ENERGY, GREEN AND ENVIRONMET AUDIT - 2020

EMEA COLLEGE OF ARTS AND SCIENCE
KONDOTTY, MALAPPURAM
Kerala

EXECUTED BY

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February – 2020

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PREFACE

Every institution should be imparting knowledge about the campus environment and its surroundings through activities that follows the principles of sustainability. Hence an evaluation is needed to understand where it stands in the path to be an environment friendly, talent nurturing educational institution. This Green Audit was done with the aim to assess and rate the sustainable nature of the campus. The college vision is "to enlighten and empower women in rural and suburban society and enable them to act as agents of social transformation and acquire knowledge of self and surroundings and to make the world a better place". And in the **social goals**, it is written as **"to make the students aware of the pressing global issues and the moral responsibility to handover to the coming generation an eco-friendly life style and an earth free from pollution, filth, bigotry and corruption".** It was clear from the students' participation during the energy, green and environmental audit..

This report is compiled by the BEE certified Accredited energy auditor and GRIHA rated certified professional along with the project engineers who are experienced in the field of energy, environment and management. The student volunteers especially from the Physics department made a mammoth contribution with data collection and preparing an initial skeleton for the report.

ACKNOWLEDGEMENTS

We express our sincere gratitude to the **EMEA COLLEGE Kondotti** for giving us an opportunity to carry out the project of Green, Energy , green and Environmental audit We are extremely thankful to all the staffs for their support to carry out the studies and for input data, and measurements related to the project of audits.

1. Executive Director
2. Principal
3. Staff
4. Students

Also congratulating our Energy audit team members for successfully completing the assignment in time and making their best efforts to add value.

AUDIT TEAM

1. **Mr. Santhosh A**
   Registered Energy Auditor of Bureau of Energy Efficiency (BEE – Govt. of India)
   Accredited Energy Auditor No – EA 0275

2. **Mr. Ashok KMP**
   Registered Energy Manager of Bureau of Energy Efficiency (BEE – Govt. of India)
   Energy Manager No – EA 25612 and GRIHA Certified Professional

3. **Mr. Jaideep P P,** Project Engineer - ME, Energy Engineering.

Yours faithfully

Managing Director
Athul Energy Consultants Pvt Ltd

EXECUTIVE SUMMARY

ANNUAL ENERGY CONSUMPTION

Annual cost for energy consumption during last 12 months (Feb-2019 to Jan-2020).

Particulars	Unit	Quantity	Average Cost (Rs Lakhs)
Electricity	kWh	76260	5.82
Diesel	Liters	1000	0.65

TABLE 1: ANNUAL ENERGY COST

Environment & Energy summary:

kW	Particulars	Annual Energy	Carbon dioxide Emission	Carbon dioxide emission – Reduced
1	Replacement of ceiling fans with BLDC	6750 kWh	4.09	1.7
	TOTAL	6750	**4.09**	

TABLE 2: EXECUTIVE SUMMARY – ENVIRONMENT AND ENERGY

Inference:

20% of carbon dioxide level is reduced by implementing energy conservation measures by the college
Other measures like tree planting, bio gas installation also done by the college

Water resources:

There are two bore wells in the college campus .and a borewell in the Ladies Hostel.
Water recharging or rain water harvesting is done by collecting the water in the nearby old quarry.

Waste management:

The biodegradable wastes are either fed in to the biogas plants installed behind college canteen and one in the ladies Hostel. Incinerator is installed in the ladies hostel Other wastes are disposed separately.

GREEN AUDIT

The whole world is on the road to a sustainable development, and the environment conservation is the top priority among the list as every human activity has its effect on their surroundings, which is the environment. Hence be it a house, a commercial building, an industrial building, or any other construction will disturb the balance of the environment. It is very important to do a detailed study about the effects on the environment. This is conducted under the name of *Green Audit*, which can be defined as *the official examination of the effects a company or other organization has on the environment, especially the damage that it causes*. The objectives of the green audit can be listed as follows:

- Including participants from every section of the organization in the auditing process.
- Understanding the environment by drawing a simple sketch of the total area.
- Identifying the activities in the premises and listing them.
- Calculating the resource consumption like the land and water.
- Assessing the waste management and disposal.
- Study the energy usage pattern.
- Identify the good practices.
- Suggest the viable solutions to improve the sustainable nature of the organization.
- Compile the report with the above-mentioned details.
- Conduct a walkthrough audit to verify the suggestions implemented by the organization.

EMEA COLLEGE KONDOTTY

EMEA College of Arts and Science, Kondotti is fast emerging as a resourceful destination for higher studies in Malabar, spreading the fragrance of education in the society. This college is affiliated to the University of Calicut. The college offers up-to-date, advanced, and job-oriented programs in the vast expanding horizon of humanities, commerce, and science and technology. The college is situated at Kumminiparamba in Kondotti, 6 KMs away from University of Calicut, 2 KMs from Calicut International Airport, 18 KMs from Feroke Railway Station, and 32 KMs from Calicut City; with a congenial atmosphere for academic pursuits. The place is ideally suited for the growth and development of educational institutions for higher learning. The institution aims at the overall development of this backward area of Kerala by opening new vistas of opportunities to the future generations, without any discrimination against caste, creed, sex or colour. The college is run by Ernad Muslim Educational Association, which was formed with the objective of establishing a chain of educational institutions and cultural centers to cater to the needs of educationally and culturally backward section of the community. The college is a stepping stone to realize the objectives envisaged by the Association. Established on 1st November 1982 as a junior college, it flourished as a post graduate college today.

Vision

To be a centre of excellence in higher education, affordable to common man.

Mission

Identifying and developing the talent of the youth and moulding them into useful citizens with due emphasize on right character formation is the avowed mission of EMEA College. The fulfilment of this lofty goal is the basis of educational programs formulated and pursued by the institution.

FIGURE 1: COLLEGE CAMPUS – SATELLITE VIEW

CARBON DIOXIDE LEVELS

Air quality is a major area of concern inside a building. The percentage share of oxygen and carbon dioxide should be such that the occupants are able to perform their tasks without any discomfort. This is generally done through a provision of fresh air duct for the air conditioning systems or by providing windows. Numerous factors need to be considered for the design and fabrication of the fresh air supply system like the number of occupants, weather pattern and air quality of the location, and so on. For the human comfort, production of carbon-dioxide (CO2) within a building space is the prime area of consideration. This is associated with respiration which produces CO2. As a result, the carbon-dioxide levels will increase if ventilations are not provided. As a solution, fresh air is usually introduced by opening windows or using a CO2 sensor, which will operate a fresh air inlet valve of the AC system.

As per various standards (like the ASHRAE Standard 62.1-2016), indoor CO2 concentrations up to 1200 ppm is considered acceptable. For a typical outdoor condition, this value may change from 300 to 500 ppm.

The measurements were recorded along different locations inside the campus and the peak values are given in the following sections. The key concentration was on the study of carbon dioxide levels. The measurement has been done. The measured readings are given below in Table.

Sl. No.	AREA	Measured CO_2	Standard CO_2 level(Range)	Remarks
1	Class room	460	300-500	**Good**
2	Corridor	450	300-500	**Good**
3	Laboratory	580	300-500	**Good**
4	HOD room	650	300-500	**Good**
5	Front Office	400	300-500	**Good**
		Miscellaneous		
1	Canteen	450	300-500	**Good**
2	Auditorium	550	**300-500**	**Good**

TABLE 3*: CO2 LEVELS*

WATER RESOURCES

The pond and tube well are the main source of water resource in the college campus. Consumption over the past one year is found with the data given by the authority about the pump hours and the capacity of water tanks. It is given in the Table 5. The assumption was made on the data identified about the pump hours.

Location	Daily consumption	Average working days	Total consumption
	m^3		KL
College tank 1	1	200	200
College tank 2	0.8	200	160
Main block	150	200	30000
Hostel	25	300	7500
Total			37860

TABLE 4: WATER CONSUMPTION

Inference:

100% of the college water consumption is met by the college bore wells, Ponds which implies the ground water levels are good and the rain water is efficiently recharged in to the ground.

WATER UTILITIES

The labs are most of the outlet points. But the toilet flushes will account for the major consumption. The water outlet points in the college campus and hostel are listed in the following:

location	No: of taps
Washing area taps	8
Toilets	16
Flushes	16
College compound and garden	10
College hostel	22
Canteen	02
Lab	21

TABLE 5: WATER OUTLET POINTS

Suggestion notes:

- Drip irrigation can be used for the watering the garden plants.
- Sprinklers can be used wherever possible.
- Toilet flushes can be made more usage efficient by using dual-flush system

GROUND WATER RECHARGING/COLLECTION

From the water consumption data (Table 5), the college utilizes about 40000 kL of water. The average rainfall in the college during monsoon(June-August) is around 600mm of rain. This brings about 28000 Kl of water in the college campus area. Construction of recharging pits are one of the best ways to improve the ground water level. Hence recharging pits must be made at strategic locations in the college premises. The details of proposed systems are given in the Table.

Preferred Location	Source	Recourses done in college
Near college ground	Run off water from the ground	Improved ground water level by Bamboo Lake
Hostel	Hostel roof	Resource for hostel well.
Canteen	Roof	Resource for college well.
Main block	College Roof	Recharging and divert water to pond

TABLE 6: RECHARGING PITS

Notes:

- The use of biomass in the form coconut shells can be used to cover the foot of the trees which can behave as recharging soak pits. These are plentily available in nearby areas.

ENVIRONMENT OF CAMPUS

HERBAL GARDEN

The herbal garden is helpful for the students in knowing taxonomic knowledge and identification of the local plants. In addition, they promote relaxation; maintain a healthy mind in the surrounding environment. The diverse collection of plant species facilitates visitors to experience new plants and enables opportunities for learning. The herbal garden provides valuable information on various plants and act as outer laboratory for students and scientific researchers.

AGRICULTURE

This will develop not only an understanding of the importance of agriculture but also a community spirit. Do not limit learning to the knowledge and skills necessary for industry and/or business.

EMEA management taken special care to nurture and development of students in the college to land management, soil management due to this will increase the interaction among students and society will improve, act as a reliever of academic stress .

STUDENT ACTIVITIES ON ENVIRONMENT

NATURE CLUB

Trees are the major source of the oxygen we breath and receiver of the carbon dioxide we exhale. The sustainability of an ecosystem depends on the number of plants and trees in and around the surroundings. There is well maintained garden and pond inside of the college.

College nature club conducting various programs on environmental day June-5 . Energy conservation December -14, and Ozone layer protection day as September -16. Protecting the pond and garden is the duty of nature club.

- College nature club conducting various programs on environmental day June-5. Protecting the pond and garden is the duty of nature club.
- Conducted various training programs with nearby schools and public about importance of energy and environmental conservation
- Maintaining the trees in college campus and new sampling of trees.
- Conducted nature quiz programs in college.
- Conducted rally in connection with world environment day

NSS UNIT

- Tree planation programme with the coordination of CISF Calicut airport unit during their Silver Jubilee celebrations.
- Organized one-week programs in and around of college for creating awareness to society for nature conservation. June 1 to 7 various programs such as Photo exhibition, drama, tree sampling distribution, classes and seminars about importance of organic farming etc conducted.
- "KADUMM KATTARIVUM "Nature camp organized at Silent valley by college students.
- "PARVAKALKU ORU URAVU" pots for storing drinking water around trees for birds during summer season. Installation & maintaining and filling of water during summer is taken care by students.


EMEA COLLEGE NSS UNIT
KONDOTTY
"Out of syllabus
കാടും കാട്ടറിവും"
Nature camp
2016 Octo. 28-30
silent valley
There is no Wi-fi in the forest, but I promise you will find a better connection.

WASTE MANAGEMENT

Waste is generally termed as 'a resource at the wrong place'. The college changed the thought process as waste is wealth and it is not waste. The college authorities are aware of the possible methods and have installed waste management measures like the vermicompost and biogas systems. Segregation waste is primary concern and it is done successfully in the college. Then it is treated in different ways and thus the pathway for waste management is done by the college. The waste clearance measures associated with different types of wastes are briefly given below.

BIODEGRADABLE WASTES

The biodegradable wastes are mainly from the college canteen and hostel. The bio-slurry is used as manure to the plantation.

College Canteen &College Hostel:

- It is found that around 5-10 kg of biodegradable food waste is available per day and is fed in to one biogas plants installed behind the ladies' hostel. The liquid waste from the bio gas plant is taken to bio manure used for plants, trees and gardening in college campus.
- Other wastes like those from the toilets are disposed through septic tank at locations situated away from water sources.

NON-BIODEGRADABLE WASTE

Non-recyclable wastes are collected and burned once in a month. The recyclable wastes are sorted out in to categories and supplied it to the collecting units. This is burned in a incinerator

ELECTRONIC WASTE

The college e-waste includes mainly of damaged computer parts. The auditors found that they are stored safely in a building room. These can be given away to the e-waste collecting units.

LABORATORY WASTE

Waste materials from the labs are neutralized and disposed in an identified area.

FIGURE 2: WASTE MANAGEMENT

STUDENT ACTIVITIES

- Suchithwa Mission wall partings are done by NSS wing of college in Sub registrar of Kuruppam, Kuzhisseri. They also intended and done many govt. departments walls also.
- Rally is conducted in the surrounding areas for spreading about the awareness about importance of waste management.
- Collection and segregation of waste in nearby village on the part of NSS camp.
- Segregation of waste at the user end is the moto of the college and it is perfectly maintained by the students.
- The bio maneuver from the biogas plant is diluted and fed for gardening and used as fertilizer for agricultural purpose in the college.

ശുചിത്വ സന്ദേശ ചിത്രങ്ങളുമായി
എൻ.എസ്.എസ് വിദ്യാർഥികൾ

ENERGY

OBJECTIVES

An energy audit is a key to assessing the energy performance of facility and for developing an energy management program. The typical steps of an energy audit are:

- Preparation and planning
- Data collection and review
- Plant surveys and system measurements
- Observation and review of operating practices
- Data documentation and analysis
- Reporting of the results and recommendations

1.1. Definition of energy auditing

In the Indian Energy Conservation Act of 2001 **(BEE 2008)**, an energy audit is defined as: **"The verification, monitoring and analysis of the use of energy and submission of technical report containing recommendations for improving energy efficiency with cost-benefit analysis and an action plan to reduce energyconsumption."**

1.2. Objectives of Energy Auditing

The objectives of an energy audit can vary from one plant to another. However, an energy audit is usually conducted to understand how energy issued within the plant and to find opportunities for improvement and energy saving. Sometimes, energy audits are conducted to evaluate the effectiveness of an energy efficiency project or program. In Sahrdaya College of Engineering and Technology as per the request, we have assessed the energy consumption and saving opportunities at present scenario.

Methodology for the study

The methodology adopted for energy audit starts from historical energy data analysis, power quality analysis, monitoring of operational practices, system evaluation, cost benefit analysis of the energy conservation opportunities, and prepare plan for implementation. The proposals given in the report includes economical energy efficiency measures to reduce facilities unnecessary energy consumption and cost. The energy conservation options, recommendations and cost benefit ratio, indicating payback period are included in this report

The different types energy usage is given in this section. The major source of energy to the college is electricity. Other forms come in the form of LPG, petrol, diesel etc.

Details Work

The Scope of Work includes:

1. Historical energy data analysis.
2. Electrical, Mechanical and Thermal energy analysis.
3. Power Quality Analysis.
4. Identification of Energy saving opportunities.
5. Cost Benefit Analysis

ELECTRICAL ENERGY

The major source of electricity to the college and hostel is the electrical connection from the KSEB. Separate connections are provided to the college and hostel. A diesel generator is provided in the college, but it is only used during critical days like examinations or college events. In addition to this college installed 40kW solar panel for reducing the electricity consumption and also show the responsibility of college for sustainability.

DESCRIPTION OF ELECTRICAL BILL

Base line data given below is based on the Electricity bill provided by the supplier of electricity to the College. Details obtained from the KSEB bill for the month of November 2020 is as follows in the Table:

Electricity connection	COLLEGE
Consumer No	115529015264
Contract Demand	80 kVA
Connected Load	41995 W
Tariff	LT-6A /Three
Month & Year	Februvary -20202
Consumption (kWh)	6355
Fixed charges (Rs)	2730
Energy charge (Rs)	41308
Duty (Rs)	4130
Fuel surcharge	2730
Meter rent (Rs)	15
FS	360
tax	3
Total amount to be paid (Rs)	48547

TABLE 7: KSEB BILL ANALYSIS

ENERGY PERFORMANCE

The objective of this subsection is to establish how the facility is performing in terms of energy consumption.

MAIN EB INCOMER (COLLEGE)

The EB Incomer was logged by using the power quality analyzer Krykard ALM 35. Logged details are given below in the Table 10.

Actual Energy for 24 Hrs	kWh	**32**		
Apparent Energy for 24 Hrs	kVAh	**35**		
Power Factor	0.92			
Particulars	**Units**	**Minimum**	**Maximum**	**Average**
Active Power	kW	**0**	**53.21**	**12.18**
Apparent Power	kVA	**0**	**57.27**	**20.44**
Voltage	Volts	**0**	**233**	**213**
Current	Amps	**0**	**118**	**27.9**

TABLE 8: ENERGY CONSUMPTION – MAIN EB INCOMER(COLLEGE)

POWER CONSUMPTION FOR 24 HOURES

CONNECTED ELECTRICAL LOAD

The connected load details of EMEA College -Kondotty are given below in the Table 12:

Sl. No:	Particulars	Power in kW
1	Lighting load	18.21
2	Ceiling Fan	13.86
3	UPS	20
4	Computer and Printer load	15.75
5	Air conditioner	6.3
6	Pumps	9.5
7	Miscellaneous	30.01
	Total	113

TABLE 9: CONNECTED ELECTRICAL LOADS

Notes:

- As per bill the sanctioned load of college building are **113kW.** Here the
- The below pie diagram shows the load pattern.

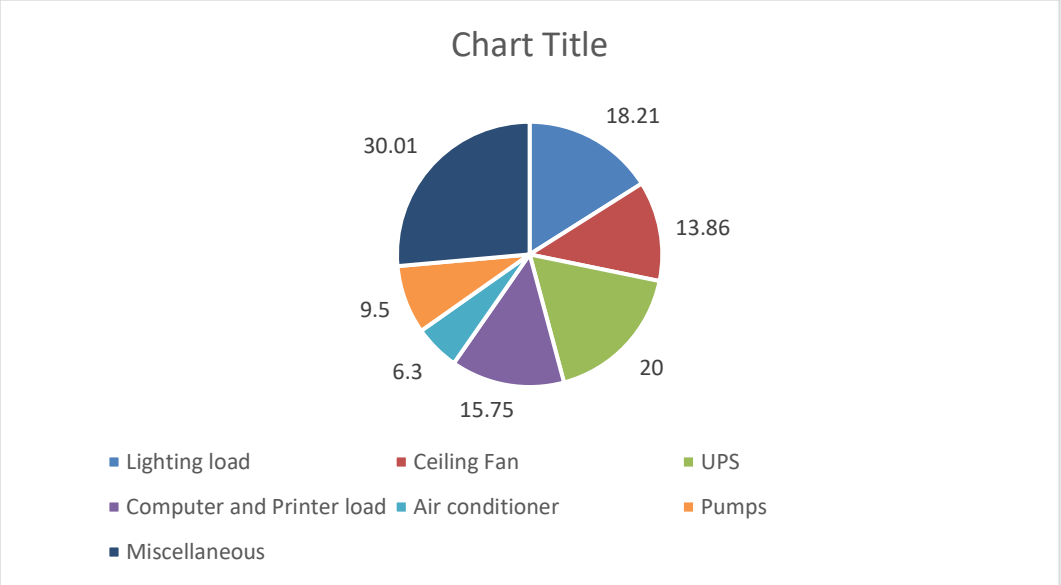

FIGURE 3: CONNECTED ELECTRICAL LOAD

Suggestions:

- Clean the lights and fixtures regularly for removing the dust particles.
- Replace the ceiling fans with star rated fans or BLDC (Brush Less Direct Current) fans.
- Use low-energy sleep functions on computers, printers, and copiers, when not in use.
- Consider BEE labelled/ISI Marked office equipment and appliances for procurement.
- Switch off all equipment's when not in use and enable power-down mode.
- Place heat-emitting equipment such as printers and photocopiers in a separate, ventilated area with good airflow. This helps prevent overheating, removes potential emissions from the equipment and reduces noise.

LUX MEASUREMENTS

According to National Lighting code-2010 BIS to determine the overall energy efficiency of lighting system using measurements and methods, which is applicable to all commercial buildings. One of the methods is Illuminance method, which is the most practicable one. Details are given in the section. Lux levels of some areas are given in the Table 15. The lux levels mentioned as satisfactory need to be improved.

Sl. No.	AREA	Measured Lux	Required Lux	Remarks
1	English classroom	120	150	Satisfactory
2	Commerce class	160	150	Good
3	Economics classroom	110	150	Satisfactory
4	Office	180	150	Good
5	Microbiology	180	150	Good
6	Entrance	125	150	Satisfactory
7	Biochemistry	135	150	Satisfactory
8	Biotechnology	156	150	Good
9	Computer Science	185	150	Good
10	Hostel	111	150	Satisfactory

Table 13: LUX MEASUREMENTS

ANNEXURE 1

ENERGY CONSERVATION MEASURES

ENERGY CONSEVATION MEASURE -1

REPLACEMENT OF CEILING FANS WITH BLDC FANS.

Background

A BLDC fan takes in AC voltage and internally converts it into DC using SMPS. The main difference between BLDC and ordinary DC fans is the commutation method. A commutation is basically the technique of changing the direction of current in the motor for the rotational movement. In a BLDC motor, as there are no brushes, so the commutation is done by the driving algorithm in the Electronics. The main advantage is that over a period, due to mechanical contact in a brushed motor the commutators can undergo wear and tear, this thing is eliminated in BLDC Motor making the motor more rugged for long-term use. To explain, BLDC technology in simpler terms, BLDC uses a combination of Permanent Magnets and Electronics to achieve the kind of efficiency and performance, it delivers. A BLDC fan composes of 3 main components: - 1. Stator 2. Rotor 3. Electronics

Proposal

Replace the ceiling fans with BLDC in the as per preference of operating hours as office areas., staff rooms and in security cabin and in hostels The calculation for the savings is given in the table below:

Existing Ceiling Fans	**Watts**	**60**
Proposed BLDC Fans	Watts	35
Difference in Wattage	Watts	25
Avg No: of working hours/day	Hrs	10
No: of working days per year (Average)		250
No: of working hours per annum	Hrs	2500
Number of Fans operating	Nos	45
kWh Saving per Annum	**Rs**	**2813**
Cost per kWh	Rs	6.0
Annual Financial Savings	**Rs**	**16878**
Cost of BLDC Fans	Rs	3000
Investment for BLDC Fans	Rs	135000
Simple Payback period	Months	96

TABLE 10: ENERGY CONSERVATION -1

ANNEXURE-3

LIST OF INSTRUMENTS

SL.NO	EQUIPMENT DESCRIPTION	MAKE & MODEL
1	POWER ENERGY & HARMONIC ANALYSER	KRYKARD ALM 30
2	POWER ENERGY & HARMONIC ANALYSER	FLUKE 1730
3	AIR QUALITY METER	TESTO 480
3	LUX METER	LM 100

ABBREVIATIONS

AVG	:	Average
BEE	:	Bureau of energy efficiency
CO_2	:	Carbon dioxide
KSEB	:	Kerala State Electricity Board.
DB	:	Distribution Board
EC	:	Energy Conservation
IEEE	:	The Institute of electrical and electronics engineers
IS	:	Indian Standard
kL	:	kilo Littre
KVA	:	kilo Volt Ampere
kVAh	:	kilo volt Ampere Hour
kVAr	:	kilo volt ampere
kW	:	kilo Watts
kWh	:	kilo watt hour
LT	:	Low tension
MAX	:	Maximum
NSS	:	National Service Scheme
SLD	:	Single Line Diagram

REFERENCES:

- Handbook on energy audit and environment management by TERI.
- Bureau of Energy Efficiency (BEE) books for certification of Energy Auditors & Managers.

ENERGY IS LIFE
BEE
CONSERVE IT

BUREAU OF ENERGY EFFICIENCY

Examination Registration No.: EA- 7597

Accreditation Registration No.: AEA-0275

Certificate of Accreditation

This is to certify that Mr./Ms. Santhosh. A having its trade/registered office at Kerala has been given accreditation as accredited energy auditor. The certificate shall be effective from 2nd day of November, 2017

The certificate is subject to the provisions of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

This certificate shall be valid until it is cancelled under regulation 9 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

On cancellation, the certificate of accreditation shall be surrendered to the Bureau within fifteen days from the date of receipt of order of cancellation.

Your name has been entered at AEA No. 0275 in the register of list of accredited energy auditors. Your name shall be liable to be struck out on the grounds specified in regulation 8 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

Given under the seal of the Bureau of Energy Efficiency, Ministry of Power, this 12th day of February, 2018

Secretary,
Bureau of Energy Efficiency
New Delhi

Energy Management Centre - Kerala
(Department of Power, Govt of Kerala)

CERTIFICATE OF EMPANELMENT

This is to certify that ***M/s. Athul Energy Consultants Pvt Ltd*** *(4/2, Capital Legend, Korapath Lane, Round North, Thrissur – 680 020) is empanelled as Energy Audit firm in Energy Management Centre Kerala to conduct mandatory energy audit as per Government of Kerala G.O (Rt) No.2/2011/PD dated 01.01.2011.*

Empanelment No:
EMCEEA- 0811F-2

Scope/Area	Building	Industry -Electrical	Industry Thermal
	Yes	Yes	Yes

This empanelment is valid up to 20th December 2020
Issuing Date: 01/01/2018
Place: Thiruvananthapuram

Director,
Energy Management Centre Kerala

CERTIFICATE

Ministry of New and Renewable Energy
Government of India

GRIHA Council

The Energy and Resources Institute

This is to certify that

Ashok K M P

of

Athul Energy Consultants Pvt Ltd, Thrissur

has qualified as

GRIHA Certified Professional

on

01st August 2018

Sanjay Seth
Chief Executive Officer
GRIHA Council

Note: This certification is valid for a period of 2 years from the date of qualification (exam).

GRIHA

http://community.grihaindia.org/blocks/verify_certificate/index.php?certnumber=fyiPq2Q5JA

@GRIHA Council