and knowledge, the communities make an effort to reduce their vulnerability and to adjust to the mounting climate impacts. Local solutions are crucial elements of climate action to deal with both climate and livelihood impacts. With the support of local institutions, local government, civil society and local solutions, the communities have a chance to adapt to climate impacts, help mitigate climate change, and improve natural, social, financial, and physical capital. However, there are a multitude of challenges – technical, social, financial and capacity-related gaps that limit the dissemination and adoption of local solutions. This chapter captures these challenges and gaps and suggests approaches taken by project implementers to overcome them.

## CHALLENGES AND SOLUTIONS TO PROJECT IMPLEMENTATION:

### Financial Challenges

For project implementers, it is often a challenge to cope with the high expectations of the target community while introducing sustainable solutions. Often, the beneficiaries (community or households) expect to obtain the equipment and other hardware free of cost as they cannot afford to pay much. The standard approach of EVD projects is to make the **beneficiaries equal partners** in the process. Thus, a contribution in the form of cash, material and labour as applicable is sought. The remaining funds are provided by the project. **Own contributions** are sought to ensure beneficiary ownership of the solution. Continuous engagement with beneficiaries in the form of village meetings and one-to-one conversations makes it possible. There are instances where the beneficiary is not in a position to contribute 50% of the cost. In such cases, the beneficiary is asked to pay the bare minimum and the remaining funds are provided from the project funds.

Interventions of other communities and local governments in the EVD project areas influences the financial participation of the communities. For instance, Grameen Shakti has implemented a Rainwater Harvesting System (RWHS) in the Majher Chor village of Pirojpur district, Bangladesh. In the same village, government and other donor agencies previously distributed the RWHS free of cost. Hence EVD project beneficiaries were not willing to contribute in cash. However, they contributed through providing labour for installation.

Organising **self-help groups** also proved to be a good option. Many of the solutions of the basket are low-cost and can be made from local material, so involving local production also provides jobs, and income.

Beneficiary expectations can also involve activities or solutions that they want, which are **beyond the donor approved set of activities and the budget** of the project. At times, the community priorities and needs are not met with the project funding even though it's urgent and critical for life and livelihood sustenance. For example, in Bhalumara Sindhuli village of Nepal, access to safe drinking water was the dire need of the community. However, the provisioning of a solar powered drinking water system (lifting plus distribution network) was beyond the scope and budgetary allocation of the project. Thus, the Centre for Rural Technology Nepal partnered with other donors to fulfil the demand.

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The Eco-Village Development project implementation needs to adopt a **mixed strategy** – both bottom-up and top-down approach. A top-down only approach in designing projects is flawed. The top-down approach to project design undermines communities' needs and priorities. Stakeholder consultation, particularly community consultation, to gauge community needs and priorities needs to be mapped before project commissioning. The learning of engagement with communities could inform policy advocacy and engagement with policy makers at the national, provincial and local levels.

A limited project budget is a challenge on the face of the scale of demand for solutions from communities. Further, villages neighbouring the target village are also facing the similar impacts of climate change and expect similar kinds of capacity building, sensitization and support provided by the EVD project. Thus, besides the project funding, the **convergence of schemes and programmes implemented by the local government** is sought. The multiple schemes and programmes of the government can be leveraged. The local government is made a potential partner in disseminating and scaling-up local solutions. The typical CSO project with its meagre resources will not be able to cater to the needs of all vulnerable people. Thus, the provincial and local governments need to participate in scaling up local solutions.

Involvement of local governments holds good in the case of Nepal, Bangladesh and Sri Lanka. It helps to address many livelihood-related issues not attended by the EVD project, for example, smart agricultural solutions along with irrigation and greenhouse tunnel farming and electric cooking in Nepal. Subsidies up to 50% are provided to these technologies and CRT Nepal assists communities to avail of the solutions. Therefore, in Nepal, efficient electric cooking is also now added to the EVD basket.

In order to address the financial constraint of replicating and scaling up local solutions, **promoting social business models** is a viable approach. In Nepal, the electric cooking technologies could activate social enterprise. However, CRT Nepal shelved ideas such as the electric cooking technologies because of inadequacy in quality and quantity of electricity supply in the target village.

**Microfinance institutions** have been instrumental in making local solutions accessible and affordable to communities. The dissemination of solar home systems by Grameen Shakti in Bangladesh is a major success story. To enhance affordability, the cost of a Solar Home System (SHS) can either be paid in cash, or can be purchased through a variety of monthly instalment plans (up to 36 months) to maximise participation by increasing affordability. Grameen Shakti has installed over 1,800,000 such systems in Bangladesh. The use of solar home system technology displaces kerosene and/or diesel for larger systems to meet household lighting, use of appliances and charging needs. Grameen Shakti also established revolving funds for upkeep and maintenance of SHS. The model has been very successful with the result that the SHS market is now saturated, except for replacements and repair services. In Nepal, the microfinance model has been tried with success in at least two sites utilising the corporate social responsibility (CSR) fund of the micro-finance institution to sensitise and orient the communities and local government on climate change and importance of EVD solutions. The umbrella institution of microfinance provided

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financial support for training, the branch manager of the corresponding microfinance supported community mobilisation and CRT/N provided the technical support and promoted sustainability strategy by engaging communities and local government.

### Social Challenges

Acceptance is a major factor for the uptake and scale-up of local solutions. The communities need to build high trust levels to adopt a solution. The communities need to be convinced that the solutions proposed are good ones and that choosing them brings opportunities, which can address their climate change and livelihood-related issues. Thus, participatory assessment including both men and women of all strata of society, community mobilisation, technology demonstration, peer-to-peer communication, and exposure visits, stand crucial to engage early adopters.

For acceptance, there is also focus on the needs and aspirations of the community. For instance, by establishing a solar-powered drinking water facility with the involvement of separate donors in the project area, CRT Nepal could win the trust of these communities and the local municipalities. It helped to build bridges among communities and local self-governance institutions, facilitating the implementation of local solutions. Moreover, social cohesion is a must for effective implementation of solutions and get the community actively involved in all activities with a clear understanding of the nature of delivery and a know-how of how anyone can benefit from the intervention.

### Technical Challenges

The change in agroclimatic zones requires suitable changes in local solutions to keep them contextual and relevant to communities. The technical modifications are anticipated as the solutions are used in new socio-cultural and environmental realities. For instance, the plastic pond, as water storage solution for critical irrigation in higher altitudes, is not useful in the sandy soil of Terai region of Nepal. The biogas system, though useful in general in warmer climatic zone, is not technically viable in colder regions and also household biogas systems are stranded since cattle rearing practice is declining. Biogas cannot be used in mountains because low temperature affects bacterial activity during anaerobic digestion. In coastal areas, which are often flooded, mobility of the solutions is important. Bamboo used for composting baskets, solar dryers and reinforced cement walls of rainwater tanks, are handy solutions, but only when the bamboo is locally available, and there are women who can use their knowledge of basket making (or that can learn it). Making improved mud and clay stoves need clay nearby. Technical quality assurance is also important. The 2-pot Anagi stoves in Sri Lanka became successful also because IDEA introduced standardisation, and quality control.

### Policy Challenges

One of the biggest policy-related challenges is the lack of coordination among multiple ministries, departments and nodal agencies overseeing climate and energy policies. For instance, in Bangladesh, IDCOL (Infrastructure Development Company Limited), which finances all renewable energy projects, financed an off-grid renewable energy project with penetration of local solutions in a remote island that could be jeopardised because of the extension of grid connection.

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In other cases, the government decision to provide local solutions free-of-cost creates behavioural challenges for dissemination. Often, 'quality and after sales' is the sales pitch to counter government distributed free-of-cost local solutions.

Moreover, there is often a policy dominance of centralised utility scale units over decentralised local solutions. For example, the National Solar Energy Roadmap 2021 of Bangladesh envisages and prioritises utility scale solar power plants over decentralised mini grid solar power. The policy distortions are not easy to overcome. The introduction, adoption and dissemination of local solutions need to be backed by appropriate policy instruments. The climate and energy policies need to create an enabling environment for local solutions to thrive. The coherent policies across sectors can create a level playing field for various technologies and solutions, and can create a market with actors. But in the long run, these market forces decide which solutions continue. These markets can be advantageous or disadvantageous. Increasing the demand leads to increased production and the supply, which decreases the costs. For example, the prices of the PV decreased drastically in the last decade making solar home systems much more affordable, hence leading to greater adoption. An example of a problematic policy is the provision of free or heavily supported LPG, which became a barrier for rolling out improved cookstoves and household biogas for cooking. When LPG later became expensive, many rural people turned back to cooking on 3-stones and simple chulhas without chimneys.

Regular changes in officers and elected members at local government offices reduces the impact of advocacy events. As soon as there is change in personnel, the project is having to re-introduce the project, its implementation modality and approaches to the stakeholders. Local politics and political ideology sometimes overwhelms the activities to be undertaken under the EVD concept. In such circumstances, social mobilisation and skill of field facilitators and deliberation of the facilitators with respect to sentiments of the locals is inevitable.

### Knowledge Gap

Lack of recognition, awareness and knowledge about climate change or development issues could hinder the dissemination of local solutions. For instance, lack of recognition that clean drinking water is a priority and is related to good health outcomes, and the willingness to pay for a water filter and clean water dispenser is close to zero for many community representatives in Bangladesh. However, a local drinking water solution has been implemented by building community capacity of knowledge. In Bangladesh, customer training is organised by the firm disseminating any local solution that receives subsidy. This is mandatory by IDCOL that provides the subsidies. For example, a firm installing a biogas unit needs to organise customer training, which ensures better use, repair and maintenance. Some examples of knowledge gaps are lack of knowledge on health issues connected to indoor air pollution caused by cooking without a chimney, desertification consequences of increased use of firewood, social and livelihood consequences of women and children, mainly girls, using excessive time to collect firewood and water instead of going to school.

Finally, the lack of knowledge of existing local climate solutions is a barrier. If you do not know that there is an existing solution, you would not wish it. Many have never seen a solar dryer, which can

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conserve food hygienically that can be consumed later or sold on the market, as well as have not seen a greenhouse, rainwater collection tank or a solar lamp, and so on.

To bridge these knowledge gaps, training in the communities, and demonstrations can make the knowledge available on these local solutions. Therefore, the South Asian EVD Project partners (CRT, IDEA, INSEDA GS, INFORSE, and CANSA) published a socio-technological manual in national languages, and an online catalogue of solutions (see publication list in Chapter 6).

Semi-structured interview to identify village issues and concerns (using PRA tool) in Sri Lanka,
**Photo:** IDEA, Sri Lanka

# 4 POLICIES AND STRUCTURES TO SCALE-UP ECO-VILLAGE DEVELOPMENT

A number of Eco-Village Development (EVD) projects throughout South Asia have proven that the EVD Concept is a successful development strategy to bring villages further in their development in climate friendly ways for the benefit of the villagers. To use these successful experiences for a larger scale development, making a real dent into reduced poverty in climate friendly ways, policies and larger actions are needed.

We have identified four areas for this:

- Local planning and policies programme
- National planning, relation with climate policies and implementation plans of Nationally Determined Contributions (NDCs) of the UN Climate Paris Agreement, and Sustainable Development Goals (SDGs)
- Private sector involvement through Corporate Social Responsibility (CSR), Environment and Sustainable Governance (ESG)
- International Cooperation

### Local Planning and Policies Programme

In all South Asian countries, local planning and local level policies are important for the development, distribution of subsidies, financing, etc.

It is important to have public information that can reach and be understood by villagers, for instance, short descriptions of eco-village development (EVD), of village development plans (VDP) and of solutions. The information should be available on the internet and readable on mobile phones. It should be promoted via relevant media and social media. It can also be promoted via NGOs and civil society structures as farmers' organisations and groups. It should enable villagers and groups in villages (as women's groups, self-help groups, etc.) on how to use and benefit from the EVD concept and solutions.

To enable large-scale, successful, climate conscious village-level development, the local level administration should be engaged and supportive. Conditions for this are that:

- The local level leaders and officials are aware of the EVD solutions, their benefits, and how local policies and planning can support EVD solutions. This can be enabled with information and training.
- Local planning includes participatory village development planning (VDP), where villagers are able to decide to focus on EVD solutions, in addition to traditional development solutions (such as roads, water supply, or schools).
- Subsidy schemes include EVD solutions and that subsidies are coordinated with VDP to optimise their benefits.
- The subsidy schemes involve local NGOs that can provide trained technicians and skilled workers in the area, where they can do user training, repairs and others.
- Planning and subsidy schemes involve all parts of the village structures, including women's groups as self-help groups and village savings and loans (VSL) groups.

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It is important to involve local banks and micro-finance institutions (MFIs) that should have financial products in the form of financing for local solutions. MFIs must understand climate solutions – they need orientation and training. They also need specific descriptions of solutions to finance, such as decentralised electricity, household biogas plants, community biogas plants, commercial farming.

It is important to involve local science and resource centres for farmers, where they exist. They already do farmer training, and should include training in the EVD concept and in EVD solutions with the training.

### National Planning, Relation with Climate Policies and Implementation Plans of Nationally Determined Contributions (NDCs) of the UN Climate Paris Agreement, and UN Sustainable Development Goals (SDGs)

There are national programmes on local solutions in many countries, for instance on improved cookstoves (ICS). The national agencies in charge, such as IDCOL in Bangladesh, must ensure that the subsidies are available to rural villagers, so they can be part of EVD programmes.

National entities, such as Sustainable Energy Authority (SEA) in Sri Lanka and public banks like NABARD in India, can take up support for EVD in their portfolio. Then they can both promote and support it.

National planning bodies, such as NITI Aayog in India can include EVD in their strategies. If it is part of their strategies, they will use their influence on local public bodies and even on corporates to include EVD promotion in their activities.

In Sri Lanka, the Blue Green Village Development Programme was launched by the Ministry of Environment in 2016 following the Paris Agreement, with a target of 10,000 villages to be transformed. The programme had several active interactions with the EVD intervention. However, this programme was discontinued due to several reasons. In recent times, the climate-resilient villages programme has been proposed by the government under the Sri Lanka Climate Prosperity Plan 2022 in collaboration with Climate Vulnerable Forum -Vulnerable 20 Group. This carries a lot of similarities conceptually but lacks the experiences from the ground. In this context, EVD can be an asset in helping shape realistic development plans. Here, the ground experiences of EVD implementation, learnings and strategic approaches can be made use of to improve and scale-up the programme effectively.

Some national agencies also started village programmes, such as Climate Resilience Village Programme in Bangladesh (launched by Climate Change Secretariat). They can include EVD as part of their concepts, ensuring bottom-up planning and inclusion of local climate solutions with development co-benefits.

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National climate and development plans are important in guiding of local policies and development, subsidies, etc. The top-level climate plans are the NDCs to the UNFCCC Paris Climate Agreement and National Adaptation Plans (NAPS). The development of the 5-year NDC plans shall be open to civil society organisations and it is important that this is used to include local solutions in the NDCs, and subsequently in climate plans.

EVD also contributes to many other sustainable development goals (SDGs) than the one on climate (SDG13) and therefore EVD should also be included in national SDG plans.

**National Programme for Local Solutions that could be model for scale up Eco-Village Development**

Bangladesh has set a great example of how a sustainable implementation model can significantly contribute to upscaling of clean energy and energy efficacy solutions for the local communities. Infrastructure Development Company Limited or IDCOL is a government-owned non-bank financial institution. The implementation model, developed by IDCOL, has contributed significantly to upscale different solutions like Solar Home Systems (SHS), biogas plants, improved cookstoves (ICS), etc. As of December 2022, IDCOL's partnering with non-governmental organisations (NGOs) have provided nearly 14% of the Bangladeshi population (20 million people) with access to SHS electricity, and have disseminated 2.67 million ICSs as well as 63,400 biogas plants.

**IDCOL's implementation model**

The Bangladesh government obtains funding from development partners like World Bank and GIZ. IDCOL mobilises partner organisations (POs), mainly NGOs and microfinance institutions (MFIs) that have a strong rural presence. The POs promote, sell, finance, install and provide services to rural people using IDCOL finance as well as IDCOL subsidies to increase affordability of some solutions. The rural people repay the loans to the POs which repay their loans to IDCOL. This business model has permitted loans of hundreds of millions of dollars from international sources to flow through to give microloans to millions of rural people, creating a large impact.

IDCOL leads, manages, and supervises the overall programme and also provides technical assistance to the POs. Technical quality audits, field surveys, and consumer satisfaction surveys are conducted regularly.

The key success factors of the IDCOL model and the learning from it can be used in upscaling the EVD concept.

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**Scaling up with CSO Network**

The promotion of biogas was scaled up in India only when CSOs along with Action for Food Production (AFPRO) supported by an overseas donor got involved in the promotion of biogas. The biogas network was initiated in 1982-83 with a smaller number of NGOs/VOs which later grew to 80 members. A low-cost fixed dome plant called Deenbandhu biogas was then developed by AFPRO team of technical and specialist staff, led by Dr. Raymond Myles. The network organised workshops of 24 Technical and Field Staff of 20 CSOs from 8 States of India. A comprehensive programme was developed – construction-training-cum-demonstration, where rural masons were trained on construction techniques with NGOs while Project Directors, Engineers, Technical Officers, Supervisors, Trainers (ToTs) from government and NGOs were oriented on the technology.

Meanwhile, the network grew and the nodal ministry, the Ministry of New and Renewable Energy (MNRE), Government of India (GoI), for the first time in 1989-90 channelised funds to NGO Network of Biogas, through AFPRO. All this led to the construction of 80,000 plants by 1989.

By December 1996, there were more than 80 members in the network who now have built over 400,000 biogas plants. Around 5 million household-size biogas plants have been installed in India since the inception of the biogas programme in the country until 2018; however, a lot of potential is still untapped. With around 300 million bovine population in India, there is a potential of constructing at least 30 million family-size biogas plants and producing around 20 bcm (billion cubic metres) of biogas per annum while saving 120 MT of $CO_2$ a year.

This experience with scaling up through a CSO network can be used to scale up the EVD concept, using the experiences of the biogas network.

## Private Sector Involvement and Business Responsibilities for Development and Climate Actions / Corporate Social Responsibility (CSR) Opportunities, Environment and Sustainable Governance (ESG)

The private sector can be involved in promoting and supporting Eco-Village Development (EVD) in a number of ways, with organising carbon credits, with corporate social responsibility (CSR) funding, and otherwise.

Carbon credits for replacing 3-stone fireplaces and traditional inefficient stoves with improved cookstoves, biogas and efficient electric cooking can help spread these solutions. EVD villages can engage with companies and NGOs that promote and provide these solutions. NGOs can also cooperate with private companies that trade carbon credits to support these solutions.

CSR funding is available in some countries (India, Nepal) and can be used for development in various ways. NGOs that promote EVD can engage with companies that have CSR funding or with

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intermediaries, such as Climate Collaborative in India. CSR funding can be an important support for upscaling EVD and reducing poverty, if companies want to use their CSR funding for this development.

### International Cooperation

All countries are reviewing their climate plans and producing new climate plans that are summarised in the nationally determined contributions (NDCs) to the Paris Climate Agreement. If these top-level plans include local solutions, such as eco-village development (EVD), this will be guiding national climate action for the following years.

To have more focus on local solutions, the international process with NDCs must guide the countries to include them in their NDCs and national plans. This includes having local solutions assessed in the global stocktake (GST) of the NDCs, to have local solutions highlighted in the outcome of GST, and to have civil society proposing local solutions in the coming processes of formulating new NDCs.

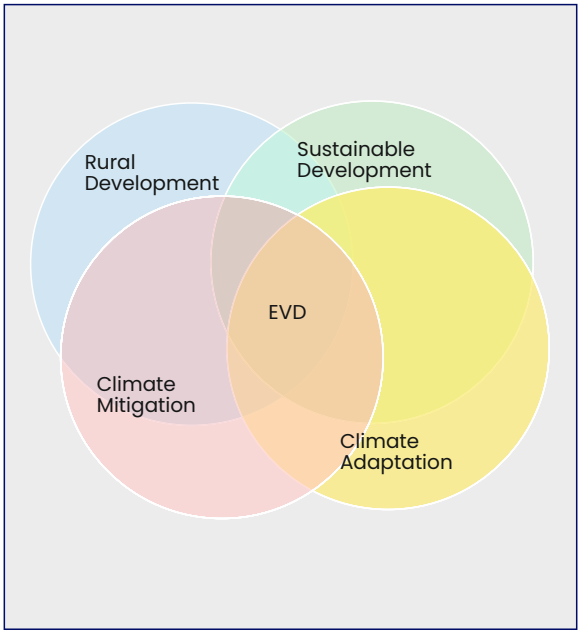
Other parts of the international climate organisation, such as the UNFCCC Climate Technology Mechanism, can play an important part in making information on EVD and local solutions available for the climate negotiations, including an international framework for developing new NDCs.

International climate and development funding is important for development, in particular for smaller, developing countries. The funding agencies must know about EVD and can then include it in their programmes.

Also, the international cooperation on implementation of Sustainable Development Goals (SDGs) should also recommend EVD solutions as a contributor to several SDGs.

Other parts of the international climate organisation, such as the UNFCCC Climate Technology Mechanism, can play an important part in making information on EVD and local solutions available for the climate negotiations, including an international framework for developing new NDCs.

International climate and development funding is important for development, in particular for smaller, developing countries. The funding agencies must know about EVD and can then include it in their programmes.



Village development plan meeting in progress in Sri Lanka
**Photo credit:** IDEA, Sri Lanka.

# 5 ECO-VILLAGE DEVELOPMENT IN PRACTICE

## 5.1 ECO-VILLAGE DEVELOPMENT (EVD) IN PRACTICE IN BANGLADESH

### Short about Bangladesh

| Description | Facts |
|---|---|
| National population (estimated) | 169,356,251 (2021) |
| Rural population | 38.17% |
| Population growth (annual %, estimated) | 0.98% (2022) |
| $CO_2$ emissions (metric tons per capita) | 0.5 (2019) |
| Main source of energy | Natural gas |
| Energy for cooking | 40.6% use solid fuel, 57.7% LPG, 0.6% electricity |

Climate Change implications based on scientific evidence

- Bangladesh ranks seventh on the list of countries most vulnerable to climate devastation, according to Germanwatch's 2021 Global Climate Risk Index (CRI).
- During 2000 to 2019, Bangladesh suffered economic losses worth $3.72 billion and witnessed 185 extreme weather events due to climate change.
- Sea level rise is a threat to a third of the population as two-thirds of the country is less than 15 feet above sea level.
- Salinization threatens the drinking water supplies of tens of millions of people in coastal communities.
- Devastation caused due to heavy floods contributes to over 10 million Bangladeshis losing livelihood and becoming climate refugees.

Bangladesh, with its 164 million population, has made remarkable progress in reducing poverty, supported by sustained economic growth. Since 2000, the country has reduced poverty by half. Bangladesh is expected to graduate from United Nations' Least Developed Countries' (LDC) list in 2024. However, the country faces many daunting challenges to poverty reduction. Due to its geographical location, Bangladesh is highly exposed to different climatic hazards and natural disasters. Environmental vulnerability coupled with poor infrastructural and socio-economic factors reduces the capacity of local communities to tackle the impacts of climatic shocks, not the least for the 22 million people that still live below the poverty line.

Around 80% of Bangladesh's population relies on solid biomass fuel for their household cooking and heating needs. Indoor air pollution (IAP) caused by inefficient traditional mud stoves accounts for nearly 106,900 deaths in Bangladesh. Different diseases like chronic obstructive pulmonary disease (CODP) and acute respiratory infection (ARI), cataracts, high blood pressure, among others, are also caused due to IAP.

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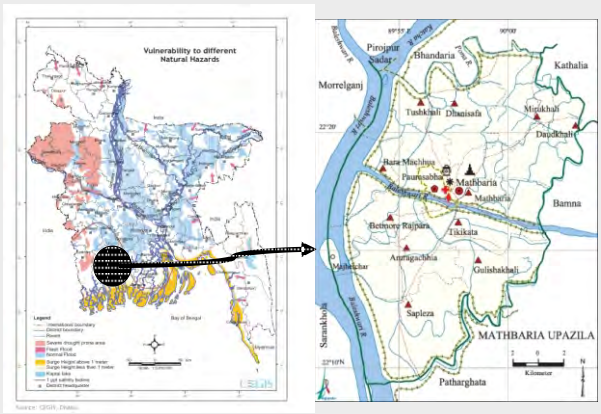
Like many other countries, a recent challenge is that Bangladesh's power sector is affected due to the Russia-Ukraine war. In March 2022, the entire country achieved 100% access to electricity. However, due to war-induced fuel crisis, during the months of July to October in 2022, the electricity supply was only 60% to 80% of the demand in rural areas (5-10 hours of daily power cut).

The coastal belt of Bangladesh covers 32% of the country's area and accommodates more than 35 million people. Over the past 35 years, salinity intrusion in Bangladesh has increased by about 26 %. The people in the coastal zone have other problems as well:

- Around 70% of them rely on unhygienic sources for drinking water.
- A higher percentage of them live below the absolute poverty line than in the rest of the country.




### Eco-Village Development in Bangladesh

Supported by CISU and in coordination with INFORSE and DIB Denmark, Grameen Shakti has been working to promote and advocate Eco-village Development projects in Bangladesh since 2015. In the current phase, one of the major objectives is to establish an EVD model village. For this, Majher village of Pirojpur district has been selected. Pirojpur is a riverine district situated at the south-western coastal belt of Bangladesh. Grameen Shakti has conducted the baseline survey and village development plan (VDP) in the village.

### The Majher Village in Brief

The village's population is just above 800 people, and the major livelihoods are fishing, agriculture, and remittance. Major crops are pumpkins, rice, melons, and maize. The most important natural resources are rivers and forests. Major natural disasters are salinity intrusion, flood, and cyclones. In terms of infrastructure, there is one cyclone centre, one primary school, and there is power from an existing electric grid. Access to electricity is nearly 80% (including solar home systems (SHS) that co-exists with the power grid). There are no permanent roads to the village and there is no water supply system. Primary cooking fuel is biomass-based fuels (firewood, cowdung cake, straw, average family requirement is nearly 250-300 kg/month) and secondary fuel is LPG. Major challenges faced by the villagers are scarcity of clean drinking water, limited access to reliable electricity (the grid power is unstable), lack of clean cooking solutions, and limited income-generating opportunities.

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Based on the findings of baseline survey and the village development plan (VDP), Grameen Shakti has identified the scope of climate-friendly technology solutions in cooperation with the villagers and has organised training for building the capacity of the villagers to implement and use the EVD solutions.

Grameen Shakti started implementation with three biogas plants designed with protection against flood water up to 3-4 feet, made of plastic and are portable. The gas (60-70% methane) that is produced from the biogas plant is preliminarily used for domestic cooking. Apart from the biogas, the plants also generate bio-slurry which is an excellent organic fertiliser that can be used to improve soils and is used in the homestead gardens. These biogas plants are expected to facilitate management of 876,000 kg of organic waste, will produce 131,400 kg of dry slurry and contribute to 17,600 kg $CO_2$ reduction in this lifetime. Daily gas production capacity of each plant is 1.35 m3, which replaces nearly 2,000 kg of firewood each year and contributes to 306 kg $CO_2$/year. The users contributed 19% of the costs of the biogas plants.

Grameen Shakti continued implementation with 50 improved cookstoves (ICS). These ICSs are designed to reduce fuel consumption and curb smoke emissions from open fires inside the dwellings during cooking. The main goals of ICSs are to reduce the negative health impacts associated with exposure to toxic smoke from traditional stoves and to reduce the pressure on local forests by reducing the wood used for cooking. Fuel consumption is reduced by as much as 50% (conventional stoves consumed 6.5 kg of firewood every day, whereas an ICS consumes around 3.5 kg of firewood for a family size of 4-6 people), saving money for families that often have to buy fuelwood. Therefore, by reducing the fuel consumption and the smoke (whose black carbon contributes to climate change), the improved cookstoves contribute to reducing global warming. For each household, the reduction is typically about 4 tons of $CO_2e$ per year. The users contributed 10-12% of the costs of the ICS.

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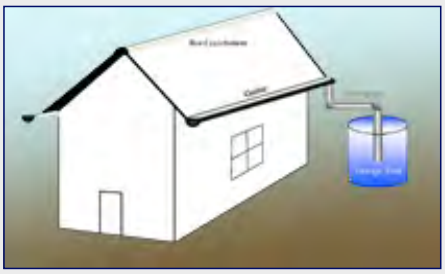
In the village, EVD solutions also included:

- 6 solar streetlights
- 3 bamboo-made slurry pits to store the bio-slurry
- 10 rainwater harvesting systems (RHS)
- 10 kitchen gardens developed
- 3 solar home systems (SHS) enabled with productive use appliance like sewing machine
- 1 solar water pump for drinking, integrated with drip irrigation and rice husking machine
- promotion of climate resilient crop cultivation

To make the solutions self-sustaining and reduce poverty in the village, a Social Enterprise Model is being developed.

For broader impact, Grameen Shakti conducts local- and national-level advocacy to scale-up the EVD solutions.

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## Background for the main EVD Solutions

EVD is not about inventing new technologies, but to combine well-proven solutions in a village concept. This section gives the background for four of the selected EVD solutions for the Majher village: solar home systems, biogas plants, rainwater harvesting, and improved cookstoves.

Bangladesh started installing solar home systems (SHSs) in the mid-90s and, as of 2022, Bangladesh has installed nearly 6 million units, which has created access to electricity for 14% of the population (20 million people). In early 2022, Bangladesh reached the milestone of achieving 100% access to electricity and with that the demand for new SHS installation shrunk rapidly. However, the fuel crisis triggered by the Russia-Ukraine war resulted in miserable power cuts throughout the country; this has created a surge in SHS demand in the on-grid areas. Many communities, who switched to utility grids, are now coming back to the solar home system. In the peak time of this switch, mid 2022, the installation was 3,000-5,000 units of SHS per month at the national level.

The first biogas plant (floating dome type) was constructed in 1972. However, the first biogas programme was adopted by Infrastructure Development Company Limited (IDCOL) – a government owned specialised non-bank financial institution – in 2006. As of February 2023, Bangladesh has installed 87,536 units of biogas plants, mostly with IDCOL financing, and implemented by Grameen Shakti and other IDCOL partner organizations. In addition to saving energy and $CO_2$ emissions, biogas plants reduce the use of 70,000 tons of chemical fertiliser by producing 490,000 tons of oganic fertiliser.

The Rainwater Harvesting System (RHS) is implemented mostly by developing agencies in association with the local government of Bangladesh. For instance, WaterAid installed more than 7,000 different RHSs in Bangladesh since 2010. The Government of Bangladesh, the Green Climate Fund (GCF), and UNDP are jointly working to provide 13,000 units RHS in the coastal region as a climate adaptation solution.

The ICS programme was developed by IDCOL in partnership with the World Bank. It mobilised a network of local entrepreneurs, partners and financing, which led to the success of the programme. Currently, the phase II of the programme brings together financing from International Development Association (IDA) and Green Climate Fund (GCF) to scale it up. As of July, 2021, 2.67 million ICSs have been disseminated and IDCOL has set a target of disseminating a total of 5 million ICS by June 2023. One of the leading NGOs of Bangladesh – Grameen Shakti has been disseminating improved cookstoves all around the country since 2006 and so far, have distributed nearly 1 million units. Bangladesh has adopted a Country Action Plan (CAP) for clean cookstoves with the targets of disseminating cookstoves to over 30 million households in Bangladesh by 2030 and achieve 100% clean cooking the same year.

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## 5.2 ECO-VILLAGE DEVELOPMENT (EVD) IN PRACTICE IN INDIA

**Short about India**

| Description | Facts |
|---|---|
| National population (estimated) | 29,192,480 (2023) |
| Rural population | 78.99% |
| Population growth (annual %, estimated) | 0.68% (2022) |
| $CO_2$ emissions (metric tons per capita) | 2.4 (2022) |
| Main source of energy | Coal |
| Energy for cooking | 40.6% use solid fuel, 57.7% LPG, 0.6% electricity |

Climate Change implications based on scientific evidence:

- India's average temperature has risen by around 0.7°C during 1901–2018. By the end of the 21st century, average temperature over India is projected to rise by approximately 4.4°C relative to the recent past (1976–2005 average)
- Summer monsoon precipitation (June to September) over India has declined by around 6% from 1951 to 2015
- Overall decrease of seasonal summer monsoon rainfall during the last 6–7 decades has led to an increased propensity for droughts over India.
- The frequency of very severe cyclonic storms during the post-monsoon season has increased significantly (+1 event per decade) during the last two decades (2000–2018).
- Sea-level rise in the north Indian Ocean occurred at a rate of 1.06–1.75 mm per year during 1874–2004 and has accelerated to 3.3 mm per year in the last two and a half decades (1993–2017), which is comparable to the current rate of global mean sea-level rise.

Around 70% out of 1.38 billion Indian population lives in rural areas. One-third of these families live in abject poverty. Most of these families live in small homes with no proper ventilation in the kitchen and use polluting fuels and inefficient traditional cookstoves using fuelwood, crop residue, dung cakes and other locally available waste biomass for cooking. They will continue to use firewood and other locally available polluting fuel, due to their inability to afford commercial fuel like LPG. The habit of cooking chapati (Indian flat bread), especially makka (corn)/ bajra (millets) on firewood is another reason for continuing use of polluting fuels. Some purchase firewood, but in most cases the women must spend substantial time in firewood collection.

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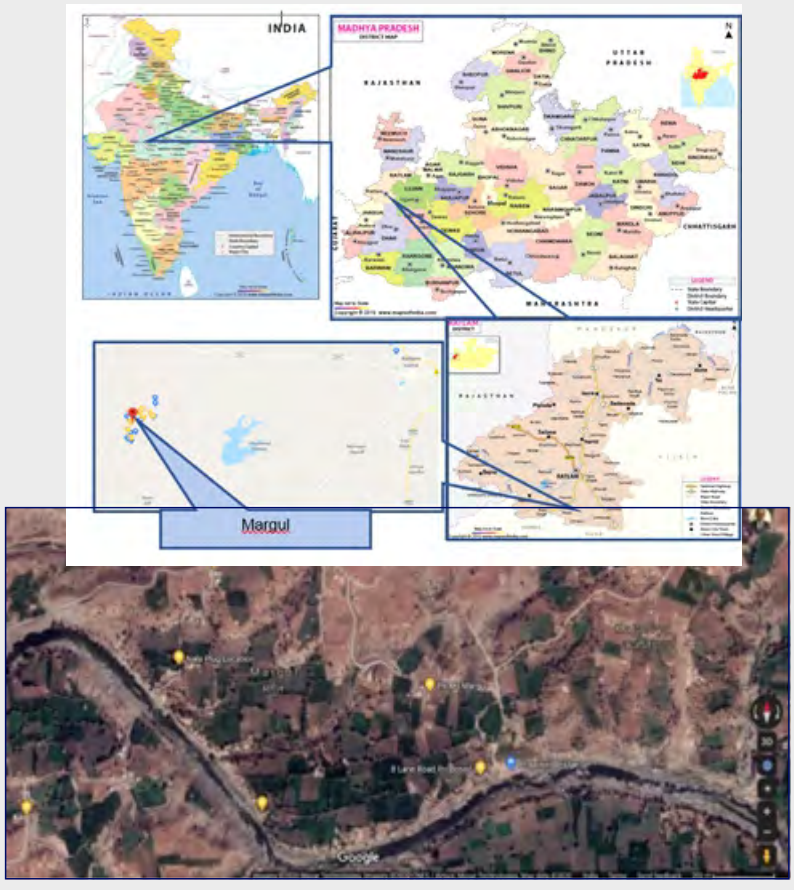
The Government of India has declared that 100% of the villages have been electrified, however, many households are still deprived of electricity because a village is declared electrified even if 10% of households have access to electricity and are often faced with the problem of irregular and erratic supply from the main (centralised) power grids. As a result, millions of families in rural India continue to rely on kerosene and torches for light while struggling to get electricity for mobile phones, etc.

In addition to struggling with lack of basic, clean energy for cooking light, people living below the poverty line are more adversely impacted due climate change. INSEDA therefore felt it necessary to consider innovating and developing affordable eco-friendly, climate change-resilient solutions for rural communities and for improving agricultural production through the promotion of local sustainable energy solutions and scientific organic farming for ensuring food, water, and energy security as well as health security, supported by a minimum prescribed intake of balanced nutrition rich food. The Eco-Village Development (EVD) concept was then visualised in late 1990s by INSEDA, followed by innovation of green technologies – their pilot field testing was undertaken in 2002, followed by field demonstration in 12 villages of Bharatpur district of Rajasthan state and in six villages of Rani Chauri area, New Tehri district of Uttarakhand state in India. Based on end users' response, feedback, and experience of implementation, the EVD solutions were further developed by INSEDA, and are now being promoted in South Asia.




Under the previous CISU supported project, a feasibility study of EVD solutions was conducted in six villages of Margul Panchayat in Ratlam district of Madhya Pradesh.

**Margul** is a small tribal village with 106 families and total population of 629 persons of which 320 are male and 309 are female There are 11 different tribes in the village of which Maida tribe is dominant.

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All the families in Margul Panchayat are dependent on locally available biomass for cooking and most of the families do not have access to electricity due to erratic power supply and unscheduled load shedding. There is water scarcity, particularly during the severe summers. Family members migrate for around six months for livelihood during the dry season. The health and education system are very poor and there is no other economic opportunity.

The families depend on income from agriculture and labour as well as subsistence farming for survival. The income level is very low, and families earn between Rs. 50,000 to 100,000 per year (USD 607 to 1214). They own livestock and still use bullocks for ploughing and tilling operations.

The education level is very low and there are about 30% literates in the six villages, but literacy is much lower among women. The majority of houses are mud houses with tiled roofs, while 12.5 % live in huts. Only 5% of the families have functional toilets.

Absence of streetlights in the villages poses danger for women and children as the area is snake infested. Almost all farmers use dung from their domestic animals to make compost in the traditional way, i.e., drying in the sun in a heap, which causes loss of important nutrients and humus. The forest cover is reduced to 20%, much less than what it was 50 years ago and the water level is depleting every year. Negative impact of climate change is being felt by farmers and they are aware of the same. The communities are willing to act on it by taking up appropriate measures to mitigate impact of climate change and for developing climate resilience, however, they have a meagre income source and limited knowledge about appropriate solutions.

Based on the feasibility study, INSEDA proposed different EVD solutions for the region. In the current phase of the project, INSEDA developed a village development plan (VDP) endorsed by Gram Sabha (village authority) in Margul village, inhabited by 106 tribal families, to develop it as a model EVD village. As a first step, INSEDA organised practical hands-on training of masons, master masons, village women, and local artisans and local entrepreneurs in construction/ fabrication and installation of EVD solutions. INSEDA conducted a baseline survey considering various indicators, which would help in assessment of impact on mitigation and adaptation along with socio economic benefits of the project.

**The solutions include:**

- Four HEERA multipurpose Hybrid Improved Cookstove (HICS – innovated by INSEDA) with a two-pot hole, chimney, warm water tank, small solar panel with charge controller which charges a battery to power a small exhaust fan for forcing exhaust gases through chimney into a bucket of water to dissolve harmful particulates. It is also integrated with a mobile charging port and powers an LED bulb.

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- The rest of the 102 families got the JWALA Improved Cookstove (smokeless stove with chimney, innovated by INSEDA).
- Three Grameenbandhu biogas plants, built using bamboo reinforced cement mortar (BRCM)
- Six rooftop rainwater harvesting units with storage tanks built using BRCM
- Six solar tunnel dryers
- Two solar poly greenhouses
- Two greenhouse nurseries
- 41 bamboo compost baskets
- 46 vermicompost units
- Kitchen gardening for most of the families
- Energy plantation, horticulture as household forestry for most families
- Ten solar PV powered streetlights
- 106 solar lanterns with LED and mobile charger, one for each family
- One 'day and night' indoor solar PV powered cooker with inverter and e-pressure cooker
- Income generation activities through Self Help Groups (SHGs) - including poultry for six SHGs.

A Social Enterprise Model has been developed to promote JWALA cookstove using microfinance institutions in three nearby areas. The entrepreneur is trained to fabricate chimneys of JWALA ICS and ten masons in different project areas have been trained to construct JWALA ICS. Three willing CSOs are involved to initiate the Social Enterprise Model to promote JWALA ICS on a commercial basis. The finance is arranged by INSEDA through its microfinance team. The fund available under the project will be utilised as a revolving fund for construction of the JWALA stoves initially.

### Local benefits of the specific solutions

With Jwala and Heera Improved Cookstoves, women are extremely happy that there is almost no smoke inside the kitchen and children can also stay around with them in the kitchen. Women can now breathe easily inside the kitchen and do not have to blow air to keep the flame burning as the chimney helps in creating enough suction.

Behera Bai is happy as Jwala ICS has two burners for cooking, time is saved & less wood is consumed in ICS as compared to old traditional chulhas (stoves). Now the house is not filled with smoke as all smoke goes out of the chimney.

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Using a traditional cookstove, women must blow very hard on the fire which results in excessive smoke being inhaled. They are also happy that there is reduced wood consumption, so their time is also saved to some extent.

The women using **Grameenbandhu biogas** biogas plant are very happy as the biogas stove gives the comfort and status similar to that of an LPG stove. Their pots are not getting black soot and kitchens remain clean. They no longer need to collect much firewood. Though there is some effort required from the users where they must feed the plant daily with bovine dung and water, but the comfort in cooking and the bio-slurry, which is a very good manure for their kitchen garden, compensates for that.

Rakesh Maida is very happy to have bamboo-based biogas plant installed at his home as now cooking is easier, time collecting wood is saved, , no additional cost is incurred, utilization of cow dung and use of slurry as organic manure is additional benefit.

**Rooftop Water Harvesting Units** constructed using bamboo reinforced cement mortar (BRCM) were quite successful in Ranichauri area (New Tehri district of Uttarakhand state), as water scarcity in hilly regions is very common. The rooftop water harvesting units are also much needed in Margul and people also use them as storage tanks during summer and winter seasons when there is no rainfall.ot have to blow air to keep the flame burning as the chimney helps in creating enough suction.

Prabhu Dayal Ninama is happy to have a bamboo-based Rooftop Rainwater Harvesting Unit installed. Now rainwater can be stored and can be utilized later for household use and for animals to drink. It is used to store drinking water after properly cleaning it once raining season is over. Now he can use drip irrigation to do agriculture in summers as well.

The **solar tunnel dryer** had been successful in Ranichauri area (New Tehri district of Uttarakhand state) where women used the same for drying turmeric, chilly, tomato, and bari (sun-dried and spiced dumplings/nuggets) and papad (spiced dried patties), both mainly prepared from certain types of pulses. The dryer also safeguards the product from wild animals, flies, and dust particles.

Organising training to the community in efficient use of solar tunnel dryer through Krishi Vigyan Kendra – which is an Agriculture Science Centre established by the government functioning as knowledge and resource centres of agriculture technology for farmers are being planned. The bari, papad and spices can be sold in the nearby town Ratlam as well as locally since it has a long shelf life.

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**Solar poly-greenhouses and the green net nurseries** also helped farmers to generate income by growing off season crops. The training of farmers to effectively utilise the technology is underway through the government agencies as mentioned above.

Prabhu Dayal Ninama is grateful for the solar poly greenhouse. As the solar panel is installed, he can grow off-season vegetables and earn a healthy amount. He doesn't need to depend on the electricity from the grid to power the exhaust fans, and can also charge his mobile.

The **compost basket** has been very popular in Ranichauri area (New Tehri district of Uttarakhand), where more than 400 compost baskets were provided to farmers in the area as the quality of compost was much better as compared to open dried dung or the traditional way of making manure from dung. **Bamboo,** which **has multifaceted benefits**, is used for construction of most of the EVD solutions. There is an income generation opportunity for women trained in weaving bamboo structures for components.

The **bamboo plantation** helps in drawdown of $CO_2$, environment restoration, soil rejuvenation, reforestation and erosion control, moisture conservation, and is a source of income for farmers and women, as there is no ban anymore on cutting bamboo, now classified as grass. Bamboo also improves the local (micro) and surrounding environment and in providing material for fencing.

**Vermicomposting** has been quite successfully implemented by INSEDA in the 12 EVD villages of Bharatpur district (Rajasthan state), while in Margul (Ratlam) farmers have shown interest only after witnessing the good quality manure produced through vermicompost. In Margul, a few families have successfully utilised vermicompost and the community suggested making vermi beds using bricks and cement instead of HDPE (High Density Polyethylene) sheets so that these would be long lasting. The families were given good quality **seeds for kitchen gardening** where they utilised the manure from compost basket, vermicompost, slurry from biogas plants as well as from traditional composts. The women were very happy with the quality and taste of the vegetables which was mainly for their own consumption so far. The saplings of **fuelwood trees** and **horticulture trees** were given to almost all the families. Some of the plants distributed are mango, guava, lemon, custard apple, jackfruit, Java plum, bel patra, amla, drumstick and bamboo.

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**Solar lights** have been very helpful as the people can move out safely in the snake-infested area. The **solar lamp** is also much appreciated as women use it while cooking and children use it for studying. The solar lamp is helpful when women and children need to go out at night for relieving. The farmers can easily carry it to the field at night to turn the electric motor on/off for irrigation. The mobile charging facility is also much appreciated as often electricity is not available for a couple of days for even those who have electricity connection. The **day and night indoor solar PV powered cooker** along with inverter and **e-pressure cooker** is planned to be installed for cooking mid-day meals for around 100 students in the primary cum middle school in Margul village. The mid-day meal is prepared by a self-help group of women from Margul village, and the solar cooker can be utilised daily, thus eliminating the chances of overcharging.

### Self Help Groups

Women's empowerment through **income generation activities for Self Help Groups (SHG)** of women is a core component of the EVD concept in view of the impact of climate change which results in losses due to crop damage because of untimely and erratic rainfalls. Six SHGs are being formed and are being provided country chicken to enhance their income and livelihood support. The chicken distributed to the members of two SHGs have started giving results and some chicks have also hatched. **Livelihood support** is also envisaged from solar poly greenhouse, green net nursery, solar tunnel dryer, kitchen garden, horticulture, and energy plantation as well as from sale of earthworms and vermicompost, in case of surplus produce. These EVD solutions therefore act as mitigation measures while improved cookstoves, solar cooker, rooftop rainwater harvesting units, solar lanterns and solar streetlights are considered as adaptation measures to address climate change impact.

### Indian Policies for Improved Cookstoves and other local solutions

Improved cookstoves (ICS) were being promoted in India in the 1980s and '90s but lost focus of both the government and NGOs. In recent years with climate change impacts becoming visible, improved cookstoves are being given due importance. Government subsidy is available for the ICS while many players are distributing various ICS models under carbon credit projects. As mentioned, around 150 million families in India need an improved cookstove. Similarly, around five million family-size biogas plants have been constructed in India so far. At this speed, it will take nearly 100 years to reach the potential of around 30 million plants with a target of 0.3 million plants per year under the government subsidy scheme, to promote decentralised renewable energy (DRE) livelihood applications, which include solar dryers and solar poly greenhouses, etc.

The Ministry of New and Renewable Energy (MNRE) has proposed a policy framework to provide a conducive environment for development and large-scale adoption of these appliances. Organic

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farming, vermicomposting and social/agroforestry are in focus of the government and are being promoted through various government institutions as mentioned before.

There is huge potential to promote these technologies to reduce carbon emissions and to save the health of women and children for which financial resources are to be sought. However, financial resources are needed to meet the potential of these EVD solutions not only in India but across the world.

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## 5.3 ECO-VILLAGE DEVELOPMENT (EVD) IN PRACTICE IN NEPAL

### Short about Nepal

| Description | Facts |
|---|---|
| National population (estimated) | 29,192,480 (2021 ) |
| Rural population | 78.99% |
| Population growth (annual %, estimated) | 0.93% (2021) |
| $CO_2$ emissions (metric tons per capita) | 0.5 (2019) |
| Main source of energy | Biomass |
| Energy for cooking | 63.6% Firewood, 33.1% LPG |

Climate Change implications based on scientific evidence:

- Nepal is highly vulnerable to climate change. The country is subjected to extreme and slow-onset climate-related hazards.
- Nepal's climate vulnerabilities emerge from a combination of fragile mountainous topography and ecosystems, highly variable monsoon-driven hydrology, unplanned settlements, and a lack of resilient infrastructure.
- The population is subjected to extreme heat stress, flooding, landslide, and air pollution.
- The number of flood events has doubled in recent years; storms, erosion, and landslides, are also on the rise, resulting in loss of life and livelihoods.

In Nepal, carbon-intensive fuels, biomass and fossil combined, occupy a dominant share in the total national energy consumption (TEC). Although the proportion of biomass use has reduced from 87.3% to 66.3% on TEC from 2006 to 2021, biomass consumption is still growing at an annual growth rate of 1.56%. 99% of the population across the country has access to electricity. However, in many parts of the country, the connections are only for lighting services, not for productive uses of electricity. The annual electricity use per capita, including from alternative energy sources, is 265 kWh in 2021. Recently, the Government of Nepal has made provision to provide free electricity for household use up to 20 kWh/month, expected to benefit nearly 2 million residential consumers with low incomes. These poor consumers cannot afford to pay for electricity even if they are provided the electric cooking technology at no cost (20 kWh/month is not enough for efficient electric cooking and electric light, etc.).

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The residential sector is responsible for 35% of the total GHG emission from energy use. It is primarily due to the large quantity of energy being consumed in this sector for cooking. 73.5% of the Nepalese households rely on fuelwood from cooking services. (Pinto et al., 2019).

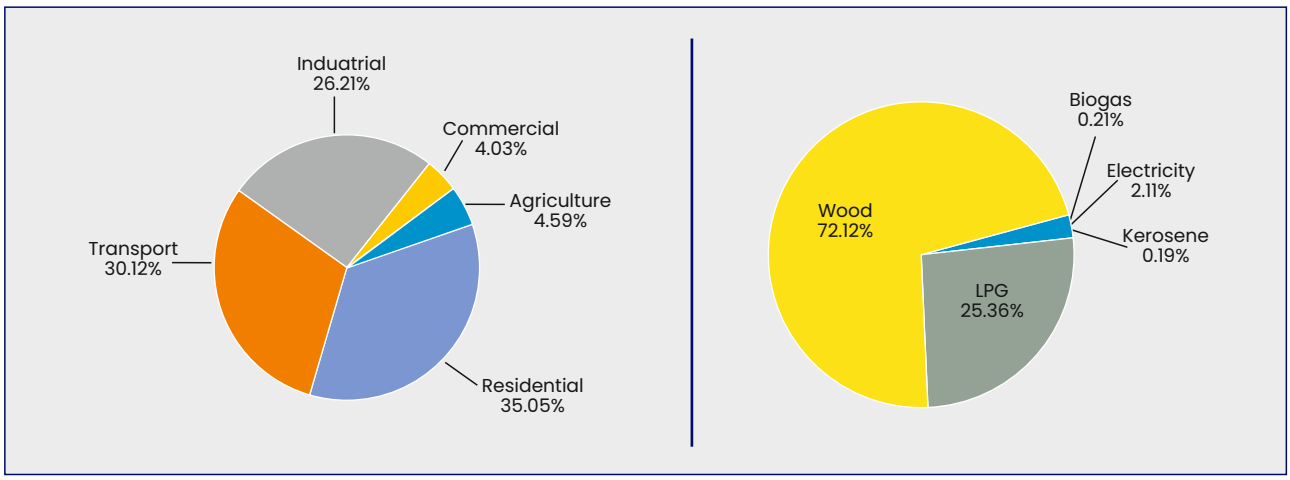


**Figure 1: (a)** GHG emission from energy use (17 Mt, 2019) **(b)** Residential cooking fuel share (98PJ, 2020)
**Source:** (Government of Nepal, 2021)

Two-thirds of the population relies on agriculture for livelihood; this is also the sector most severely impacted by climate change, with changes in precipitation and temperature patterns. Smallholder farmers are highly vulnerable to climate change because they are most dependent on rain-fed agriculture, cultivate marginal areas, and lack access to technical or financial support that could help them adapt to climate-resilient agriculture.

The Concept of "Eco-Village" development is very pertinent when we envisage impacts of climate change in a small mountainous country like Nepal.

CRT/N, with financial aid from CISU, Denmark and partnership with CSOs/NGOs in Bangladesh, India and Sri Lanka, has been promoting the Eco-Village Development (EVD) concept in Nepal since 2015.

In the present phase, the EVD concept is implemented in Bhalumara village in Ward-3, Marin Rural Municipality of Sindhuli district in the lower plain area of Nepal.

The major problems identified were lack of water for drinking and irrigation, infertile soil, high wood consumption and indoor air pollution with inefficient cookstoves, poverty, and increasing migration of younger men for sustaining family needs.

# 5

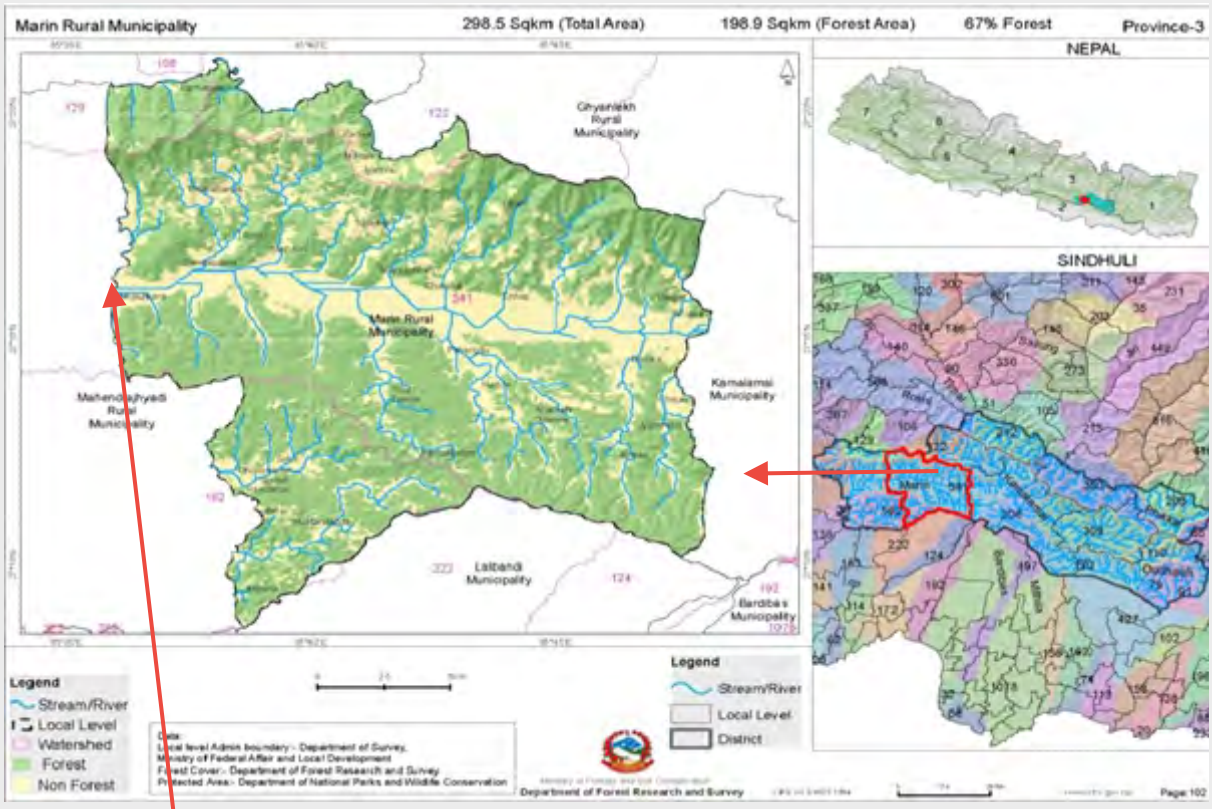


**Figure 2:** Map of Marin Rural Municipality


**Figure 3:** Bhalumara village

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The essence of EVD concept has always been to promote and advocate low carbon local solutions for rural development and enable them to mitigate and adapt to the climate change impact. However, in the Bhalumara village, while developing the Village Development Plan, we came across issues that could not have been addressed necessarily by the low-carbon local solutions of the EVD concept. Since the EVD concept advocates and adopts a bottom-up approach, it became clear that it was essential to address the communities' most urgent priority problem, which was the water shortage.

**The activities completed so far are:**

- 250 trees planted along the main roadway for greenery purpose on the occasion of Environment Day (5 June) and each beneficiary household was provided with two high value fruit saplings (100 mango and 100 litchi). In the case of tree plantation along the roadway, the closest household to each sapling contributed in kind to dig the spot, put manure, prepare the fence, and to take care of the plant. This way each household along the roadway would be taking care of at least three plants.

Mr. Biman Muktan, Chairperson of Marin Rural Municipality, planting saplings along the roadway.

Distribution of mango saplings

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- EVD solutions demonstration was organised, where nine types of cooking technologies, commercial improved cookstoves (ICS), solar dryers, modular solar pump and climate-smart agriculture technologies were demonstrated. After the demonstration, beneficiaries were interested in induction cookstoves, commercial scale ICSs and modular solar pumps and bio-pesticides. Since the area had just begun vegetable production beyond subsistence level, they did not show interest in solar dryers. As of now 100% of the target households have access to clean cooking.

Solar dryer

- Local stakeholders were taken on an excursion to Bethanchowk, Kavre, where the EVD concept was promoted and implemented with support from GEF/SGP so as to motivate the targeted beneficiary accepting the EVD concept and to capacitate the local government on eco-friendly livelihood development planning. Consequently, an improved level of enthusiasm was observed among the beneficiaries to link EVD technologies with improved standard of living and income generation. The local government expressed keen interest in implementing a similar kind of concept in other villages where the local government can provide matching funds to the financial and technical aid of donor/organisation for larger impact creating project(s).

- The project site is supplied with electricity through a community electrification approach where a 50 kVA transformer meets the total electricity demand of 150 households. An electric load analysis was carried out, which revealed that the transformer installed at the project site can support a maximum of 20 induction cookstoves. Hence, a modern cooking solution package – that included an induction cookstove, a five-liter pressure cooker and a saucepan – was disseminated to 19 out of 97 households in which the project supported 38% of the total cost. Twelve households installed institutional-scale improved cookstoves which was the most appropriate technology to cook feedstock for cattle and cooking at a larger scale. Forty households installed mud-based improved cookstoves and the rest of the households used LPG to meet their cooking needs.

Feedstock cooked previously in a traditional chuhla (left), now in an improved cookstove (right).

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- Twelve interested beneficiaries were trained on commercial vegetable farming. 10 of them were supported on installation of climate adaptation agro-technology plastic tunnel greenhouses, drip irrigation set, and safe food production farming. Further, these beneficiaries were trained on vermicomposting, preparing bio-pesticide and liquid fertiliser from locally available insecticidal plants, capsaicin-based spices and cattle urine.

Vegetables grown inside the poly tunnel house integrated with drip irrigation

- Improved access to safe drinking water was provided to 96 households and three public institutions through a 3.2 kWp solar-lifting system with a water reservoir tank of 32 cubic metres. The total project cost was NPR 69,85,028, of which 70% was granted by GMZ, Germany, in support of WWF-Nepal and PRC under the project "Multi-actor partnership for 100% Renewable Energy", 10% was co-funded by CISU, Denmark, from the EVD-4 project and the rest was contributed in kind by the beneficiaries.

With the successful completion of the drinking water project, the drudgery of the villagers for collecting safe drinking water was eliminated, sanitation levels improved, health service in the local ayurvedic hospital became more effective, villagers started kitchen gardening by utilising the grey water, and students getting extra study hours are few of the direct benefits being experienced by the villagers.

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Kancha Man Bomjan provided his private land to excavate well and now the well is registered as a water source i.e. public property.

- In order to integrate local solution/resource utilisation to promote a social enterprise, a rapid market assessment was conducted to identify the potential enterprises. The enterprises of four categories: forest resource-based, livestock-based, agriculture-based and solar-lifting water-based were assessed. Vegetable production has been identified as the most appropriate and sustainable social enterprise in the area. Due to lack of water for irrigation, villagers relied on rain-fed agriculture and cultivated rice during wet season and other cereal crops like maize, millet and wheat during dry season as they require little precipitation. Villagers were dependent on neighbouring districts for daily consumable vegetables. Since the project's intervention with solar water lifting and training and support commercial vegetable farming of tomato, chilli, cauliflower and other green leafy vegetables under the poly-tunnel house, an overwhelming harvest of tomatoes for approximately three to five months was observed. The vegetables grown are consumed within the village. From the experience of eight months on vegetable farming in Bhalumara village, it was learnt that if the vegetables can be grown at scale, it can be taken to the market in the neighbouring villages and to regional collection centres as well. Meanwhile, the local government has policies and plans to promote agri-businesses. In order to bring the villages on board to participate in vegetable production at scale, the project has supported the establishment of Bhalumara Model Agriculture Group, and has been developing its capacity to operate sustainably. Recently, the project has supported it with three sets of 330 Wp-0.35 hp modular solar pumps and a spare pump to improve irrigation. One of the beneficiaries has been promoted as a vegetable vendor. The project team worked with her to develop a business plan. Along with this, to assess the quality of the soil, a soil test has been conducted. The government is constructing an irrigation canal along the village which is to be commissioned soon. However, the water had to be pumped about 3m out of the canal and then vertically fed to the fields. All these interventions add on to the higher productivity of the area.

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- Capacity building of local CSO, Bhalumara Model Agriculture Group, on accounting and financial auditing was enabled.

- Behavioural change has been identified as an important ingredient for effective climate action. Teaching sustainable consumption of resources and waste management can engrave and scale-up the concept of living in harmony with the environment. Thus, the youth of Bhalumara villages were sensitised on climate change and were oriented on roles an individual can play for a sustainable environment. At the end, the participants, along with the beneficiary households, were provided with dust-bins to practise waste segregation at source and waste minimization, utilisation and management.

Dust-bins being distributed to practise waste segregation at source for waste management

**The EVD does not stop in Bhalumara with this. It continues with:**

- Renovation of four household biogas plants.
- Retrofit of five community wells that dry up in the dry season. Once retrofitted, the water can be lifted and used for irrigation in the fields when required.
- Refresher training on commercial vegetable farming in collaboration with the local government and villagers would be provided with distribution of seasonal vegetable seeds to encourage them in vegetable farming. Once home-grown safe vegetables are consumed, and income generation started by selling the surplus produced, the initiative would most likely continue. The project has offered required support and coordination to secure the market for vegetables.

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- Preparing and sharing the crop calendar along with advocating the EVD solution.

The EVD Project and the developed concept paved the way for several other new projects for CRT/N. These include the implementation of the EVD concept in three villages supported by the UNDP/Global Environment Facility/ Small Grant Programme and two villages supported by the Centre for Self-Help Development (CSD) where micro-finance institutes (MFIs) are deployed. The CRT/N is providing consultation services to MFIs for the deployment of their CSR funds in eco-village development.

In Nepal, the Eco-Village Development (EVD) concept has become an emerging concept to achieve the national targets of the UN Sustainable Development Goals (SDGs) and of the Nationally Determined Contribution (NDC) to the UN Climate Paris Agreement. Among the various targets set out, the Nepali NDC has a target to establish 200 climate-smart villages and 500 climate-smart farms. Since the project also falls under the national priority agenda, its acceptance by the local/national partners is overwhelming. However, the major hurdle for the scale-up is the fund availability because the target beneficiaries are the poor communities who lack the capital investment to adapt and build resilience to climate impacts.

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## 5.4 ECO-VILLAGE DEVELOPMENT (EVD) IN PRACTICE IN SRI LANKA

**Short about Sri Lanka**

| Description | Facts |
|---|---|
| National population (estimated) | 22,156,000 (2021) |
| Rural population | 81% |
| Population growth (annual %, estimated) | 1.1 (2021) |
| $Co_2$ emissions (metric tons per capita) | 1.1 (2019) |
| Main source of energy | Biomass |
| Energy for cooking | 68.6% firewood (76.8% in rural areas ) 29.1% LPG |

Climate Change implications based on scientific evidence:

- Increase in temperature
- Increased frequency of floods: Floods in western and southwestern provinces due to southwest monsoon (May to September). Floods in eastern, northern and north central provinces due to northeast monsoon (December-February).
- Large portions of the island is drought-prone from February to April.
- Intensified rains in highland regions and landslides - in districts Badulla, Nuwaraeliiya, Ratnapura, Kegalle, Kalutara, Kandy, and Matale.
- Sea-level rise, storm surges and coastal erosion. The western, southwestern and southern coastal regions are more vulnerable to these changes, where around 50% of Sri Lanka's population resides.
- Projections for increased frequency of cyclones.

In the foreseeable future, South Asia's emerging economies, including Sri Lanka, will experience an increase in standards of living for many people. However, with emerging economies and an expanding population growth, greenhouse gas emissions can easily increase along with the increased living standards, development of industries, while leaving large parts of the rural population in poverty. Both the wealth and the continued poverty threatens Sri Lanka's rich environment and natural resources with high biodiversity and ecosystems with immense storage of carbon.

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Sri Lanka is a global climate vulnerable hotspot. According to the Global Climate Risk index put forward by Germanwatch, Sri Lanka ranked fourth in 2016, second in 2017 and sixth in 2018 among the most climate-vulnerable countries. Scientific studies have clearly identified that climate change has altered the climate profile of Sri Lanka, by increasing the intensity and frequency of floods, drought, landslides, lightning events, with significant effects on temperature and seasonal variability of rainfall.

A means of a development pathway especially for the poor and village communities should entail a bottom-up planning approach and decentralised solutions to enhance their living standards in climate-friendly ways and including climate adaptation. In this regard, Eco-Village Development has proven to show all the key elements in transforming lives for the better in a holistic manner which caters to sustainable development.

The current Eco-Village Development activities are being implemented in the southern coastal district Matara since 2021. The village 'Kottawatte' belonging to the Thihagoda divisional secretariat of Matara district is chosen to be transformed into an eco-village under the project with the engagements of stakeholders both at government and non-government levels. The village of 683 people in 180 households are mainly living from agriculture and livestock, predominantly paddy farming with rice. While the village is 100% electrified, 90% of the families cook with biomass. In the village is a Grama Niladhari (village official) office while the nearest school is two kilometres away.

Village Kottawatte in Matara district in Southern Sri Lanka

The main climate-induced problems in the village are floods and crop damages in certain lowland paddy areas, extreme rainfall events, and mild drought events.

The main challenges for the villagers are:

- Difficulty in finding employment and high unemployment rates,
- Low agricultural productivity
- Soil infertility due to excessive use of chemical fertilizers and pesticides
- Improper waste disposals
- Food security and malnutrition issues
- Lower literacy rates
- Lack of clean cooking options
- Lack of entrepreneurial skills

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## EVD Implementation

Given the holistic development approach of EVD, numerous activities have been conducted with diverse solutions implemented with the focus of ensuring, energy, food, water and livelihood security of the communities, while improving climate resilience. A brief account of a few of the key solutions implemented are given below.

### Improved Cookstoves (ICS)

To tackle the high biomass use and its harmful implications in terms of health, cost, environment and climate change, the improved cookstove programme has been an integral activity of the EVD programme.

The household ICS used in the EVD programme in Sri Lanka is from Sri Lanka's Improved Cookstove programme **'Anagi'** that can be identified as one of the large-scale successes in the developing countries' quest for sustainability. The stove dissemination is fully commercialised and evidence shows that its production and social marketing process has reached sustainable levels in Sri Lanka. At present, over 300,000 stoves are produced annually by over 200 rural potter families.

### Institutional ICS

Biomass is the main source of energy for a majority of rural food processors. However, the biomass practices adopted are not the most efficient. Improved institutional stoves have a lot to offer in this context in improving the productivity of these enterprises through reduced firewood usage and relevant costs, reduced processing times, and reduced indoor air pollution and other health hazards. Under this intervention, curd producers and traditional string hopper producers are benefitted.

**Advantages:**

- Halves firewood consumption
- Significant firewood cost savings
- Improved safety and eliminates the fire hazards
- Mitigates carbon emissions and air pollution
- Discourages deforestation

Moveable Institutional ICS

### Rural Kitchen Improvements

It is observed that a majority of rural households in Sri Lanka experience indoor air pollution (IAP) due to the use of biomass for cooking. The same issue persists in Kottawatte (selected village). The main causes to accentuate this issue lie in biomass malpractices and inappropriate kitchen designs, which prevents optimum ventilation and air circulation. Kitchen improvements provide an affordable solution, which offers efficient cooking, improved ventilation and an optimum kitchen arrangement to minimize the drudgery of women, the main affected group with children.

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Scientific studies in the village show that an improved kitchen can potentially reduce particulate matter (PM2.5) emissions by 75% and carbon monoxide emissions by more than 60%.

**Purpose of kitchen improvements:**

- Reduce indoor air pollution and health impacts on women and children
- Reduce drudgery of women
- Reduce firewood consumption
- Climate change mitigation through reduced carbon emissions

Improved rural kitchen in Matale district

## Integrated Home Gardening

Home gardening is an integrated household activity which supports food security of a household. The EVD home gardening programme adopts a development criterion to assess and qualify gardens as home gardens. This criterion assesses availability of essential vegetables, herbal remedies, fruits, yams, composting and organic fertilizer, pesticide producing techniques, soil conservation methods, water use, planting methods, landscaping, etc. The aim of the programme is not solely to provide all the food needs of the family but to support food and nutritional requirements of the household. In integrated programmes, the home gardening groups obtain liquid fertilizer from the locally installed domestic biogas free of cost.

**Purpose of home gardening:**

- Improves food security, nutrition and wellbeing
- Enhances knowledge and capacity on best agricultural practices
- Creates unity among the community for collective action
- Reduces the cost of food
- Improves the environment

Locally produced domestic biogas units to be installed at the village

Home gardening

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## Sustainable small holder paddy farming

Traditionally, small holders are used to direct seeding, excessive chemical fertilizer applications and usage of chemical pesticides and weedicides. However, these approaches have produced lower yields and are less resilient to external factors such as climate change. Through EVD interventions, small holders are introduced to intensive farming techniques which utilizes transplanting, using a mix of both chemical and organic fertilizers with no chemical pesticide and weedicide applications. These methods have shown that farmers can increase their yield by more than 100% while showing increased resilience to changes in climate, and crop diseases. Paddy farming with optimum use of a mix of both organic and chemical fertilizers (essential levels) is promoted.

**Purpose of improved paddy farming:**

- Increased resource efficiency
- Improve productivity and increased yields
- Increased capacity of farmers


Mrs. Soma with her paddy plot which was developed under the technical guidance of the project

# 5

### Strengthen Women Entrepreneurship

EVD interventions emphasize on strengthening women as entrepreneurs in efforts to empower women to be less dependent, and to be contributors to the household income. EVD portrays a gender-responsive development approach which identifies existing businesses and women from the community who have the potential to be developed as entrepreneurs. Upon identification, these women are capacitated, facilitated and linked to lucrative market opportunities, and are closely monitored until they are confident to move on their own. Both traditional and novel business ideas are nurtured and sustained under this programme.

**Purpose of women entrepreneurship:**

- Introduction and promotion of alternative livelihoods
- Improve and optimize production processes
- Establish market linkages

### Empowering traditional coir yarn producers

Solutions implemented in the Kottawatte Village:

| Solution | Number (as of now) |
|---|---|
| Improved cookstoves | 67 |
| Improved kitchens | 5 |
| Cash crops as an additional income | 9 |
| Sustainable paddy farming for small holders | 5 |
| Rural entrepreneurs /livelihood development activities | 17 |
| Plant nurseries | 2 |
| Home gardens | 40 |
| Mushroom farming | 2 |
| Yams and tubers cultivation for income generation | 6 |
| Domestic biogas | 1 |

### Replication of EVD through Green Village Programme of Central Bank

Replication and scale-up of the EVD concept is one of the key objects of the project and hence several key advocacy efforts were taken up to date. In recent times, the replication of EVD by the Matara Regional Branch of the Central Bank is to be noted. The Central Bank of Sri Lanka promotes

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regional development through its Economic and Price Stability Cluster, under which transformation of villages into green villages is emphasised as follows:

*"Promoting eco-friendly village environment by transforming selected villages as green villages to improve healthy living standards and best practices among the community, while focusing on uplifting the livelihood of the underserved people, and promote agricultural exports and market linkages with value chain, while enhancing quality food production for sustainable development."*

In light of this initiative, Matara Regional Bank has initiated its Green Village Programme in Dematha Hettigoda GN division, Thihagoda, Matara, since 2021. IDEA has been providing guidance to this intervention mainly through the development of baseline survey, capacity building on climate change and resilience related aspects, home gardening and improved cookstove programme. As of now, the home gardening programme and the 'Anagi' improved cookstove programme has been implemented progressively. The long-term plan is to carry out other solutions and livelihood development activities in the future in coordination with relevant stakeholders.

In the past, official programmes have also replicated the idea from Eco-Village Development (EVD) and other village concepts, starting with the 'Sri Lanka NEXT Initiative - A Blue Green Era' in 2016. This initiative gave rise to several programmes which were aimed at achieving sustainability with emphasis on climate adaptation and mitigation. The national programme to develop 10,000 eco-friendly 'Haritha Suhuru' – Green Smart Villages by 2021, was launched in 2016, but only a small fraction of the target was reached. This was followed by the Gramashakthi People's Movement, a programme launched in 2017 to eradicate poverty in Sri Lanka. Similar to Green Smart Villages, the Gramashakthi programme emphasised a bottom-up village development planning (VDP) approach emphasising community needs and ownership. EVD mainstreaming efforts came in the form of training Gramashakthi-assigned development officials on sustainable and integrated village development planning.

## Similar Interventions Introduced by the Government in 2022

### Sri Lanka Climate Prosperity Plan 2022: Climate Resilient Villages (CRVs) Programme:

The Climate Prosperity Plan presents an investment strategy on maximising socio-economic outcomes within the contexts of climate change. Tapping the true potential of renewable energy sources, enhancing resilience through nature-based solutions and financial protection are emphasised. Within this agenda, with a focus on enhancing climate resilience and adaptive capacity of climate vulnerable communities, the Climate Resilient Villages (CRVs) Programme is presented as a hallmark project. The project is to be initiated from 2023 to 2030 with an initial investment of USD 5 million with a scale up of USD500 million by 2025. The project rationale is as follows:

*"Climate Resilient Village (CRV) is a concept developed to provide stability to agricultural productivity and household incomes and resilience through livelihood diversification in the face of extreme climatic events like droughts, floods, landslides, cyclones, heat wave, and seawater inundation."*

# 6 ECO-VILLAGE DEVELOPMENT RESOURCE MATERIALS

**Publications and Resources Published by the Eco-Village Development Project Partners: INFORSE, INFORSE-South Asia, CANSA, INSEDA in India, CRT/N in Nepal, IDEA in Sri Lanka, Grameen Shakti in Bangladesh, and DIB in Denmark.**

**Website of the Eco-Village Development Project in South Asia, 2015-2023.**

https://ecovillagedevelopment.net/

**Online Database of Eco-Village Development (EVD) in South Asia: Bangladesh, India, Nepal, and Sri Lanka.**

The main categories are:

Solutions, Media (photos, videos), Publications, Organisations. The main topics are: cooking, off grid power, heating and cooling, water supply, organic gardening and agriculture and village development planning tools.

The database was launched on August 31, 2022. By March 2023, the database includes 50+ solutions, 150+ media (photos, videos), 30+ publications, 10+ organisations.

Link: https://www.inforse.org/evd/ and https://ecovillagedevelopment.net/ under EVD database.

Solutions: https://www.inforse.org/evd/output/solution_list.php

Publications: https://www.inforse.org/evd/output/publication_list.php

Media. Photos, Videos: https://www.inforse.org/evd/output/media_list.php

Organisations: https://www.inforse.org/evd/output/organisation_list.php

**Socio-Technical Manual for Training of Trainers (ToT) - Manual on Participatory Planning, Technology and Knowledge Transfer of Eco-Village Development (EVD) in India, Nepal, Sri Lanka and Bangladesh.**

Available in English, Hindi, Nepalese, Bangla, and Sinhala. 132 pp., 2018. ISBN: 978-87-970130-3-8 (PRINT), 978-87-970130-4-5 (PDF) Download from INFORSE, UN CTCN:

https://www.inforse.org/asia/Pub_EcoVillageDev_TOT_Manual_SouthAsia.htm
https://inforse.org/evd/presentation/present_publication.php?id=62

https://www.ctc-n.org/resources/socio-technical-manual-training-trainers-eco-village-development-south-asia

**White Paper: EVD Climate Mitigation and Adaptation with Eco-Village Development (EVD) Solutions.**

45 pp., 2018. English. ISBN 978-87-970130-0-7. INFORSE. Download from INFORSE, and CTCN:

https://www.inforse.org/doc/Pub_EVD_White_Paper_Climate_Mitigation_Adaptation_2018.pdf

https://www.ctc-n.org/resources/white-paper-mitigation-and-adaptation-eco-village-development-solutions

# 6

**Submission to United Nations Sustainable Development Goals Knowledge Portal of Good Practices: Evidence-based, Low Carbon, Pro-Poor Advocacy on Sustainable Eco-Village Development in Bangladesh, India, Nepal. Sri Lanka in 2015-18. by INFORSE.**

https://sdgs.un.org/partnerships/evidence-based-low-carbon-pro-poor-advocacy-sustainable-eco-village-development-evd

**Submission and Speech to Talanoa Dialogue, Marrakech Partnership, 8 April 2018, May 6, 2018. Talanoa Dialogue Question No. 2: Where do we want to go? Story brought from villages in South Asia (Sri Lanka, Nepal, Bangladesh, and India): Download from;**

https://unfccc.int/sites/default/files/resource/189_Talanoa-Question2-EVD-input-incl%20pub_.pdf

**Presentation at the Climate Technology Centre and Network (CTCN) at the UN European Environmental Days (EED) Event: Rise of the eco-village: How community-based design and supportive technologies are creating new models for equality and sustainability, Brussels, Belgium, June 19, 2019.**

https://www.ctc-n.org/news/rise-eco-village-how-community-based-design-and-supportive-technologies-are-creating-new and presentation shared by INFORSE

https://www.ctc-n.org/sites/www.ctc-n.org/files/evd2_presentation_edd_judit_sz.pdf

**Eco-Village Development Policy Briefs for the UNFCCC Negotiations:**

Enhance Climate Ambition and Global Stocktake With Local Sustainable Energy - UNFCCC COP27 Policy Brief, 11.12.2022, (pdf, 3 pp.)

https://www.inforse.org/asia/pdf/EVD_PolicyBrief_GST_UNFCCC_Nov12_2022.pdf

- UNFCCC SB56 Policy Brief, 11.06.2022, (pdf, 2 pp.)

https://www.inforse.org/doc/UNFCCC_SB56_EVD_PolicyBrief_GST_11_06_2022_F.pdfcansouthasia.net/policy-brief-enhance-climate-ambition-and-global-stocktake-with-local-sustainable-energy/

**Eco-Village Development as Climate Solution - Proposals from South Asia**

Available in English, Hindi, Nepalese, Bangla, and Sinhala. 60 pp., 4th Edition, 2017. ISBN 978-87-970130-1-4. Download from https://www.inforse.org/asia/Pub_EcoVillageDev_SouthAsia.htm

https://www.inforse.org/evd/presentation/present_publication.php?id=50

Remember the Local Actions: From Global Climate Negotiations To Local Initiatives UNFCCC SB48 Policy Brief, 1.05.2018, (pdf, 2 pp.)

https://www.inforse.org/doc/SB48_EVD_PolicyBrief_Bonn_1_May_2018.pdf

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Make the Paris Rulebook Promote Poverty Eradication and Improved Climate Actions UNFCCC COP23 Policy Brief, 9.11.2017, (pdf, 1 p.)
http://inforse.org/doc/Policy_brief_EVD_COP23_Nov9_2017.pdf

NDCs and Global Stocktake Must Recognise Local Solutions and Reductions of Poverty UNFCCC SB46 Policy Brief, 15.05.2017, (pdf, 1 p.)
https://inforse.org/asia/pdf/Policy_Brief_UNFCCC_15_May_2017_Bonn_EVD.pdf

**Eco-Village Development as Climate Solution**

- UNFCCC SB44 Policy Brief, 20.05.2016, (pdf, 3 pp.)
  https://inforse.org/asia/pdf/Conf16_EVD_Policy_Brief_20_05_2016_INFORSE_CANSA.pdf
- UNFCCC COP21 Policy Brief, 03.12.2015, (pdf, 6 pp.)
  https://inforse.org/asia/pdf/EVD_Policy_Brief_UNFCCC_COP21_Dec3_2015.pdf
- UNFCCC SB42 Policy Brief, 10.06.2015
  https://inforse.org/asia/pdf/EVD_Policy_Brief_Bonn_UNFCCC_June10_2015_F.pdf

**National Publications on Eco Village Development in South Asia:**

Collection of Success Cases, Case Studies, Feasibility Studies in Nepal by CRT/N, in Sri Lanka by IDEA and in India by INSEDA. Download them from the Online Database:
https://www.inforse.org/evd/output/publication_list.php

**United Nations' Side Events of UNFCCC and UN HLPF, HLDE covering Eco-Village Development in South Asia:** Proceedings of the UN Official Side Events available from:
https://inforse.org/asia/INFORSE_Asia_UN.htm and
https://seors.unfccc.int/seors/reports/archive.html

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## PARTNERS OF THE ECO-VILLAGE DEVELOPMENT PROJECT:

**INTERNATIONAL / REGIONAL:** Eco-Village Development:
https://ecovillagedevelopment.net/

**INDIA: INSEDA** - Integrated Sustainable Energy and Ecological Development Association), India
https://www.inseda.org/eco-village-development.php

**NEPAL: CRT/N** - Center for Rural Technology Nepal
https://crtnepal.org/next-generation-low-carbon-climate-resilient-eco-village-development-in-south-asia

**BANGLADESH: Grameen Shakti**
https://www.gshakti.org/what-we-do/keyprojects/eco-village-development

**SRI LANKA: IDEA - Integrated Development Association**
http://www.ideasrilanka.org/evdproject.html

**DENMARK / EUROPE:**
DIB: https://www.dib.dk/en/projekter/sydasien/
INFORSE-Europe: https://www.inforse.org/europe/

**INFORSE SOUTH ASIA** - International Network for Sustainable Energy and INFORSE South Asia:
https://inforse.org/asia/EVD.htm

**CANSA** - Climate Action Network South Asia
https://cansouthasia.net/our-work/multilateral-processes-advocatory/next-gen-eco-village-development/

# LOW-CARBON, CLIMATE-RESILIENT ECO-VILLAGE DEVELOPMENT IN SOUTH ASIA