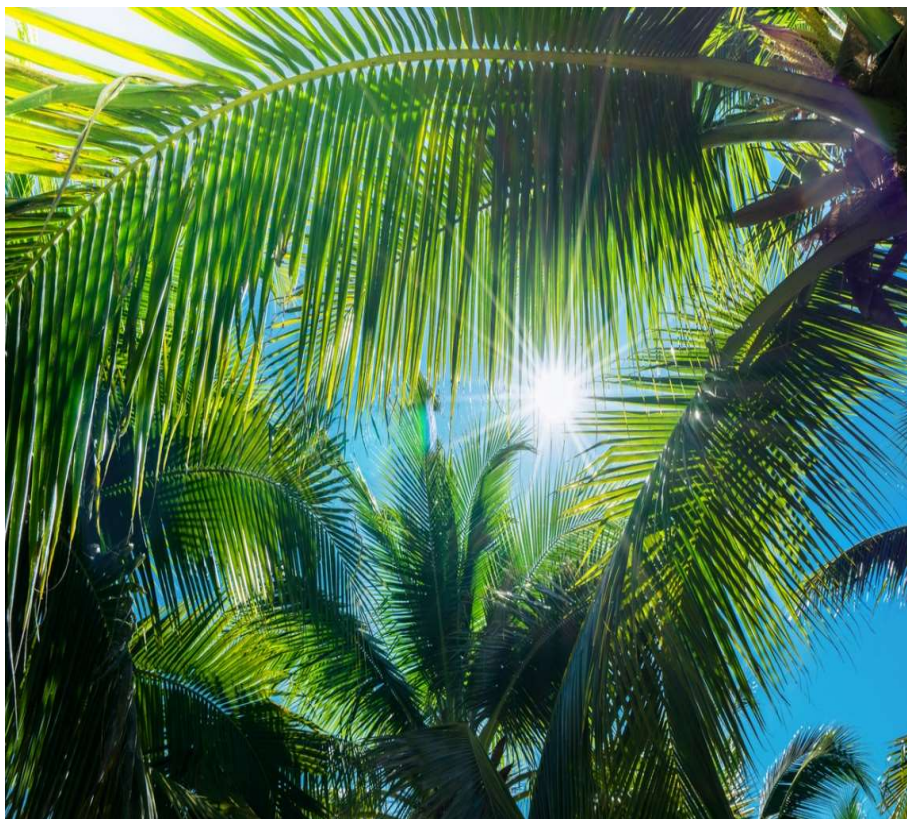


CARES: SOLAR VILLAGES PROJECTS

SRI LANKA: Towards sustainable development, reduction of poverty and climate action



Solar Villages 4 SDG



Emeritus Professor “Dharme” I.M. Dharmadasa PhD

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FOREWARD

In 2015, leaders from 193 different countries agreed 17 sustainable development goals (SDGs) to achieve by 2030. The first goal is to end poverty in all its forms globally. This category is for the most vulnerable people who will suffer from catastrophic events like severe droughts, flash floods, hurricanes and tornadoes created by climate change. In order to safeguard the whole of society and help the sustainable development of needy people, practical projects must be designed and introduced to mitigate these damaging effects.

Solar Village project is such an attempt to deal with these issues and it embeds 14 out of 17 SDGs. This document presents the background to this project, its concept, activities taking place in a typical solar village and the impacts on needy communities. This is a living document, and it provides the reader an understanding of how the project works and its huge impact.

The solar village concept has been tested using donations and support from charitable organisations. After experiencing its vast impact on needy communities, the project is entering into a rapid replication stage with expected numerous funding routes. In the noble prize winner, Professor Yunus Muhammad's words, "this is a social business". This project has been designed for sustainable development of needy communities using solar technology, reduce poverty and mitigate damaging effects of dangerous climate change incidents.

I would like to express my sincere thanks to all donors to date, colleagues who worked together to complete these projects successfully, Mr Leslie Dep for his excellent project management, and Ms Nilmini Roelens for encouraging me to produce this document for advocacy and for editing it.



Emeritus Professor I. M. Dharmadasa Banda (“Dharme”)

EXECUTIVE SUMMARY

(a) Solar Village Concept

The "Solar Village" or "CARES – Centres for Application of Renewable Energy Sources" initiative selects a needy community and implements clean solar energy solutions to create wealth and support sustainable development. Wealth creation methods include solar water pumping for clean drinking water and payment of bills, solar roofs connected to the national grid to generate regular income, and solar water pumping for irrigation and food production. After establishing a Village Development Committee (VDC) and a bank account, arrangements are made to credit the continuous income to this account. The VDC, consisting of approximately equal numbers of responsible male and female members, manages this revenue with full transparency. They use the funds for various community development projects and to reduce poverty among participating families. A typical solar village has about a thousand inhabitants.

The Solar Village project team then guides the empowered community to improve their nursery, local school, library, and community centre, and enhance the environment through activities such as tree planting, beekeeping, organic farming, and voluntary work (Sramadana). These efforts aim to improve the living standards of the participating families. Solar Village Foundation representatives organize annual meetings at the local school with teachers, pupils, and parents to discuss various income-generating development projects and address community issues through education.

By using a clean energy source like solar, carbon dioxide emissions are reduced. Additionally, tree planting increases carbon dioxide absorption through photosynthesis, further reducing greenhouse gases in the atmosphere. These activities contribute to mitigating the dangerous effects of climate change while improving the living

environment. The Solar Village project addresses 13 out of the 17 UN Sustainable Development Goals (SDGs) and is suitable for solving many issues in the developing world.

(b) Background to the Solar Village

The Solar Village project evolved from a six-year Higher Education Link (HE-Link) programme completed in the early 1990s. Funded by DFID-UK (now known as FCDO) and administered by the British Council, this initiative aimed to facilitate professional mobility between the UK and Sri Lanka. Professor I. M. Dharmadasa (Dharme) initiated and coordinated the HE-Link programme, partnering his employer, Sheffield Hallam University, with several Sri Lankan universities, including Peradeniya, Colombo, Moratuwa, Kelaniya, and Matara. The primary objective of this collaboration was to establish and advance solar energy conversion research in Sri Lankan universities and to promote renewable energy applications across the country.

Professor Dharmadasa is the project lead.

This collaboration led to the formation of SAREP (South Asia Renewable Energy Programme), a national and regional network that continues to support these activities. Public engagement efforts from this initiative also gave rise to the "Solar Asia" conference series and the "Solar Village" project. Over the past 15 years, five solar villages have been established, with three more currently under construction.

Video-1: <https://www.gofundme.com/f/Help-us-build-resilient-communities-in-Sri-Lanka>

(4.25 minutes video with English sub-titles)

Video-2: [solar village project in Sri Lanka \(youtube.com\)](https://www.youtube.com/watch?v=...)

(2.41 minutes video with English sub-titles)



1.THE “CARES” or “SOLAR VILLAGES” CONCEPT

Technical name of the “Solar Villages” is “CARES”.

CARES = Centres for Application of Renewable Energy Sources

For the ease of use, “Solar Villages” is used in this document.

(a). Concept

Select a needy community and find a solution with solar energy to create wealth for that community. After forming a VDC (Village Development Committee) and a bank account, arrange to credit the continuous income stream to this account. The VDC consisting of approximately equal numbers of responsible male and female members manage this revenue with full transparency, towards numerous development projects in the community.

Solar Village project team guide the empowered community to improve their nursery, local school, library, community centre, and improve the environment by planting trees, beekeeping, organic farming etc. and carrying out voluntary work (Sramadana) for many activities.

(b). How we ensure transparency

Right from inception, the empowered community will appoint a Village Development Committee (VDC) to manage the revolving revenue with complete transparency. During each meeting, the Treasurer presents the income received, and the expenses occurred, discussed, and approved by the VDC. The solar village projects can be modified according to the requirements of the community, and the project team will act as advisors to the project. The solar village project team will keep close contact with the VDC and guide them to advance the whole community. The main aim of this project is to plant the “seed of the solar village”, and the VDC will organise activities to grow this into a “Large Solar Village”.

2. THE BEGINNINGS

Solar village project evolved out of a six-year Higher Education Link (HE-Link) programme completed in the early 1990s. This initiative was funded by the DFID-UK (now known as FCDO) and administered by the British Council to facilitate professional mobility between two countries. Professor I M Dharmadasa (Dharme) initiated and coordinated between his employer, Sheffield Hallam University, and several Sri Lankan Universities (Peradeniya, Colombo, Moratuwa, Kelaniya & Matara). This link’s primary objective was to establish and collaborate on solar energy conversion research in Sri Lankan universities and promote the renewable energy applications in the country. As a result of this work, a national and regional network known as SAREP (South Asia Renewable

Energy Programme) was formed, which continues to self-sustain these activities. These public engagement efforts resulted “Solar Asia” conference series and the “Solar Village” project.



Conferences organised during the HE-Link programme were supported by the British Council, British High Commission in Sri Lanka, Science & Technology Ministry and Five local Universities.

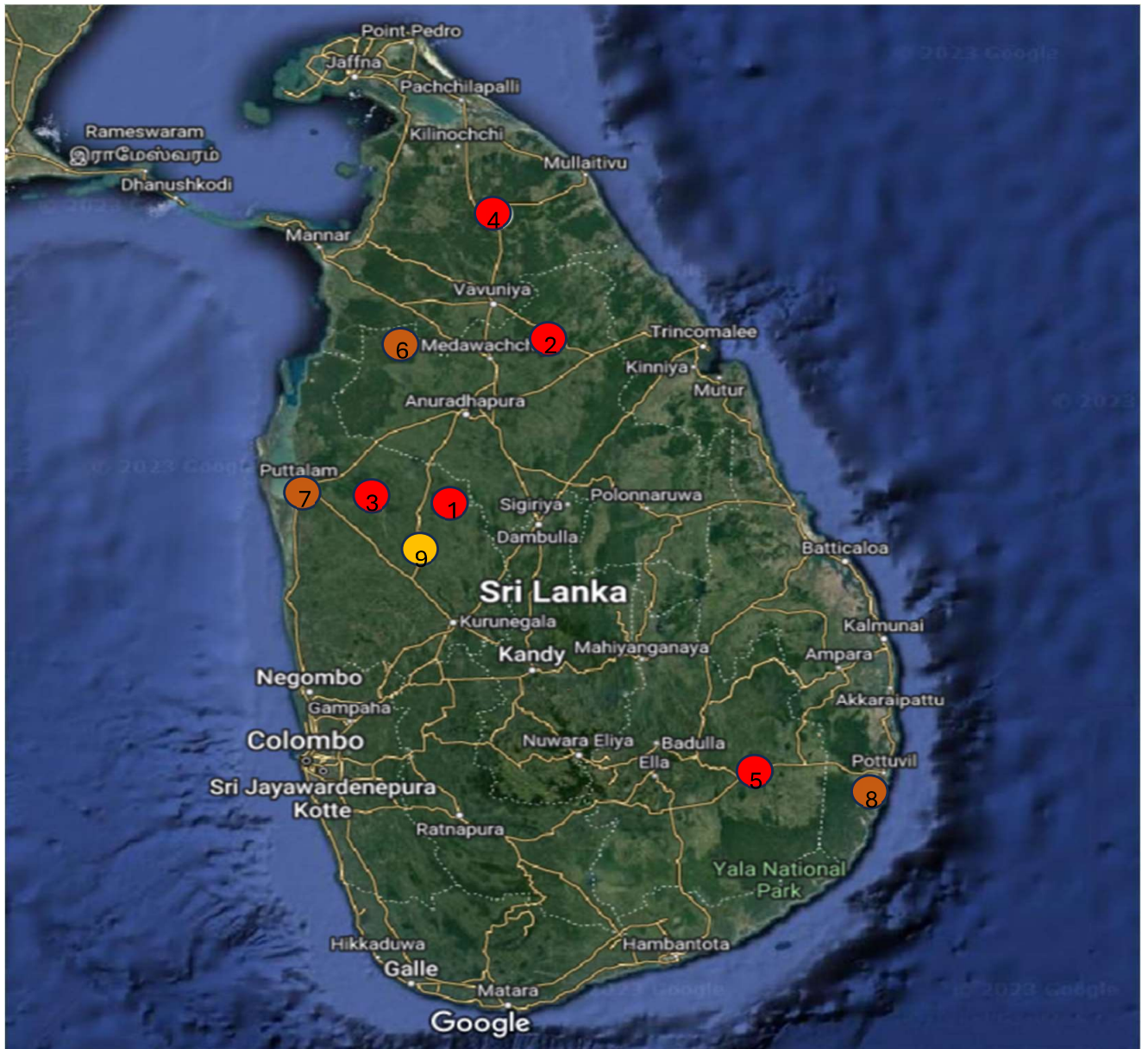
3. THE PROJECT SITES SO FAR

(a). Already Established Projects

Five solar villages have been established in **Kaduruwewa, Pulmudai, Nochchiya, Puthier Nagar, and Monaragala** thus far. On average each solar village cluster has about 1000 inhabitants. These five solar villages were made possible by individual contributions, corporate donations and two UK based charitable organisations, APSL-UK and Hela Sarana. Monaragala solar village was established to celebrate 25th-anniversary of the Hela Sarana charity in the UK.

The choice of the sites was selected based on several factors, such as lack of clean drinking water, non-availability of common facilities, threat of school closure due to various reasons, and the poverty level of the inhabitants.





- Existing: 1 Kaduruwewa 2 Pulmoddai 3 Nochchiya 4 Puthiya Nagar 5 Monaragala
- Forthcoming with possible charitable funding: 6 Panama/Ampara
- Forthcoming with APSL UK Funding: 7 Mediyawa/Maho

THE PROJECT SITES TO DATE

(i) KADURUWEWA in Kurunegala District

Pilot solar village project was first started in 2008, to safeguard the closure of the primary school in this village cluster. This school was built by the village community by Sramadana (Voluntary work) and ran for fifty years without electricity and tap water. The

village is in the dry zone and many teachers did not like to work there due to poor facilities. As a result, the student numbers reduced to about 20 and the Government decided to close this school in 2007.



In order to save the school, the Solar Village project leader, Prof. Dharmadasa, with his own funds, arranged to provide the electricity from the national grid and replaced the diesel-powered water pumping system of the village by a solar-powered water pumping system. This removed the sound pollution and CO₂ emission improving the living environment. Through this arrangement the school received free tap water and the villagers saved a considerable revenue used to buy imported and expensive diesel in the past.

This was the wealth creation step for the community, and with this empowerment people worked together to develop their community. Encouraged by this, several other donations were made, and the school turned into a very active school in the village cluster.

Through the APSL scholarship programme, three primary school children were awarded scholarships, until they enter the university, if they performed well in their GCSE and Advanced level examinations. Student number rapidly rose to about 85 and the villagers built a library building and a classroom within the first year of the project. Most of the work was completed by voluntary work from the villagers in addition to some donations.



The project leader visits this village every year for monitoring the progress, and guide the teachers and the village community for rapid development. It has been a common practice of the project leader to present educational material and motivation certificates

to needy children. This school is now performing extremely well and produce over 60% pass rate from their annual year-five scholarship examination results. In 2023, this school was ranked second place out of 186 primary schools in the region.



The economic development of the community has been impressive. People have improved their standard of living, and the environment has been enhanced due to tree planting projects.

The project leader has worked with a government Ministry and distributed 100,000 Tom EJC mango plants. This new variety is suitable for export, bringing extra income for the villagers. A few hundred Bee-hive boxes were also provided to the surrounding area. Active beekeeping also Improved agricultural crops in the area due to enhanced pollination.



Most of the developments in the pilot solar village was around the primary school of this village cluster, saving the school for future generations. The community also improved their standard of living in all aspects saving funds from the distribution of water. The submersible water pump broke down after eight years, but the VDC had enough funds saved to update and expand the system to cater for an increasing number of customers.

THE PROJECT SITES TO DATE

(ii) Pulmudai

This project was funded by a generous retired professional, who heard about the pilot solar village. He contacted the project leader, came to meet him, and said he has allocated Rs 15 Lakhs from his pension fund for the next solar village. He also mentioned that this solar village must be in the conflict affected area in the North to repair damaged infra-structure. This was a unique practical project for reconciliation, and it was established, coordinated, and monitored by this anonymous donor from the Sinhalese community.

THE PROJECT SITES TO DATE

(iii) Nochchiya

It has taken a long time to raise funds for establishing solar villages. After a presentation given by the project leader in London, Hela Sarana, a UK based charity, expressed interest in supporting this project. At this point APSL-UK, another UK based charity, joined Hela Sarana, to jointly fund the next solar village. It was also hard to find a suitable local coordinator and a site from Jaffna or Batticaloa area. Failing these efforts, Prof. Dharmadasa proposed to establish the next solar village at Nochchiya. These villagers heard about the pilot solar village, a few people visited the Kaduruwewa water pumping site, and sent a letter to the project leader asking for a similar project for their village also. This letter came with 104 signatures from the village community. Nochchiya was a poor village without clean drinking water and facing elephant-human conflict. This site was therefore selected for the third solar village project.



After meeting the village community, and explaining the concept of the solar village project, a 7 kW solar roof was installed. By this time the local government had installed a water purification system, and villagers built a suitable roof for the installation of solar panels. In 2017, this solar roof cost about Rs 18 Lakhs, and this cost was shared by the APSL-UK and Hela Sarana charities. This solar village also named as the “Raja Meehitiya Memorial Solar Village” to remember the first Hela Sarana president, late Raja Meehitiya. The solar roof was connected to the national grid under “Net-Plus” scheme, and the CEB

paid the VDC for the total power produced by the solar roof. This is the wealth creation step arranged for the Nochchiya solar village.



Prof. Dharmadasa visited this solar village every year except during the Covid period, and on each occasion held meetings with the village community and distributed educational packages with motivation certificates to encourage the children. Two APSL scholarships were also awarded to two children in this village.

In this village community, there are two water pumping systems with electricity from the national grid. Part of the revenue from the CEB was used to pay the electricity bills for water pumping and purification. Since the surrounding villages had chronic kidney disease, the Nochchiya water purification centre started selling clean drinking water to about eight surrounding villages, for a nominal fee. These two methods accumulated considerable revenue in the VDC account, and the committee started micro-credit facilities to villagers to start new development projects. At present the VDC has improved their income and saved over Rs 60 Lakhs in their account. Out of these Rs 50 Lakhs has been deposited in a fixed deposit to earn further income.



In addition to the above savings, the community has worked together to remove their old community hall and built a new and better community hall. At present they are building an office and a library for the village next to the installed solar roof. Their aim is to install

another solar roof on the new building with their own funds. This is an ideal example for other villages on sustainable development improving the facilities in villages.



In February 2024, the project leader visited the Nochchiya solar village with a generous donor to Solar Villages, Mr Gamini Jayasinghe who is a Sri Lankan living in the USA, and another donating family from the UK. About two miles to their village was an un-tarred road full of potholes and which was impossible to access by vehicles. During the same month, this community organised a sramadana activity, collected about 300 people, hired tractors and other machines to repair the road.

Such further activity was a testament to the generosity of Sri Lankan villagers. There was a large white board with a list of names and various donations from the Nochchiya villagers. When they have a special occasion like a birthday or an anniversary, they donated cash amounting few thousands of Sri Lankan rupees to the VDC account. Thus, the surrounding villagers could have clean drinking water free of charge. We were all delighted to see that kind of generous activities to look after neighbouring village communities. During the visit, we interviewed a few villagers about their observations of the development. They were very positive and when asked about kidney disease, they mentioned that there were several cases in each village, but after providing clean drinking water, there have been no new cases. We learned from this experienced and passed on this knowledge to other solar village communities.

THE PROJECT SITES TO DATE

(iv) Puthier Nagar

“We Sri Lanka” is another project within APSL-UK to help and support reconciliation among Sri Lankans living in the country and outside. As a practical project, a solar village was established in the ethnic conflict afflicted area, Puthier Nagar. Mr Gihantha Jayasinghe is leading this project, and the APSL and FOG (Foundation of Goodness) jointly completed this project. Mr Jayasinghe also visited this village to meet the VDC

members, monitor progress and guide them with solar village concept for their sustainable development.



Mr Gihantha Jayasinghe, Programme Lead, APSL WE SRI LANKA visited the WE SRI LANKA Solar Village in Puthiya Nagar in February 2024 along with Mr Arnold Jenoson of the Foundation of Goodness (FOG), Sri Lanka. During the time of this visit, women in the village were receiving education on prevention of cervical cancer at the Community Centre from a mid-wife of the local health system. Afterwards, Mr Jayasinghe consulted the VDC Chairman and members present about how income generated from the solar roof could be reinvested. During the productive conversations that followed, village needs were prioritised for evaluation and costing by FOG. FOG has now discontinued their training programmes at Puthiya Nagar because take-up has been low. However, FOG will continue to assist APSL in liaising with the VDC for the sustainable development of the village.

THE PROJECT SITES TO DATE

(v) Monaragala

Hela Sarana is another UK based charity, performing numerous projects in Sri Lanka. They have started this organisation in the mid-1990s and celebrated their 25th anniversary in early 2020s. To mark this event, they decided to establish a solar village in Sri Lanka. After selecting the colleagues at the Faculty of Technology, University of Colombo, the site at Monaragala was selected. Completion of this project took nearly a year, due to Covid-19 and Mr Lelie Dep is coordinating this solar village.

The school selected has about 200 pupils but there was no reliable water supply to the school. In order to help this situation, a 5 kW solar roof was installed within the school premises, and connected to the national grid under “Net-Plus” scheme. A VDC has been established and the revenue from the solar roof is the wealth creation step for this solar village. VDC has been advised to use 30% of the income towards the water supply and other activities like prize giving etc. in the school, and the remainder towards development projects in the community. In parallel a water pumping system was established separately using the electricity from the grid.



CURRENT PROJECTS

(vi) Mediyawa

The network established within Sri Lanka during the HE-Link programme is self-sustaining and works to promote renewable applications in the country. Six senior members of this network are also completing charitable projects in Sri Lanka with various donations. They came across two different suitable sites for solar villages, and one is a Mediyawa village close to Maho. The main issues of this community are the elephant-human conflict and poverty levels. Two people have been killed by the elephants and one of them was a student preparing to enter University. The community was very anxious and desperate for their safety from elephants and requested an electric fence to protect them. We are mindful of the need for humane resolution of human animal conflict. Since this is not a wealth creation method for the community, a solar powered electric fence and a 5-kW solar roof was planned for this village cluster.

Funds required were raised via a “GoFundMe” platform, established by Ms Paola Bethmage and the project leader, and with a raffle organised by Dr. Anuradha Samarasinghe. Dr. Samarasinghe, a GP in the UK is coordinating the Mediyawa solar village project.



First visit to Mediyawa by the project leader to meet community leaders and look for a suitable community building.

During the Jan/February 2024 visit, the project leader made a short visit on 7th January to Mediyawa to find a suitable place for the 5-kW solar roof. Their existing community hall is suitable for this purpose. Furthermore, on 14th January, he visited Mediyawa village to meet many community leaders to fully explain the solar village project. Three members from the local team also travelled to Mediyawa to take part in this meeting. Establishing this solar village is currently in progress.



On 10th November 2024, the 5 kW solar roof was installed on a community building in Mediyawa village.

CURRENT PROJECTS

(vii) Sobithagama

Sobithagama is a new village created to settle Tsunami affected, and conflict affected people. This village is situated about 16 miles from Anuradhapura along the Tantirimale road. Their initially settled homes are very small, and education and health facilities are not available. Most of the families are involved in agricultural activities, thus sudden severe droughts or floods destroy their livelihoods. During a severe drought, the Buddhist monk who is developing this village requested donations to prepare an agro-well in order to grow vegetables around it. The local team member forwarded this request to us, and this village was selected as a suitable site to develop a solar village.

On 8th January 2024, both the project leader and a family from UK visited the village and met the Rewatha Thero who is currently developing this village. He kindly showed us the village and explained the dire situation there. At the end of these discussions, the family from the UK who were on holiday decided to sponsor this solar village. During this visit a

5-kW solar roof, solar water pumping system for the agro-well and the support to build the hospital roof were discussed. As the first step of this support, the arrangements are taking place to install a 5-kW solar roof on the roof of the building with a water purification system.



Visit to Sobithagama in February 2024 by the solar village team members to meet the VDC members and other community leaders.

NEW PROJECT

(viii) Panama

This is a very large community consisting of Sinhalese and Tamil people. There are three schools in this community: Sinhala Primary, Tamil Primary, and a common Secondary school. This project assists “reconciliation” and develops the community in a sustainable way using solar energy to reduce poverty and aids all Sinhalese and Tamil people in this community to live in harmony.

This project aims to install three 5-kW solar roofs in the three schools and connect to the national grid using latest scheme available in the country. The total energy produced by the solar roofs will be fed into the grid and CEB (Ceylon Electricity Board) will send a quarterly cheque to the VDC (Village Development Committee) bank account. These funds need to be managed by the VDC with full transparency to develop nurseries, schools, libraries, and the community. With APSL-UK Solar Village team’s guidance, and the local coordinators’ support, the project will strive to empower an equal gender balanced VDC and develop all aspects of this community. The project will be supervised by Brother Charles and his team.

The UK family visiting Sri Lanka on a holiday, visited the Panama village on 2nd January 2024, to have a look around and speak to some people in the community. After seeing the poor teaching facilities in one of the schools, they purchased and arranged to deliver 11 green boards to that school. With an introduction from this family to another charitable foundation, the project leader submitted a proposal, and it was approved. The work is continuing to install three 5-kW solar roofs on the three-school premises.



Project sponsors visiting Panama village on 2nd January 2024, and three head teachers meeting to prepare for the project.

As a preparation for these installations, three Head teachers have met to arrange a letter to the regional Education Director to get permission to install three solar roofs on three schools and organise a community meeting to establish a VDC for the Panama solar village.

(ix) Kanatholuwa

This is a very poor community in Kurunegala district, and the NSF has selected this village for development. In February 2024, the Chairman of the NSF, Professor Ranjith Senaratne arranged a special meeting to introduce Dr Vinya Ariyaratne, Head of Sarvodaya to Professor Dharmadasa so that this village cluster can be developed in collaboration with them. Since then, Sarvodaya organised a 3-day “sramadana” camp in this village. Following an appeal made by the solar village project leader to PV companies in Sri Lanka to donate 5 kW solar roofs to develop solar villages, Reagen Renewables Ltd kindly donated a solar roof from their CSR (Corporate Social Responsibility) funds. The work is continuing to establish this solar village, and it is anticipated that more PV companies in Sri Lanka will join in to support similar projects.

FURTHER PROJECTS PLANNED

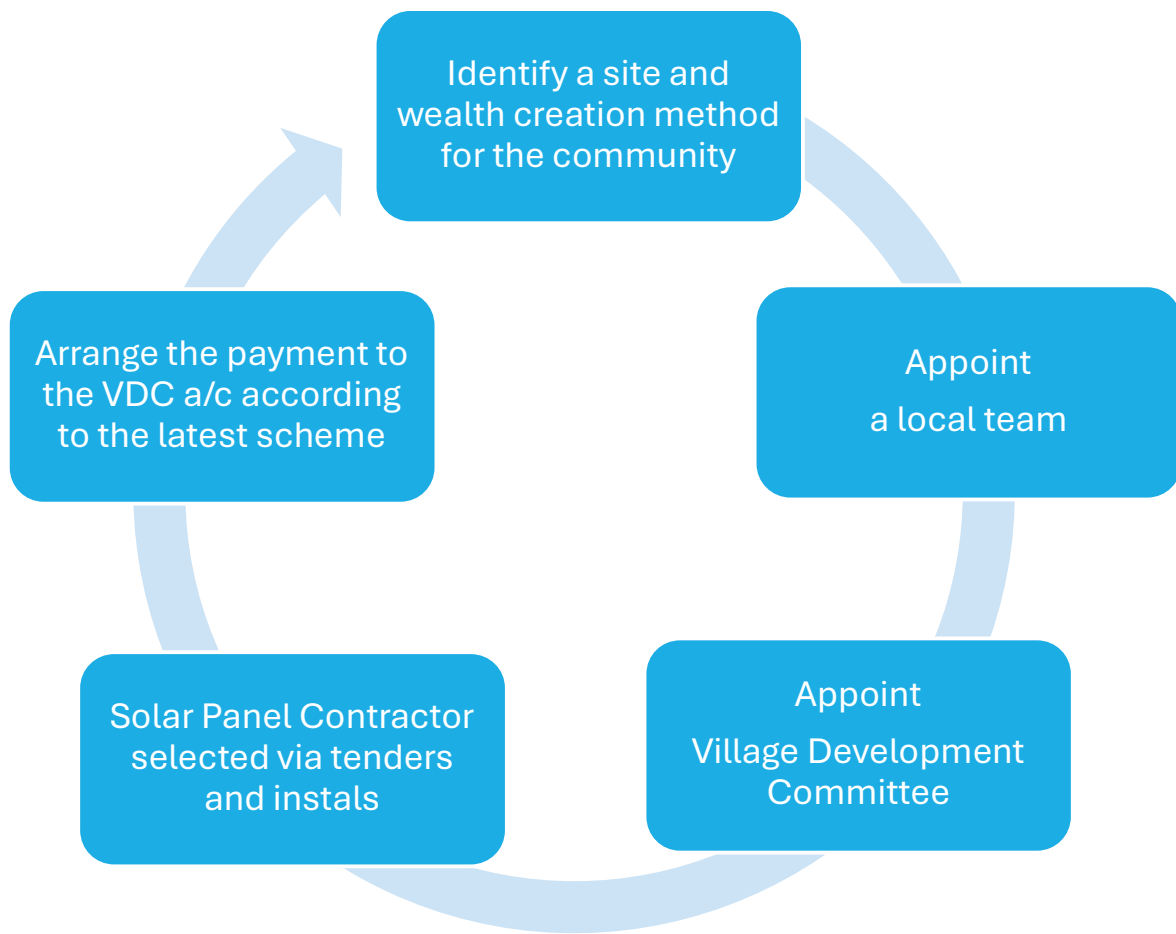
(x) Jaffna, Puttalam, Batticaloa, Medagama etc ...

Discussions are taking place to identify suitable sites and local coordinators in Jaffna, Puttalam, Batticaloa and Medagama villages. While fundraising is necessary to start these projects, the project leader is encouraging some villages to install solar panels using a “Crowd Funding” method.



Solar Villages 4 SDG

STEPS TO ESTABLISHING A SOLAR VILLAGE



Solar Villages 4 SDG

14 STEPS TO ESTABLISHING A SOLAR VILLAGE

1. The local project team selects a needy community to support sustainable development using solar technology.
2. A funder is identified, or funds are raised for the purpose of establishing the project.
3. A key person from the local project team explains the aims of the project to the community at say the village school. “Empowerment” and sustainable development is explained, and the engagement of the community is sought.
4. A Village Development Committee (VDC) is established. In Sri Lanka, most villages have a “Grama Sanwardhana Samithiya”. This may be converted to a VDC and other community leaders in the village, the principal of the village school and teachers may be added. 50% female participation in the VDC Is encouraged.
5. The VDC opens a Bank account to manage the project with two signatories. All project income generated is paid into the Bank account, for the village development projects.
6. The local project team, and the funding organisation prepare a scheme of “wealth creation” structure to assure a regular income for the community. E.g. Installation of a solar roof under the “Net Plus” scheme provided by the CEB. Net Plus Scheme enables total power generated by the solar roof to be fed to the national grid, and CEB pays the VDC bank account.
7. VDC members with help from the local project team, identifies the best location for a solar roof, to comply with the requirements of the CEB. [The solar roof becomes the common property of the VDC/community].
8. The project team obtains three tenders for the supply and installation of the solar roof system from solar companies and submits these to the funding organisation. The funding organisation selects from the tenders based their credentials, cost and after sale service, and enters into a formal contract with supplier.
9. The payment terms agreed is paid to the Contractor by the funding body in stages until final completion. All supervision and certification of work completed is carried out by the VDC.
10. VDC manages the income generated transparently with accountability, applying them to development projects in the community (e.g.: to support the school, to develop a nursery, provide micro-credits to community members, develop the library, etc...).
11. The VDC prepares a statement of accounts of all the projects which are made available for auditing.
12. The local project team monitors progress with the community and VDC providing guidance for the rapid development and any new developmental projects.
13. The funding organisation requests an annual report from the VDC regarding the development projects/activities with an annual statement of account.
14. The local project team disseminates outcomes and impact of the project for wider publicity and growth of solar villages elsewhere.

VII. MEETING SUSTAINABLE DEVELOPMENTAL GOALS



1. No Poverty,
2. Zero Hunger,
3. Good health and well-being,
4. Quality Education,
5. Gender equality,
6. Clean Water and sanitation
7. Affordable and clean Energy,
8. Decent work & Economic Growth,
9. Industry, Innovation & Infra Structure,
10. Reduced inequalities,
11. Sustainable communities,
12. Responsible consumption & production,
13. Climate Action,
14. Life below water ??
15. Life on land,
16. Peace, justice and strong institutions??,
17. Partnership for the goals

(Solar Village projects fulfil at least 14 out of 17 SDGs)

VIII. FUNDING REQUIRED

The initial five solar villages were established using personal donations, and contributions from two UK charities, APSL UK and Hela Sarana. Initiation of each solar village cost between 1-3 million Sri Lankan Rupees (~£3000 - ~£6000), depending on the nature of the project. When the new technologies are introduced, there are numerous issues to solve at the Technology/Society interface. The project team has accumulated a wealth of knowledge during the establishment of these first five solar villages and is now working to attract funds from various funding bodies.

The funds for the solar village in Panama have been secured from an international charity, Helios Renewable Energy Foundation. The project team is working to rapidly expand the number of solar villages in the future with corporate and institutional funding as well as through charitable fundraising. The ability to initiate four new solar villages in 2024 shows the growing interest by many organisations, and a good sign for rapid replication of this project.

Although the name “Solar Village” is used for convenience, this project can be modified to develop urban areas too. “Crowd Funding” is a possible method especially in urban communities to spread PV roof top project throughout the country. For example, the lowest cost of a 5 kW solar roof at present is Rs 10 Lakhs. If this amount is deposited in a Bank with 10% interest, the gain will only be Rs 8,333 per month. However, if this amount is used to install a 5 kW solar roof, it will produce 500 – 600 kWh per month. With the current rate of Rs 37 per unit, the minimum income will be Rs 18,500, more than double the interest earning capacity by savings. The Rs 10 Lakhs can be easily raised within the community in a shared project. This is known as “Crowd Funding” and this is how the solar applications were popularised in Germany in the past.

IX. PREVIOUS PRESS COVERAGE

There are numerous articles written on this project, and some of these can be found in the APSL-UK website (www.apsl.org.uk) for more details.

1. Numerous articles, newsletters, renewable energy handbook, posters, TV interviews and videos at: <https://dharmesblog.wordpress.com/>

2. Monaragala Solar Village article at:
<https://dharmesblog.files.wordpress.com/2022/02/monaragala-solar-village-write-up-1-ld-002.pdf>

3. Transforming lives of people using Solar Villages at:
<https://dharmesblog.files.wordpress.com/2021/09/transforming-lives-using-solar-villages-revision2.pdf>

4. Main steps of establishing a Solar Village at:
<https://dharmesblog.files.wordpress.com/2022/02/main-steps-to-establish-a-solar-village-project.pdf>

5. Performance of solar roofs in Sri Lanka at:
<https://dharmesblog.files.wordpress.com/2021/10/performance-of-solar-roofs-in-sri-lanka-2.pdf>

6. Next Generation Multilayer Graded Bandgap Solar Cells, A.A. Ojo, W.M. Cranton and I.M. Dharmadasa, Monograph published by Springer, August (2018). ISBN 978-3-319-96666-3.

X.FREQUENTLY ASKED QUESTIONS (FAQ's)

Q1. What is the full cost to set up a Solar Village in Sri Lanka?

Our current model uses a 5 kW solar roof under the NET-PLUS scheme to create a continuing income stream for the selected community. The total cost of this system in Sri Lanka today is Rs 1,200,000 (~£5000). This covers Solar panels + DC to AC Inverter + Associated electronics + Travel & labour costs of installation.

Q2. How many years will it be, before the initial cost is recovered?

The simple financial payback period of a solar roof in Sri Lanka varies in the range 3.5 – 6.0 years depending on several factors. The power outputs produced by the solar roofs depend on several extrinsic and intrinsic factors. The direction of the roof, angle installed, shading effects and climatic conditions of the area are some of the external factors. Intrinsic factors such as the properties of the solar panels and components used also contribute to the outputs depending on the manufacturer. For more details, see reference [5] above.

Q3. What are the likely maintenance issues?

There are no moving parts involved in a solar roof, and hence the wear and tear and maintenance is minimum. The only issue is the gradual reduction of the power due to settling down of dust, leaves and bird drops on top of the solar panels. Rain will naturally wash some of these away, but stubborn materials can be washed off using a soap solution and a hose pipe. The top surface is a thick glass plate; hence it can be cleaned as necessary. Frequency of cleaning depends on the surrounding environment. For example, in a dusty environment cleaning may need more frequently, but in a clean environment cleaning may not necessary for 4-5 years.

Q4. What is the cost of maintenance?

Cost of maintenance is nil/zero other than routine cleaning of the solar panels. The guarantee for the DC to AC Inverter is only 10 years, mainly due to failure of electronic components used in these. The 5kW single phase inverter would cost around Rs. 375,000 (~£1,690).

Although the manufacturers' guarantees are given for solar panels and the inverter, there is no insurance cover for the whole system at present. Therefore, project initiators encourage and advice the VDC to put aside some savings for future use. For example, in the pilot solar village, the DC water pump, with moving parts needed replacement after eight years of working. At that point the VDC had adequate funds saved to replace the water pump and upgrade the system to cater for increased customers.

Q5. How do the solar panels work and how long will they last?

Sunlight consists of ~48% light (UV and Visible) and ~52% heat energy (Infra-Red radiation). The individual cells in a solar panel consist of rectifying junctions like p-n or p-i-n diodes, with strong internal electric fields. These diodes absorb light photons with energy greater than the bandgap of the semiconductor used, create charge carriers (electron-hole pairs), separate them before they recombine and send to the external circuit as a direct current (DC). To harvest the whole solar spectrum (both light & heat (IR)), graded bandgap multi-layer solar cells are under intense research at present [6].

Companies provide silicon based solar panels exist in the market today with a 20-year guarantee, but these can work beyond 30 years.

Q6. Can additional units be added to increase the capacity?

This is possible but depends on the capacity of the inverter used in the system. If the anticipated increase of capacity exceeds the limit of the installed inverter, a new inverter with higher capacity must be used.

This is when “String inverters” (all power produced from solar panels pass through this inverter) are used. New solar panels are produced with “micro-inverters” (small capacity inverter for individual solar panel). If these solar panels are used, capacity can be increased simply by increasing solar panels.

Q7. Are there relevant Sri Lanka Government Regulations?

According to the Soorya Bala Sangramaya (battle for solar energy) programme, a solar roof can be connected to the national grid using three established methods, according to consumers preference.

(a) Net-Metering: Consumers have option to consume energy produced and feed the excess energy to the national grid for future use.

(b) Net-Accounting: Consumers have option to consume energy produced and sell the excess energy to the national grid and receive an income from CEB (Ceylon Electricity Board).

(c) Net-Plus: The total energy produced by the solar roof is fed to the national grid, and a regular payment is received for the whole amount from CEB. During the first 7 years, CEB pays Rs22 per unit (1-kWh), and next 13 years, payment will be Rs15 per unit.

For the five Solar Village projects in the past, we used “Net-Plus” scheme as a preferred first income generation step.

However, a recent policy change introduced a new tariff system paying Rs 37 per unit, for a period of 20 years. This is a better income generation for new solar roof owners, but for the previously installed systems, old contracts remain the same.

Biography of the Project Leader

I.M. Dharmadasa, PhD, is an Emeritus Professor at Sheffield Hallam University in the United Kingdom. He is an alumnus of the University of Peradeniya in Sri Lanka, where he earned a BSc Hons with a 2.1 class in Physics, Chemistry, and Mathematics in 1972, and a BSc Hons with First Class honours in Physics Special in 1975. In 1977, he was awarded an open Commonwealth scholarship, allowing him to complete his PhD in Solid State Electronics at the University of Durham, UK.

He has five decades of university lecturing experience and four decades of active research in solar energy conversion. While most of his research has been conducted in academia, he has also worked in industry with British Petroleum Solar's Apollo project, focusing on the scaling up and commercialization of CdS/CdTe thin-film solar panels. His research primarily aims to develop next-generation, low-cost, and high-efficiency solar cells using electroplated semiconductors, with recent efforts concentrated on graded bandgap multi-layer solar cells. He has published over 260 articles, holds six GB patents, and authored two books: "Advances in Thin Film Solar Cells" and "Graded Bandgap Multi-Layer Solar Cells." Additionally, he has edited a book on "Advanced Thin Film Materials for Photovoltaic Applications." Throughout his career, he has successfully supervised 30 PhD students, conducted 14 years of postdoctoral research, and examined 33 PhD theses.

Professor Dharmadasa has served as a reviewer for 12 distinguished journals in his field and is currently on the editorial board of three journals. He has also been an assessor and panel member for several prominent organizations, including EPSRC-UK, British Council, CSC, DTI-UK, and the Solar Energy Panel of the European Commission, each for a minimum of six years. He currently serves as an assessor and panel member for the Queen Elizabeth Commonwealth Scholarships. Additionally, he has advised on renewable energy projects for countries such as Germany and Chile. A Chartered Engineer and Fellow of the Institute of Physics in the UK, he holds dual citizenship in Sri Lanka and the United Kingdom and resides in the UK.

Over the past three decades, Professor Dharmadasa has been actively promoting clean energy for sustainable development and poverty reduction. In 2008, he designed and piloted the "Solar Village" project in Sri Lanka, which he has monitored for several years and which he is now replicating. To date, five large solar villages have been established, with further replication underway. More details can be found at:

<https://www.gofundme.com/f/Help-us-build-resilient-communities-in-Sri-Lanka>



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