



Across the Nation.

Promoting
Sustainable Biomass
Energy Production
and Modern Bio-Energy
Technologies



Ministry of Power and
Renewable Energy



Food and Agriculture
Organization of the
United Nations



SRI LANKA
SUSTAINABLE ENERGY AUTHORITY



Empowered lives.
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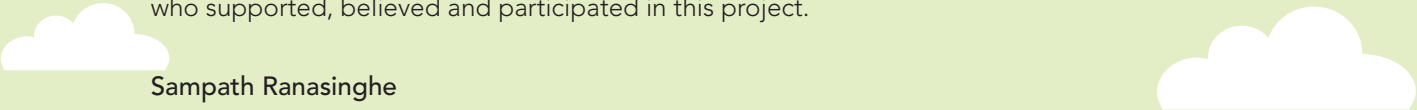
I would like to thank Ms. Nina Brandstrup, FAO Representative, Sri Lanka and Maldives, and Dr. D. B. T Wijeratne, Assistant FAO Representative, Ms. Roshini Gunaratne, Programme Officer, and all the international and local supportive staff of FAO for sharing their knowledge and experience in implementing this nationwide project.

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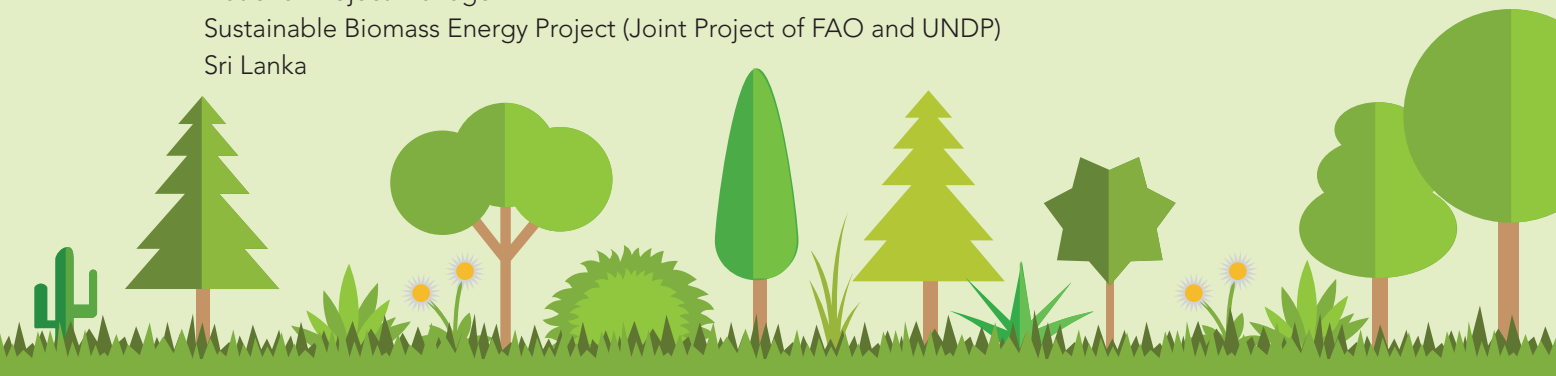


Sampath Ranasinghe

National Project Manager

Sustainable Biomass Energy Project (Joint Project of FAO and UNDP)

Sri Lanka





The PROJECT:

Promoting Sustainable Biomass Energy



Implemented in 2013, the “Sustainable Biomass Energy” project was undertaken by the Global Environmental Facility under the Sri Lanka Sustainable Energy Authority (SLSEA), the Ministry of Power and Renewable Energy, and spearheaded by the FAO and UNDP. The primary goal of the project is to reduce greenhouse gas emissions from the use of fossil fuel for thermal energy generation in the Sri Lankan industrial sector. The goal will be reached by means of removing obstacles to the realization of sustainable biomass plantations, increase market share of biomass energy generation, and the adoption of biomass based energy technologies in Sri Lanka.

The four main components of the project are 1) policy institutional support for effective fuel switching using fuel wood, 2) barrier removal for sustainable fuel wood production, 3) enabling environment for fuel wood suppliers, and 4) wood based energy technology development under the said project.

This five-year energy project works across the fuelwood value chain, tackling barriers for the wider adoption of modern biomass technologies from systematic growing of fuelwood species to mechanized harvesting and preprocessing, transport and storage to the efficient use for industrial processes. Additionally, this initiative supports the conservation of existing forests while meeting the wood energy demand for industries.

Under component 4, the project supports small, medium and large scale industries to become sustainable businesses through the adoption of modern biomass technologies. Large scale industries include hotel chains, estates and plantations, and manufacturing plants etc., and small and medium scale industries include home-based businesses, cottage industries, rural enterprises and entrepreneurs who benefit through technologies that can accelerate production and improve quality.

SUPPORTING ORGANIZATIONS

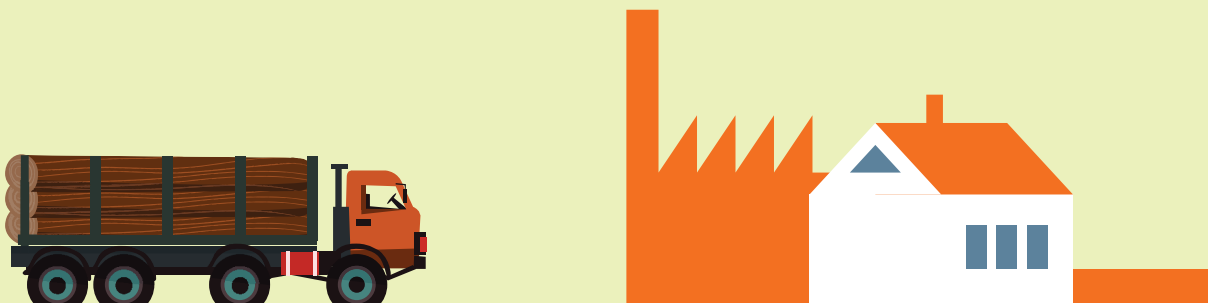
The project has supported 26 organizations; large scale, SMLs, governmental and non-governmental, to switch to biomass energy by way of providing financial and technical assistance. The total GHG savings from the 26 organizations switching to biomass energy is 539 ktCO₂e over 10 years. The applications of these modern biomass technologies cater for the thermal requirements of a large cross section of the industries in Sri Lanka and have been demonstrated in the following sectors: tea, spice, rubber, pepper, accommodation, food, beverage, etc.

The project worked closely with local technology manufacturers that could match the requirements of the SMLs mainly being that the equipment was easy to operate, maintain and scalable. This also allowed women entrepreneurs to easily switch to these biomass technologies. The scalability of the equipment gave the SMLs the flexibility to invest in phases to match their budgets and capacities and to add more equipment as and when production grew.



The OBJECTIVE:

Introducing Fuelwood Growing Models and Modern Biomass Technologies in Sri Lanka



To accommodate scalability, the piloted equipment was modular in nature or had the flexibility to be manufactured to custom specifications.

A survey conducted by this project has found that the availability of biomass in home gardens, plantations, farms and agro-forestry systems is much higher than what has been estimated. Additionally, to support the use of biomass energy, many Model Fuelwood Plantations have been set up under the Forest Department, Rubber Research Institute, Coconut Cultivation Board, and smallholders and home gardens through CBO/NGOs. These model plantations are intended to create a sustainable fuelwood supply for industrial and domestic use. A total of 1000 hectares throughout the island was established as pilot fuel wood growing models including the following: intercropping in cash crops, shade trees for plantations, protection of sloping agricultural land, live fencing, short rotation monoculture, etc.

SLS 1551 CERTIFICATION

To support and trace back to sustainable supply of biomass the project developed a Sri Lankan standard SLS 1551: Principle criteria and indicators for sustainably produced fuelwood. A certification scheme was developed and a team of auditors have been trained by the project to carry out certification of sustainably produced fuel wood.

BIOMASS ENERGY TERMINALS

Three biomass energy terminals were established by the project in Colombo, Monaragala and Kurunegala by way

of financial and technical support. The function of these terminals is to collect sustainably produced fuelwood, improve quality and process the wood according to the requirements of the end user. The locations for the terminals were strategically placed based on a study carried out by the SLSEA on biomass resource availability and demand. As such the terminal in Monaragala will be supplying to the tea factories in Badulla and Nuwara Eliya, the terminal in Colombo will supply biomass to the export processing zones in Biyagama, Avissawella and other industries in Colombo, and the terminal in Kurunegala will be supplying biomass to the industries mainly in Kurunegala.

The terminals have the capability of producing wood logs, split wood and chips, being the most popular form of biomass energy used in the industry, which can be fed directly into boilers, heaters and other thermal generators. The terminals in Colombo and Monaragala have the capacity to produce 40 MT per day and the terminal in Kurunegala has the capacity to produce 80 MT per day.

SUSTAINABLE DEVELOPMENT GOALS

The project has also contributed to the Sustainable Development Goals set by the United Nations. The SDGs cover a broad range of social and economic development issues. These include poverty, hunger, health, education, climate change, gender equality, water, sanitation, energy, environment and social justice. The relevant goals achieved at each pilot site is highlighted.



EMPOWERING WOMEN THROUGH MODERN BIOMASS TECHNOLOGY



INTRODUCTION

Located deep in the south of Sri Lanka, Tangalle is an important hub for deep sea fishing with a thriving local dry fish industry. With fish being an easy source of protein, it is considered to be a staple diet of the average Sri Lankan with many opting for dried fish for its unique taste.

Therefore, while most of the fish is sold fresh daily in the market, much of it is also dried, packeted and sold via retailers.

However, unlike drying of other consumables, the process of drying fish is long and time consuming, subject to environmental hazards, unhygienic conditions and prone to contamination.

In 2016, through the assistance of the **Sustainable Biomass Energy Project**, modern biomass dryers have been given to communities working with the Sri Lanka Human Foundation to help them improve and sustain their home businesses while yielding higher benefits.

CaseStudy

For nine women, the sale of dried fish is their only source of income. They buy fresh fish daily from the boats and prepare them for drying in the backyards of their homes. After the fish is sliced, cleaned and salted, it is placed on mats in the open air. On a good sunny day, the fish would take 10 hours to dry. During the rainy season, this procedure had to be stopped, depriving them of their daily income.

Sunethra Marasinghe is the Value Chain Director of SABAH, the SAARC Business Association of Home Based Workers that helps women entrepreneurs. In 2016, Marasinghe approached the **Sustainable Biomass Energy Project** through 'SABAH' and was given a 40 kW dryer. Since then, she confirms that the production has increased and the quality has improved substantially.

Impact and Sustainability

BEFORE		AFTER	
Drying process minimum	10 hours	Drying process maximum	04 hours
Subject to harmful contaminants		Clean and eco-friendly	
200 kgs of fish per month		800 kgs of fish per month	
Depended on sunlight		Can be used in any weather condition	
Cannot be up-scaled due to space issues		Less space needed Free from harmful CO ₂ pollutants Free source of wood chips from nearby timber store	



Sunethra is surrounded by a handful of young dynamic women in the backyard of the local community center.

As they get to work, two of the women scale and slice the fish in half, while a couple more soak the fish in salt and prepare it for the dryer.

"Before we got this dryer, we would not be able to dry fish today," she says scanning the darkening skies. "This type of adverse weather would have prevented us from drying fish today."







LESSONS LEARNT

During the rainy seasons, it was almost impossible to dry the fish and as a result, much of the fish would be discarded due to spoiling. This would result in the loss of income and unrecovered expenses which was hard on their monthly incomes. As many of these rural womenfolk have already taken out loans and are unable to feed their families without a daily consistent income, it is imperative that they manage to sustain their business without additional expenditure.

The introduction of the biomass fuel dryer has helped these women tremendously. It is easy to operate, consumes fuelwood/wood chips which is sourced from the nearby timber store at no extra cost, and can be operated under any weather conditions.

During off season, when the boats cannot go out in rough seas, the dryer is used to dry chillie, pepper and cinnamon, ensuring the women have a steady income.



Technology 	Dryer 
Application	Production of DRY FISH
Output	 1200 kg/day of fish per month
 POWER	40 kW 
Annual GHG reduction	52 tCO ₂ e
Investment	LKR 597,000
Grant	LKR 597,000
Date of commissioning	May 2016
Baseline technology	Kerosene dryer 
Payback period	7 months

MAHIR BROTHERS UP SCALES WITH MODERN BIOMASS TECHNOLOGY



INTRODUCTION

The district of Matale is famous for its spice trade, supplying most of the spices for Sri Lanka’s export. In the heart of Matale, in a small town called Katugastota is one of the district’s largest local spice exporters - Mahir Brothers who process pepper, cloves and nutmeg.

The Mahir Brothers spice factory has one of Sri Lanka’s largest wood fired dryers.

The drying process is by far the most important step to ensure the quality, aroma and preservation of spices. Inadequately dried spices will become mouldy resulting in poor prices, or contain bacteria that can cause food poisoning. Although the simplest and cheapest method is to sun-dry the spices in mats on the open floors, this causes contamination or damage to the spices because of unexpected rains or being trampled by footfall.

CaseStudy

For the past three generations, Mahir Brothers has tried to maintain the consistency of their produce, sometimes traveling far distances in order to dry their spices when rains inundated the Matale district. “One of the main preparations in spices is the drying process which is vital to maintain its aroma, quality, and preservation,” explains Ikram Iyas, who runs the family business. “Drying spices in open spaces also meant contamination from dust, dirt, sand etc.”

With access to more modern ideas, Ikram convinced his family to invest in newer technology and in June 2016, Mahir Brothers invested in one of Sri Lanka’s largest biomass fired dryers through the UNDP/FAO’s **Sustainable Biomass Energy Project**.

This biomass fired dryer has a total capacity of 5000 kgs, which has increased the daily spice production by over 100 percent. The dryer is not weather-dependent and can be used every day. Additionally, the quality of the produce has



Impact and Sustainability

BEFORE	AFTER
Drying process minimum 10 hours	Drying process maximum 04 hours
Subject to harmful contaminants	Clean and eco-friendly
1500 kgs of spices per day	5000 kgs of spices per day
Depended on sunlight	Can be used in any weather condition
Lack of land space to dry spices.	Can be up-scaled to a bigger dryer Free from harmful CO ₂ pollutants Free source of wood chips from nearby timber store

improved because of the mechanism to control heat during the drying process. Wood chips for the dryer is sourced free of charge from the local timber stores.

LESSONS LEARNT

As a third generation Mahir to run this business, Ikram has realized the importance of technological change. Having heard of the dryer from the Sri Lanka Sustainable Energy Authority (SLSEA) he commissioned the largest flatbed dryer with a capacity of drying 5000 kgs daily. The dryer can be used under any weather condition and is powered by waste from the local timber store.

At the end of the process, the produce is clean and free of contaminants and perfectly dried.



Technology

Dryer



Application

Drying of SPICES

Capacity

**5000
kg/day**



Power

320 kW

Annual GHG reduction

157 tCO₂e

Investment

LKR 2,000,000

Grant

LKR 1,000,000

Date of commissioning

June 2016

Baseline technology

Kerosene dryer

Payback period

8 months





MONARAGALA DISTRICT HOSPITAL AIMS FOR ZERO CARBON EMISSION



Monaragala

INTRODUCTION

The Monaragala District General Hospital is the largest healthcare institution in the Uva province catering to over 500,000 patients per year. The hospital consists of 10 wards, an Intensive Care Unit, Preliminary Care Unit, Special Care Unit, Medical Laboratory, Blood Bank, Out Patients Department, and a Radiology Department. But what is unique about this hospital are the 'green' initiatives carried out under the guidance of Medical Superintendent, Dr. R. M. D. Rathnayake.

CaseStudy

According to Dr. Rathnayake, the hospital's ethos is to follow environmental management activities that adhere to zero waste and zero carbon emission through proper energy and waste management initiatives such as bio gas from composting, organic farming and biomass energy practices. This philosophy is diligently and passionately practiced by every member of the hospitals' staff; from tending to the organic vegetable plots, to ensuring recyclable bins located all across the hospital premises are being properly used, to feeding the biomass boiler for the use of hot water, etc.

To conform to zero carbon emissions, the hospital collaborated with the **Sustainable Biomass Energy Project**, and installed a biomass boiler that provides hot water (for drinking and personal use) in five of its wards, and hot water for use in the kitchens, etc. The boiler is powered by discarded coconut shells from the kitchen, wood chips from the garden, and other biodegradable wastes.



IMPACT AND SUSTAINABILITY



The boiler, commissioned in December 2016, has a capacity of 12 kW to provide up to 150 litres of hot water per hour.

According to Dr Rathnayake, the hospital has recorded a significant financial savings and a considerable reduction in carbon footprint. "This is such an achievement towards our goal of zero carbon emissions," he said. "Our ultimate goal is to reduce 8000 kgs of carbon emissions per year," he added.

LESSONS LEARNT

With the constant need for hot water in hospitals and the rising cost of electricity, it is prudent that the Monaragala District Hospital has shifted to biomass boilers. The everyday waste from the kitchen, a.k.a. coconut shells, is used at no cost to fire this boiler, thereby ensuring a sustainable supply of fuel for its operations. The biomass boiler produces clean energy and complements the hospitals' zero waste ethos. The total cost of the boiler has been recovered in just six months.



	Technology	Water Heater
	Application	Hot water for kitchen and wards
	Output:	150 litres/hr of water at 100 °C
	Power	12 kW
	Annual GHG reduction	2.57 tCO₂e
	Investment	LKR 520,000
	Grant	LKR 520,000
	Date of commissioning	December 2016
	Baseline technology	LPG and Electric Heaters
	Payback period	6 months



NILMINI TEA ESTATES FIRED BY BIOMASS DRYER



INTRODUCTION

In Ihala Millawa, Morawaka, in the Matara district, Sri Lanka's largest organic tea manufacturer Nilmini Estates (Pvt) Ltd has installed a biomass fired dryer to facilitate the company's strong sustainable philosophy of going 'green' and zero carbon emission. As one of the most bio-diversified organic tea plantations in Sri Lanka, Nilmini Estates processes on average, 3000 kgs of green tea leaf daily.

CaseStudy

Having previously used two archaic 100-year old biomass based (original design was fossil fuels) hot air dryers, the management decided to invest in a 1000 kW (or 250 kg made-tea output per hour) dryer through the **Sustainable Biomass Energy Project**. The dryer was commissioned in January 2017.

Prior to the introduction of the new biomass dryer, the estate was manufacturing up to 110 kgs of tea per hour using the two old dryers. According to Prof. P. Abeygunawardena, CEO/Managing Director of Nilmini Estates (Pvt) Ltd, there were several shortcomings in his daily made-tea output. First, temperature control was extremely difficult in those old dryers. It was uneven and extremely high sometimes and quite low on other occasions. The lack of proper insulation and the inefficient combustion of these old dryers was also harmful to his made-tea quality and overall output. His employees who worked in the dryer room had to face extreme temperatures that prevailed in the work stations.

IMPACT AND SUSTAINABILITY

The efficiency of the new dryer has increased production by more than 100 percent, offering better temperature control and has a convenient biomass feeding mechanism. His tea prices have dramatically improved due to better quality, and fuelwood consumption per kg of made-tea has reduced. The labour cost has also reduced due to the lesser number of hours now required to run the dryer given the green leaf intake on daily basis.

In addition, the estate has recorded a very low carbon footprint of 0.51 kgs per kilo of made tea, which he considers to be a world record. "According to online research, there has never been a better carbon footprint recorded anywhere else," he says.

Prof. Abeygunawardena adds that the value addition to date has seen the increase in per hour production, and the improvement of the quality of tea which in turn has increased the price of his tea sold at the auctions. "Overall, the tea has a better aroma, taste and feel, which has been vastly appreciated at the auctions." He expressed his total satisfaction about the new dryer project and greatly appreciates the financial grant he received (being the only financial support from any government or private entity throughout his 18-year-old business) from the UNDP Biomass Project.





With the tea sector being a major source of economic activity in Sri Lanka, it is vital that tea factories take initiatives to convert to modern efficient technologies that operate on renewable energy sources, rather than depending on fossil fuels that can harm the environment and affect climate change. There is also a saving on electricity and labour with these modern technologies. Sustainably grown fuel wood is most often readily available in these estates and can supply a healthy portion of the biomass needed to operate a biomass fired heater. The saving of fire wood, user friendliness of the system and ability to produce better quality tea makes this system more viable for tea producing factories.



JETWING HOTELS WALKS THE TALK



INTRODUCTION

In Sri Lanka, the hospitality industry is one of the most fuel-dependent industries, especially for the daily operations of the hotels. However, rising energy costs and eco-consciousness amongst travelers is forcing hoteliers to explore environment-friendly and sustainable methods of running their properties.

Renewable energy is a profitable way of reducing costs and subsidizing overheads, particularly renewable heat in the form of biomass. The benefits of biomass are far reaching; from reducing costs and carbon footprint to increasing self-reliance and creating jobs.

CaseStudy

The use of biomass energy at Jetwing Hotels goes back to 2008. "Since then the use of biomass has become a standard practice in our hotels wherever possible," says Hiran Cooray, Chairman Jetwing Group. The first biomass boiler was installed at Jetwing Blue with technical and financial success. This was replicated at Jetwing Sea, Jetwing Lighthouse, Jetwing Beach and Jetwing St. Andrew's. All of the aforementioned boilers were utilized to generate hot water for guest rooms and steam for the hotels' laundry (if available).

Taking a step further, steam-driven absorption chillers were introduced instead of electricity driven conventional chillers. These chillers, powered entirely by steam produced from the biomass boiler, reduce electricity consumption of the hotel by around 50-60 percent. While this novel technology was first installed at Jetwing Lagoon, with the success of its operation and the financial saving achieved, similar systems were installed at Jetwing Yala, Jetwing Lake and most recently a steam-driven absorption chiller was commissioned at Jetwing Blue.



IMPACT AND SUSTAINABILITY

One of the key components of Jetwing Hotels' sustainability strategy is to manage and reduce energy and carbon footprint. The transition to biomass energy aids in both avoiding emissions from equivalent non-renewable energy sources (diesel or grid electricity) and reducing associated operational costs.



"First and foremost in terms of financial savings we could obtain approximately 40-50 percent saving from the biomass boiler and 20 percent saving on boiler plus absorption chiller installations," says Cooray.

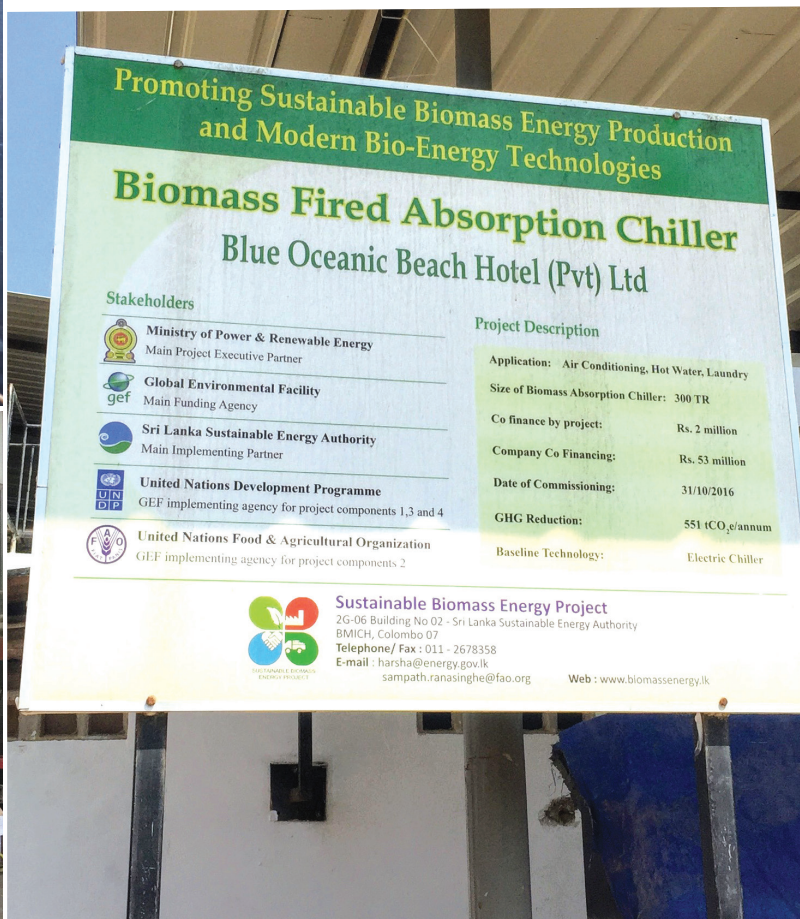
Cinnamon wood, the only fuelwood (biomass) type used at Jetwing Hotels, is considered a sustainable source of fuelwood due to its short cropping cycle when compared to other more widely available fuelwood such as rubber and off cuts. Cinnamon is a virtually carbon neutral source of energy and the transition to biomass energy has resulted in avoiding over 2,000 MT CO₂ emissions (per annum) from across the Jetwing Group of hotels.



LESSONS LEARNT

The introduction of a biomass fired boiler at Jetwing has impacted the hotel's bottom line significantly. About 50 percent of the total energy requirement across the hotels are from biomass energy and in sourcing the required quantity of biomass, have created quite a stable supply chain. The sale of this by-product provides additional revenue not just to the farmers but also to the local supply chain comprising collectors and distributors.

	Technology	Chiller
	Main application	Cooling
	Output:	Air conditioning for 120 rooms
	Power	300 Refrigeration Tonnes
	Annual GHG reduction	551 tCO ₂ e
	Investment	LKR 53,000,000
	Grant	LKR 2,000,000
	Date of commissioning	October 2016
	Baseline technology	Electric Chiller
	Payback period	6 months





Nuwara Eliya

HOTEL GREEN PALACE FUELED BY MODERN BIOMASS ENERGY TECHNOLOGY

INTRODUCTION

High in the central hills of Sri Lanka, Nuwara Eliya is considered a popular holiday destination because of its cool climes and stunning scenery. Nuwara Eliya is dotted with hotels, motels and holiday homes that cater to the vast numbers of guests who frequent this city. During the winter months, the average (low) temperature is around 11 °C, while during the summer months it averages a few degrees higher. Hence, it is a requirement that these places of accommodation require good heating systems.

CaseStudy

As a relatively small hotel, Manager Mr. Gamini Jaliyagoda has to be prudent about costs and productivity. His nine-bedroomed hotel requires hot water for the guest rooms as well as for cooking and drinking purposes in the kitchen, and laundry. Having heard of the biomass boiler through the **Sustainable Biomass Energy Project**, owner Mr. S. T. K. Jayasekera opted for power-saving measures and invested in a 12 kW biomass fired boiler under a co-financing investment of Rs. 131,777.00.





IMPACT AND SUSTAINABILITY

According to Mr. Jaliyagoda, since the installation of the biomass fired boiler, the hotel's monthly electricity bill has reduced by 50 percent. The hot water needed can be regulated as and when required, ensuring there is no wastage. Firewood is sourced from the local timber store at no cost.

LESSONS LEARNT

One of the key requirements for hotels in the hill country is hot water. The biomass fired boiler is discreetly concealed in the beautiful garden of the hotel with easy accessibility. There is no smoke or smell when the boiler is in use, thus ensuring the healthy and salubrious atmosphere that guests enjoy in this region. There is also room for scalability if and when the hotel increases its capacity.



 Technology	Water heater
Main application	Hot water for guest rooms
Output:	150 litres/hour of water at 100 °C
 Power	12 kW
Annual GHG reduction	8 tCO ₂ e
Investment	LKR 263,550
Grant	LKR 131,775
Date of commissioning	June 2016
Baseline technology	Electric water heaters
Payback period	5 months



WASANA PRODUCTS GETS LIFELINE FOR HOME-BASED ENTREPRENEURSHIP



INTRODUCTION

Drying fruit is cheap, simple and very effective. Dried food production may be considered as one of the least explored aspects from Sri Lanka's vast supply of locally grown fruits and vegetables. The process and production of dried fruits can be easily done as a home-based industry with the proper equipment and know-how. However, one of the main impediments would be the drying process as drying in open air spaces is not ideal for the final product because of its susceptibility to harmful contaminants, dust and dirt.

CaseStudy

Shanthi Menike is a single parent trying to make ends meet. Having worked in West Asia for a couple of years to educate her only daughter, she returned to a partially built home and an unsure future. But through sheer perseverance and determination, Shanthi started a home-based business of drying fruits and vegetables and selling in the local market under the brand name Wasana Products. She dried her produce using an electric dryer but was struggling to pay off her high electricity bills until she read about the **Sustainable Biomass Energy Project** that was promoting the use of dryers fueled by biomass.





"I even have enough supply to export to other countries and have now started to rebuild my home," she says.






IMPACT AND SUSTAINABILITY

In January 2017, through the assistance of the FAO and UNDP's Sustainable Biomass Energy Project, Shanthi invested in a 20 kW biomass fired dryer through a financial grant for Rs. 171,500. Now she dries 10 kgs of fruit and vegetables daily, and her production has increased by 100 percent. Firewood is sourced free of charge from the local timber store.

LESSONS LEARNT

Although her supply and demand is relatively low at present, Shanthi has the option of increasing her production in the future to overseas markets. In addition, she can also use the dryer for drying other consumables, thus giving her the option of increasing her income.

	Technology	Dryer 
	Application	Drying FRUITS and VEGETABLES
	Output capacity	240 kg/day
	Power	20 kW
	Annual GHG reduction	29 tCO ₂ e
	Investment	LKR 343,000
	Grant	LKR 171,500
	Date of commissioning	January 2017
	Baseline technology	Electric heaters
	Payback period	1.2 years





BIOMASS TECHNOLOGY ENRICHES RICHME DAIRY PRODUCTS



INTRODUCTION

Yogurt has always been a popular dairy-based meal/snack. In Sri Lanka, yogurt is consumed as a snack and dessert amongst children and adults. Its also a preferred food item for people who are lactose intolerant because the lactose in yogurt is converted to lactic acid by the bacterial cultures.

CaseStudy

For the husband and wife duo, Manthika Dilrukshi and Chathura Munasinghe, RichMe Foods and Dairies is more than just a business. It is a homage to their parents, a livelihood for their employees, a source of nutrition for children and an ode to hard work and perseverance. RichMe can easily claim to be the most popular yogurt in the Uva province considering the sales per month. But success comes at a price and that price was the hard work put in by this couple.

They started the business in 2007 with little money but a lot of hope. For years, their biggest cost was electricity consumption and the price they doled out for almost three gas cylinders per day for the heating process. "That was our biggest cost and we hardly made a profit after paying off these bills," said Chathura. Also, there were times when the production had to be halted or discarded because of contaminants or improper heating as one of the main requirements in yogurt production is the accurate heating processes to ensure the final product is of the best quality.

In 2016, Chathura approached the **Sustainable Biomass Energy Project** and through co-financing availed of a 12 kW biomass fired water heater for Rs. 425,000. This heater can boil 230 liters of milk per month saving them around Rs. 30,000 per month. Sustainable fuelwood is sourced from a neighbourhood timber store.






IMPACT AND SUSTAINABILITY

The production has increased by 100 percent; from 1500 batches of yogurt to 3000 per day. In addition, the temperature control allows the user to perfectly manage the heat required to the exact second. The entire manufacturing process is clean, safe from fire hazards, hygienic and faster.

LESSONS LEARNT

According to Chathura, his sales have increased considerably because of the better quality of his product. The demand for his product has created the opportunity for him to expand his operation with a new 20 ft cooling room that will double his production capacity and increase his sales.

	Technology	Water heater 
	Application	Yogurt production
	Output capacity	150 litres/hour of water at 100 °C
	Power	12 kW
	Annual GHG reduction	17 tCO ₂ e
	Investment	LKR 850,000
	Grant	LKR 425,000
	Date of commissioning	May 2017
	Baseline technology	open flame heating with LPG
	Payback period	2.2 years



FUELWOOD GROWING MODEL SITES FOR SUSTAINABLE BIOMASS SUPPLY

The core issue faced in this sector is a sustainable fuelwood supply mechanism. For this, the project has identified and initiated sustainable energy plantations and fuelwood growing sites across the island.

To date, under this project, over 1000 hectares of Fuelwood Production Plantation sites have been established at various locations;

- Forest Department Lands
- Estates | Plantations
- Rubber Research Institute
- Coconut Cultivation Board
- Home Gardens | CBOs | NGOs

Fuel from forests ...

With verdant natural forest lands covering almost 30 percent or two million hectares of land area in Sri Lanka, 55 percent of it comes under the purview of the Forest Department. Therefore, the Forest Department plays a huge role in maintaining, sustaining and safeguarding these national treasures from loggers, poachers and lawless habitation.

One of the primary uses of these sustainable forests is for the cultivation of fuelwood or biomass energy, which in turn has the capacity to power economic development. Wood energy can make a worthwhile contribution to economic growth at all levels of development, in environmentally sound ways that also create 'green' job opportunities, clean enterprises and improve living standards in rural areas.

... and fuel from stakeholders

Apart from using forest lands, many sustainable fuelwood plantations have been established within the purview of the Regional Plantation Companies for fuelwood plantations where the trees are used for shade, slope stabilization, and live fencing until they mature for use as biomass.

Smallholders attached to the Rubber Research Institute and the Coconut Cultivation Board are also encouraged to grow fuelwood as a supplementary crop.

Fuelwood fence Gliricidia



Gliricidia as medium shade tree

While these plantations mature and ready for harvesting, the sites can be used for;

- Intercropping with coconut
- Inter cropping with pepper and vanilla
- Alley cropping in rain-fed uplands
- Sloping Agriculture Land Technology (SALT)
- As shade trees for tea cultivation



Commonly Used Major Fuelwood Species in Sri Lanka

1. *Eucalyptus grandis*
2. *Eucalyptus robusta*
3. *Eucalyptus camaldulensis*
4. *Acacia mangium*
5. *Acacia decurrens*
6. *Corymbia torelliana*
7. *Gliricidia sepium* (Gliricidia/Wetamara/Ladappa/Makulatha)
8. *Hevea brasiliensis* (Rubber tree)
9. *Cinnamomum zeylanicum* (Cinnamon)
10. *Anacardium occidentale* (Cashew)
11. *Leucaena leucocephala* (Ipil Ipil)
12. *Calliandra calothyrsus* (Caliandra)

► Eucalyptus species

► Acacia species

Eucalyptus grandis - dedicated plantation



Rubber plantation

Fuelwood from Sanitary Program

Prosopis Juliflora - Katu andara/Kalapu andara

Clusia Rosea - Gal Goraka

Dillenia suffruticosa - Para

Alstonia macrophylla - Hawari Nuga/ Ginikura

Other Potential Fuelwood Species in Sri Lanka

Botanical name	Common name
<i>Grevillea robusta</i>	Sabukku
<i>Khaya senegalensis</i>	African Mahogany
<i>Tamarindus indica</i>	Tamarind
<i>Macaranga peltata</i>	Kenda
<i>Thespesia populnea</i>	Gansooriya
<i>Cassia spectabilis</i>	Kaha Kona
<i>Terminalia catappa</i>	Kottamba
<i>Pterocarpus indicus</i>	Wal Ehela
<i>Pongamia pinnata</i>	Magul Karanda
<i>Gmelina arborea</i>	Eth Demata
<i>Trema orientalis</i>	Gadumba
<i>Myroxylon balsamum</i>	Kattakumanjal

Forest Department **100** hectares

Estates/Plantations **150** hectares

Rubber Research Institute **100** hectares

Coconut Cultivation Board **240** hectares

Home Gardens | CBOs | NGOs **410** hectares



VALUE ADDITION FROM SOURCE TO END USER



"The advantages of using wood chips for combustion are improved combustion efficiency and controlled feeding "

Jayanath Rupasinghe



Driven by the concept of building a greener world, EcoTherm Energy Solutions is the country's first biomass terminal. Owned and managed by social entrepreneur Jayanath Rupasinghe, the plant is a hub of activity as lorries bearing heavy loads of fuelwood unload while another sits patiently until its load is topped up.

Inside a huge 80 ft by 40 ft warehouse, a machine continuously chips 40 tonnes of fuelwood a day. The wood is sustainably sourced from home gardens, fuelwood plantations etc., from within a 10-kilometer radius and brought to this location in Homagama, where the wood is then sorted, split and chipped before loading for distribution to industrial sites that use biomass boilers and dryers.

According to Mr. Rupasinghe, the benefits of using wood chips includes improved combustion efficiency and more controlled feeding which helps to reduce biomass consumption.



Process	Biomass Energy Terminal
Operations	Chipping, Splitting
Output capacity	40 tons per day
Investment	LKR10,000,000
Grant	LKR 5,000,000
Date of commissioning	November 2017
Payback period	2 years

"One litre of oil can be replaced by 3.5 kgs of wood chips"



Modern Biomass Energy Technology Demonstration Projects Implemented by the Project

No	Beneficiary	Address	Contact number of beneficiary	Modern Biomass Technology	Service Provider	Contact number of service provider
1	Lion Brewery PLC	Lion Brewery (Ceylon) PLC, Biyagama Sri Lanka	Mr. Hiran Edirisinghe - 077 2 465 970	Feasibility study for Biomass Tri-generation Plant	Forbes Marshall (Pvt) Ltd	Mr. Loshan Palayangoda - 072 758 6004
2	Nilmini Estate	Nilmini Estates, Ihala Millawa, Morawaka	Mr. Amith - 076 6916543	Biomass Hot Air Dryer	Gem Allied Industries (Pvt) Ltd	Mr. Prashant Garg - +91 -33-2217- 7328
3	Jetwing Blue Hotel, Negombo	Jetwing Blue - Ethukale, Negombo.	Mr. Jude S W Kasthuriarachchi - 011- 23457000/4790300	Biomass Boiler and Absorption Chiller	Lalan Engineering (Pvt) Ltd	Mr Thilak - 071 4301838
4	Rubber Research Institute (RRI)	Rubber Research Institute, Dartonfield, Agalawatta	Mr. Susantha Siriwardena - 011 2633352 /077 293 1073	Smoke House	RRI-Technical Division	Dr. Susantha - 077 293 1073
5	Nutri Food Packers	Kiluvanai Lane, Kopay Center, Kopay, Jaffna	Mr. S. Naguleswaran - 021 223 0455 / 076 628 9170	Biomass Hot Air Dryer	Saviru Technologies & Services	Mr. Kapila - 077 3602488
6	Wishmitha Dashabala Poshana	No. 125, Jayaganga South, Thalawa	Mr. Malith Malan - 071-8344 983	Biomass Hot Air Dryer	Saviru Technologies & Services	Mr. Kapila
7	Sri Lanka Human and Environmental Development Foundation	Palatuduwa Road, Marakolliya, Tangalle	Mrs. M.M. Sunethra Marasinghe - 077 60521113	Biomass Hot Air Dryer	Saviru Technologies & Services	Mr. Kapila
8	Mahir Brothers	No. 51, Kurunegala Road, Katugastota	K.S.H.M. Zavahir - 081 2499 395	Biomass Hot Air Dryer	Saviru Technologies & Services	Mr. Kapila
9	Lanka Spice Center	436 C, Aladeniya, Werellagama	Mr. E.J.M. Nazar - 077 173 8221	Biomass Hot Air Dryer	Saviru Technologies & Services	Mr. Kapila
10	Hotel Green Palace	No. 164, Lady Maclum Drive, Hawa Eliya, Nuwara Eliya	Mr. Kumara Jayasekara - 071 8252634	Biomass Water Heater	Spectra Industries Lanka (Pvt) Ltd	Mr. Wimalaweera - 071 857 8323
11	Sanota Blue Haven Inn	No. 102/2, Ranasinghe Mw, Badulla Rd, Nuwara Eliya	Mr. Senaka Gunasekara - 077 4245407	Biomass Water Heater	Spectra Industries Lanka (Pvt) Ltd	Mr. Wimalaweera
12	Kurunagala Teaching Hospital	Colombo Rd, Kurunegala	Dr. Chandana Kandangamuwa - 037 2223919	Biomass Water Heater	Spectra Industries Lanka (Pvt) Ltd	Mr. Wimalaweera
13	Nurses Training Collage, Teaching Hospital, Kurunagala	Colombo Rd, Kurunegala	Dr. Chandana Kandangamuwa - 037 2223919	Biomass Water Heater	Spectra Industries Lanka (Pvt) Ltd	Mr. Wimalaweera
14	D.B. Welegedera Ayurvedic Hopsital	Colombo Rd, Kurunegala	Dr. (Mrs) G.A. Dammika Gunasinghe - 071 8062632	Biomass Water Heater	Spectra Industries Lanka (Pvt) Ltd	Mr. Wimalaweera
15	Probation and Child Care Services Department	Probation and Child Care Services Dept, Kuliyapitiya	Mr. Aloka Bandara - 037 2222391	Biomass Water Heater	Spectra Industries Lanka (Pvt) Ltd	Mr. Wimalaweera
16	Cultural Heritage Hotel (Pvt) Ltd	Wijaya kumaratunga Mawatha, Yapagama, Dambulla	Mr. Pradeep - 076 614 6603 Engineer	Biomass Boiler and Absorption Chiller	Lalan Engineering (Pvt) Ltd	Mr. Chamila - 070 2735509
17	Neoprex (Pvt) Ltd	400, Deans Road, Colombo 10	Mr. Rupasinghe - 077 7747241	Biomass Fired Thermal Oil Heater	Lalan Engineering (Pvt) Ltd	Mr. Chamila - 070 2735509
18	Packwell Lanka (Pvt) Ltd	No. 26,Second Cross Lane, Off Kandawala Road, Ratmalana	Mr. Priyantha - 071 771 7134	Biomass Steam Boiler	Forbes Marshall (Pvt) Ltd	Mr. Loshan - 070 358 6004
19	Henatanne Tea Factory (Pvt) Ltd	Delmella, Egaloya, Bulathsinhala	Dr. Kolitha Ariyasena - 071 256 0560	Biomass Steam Boiler	Forbes Marshall (Pvt) Ltd	Mr.Loshan - 070 358 6004
20	Ansell Lanka (Pvt) Ltd	Biyagama Export Processing Zone	Mr. Samal Dissanaike - 773228097	Biomass Steam Boiler	Forbes Marshall (Pvt) Ltd	Mr. Loshan - 070 358 6004
21	Hero Nature Products (Pvt) Ltd	No. 49, Industrial Estate, Dankotuwa	Mr. Shantha - 077 762 2866	Biomass Steam Boiler	Lalan Engineering (Pvt) Ltd	Mr. Chamila - 070 2735509
22	Bangalagoda Rubber Sanwardhana Sansadaya	Alupotha, Monaragala	Dr. Susantha - 077 293 1073	Solar assisted Hot Air Dryer	Rubber Research Institute	Dr. Susantha - 077 293 1073
23	District General Hospital	Monaragala	Dr. Rathnayaka - 071 8127663	Biomass Water Heater with water purification system	Spectra Industries Lanka (Pvt) Ltd	Mr. Wimalaweera - 071 857 8323
24	Richme Foods & Dairies (Pvt) Ltd	No. 252 Samarawalliya, Dickoya	Mr. Chathuranga - 077 0341122/071 8286755	Biomass Water Heater with Milk pre processing system	Spectra Industries Lanka (Pvt) Ltd	Mr. Wimalaweera - 071 857 8323
25	Wasana Products	Wasana Products, Alakolamada Road, Longwill, Rattota	Ms. Shanthi - 071-244 8351	Biomass Hot Air Dryer	Saviru Technologies & Services	Mr. Kapila - 077 3602488
26	Ran Lanka Spices	No. 39, Main Street, Pujapitiya	Mr. Akraz - 081-230 7005	Biomass Hot Air Dryer	Saviru Technologies & Services	Mr. Kapila - 077 3602488





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**Promoting Sustainable Biomass Energy Production
and Modern Bio-Energy Technologies**

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