



Thunchath Ezhuthachan
Malayalam University

GREEN AUDIT REPORT



Green Audit

Introduction

Examining environmental practices both on and off university campuses is the goal of the green audit, which will have an effect on the eco-friendly environment. It was started with the intention of examining the work being done in institutions whose operations could endanger the environment's and the people's health. The process of finding and evaluating an institution's eco-friendly and sustainable practices is known as "green auditing." We have historically been wise and effective users of the environment's resources. However, excessive consumption of resources such as energy and water has become a habit in everyone over time, particularly in public spaces. It is now vital to determine whether our procedures are using more resources than they should.

Objectives of green auditing

- To make a basic map of the entire area in order to comprehend the surroundings.
- To catalogue and identify the activities that take place on the grounds.
- To compute the usage of resources such as water and land.
- To evaluate the handling and elimination of garbage.
- To examine the trend of energy utilisation.
- To determine the best practices.
- To recommend workable ways to enhance the organization's sustainability.
- To put together the report with the information provided above.
- To carry out a walkthrough audit to verify the recommendations put into practice by the organisation and make recommendations for additional enhancements.
- To confirm every point using precise measurements and provide recommendations for enhancement

Green & Clean Campus Initiatives

Thunchath Ezhuthachan Malayalam University is located in the pristine coastal landscapes of Malappuram district of Kerala. The university recognizes its responsibility to safeguard and nurture the environment, while simultaneously imparting values and quality education to its students. As a distinguished institution of higher learning in this region, we recognize the importance of imparting environmental values and sustainable practices in the campus. The

‘Clean and Green Campus Initiatives’ given below outlines our commitment for clean, green and sustainable campus. The policy was framed with the objective to institute sustainable practices across all aspects of campus life, including academics and administration and to cultivate environmental consciousness and accountability among all members of the university community.

The following are the major initiatives taken by the university:

1. **Academic Integration:** Thunchath Ezhuthachan Malayalam University prioritizes the integration of environmental values and sustainable lifestyle among the academic community. This involves instilling environmental awareness and responsibility into the curriculum, research, and co-curricular activities conducted by NSS and Bhoomithra Sena Club. By doing so, the university aims to inculcate environmental consciousness among its students and faculty. For instance, the students take part in various environmental awareness programmes and campaigns and carryout environmentally relevant projects.
2. **Reducing the Carbon Footprint:** The university has an ambitious vision to become a carbon neutral institution. As a first step in this direction, the university has implemented several strategies to reduce its carbon footprint. This includes promotion of energy conservation practices through campaigns, embracing solar energy sources, and adopting energy-efficient lighting and electrical appliances in the campus. By actively pursuing these initiatives, and consistently striving to achieve excellence in this regard, the university not only minimizes its environmental impact but also sets an example for sustainable practices within the region.
3. **Biodiversity Preservation:** Thunchath Ezhuthachan Malayalam University recognizes the paramount importance of biodiversity preservation and actively promotes diverse flora and fauna within its campus environment through various initiatives. The Medicinal Garden, Butterfly Garden etc. are the various initiatives the university has taken to enhance its biodiversity. The university also has a green space called “Pachathuruth” officially recognized by the Haritha Kerala Mission. Apart from this, the university has also taken the initiative to put labels and QR codes to its trees and plants. Through scanning the code, the detailed information about the species can be obtained. Therefore the biodiversity of the campus will serve as a valuable educational

resources for students to understand and appreciate the importance of ecological conservation.

4. **Waste Management:** The university is committed to establishing sustainable waste management practices to minimize its environmental and carbon footprint. The university has strictly adopted green protocol in all its activities and the green protocol officer is given the responsibility to enforce the same. To manage its biodegradable waste, the university has various composting facilities such as Compost Bins, Ring Composting, etc. Apart from this the University also has Biogas plants, that fulfil the partial requirements of its cooking fuel. The university also has banned single use plastics inside the campus. Apart from this, the university has tie up with the "Haritha Karma Sena" of Vettom Grama Panchayath, for responsible disposal of segregated plastic waste.

In recognition to its various initiatives taken by the university in the fields of waste management, energy conservation, biodiversity conservation etc, the Haritha Kerala Mission of Kerala Government has certified the university with A+ grade.

Biodiversity of the Campus

List of trees and other species on the university campus

When photosynthesis occurs, trees release oxygen into the atmosphere. Trees breathe in oxygen just like any other living thing do. They produce more oxygen than they use on average during 24 hours; otherwise, there would be no net gain in growth. There are 137 variety of plant species on the university campus. The campus has initiated a medicinal garden with a plenty of medicinal plants.



Figure 1 Medicinal Garden



Figure 2 Butterfly Garden

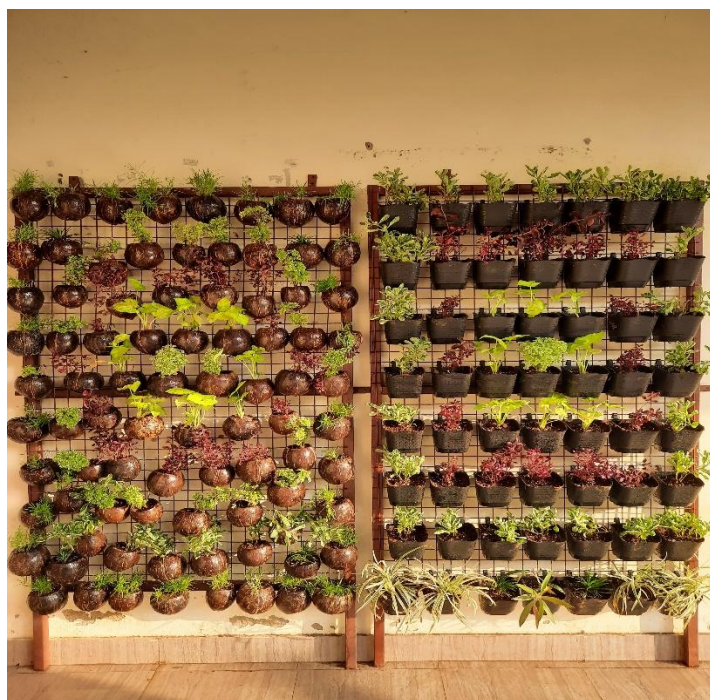


Figure 3 Vertical Garden Project



Green Campus – Clean Campus

Table 1: Flora of Thunchath Ezhuthachan Malayalam University

Serial No:	Botanical Name	Common Name	Vernacular Name
1	Acacia mangium Willd.	Brown Salwood	മാഞ്ചീയം
2	Manilkara zapota (L.) P.Royen	Sapodilla	ചിക്ക
3	Monoon longifolium	False ashoka	അരണമരം
4	Aegle marmelos (L.) Corrêa	Bael Tree	കൂവളം
5	Alstonia scholaris (L.) R.Br.	Blackboard Tree	ഏഴിലമ്പാല

6	Anacardium occidentale	Cashew	കശുമാവ്
7	Annona squamosa	sugar apple	സീതപ്പഴം
8	Artocarpus heterophyllus	Jackfruit	പ്ലാവ്
9	Artocarpus hirsutus	Anjili jack or wild jack	ആഞ്ഞിലി, അയനി
10	Azadirachta indica	nimtree or Indian lilac	ആര്യവേപ്പ്
11	Bambusa bambos	Indian thorny bamboo	ഇന്ത്യൻ മുളയ്ക്കു മുള
12	Bambusa vulgaris	Common Bamboo	മുള
13	Bauhinia purpurea	Purple Bauhinia, Butterfly Tree	ചുവന്നമന്ദാരം
14	Bridelia retusa	Spinous Kino Tree	മുൾക്കൈനി, മുളയ്ക്കുവേങ്ങ
15	Butea monosperma	Flame of the Forest	ചമര
16	Cassia fistula	golden shower tree	കണിക്കൊന്ന
17	Saraca asoca	ashoka tree	അശോകം
18	Ficus benamina	weeping fig	വെള്ളാൽ
19	Syzygium cumini	Indian blackberry	ഞാവൽ
20	Mangifera indica	mango	മാവ്
21	Cryptostachys renda	Sealing-wax Palm	ചുവന്ന പന
22	Cynadon dactylon	Bermuda grass	കറുക
23	Dracena sp	Song of India	
24	Chlorophytum sp	Spider plant or common spider plant	
25	Cocos nucifera	Coconut tree	തെങ്ങ്
26	Hibiscus rosa-sinensis	Chinese hibiscus	ചെമ്പരത്തി
27	Pennisetum orientale	Oriental fountain grass	കോതപ്പുല്ല്, പോതപ്പുല്ല്
28	Merremia tridentata	Arrow-leaf morning glory	പ്രസാരണി, തലനീളി.
29	Spermacoce remota	Woodland false buttonweed	തറുതാവൽ
30	Sida cordata	Heart leaf fan petals	വള്ളിക്കുറുത്തൊട്ടി
31	Olderlandia corymbosa	diamond flower	പർപ്പടകപ്പുല്ല്
32	Euphorbia hirta	Asthma Weed, snake weed	നീലപ്പാല
33	Croton bonplandianus	Ban tulsi	
34	Microstachys chamaelea	Creeping Sebastiania	കൊടിയാവണക്

35	sesamum prostratum	Indian Sesame Oil Plant	
36	Mimosa pudica	sensitive plant,touch-me-not	തൊട്ടാവാടി
37	Waltheria indica	sleepy morning	
38	Chromolaena odorata	siam weed	കമ്മ്യൂണിസ്റ്റ് പച്ച
39	Acacia auriculiformis	Acacia-tree, Earleaf Acacia	വാറ്റിൽ,അക്കേഷ്യ
40	Desmodium sp		
41	Scoparia dulcis	licorice weed, goatweed	കല്ലുരക്കി
42	Corchorus sp		
43	Terminalia arjuna	Arjun tree	നീർമരത്ത്
44	Swietenia mahagoni	mahogany	മഹാഗണി
45	Bogaivillea sp		
46	Emilia sonchifolia	lilac tasselflower	മുയൽച്ചെവിയൻ
47	Cyanthillium cinereum	Little Ironweed	പൂവാങ്കരുന്നില
48	Mimusops elengi	Spanish Cherry	ഇലഞ്ഞി
49	Dracena marginata	Spanish dagger or Madagascar dragon	
50	Spaghteichloa trilobata	Bay Biscayne creeping-oxeye,merigold Singapore daisy	കമ്മൽ ചെടി
51	Ixora coccenia	Jungle geranium	ചെത്തി
52	Neeriumm oleander	Rosebay	അരളി
53	Mussanda frondosa?	Wild mussaenda or Dhobi tree	വെള്ളില
54	Costus		ആനക്കുവ
55	Catheranthus roseus	Vinca rosea	നിത്യകല്ല്യാണി
56	Cosmos sulphuresus	Sulfur cosmos	മാങ്ങാനാറി
57	Ficus racemosa	Cluster fig	അത്തി
58	Tabernaemontana divericata	pinwheel flower	നന്ത്യർവട്ടം
59	Chlorophytum comosum	Spider plant	ചീലന്തി ചെടി
60	Wodyetia bifurcata	Foxtailpalm	

61	Thuja sp		
62	Alamanda blatchelli	purple allamanda, violet allamanda	അലമാന്ത
63	Palm		
64	Zamia furfuracea	cardboard palm	സാമിയ
65	Hibiscus Rosa sinensis	Chinese hibiscus	ചെമ്പരത്തി
66	Aegle marmelos (L.) Corrêa	Indian bael	കൂവളം
67	Euphorbia coloured leaf		
68	Psidium gujava	Common guava	പേര
69	Juniperous sp	common juiper	
70	Terminalaia catapa	Indian-almond	നാട്ടുബദാം
71	Croton varigatum	Garden croton	ക്രോട്ടൻ
72	Alpinia galanga	Greater Galanga	വലിയ അരഞ്ഞ
73	Butea monosperma	Sacred Tree	പ്ലാശ്
74	Pongamia pinnata	Indian beech, Pongame oiltree	ഇന്ത്യൻ ബീച്ച്
75	Garcinia gummi-gutta	Malabar tamarind, Brindle berry	കടംപുളി
76	Citrus limon	Lemon	ചെറുനാരകം
77	Jasminum multiflorum	Star Jasmine	ഇന്ത്യൻ ജാസ്മിൻ, സ്റ്റാർ ജാസ്മിൻ
78	Holoptelia intergerfolia	Indian elm, Jungle cork tree	ആവൽ
79	Clotoria ternatea	Clotoria ternatea	ശംഖുപുഷ്പം, അപരാജിത
80	Cinnamomum verum	True cinnamon tree, Ceylon cinnamon tree	കറുവ
81	Cinnamomum malabathrum	Indian bay leaf, tejpat	എടന, വഴന, കപ്പമരം
82	Terminalaia bellarica	Bahera	താന്നി
83	Annona reticulata	custard apple	ആത്ത
84	Sarcostemma viminale	Moon creeper	സോമലത
85	Stereospermum colais	Trumpet Flower Tree	കരിങ്ങഴ, പൂപ്പാതിരി
86	Wrightia tinctoria		
87	Kaempferia galanga	Maraba, Finger root, Chinese ginger	കച്ചോലം

88	Holorrhina pubescens	Indrajao	
89	Asparagua racemosus	Shatavari or Kurilo	ശതാവരി
90	Crateva religiosa	sacred garlic pear	നീർമാതളം
91	Vitex negundo	Chinese chastetree	കരിനൊച്ചി
92	Hydnocarpus pentandrus	chalmugra	മരോട്ടി
93	Flacourtia montana	Mountain Sweet Thorn.	വയ്ക്കുകര
94	Annona Muricata	Soursop	മുളുമാത്ത
95	Selaginella	Tarry spike-moss.	ഓണപ്പച്ച
96	Trianthema portulacastrum	Desert horsepurslane, black pigweed	വെള്ളത്തഴുതാമ
97	Lanea coromandelica	Indian ash tree	കാരിലവ്, ഉദി, കലശ്
98	Tabernaemonatana hgeyneiana		
99	Pilea microphylla	angeloweed	മതിൽ പച്ച
100	Pterocarpus marsupium	Malabar kino,Indian kino	വേങ്ങ
101	Pterocarpus santalinus	Red Sandal wood	Rakthachandanam
102	Glyrisiadia sepium	Nepal Gynura	Sheemakkonna
103	Alstonia vennanta	Devil Tree	Kuttippala
104	Delonix regia	Gulmohar	Gulmohar
105	Marsdfenia volubilis		
106	Ficus benghalaenis		
107	Ficus religiosa	Sacred Fig	Aaal
108	Achras sapota	Chiku	Sapota
109	Syzygium jambos	Rose Apple, Malabar Plum,	Madura Nelli
110	Ficus auricularia	Elephant Ear Fig Tree, Giant Indian Fig	
111	Idinjil		
112	Lakshmitharu		
113	Phyllanthus emblica	Indian Gooseberry	nellikka
114	Muntingia calabura	Singapore cherry, Birds cherry, Cotton candy berry	pancharappazham

115	<i>Syzygium caryophyllatum</i>	South Indian Plum	ഞാറ, ചെറുഞാറ, കരിഞാറ
116	<i>Nellippuli</i>		
117	<i>Nephelium lappaceum</i>	Rambuttan	റമ്പൂട്ടാൻ
118	<i>Ficus tinctoria</i>	Dye Fig, Humped Fig	ഇത്തി
119	<i>Ficus arnottiana</i>	Indian Rock Fig	ആൽ
120	<i>Guiliandra moringa</i>	Drumstick tree, Miracle tree	മുരിങ്ങ
121	<i>Passiflora edulis</i>	Passion fruit	പാഷൻ ഫ്രൂട്ട്
122	<i>Tridax procumbens</i>	coatbuttons or tridax daisy	
123	<i>Euphorbia heterophylla</i>	Lesser Green Poinsettia	
124	<i>Hyptis suaveolens</i>	Chia, Pignut or Chan	
125	<i>Boerrhavia diffusa</i>	Common Hogweed, Pigweed	
126	<i>Mollugo pentaphylla</i>	Carpet weed	പർപ്പടകപ്പുല്ല്
127	<i>Manihot esculenta</i>	Cassava Tapioca	കപ്പ, മരച്ചീനി
128	<i>Spermacoce remota</i>	Woodland False Buttonweed	
129	<i>Passiflora foetida</i>	Stinking Passion flower	
130	<i>Cynotis cristata</i>	Crested Cat Ears Nabhali	
131	<i>Amaranthus spinosus</i>	Prickly Amaranth Spiny amaranth Spiny pigweed Thorny amaranth	ചെറുചീര, മുളളൻ ചീര
132	<i>Cucurbita pepo</i>	Pumpkin	മത്തൻ
133	<i>Tamarindus indicus</i>	Tamarind/Indian date	പുള്ളി
134	<i>Pandanus amaryllifolius</i>	Pandan	ബിരിയാണി ഇല
135	<i>Pouteria campechiana</i>	Egg fruit, Cupcake fruit	മുടപ്പഴം
136	<i>Musa paradisiaca</i>	Banana	വാഴ
137	<i>Phyllanus niruri</i>	Gale of the Wind	കീഴാർനെല്ലി



Saraca asoca



Bauhinia purpurea



*Caesalpinia
pulcherrima*



Neeriumm oleander



Bambusa vulgaris



Azadirachta indica



Mangifera indica



Terminalia arjuna



Anacardium occidentale



*Tabernaemontana
alternifolia*



Ficus benghalaenis



Tridax procumbens



Commander
(*Moduza procris*)
വെള്ളിലത്തൊഴി



Common Indian Crow
(*Euploea core*) അരളി
ശലഭം



Common Jezebel
(*Delias eucharis*)
വിലാസിനി



Monkey Puzzle
(*Ratjomda amor*)
ഇരുതലച്ചി



Indian Sun Beam (*Caretis thetis*) സൂര്യശലഭം



Grey Pansy (*Junonia atlites*) വയൽക്കൊത



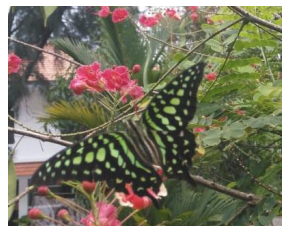
Gaudy Baron (*Euthalia lubentina*) കനിവർണ്ണൻ



Blue Tiger (*Tirumala limniace*) (നീലക്കടുവ)



Great Eggfly (*Hypolimnys bolina*) വൻചൊട്ടശലഭം



Tailed Jay (*Graphium agamemnon*) വിറവാലൻ



Common Palmfly
(*Elymnias hypermnestra*)
ഓലക്കണ്ടൻ



Slate Flash (*Rapala manea*) സ്ലേറ്റ് ഫ്ലാഷ്



Common Four-ring
(*Ypthima huebneri*)
നാൽക്കണ്ണി



Common Bush Brown
(*Mycalesis perseus*)
തവിടൻ



Plain Tiger (*Danaus chrysippus*) ഏരികതപ്പി



Figure 4 Students Participating in the Biodiversity Assessment of the Campus with Dr. Joby Paul



The presence of the above-listed Plants can have the following benefits to the ecosystem

1. Maintain the equilibrium of air and food
2. Filter and store water, and drastically reduce storm-water runoff
3. Conserve valuable topsoil and reduce soil erosion
4. Conserve biodiversity and balance ecology
5. Reduce air and noise pollution
6. Arrest or reverse global warming

Waste audit

The solid waste generated on the campus is managed properly. The campus is a plastic-free zone. Source segregation of waste is followed in the campus. For that three separate bins for paper, plastic and biodegradable waste at various points in the campus. The university is associated with Haritha Karma Sena which is associated with local bodies for collecting non-biodegradable wastes. They are collecting the waste from the campus every month.

E Waste

A total of 708.8 kg of e-waste has been reported in the 11 years. As of now the university has taken a policy to hand over the E-waste to Clean Kerala Company Limited (CKCL) - a government-owned enterprise in the State of Kerala. The company plays a critical role in promoting sustainable waste management practices across the state, with a focus on waste collection, processing, and recycling. It operates under the guidance of the Local Self Government Department (LSGD) of the Government of Kerala to manage and implement various waste management initiatives.

Food waste

Approximately 200 kg of food waste is generated per week from the academic and administrative blocks, ladies hostel and gents hostel of the university. The university has two ring compost units for the management of food waste generated in the campus including canteen. Additionally, each hostel is having ring composting units. Apart from this the Food waste generated in the hostels were regularly collected by local vendors for animal feeding.

Plastic and paper waste

Weekly estimates for paper waste amount to about 30 Kg. It is estimated that 4.2 Kg of paper are produced every day on average. 20.92 Kg plastic waste is generated weekly and approximately 2.9 kg on a daily basis. The plastic and paper waste from the campus as well as the canteen, ladies hostel and gents hostel are collected by Haritha Karma Sena of Vettom Grama Panchayath on a Monthly basis. The university pays Rs. 100 for each collection. For management of sanitary pad sanitary pad incineration machine is installed in the campus.

To address these challenges and improve overall waste management practices, a series of recommendations have been proposed:

Paper and Plastic Waste Management:

Establishing a Mini Material Collection Facility (MMCF) on campus will centralize the collection and segregation of paper and plastic waste, enhancing recycling efforts and campus cleanliness. Initiatives to reduce paper use and single-use plastics will further support sustainability goals.

E-Waste Management

Implementing a regular e-waste collection schedule and partnering with certified recyclers will ensure responsible disposal of electronic waste. Additionally, establishing Annual Maintenance Contracts (AMCs) for electronic equipment will help prolong device lifespans and reduce e-waste generation.

Food Waste Management

Promoting proper segregation and conducting awareness programs will enhance the efficiency of food waste processing.

Garden Waste Management

Adopting the Thumboormuzhy composting model will facilitate the management of garden waste and produce nutrient-rich compost for campus gardens, promoting sustainable landscaping practices.

Sanitary Napkin Waste Management:

Increasing the number of sanitary napkin incinerators and ensuring their proper maintenance will address menstrual waste management in a hygienic and efficient manner.



Figure 5 Haritha Karma Sena of Vettom Grama Panchayath Collecting Non Biodegradable Waste from the Campus



Figure 6 Seperate Bins for the Segregated Collection of Waste



Energy audit

Energy Efficiency means economising on the use of energy without affecting economic growth and development. It includes improving the efficiency of energy extraction, transmission and Distribution and increasing the productivity of energy use. As per the Energy Conservation Act, 2001, Energy Audit is defined as the verification, monitoring and analysis of use of energy containing recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption. Load distribution at the main panel of University is given below

Panel name	AVG load (W)	Energy consumption (KWh)		
		per day	per month	%
Library block	28592	151.916	4557.48	26.19%
Ezhuthachan block	9348	52.084	1562.52	8.98%
New building	4342	27.826	834.78	4.80%
Canteen	1464	14.272	428.16	2.46%
Academic block	24004	119.048	3571.44	20.52%
Administrative block	50176	214.904	6447.12	37.05%
Total	117926	580.05	17401.5	100.00%

The energy audit conducted at Malayalam University has identified significant opportunities for energy conservation and efficiency improvements. The audit revealed that the university can reduce its energy consumption by 60-70% through implementing energy-efficient measures such as led lighting, BLDC ceiling fan, solar power systems, and optimizing HVAC systems. The report recommends:

1. Replacing Traditional Lighting with LED Bulbs
2. Installing Solar Panels to Generate Renewable Energy
3. Upgrading To Energy-Efficient HVAC Systems
4. Implementing Smart Energy Management Systems

5. Conducting Regular Energy Audits to Monitor Progress

By implementing these Malayalam University can reduce its energy expenses, minimize its carbon footprint, and contribute to a sustainable future.

Carbon audit

Carbon neutrality refers to achieving net zero GHG emission by balancing the measured amount of carbon released into atmosphere due to human activities, with an equal amount sequestered in carbon sinks. It is crucial to restrict atmospheric concentrations of GHGs released from various socio-economic, developmental and life style activities using biological or natural processes. It is recognized that addressing climate change is not as simple as switching to renewable energy or offsetting GHG emissions. Rather, providing an opportunity for innovation in new developmental activities for viable and effective approach to address the problem. Carbon emission details from the campus is given below.

Source	CO ₂ emission
Energy	282.2-ton CO ₂ eq.
Transportation	31.78-ton CO ₂ eq.
Waste	22.51-ton CO ₂ eq.
Refrigerator & AC	0.17-ton CO ₂ eq.
Total	336.661-ton CO ₂ eq.

Carbon Mitigation Proposals

- Energy Saving in Lighting by replacing existing T8 (40W) Lamps to 18W LED Tube
- Energy Saving by replacing existing in-efficient ceiling fans with Energy Efficient Five-star fans
- Installation of Solar Power Plant

INSTALLATION & BENEFITS OF SOLAR PANELS

NEEDS	UNITS
On grid solar power plant	75 KW
Estimated cost	38 Lakh
Percent usage of unit per day in KWH	350 KWH
Unit per month	10500 KWH
Energy generation from solar panel eachday	300 KWH
Per year consumption	126000 KWH
Approximate area for installation	7500 sq ft
Save electricity bill per month	RS 75000
Save electricity bill per year	900000
Payback period	5 Years