

**BASELINE INVENTORY REPORT ON
GREEN HOUSE GAS (GHG) EMISSION AT
LADY DOAK COLLEGE BASED ON CALENDAR YEARS 2013 &
2014 AS PER THE GHG PROTOCOL**



LADY DOAK COLLEGE, MADURAI

“College with Potential for Excellence”
Re-accredited by NAAC with Grade ‘A’
(3rd Cycle: 3.44 out 4)

CENTRE FOR ENVIRONMENTAL STUDIES

05th JUNE 2015

S.NO	CONTENT	PAGE NUMBER
1.	EXECUTIVE SUMMARY	2
2.	INTRODUCTION	3
3.	GHG ACCOUNTING AND REPORTING PRINCIPLES	3
4.	RELEVANCE - ORGANISATIONAL BOUNDARIES	3
5.	COMPLETENESS - OPERATIONAL BOUNDARIES	8
6.	CONSISTENCY	9
7.	METHODOLOGY	9
8.	TRANSPARENCY	9
9.	GHG COVERED IN THE BASELINE INVENTORY STUDY BY LDC	9
10.	ACCURACY	10
11.	IDENTIFICATION AND CALCULATION OF GHG EMISSION FOR LDC (2013 & 2014)	10
12.	ASSUMPTION	13
13.	GHG REMOVALS AND SINKS	13
14.	MITIGATION PRINCIPLES OF THE COLLEGE	14
15.	MITIGATION STRATEGIES FOLLOWED IN LDC CAMPUS FOR THE REDUCTION OF GHG EMISSION	15
16.	MITIGATION STRATEGIES PLANNED BY THE COLLEGE TOWARDS ACHIEVING CARBON NEUTRALITY IN THE FORTHCOMING YEARS	15
17.	ABBREVIATIONS	16
18.	REFERENCES	16

S.NO	FIGURES	PAGE NUMER
1.	STEPS IN GHG MANAGEMENT	2
2.	LADY DOAK COLLEGE ORGANIZATIONAL BOUNDARY	4
3.	VARIOUS BLOCKS OF LADY DOAK COLLEGE RESPONSIBLE FOR THE GHG EMISSION	4 - 7
4.	LADY DOAK COLLEGE OPERATIONAL BOUNDARIES	8
5.	GHG EMISSION (tCO ₂ e) - 2013	12
6.	GHG EMISSION (tCO ₂ e) - 2014	12
7.	COMPARISION OF GHG EMISSION (tCO ₂ e) - 2013 AND 2014	13
8.	GIS MAPPING SHOWING THE GREEN CAMPUS OF LADY DOAK COLLEGE	13
9.	LADY DOAK COLLEGE VEGETATION	14
10.	SOLAR PANEL & STREET LIGHT INSTALLATION	15
11.	STUDENTS PROJECT ON SOLAR CANDLE	15

S.NO	TABLE	PAGE NUMBER
1	SOURCES FOR DIRECT AND INDIRECT EMISSION IN LADY DOAK COLLEGE	11
2	GHG EMISSION SUMMARY (2013)	11
3	GHG EMISSIONS SUMMARY (2014)	12
4	LDC GHG EMISSIONS SUMMARY (JAN – DEC, 2014)	12

LADY DOAK COLLEGE ACTION PLAN TO ACHIEVE CARBON NEUTRALITY BY 2025

Way Forward to Low Carbon Institution by 2025

ABOUT THE INSTITUTION

Lady Doak College is one of the leading autonomous colleges located in the city of Madurai, South India. Ms. Katie Wilcox who had a vision and fervor for women's education founded the college in the year 1948. It is affiliated to the Madurai Kamaraj University. It is functioning as an Autonomous College since 1978 and reaccredited with an 'A' Grade, CGPA 3.44 on a 4 point scale by NAAC in the year 2013. It is awarded the status of College with Potential for Excellence by the University Grants Commission, New Delhi and certified as an ISO 9001:2008 institution for its quality consciousness in every sphere of its functioning. Its challenging curriculum blended with relevant academic programmes, co-curricular activities, exposure programmes, and a well developed student's support system has placed the College at the forefront in the field of higher education.

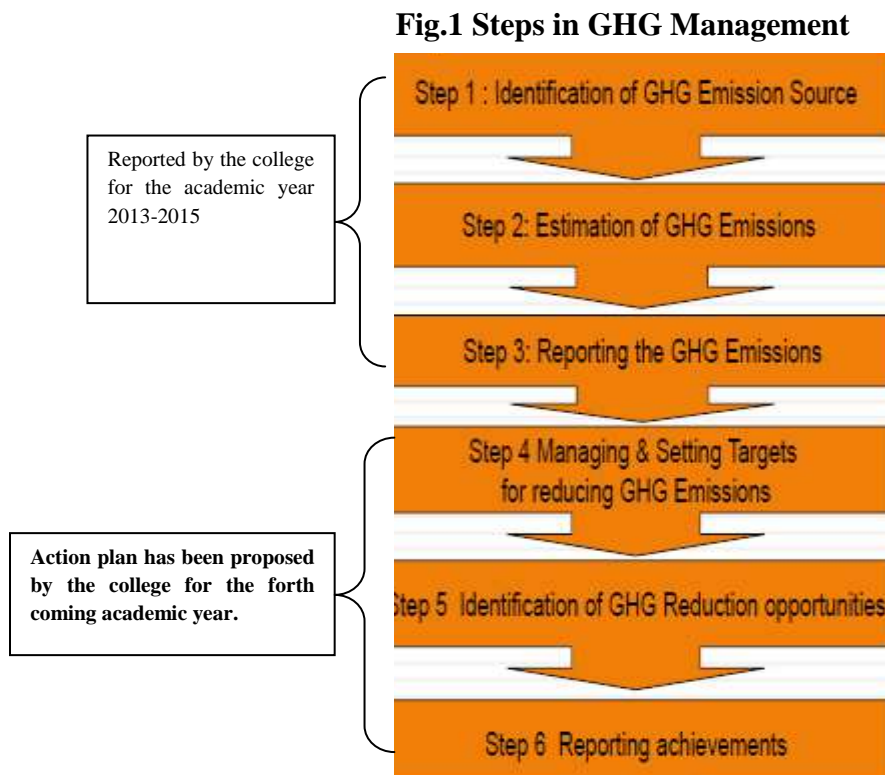
The College currently offers 26 undergraduate, 14 postgraduate, 9 M.Phil., and 6 research programmes. Besides these, 3 diploma, 3 PG diploma and 1 certificate courses are also offered. Ours is one of the first few Arts and Science colleges in the state of Tamil Nadu, which has initiated International Student Exchange Programme for credit transfer in the year 2008. Lady Doak College campus has 4000 students and the staff base of over 400, out of which 700 are resident members.

The College has a Centre for Environmental Studies, started in the year 2003 which looks after all the ecoinitiative programmes. The college was awarded **Dr. Gurusamy Mudaliar Virudhu** to an institution (I Prize & Cash award of Rs.15, 000/-) by the Government of Tamil Nadu on 5th June 2014 for Environment Protection and Management.

Executive Summary

Lady Doak College (LDC) releases its Carbon neutrality action plan that includes a time frame and steps to become a Low Carbon Institution/Carbon Neutral Institution. Carbon neutrality occurs when energy and resources are used in a way that does not increase the net amount of carbon dioxide or other greenhouse gases (GHG) in the atmosphere over time. From January 2013 - December 2013 & January 2014 - December 2014, Lady Doak College emitted 1010.368 & 1013.893 tons of CO₂ equivalents respectively. This report considers data collected for January 2013– December 2014 as the base line measurements to assess its carbon emission, from where progress could be made to reduce carbon emission.

Lady Doak College completes its Green House Gas (GHG) emissions inventory in general accordance with GHG protocol Corporate Standard convened by the World Resources Institute (WRI) specification with Guidance at the Organizational Level for Quantification and Reporting of Greenhouse Gas Emissions and Removals.



INTRODUCTION

LDC prepared the Greenhouse Emission Inventory baseline study for annual year 2013 and 2014. The College is one of the first academic Institutions in India to create an inventory study on the emission of Greenhouse gas based on the universally recognized GHG Protocol. The college holds a centre for Environmental studies which actively sorts out the issues related to the environment within the college. As a part of Green Campus Initiatives by the centre, it engages itself in bringing the college to Carbon Neutrality by the year 2025. In this regard, the college prepares a baseline inventory study to check for the GHG emission for the year 2013 & 2014. With this baseline study, the college has planned for the establishment of strategies in pursuing GHG reductions goals in the forthcoming years. The college will publicly track and report its progress every year towards achieving its GHG emission reduction goals to become a Carbon Neutral Institution.

GHG ACCOUNTING AND REPORTING PRINCIPLES:

GHG accounting is based on the following principles:

- 1. RELEVANCE**
- 2. COMPLETENESS**
- 3. CONSISTENCY**
- 4. TRANSPARENCY**
- 5. ACCURACY**

The detailed GHG accounting principle for the Lady Doak College is explained below:

1. RELEVANCE: An important aspect of the relevance is the selection of the appropriate inventory boundary. When choosing the inventory boundary, various factors such as organizational boundaries and operational boundaries are considered.

ORGANIZATIONAL BOUNDARIES: Organizational boundaries represent the areas of GHG emissions that is included in the inventory which is represented within the dark line excluding the quarters of the Principal and Non – teaching staff. LDC includes all the buildings and

facilities that could be the possible cause for the emission of GHG. For GHG inventory, equity share approach is used to develop inventory.

Fig.2: LADY DOAK COLLEGE ORGANIZATIONAL BOUNDARY



FIG.3. VARIOUS BLOCKS OF LADY DOAK COLLEGE RESPONSIBLE FOR THE GHG EMISSION

GJ AUDITORIUM



JX MILLER AUDITORIUM



LIBRARY



LUNCH PAVILLION



Newton Block



Vanallen



Western Annex



CHAPEL



CRIB



WILCOX HALL



PANDIYAN HALL



PANDITHA RAMABAI HALL



GNANATHICKAM HALL



CANTEEN



ADMINISTRATIVE BLOCK



AMY CARMIMICHAEL



CHILD



COLLEGE HALL



2. COMPLETENESS: All the relevant emission sources and activities within the chosen inventory boundary are considered for accounting. This provides a comprehensive, meaningful data.

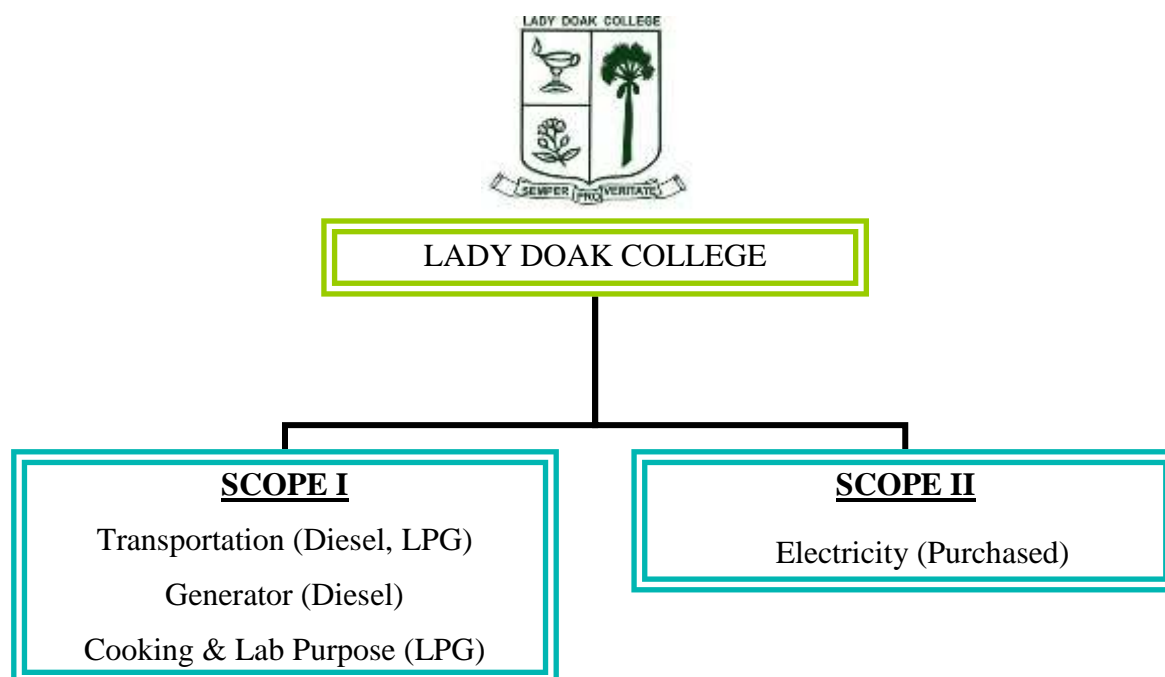
Establishing operational boundaries helps to verify that all applicable GHG emission sources are appropriately accounted for and to avoid “double counting”. For instance, an emission associated with the college buses for student transportation, auto for college activities, generators for college functioning during power cut and LPG gas for cooking purpose in college mess and for laboratory purposes is counted as a Scope I direct emission. Meanwhile, an emission associated with purchased electricity that is supplied to LDC is counted as a Scope II Indirect emission.

Scope III is not considered for this baseline inventory study. Biogas emissions from waste are also not accounted.

OPERATIONAL BOUNDARIES:

Operational boundaries represent the identification of emission sources to be or not to be included in the inventory .They include GHG emission sources and removals associated with operations and categorizing them into Scope1/direct emissions, Scope2 indirect emissions and other Scope 3 indirect emissions.

FIG.4.LDC OPERATIONAL BOUNDARIES



3. CONSISTENCY: Reliable methodologies were used to calculate the GHG emission in the college, which will be used to compare the emission over a period. The inventory boundary and methodology were transparently documented in the report, which ensures that the collective information is consistent and comparable over time series.

METHODOLOGY APPLIED

Direct emissions

“Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion”

<http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-03-v2.pdf>”

Indirect emissions

“Tool to calculate baseline, project and/or leakage emissions from electricity consumption”

<http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-05-v1.pdf>”

***Note:** GHG emissions by the vehicles are calculated using CA-CP Calculator based on fuel usage data.

GHG emissions associated with purchased electricity are calculated using the following equation:

$$\text{GHG Emissions (Metric tons CO}_2\text{e)} = \text{Purchased Electricity (Kwh)} \times \text{Grid Emission factor}$$

4. TRANSPARENCY: The College has transparently provided all the information on the processes, procedures, assumptions, and limitations on the GHG inventory. The College has disclosed in a clear and understandable manner based on the documentation on the emission sources.

GHG COVERED IN THE BASELINE INVENTORY STUDY BY LDC:

GWP is the relative measure of how much heat a GHG traps in atmosphere. It compares the amount of heat trapped by certain mass of gas in question to the amount of heat trapped by similar mass of CO₂. The GHG emission quantities were converted to carbon dioxide equivalents (CO₂e).

GHG	GWP
Carbon dioxide (CO₂)	1
Methane (CH₄)	25
Nitrous Oxide (N₂O)	298
CFC 12 (series)	10900
SF6	22800

GHG is defined as the gaseous constituent of the atmosphere, both natural and anthropogenic, that absorbs and emits radiation at specific wavelengths within the spectrum of infra-radiation emitted by the earth's surface, the atmosphere, and the clouds. **The inventory made by LDC, identifies Carbon dioxide (CO₂) as GHG.**

5. ACCURACY: The data given below is sufficiently precise which is represented in the Table 3. The data enables to understand the present scenario on the amount of GHG emission and to make decisions on possible mitigation strategies for the reduction of GHG emission.

IDENTIFICATION AND CALCULATION OF GHG EMISSION FOR LDC (2013 & 2014):

The college calculated the GHG emission using the following steps:

1. Identification of GHG emission sources
2. Selection of GHG emission calculation approach
3. Application of standards for calculation

GHG emissions by LDC are summarized below in the Table. 1 by the following ‘scopes’ as defined by GHG accounting protocol:

- Scope 1 : Direct emissions from LDC sources, primarily fuel combustion
- Scope 2 : Indirect emissions due to purchased electricity
- Scope 3 : Not considered for baseline survey

Table 1: Sources for direct and indirect emission in LDC

	Energy Source	
Direct Emission	Diesel	VAN – I VAN – II VAN - III
	LPG	Auto, Hostel & Canteen Department Research & Lab Purpose
Indirect Emission		Purchased Electricity

For Scope 3, data required for calculating emissions was not readily available. So it was not considered for base line survey. Work will be continued further to refine data collection to make the GHG estimates as accurate and practical.

Intensity ratios evaluated as part of LDC’s GHG emissions inventory are,

- MTCO_{2e} emissions per total population (faculty, NTS and students)
- MTCO_{2e} emissions per total square footage (LDC owned buildings)

Table 2: LDC GHG Emissions Summary (Jan – Dec, 2013)

Direct Emission	Energy Source	GHG Emission (tCO _{2e})
	Diesel	77.055
LPG	56.056	
Indirect Emission	EB 2013	877.248
Total GHG Emission		1010.359

Fig. 5. GHG Emission (tCO_{2e}) - 2013

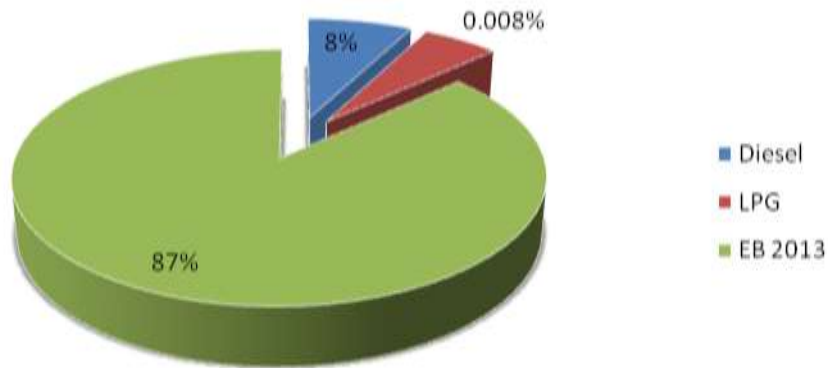


Table 3: LDC GHG Emissions Summary (Jan – Dec, 2014)

Direct Emission	Energy Source	GHG Emission (tCO _{2e})
	Diesel	40.611

	LPG	56.056
Indirect Emission	EB 2014	917.148
	Total GHG Emission	1013.815

Fig. 6. GHG Emission (tCO₂e) - 2014

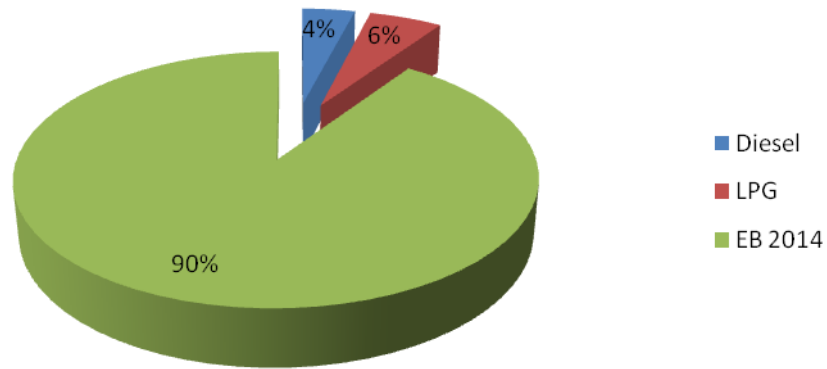
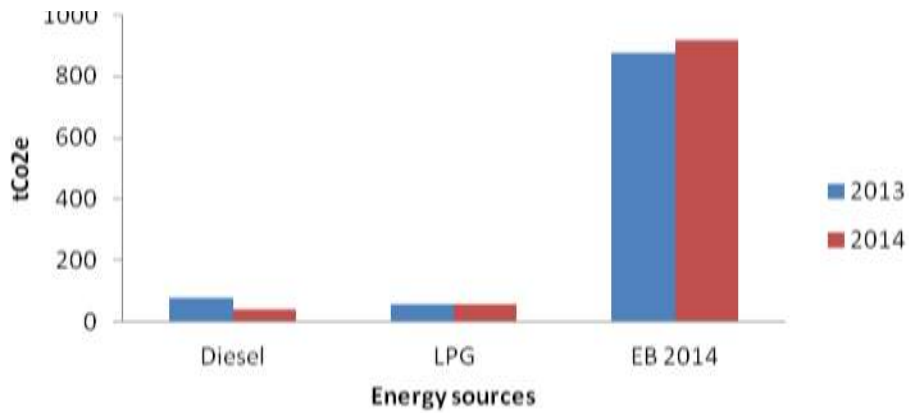


Fig.7. GHG Emission (tCO₂e) for the year 2013 & 2014



Assumption: It is assumed that the usage of diesel in the year 2013 was increased due to the increased power cut. It is also reflected in the electricity usage, which is found to be lesser in 2013 when compared to 2014.

GHG Removals and Sinks: Green vegetation removes carbon dioxide from the atmosphere and stores in vegetative tissues. LDC campus has trees, shrubs and herbs as part of the green campus. About 1100 trees are present within the campus.

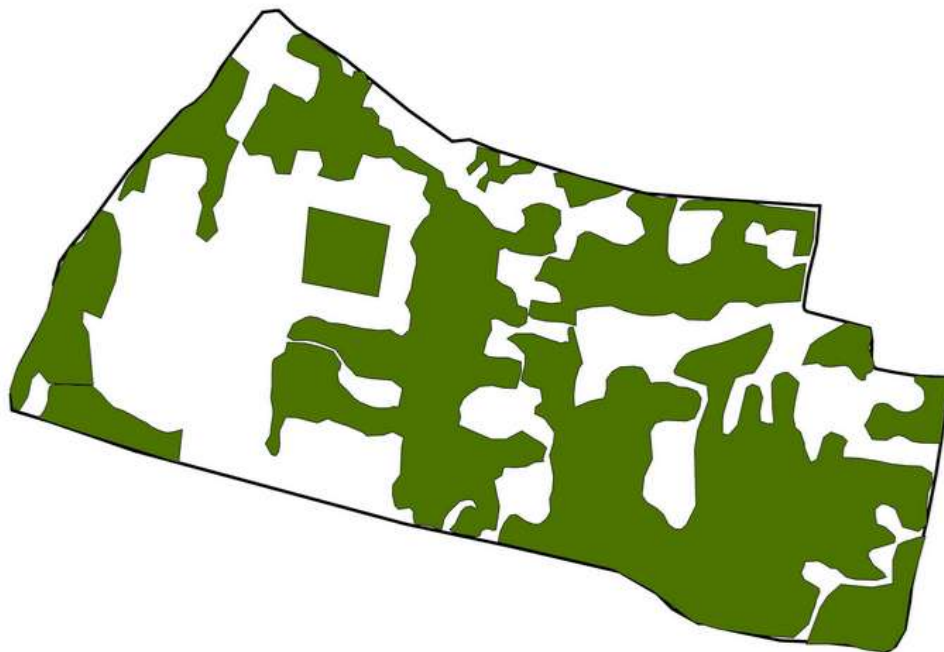
This report provides baseline measurements that will be used to assess the college's progress in reducing carbon emissions and consideration of sinks will be done in future.

Fig. 8. GIS mapping showing the Green campus of Lady Doak College


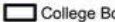


Fig. 9

LADY DOAK COLLEGE VEGETATION



Legend

-  Vegetation
-  College Boundary

*Vegetation in LDC is about 9.34 acres of land

MITIGATION PRINCIPLES OF THE COLLEGE:

Lady Doak College mitigation strategies were selected based upon the following criteria,

1. An action must be consistent with the mission and values of the college
2. It should demonstrate financial efficiencies
3. It should have a reasonable ease of implementation
4. It should be achievable and sustainable
5. The plans should demonstrate flexibility and resilience to future changes

The specific strategies are focused on:

1. Energy efficiency and conservation
2. Increase of renewable energy production
3. Waste management through source reduction and recycling

Our strategic approaches include:

1. Technical innovations for possible GHG reduction
2. Individual behavioral changes among students, teaching and non- teaching community
3. Possible changes in the Institutional policy and procedures

Mitigation strategies followed in LDC campus for the reduction of GHG emission

FIG.10. Solar panel installation

- **Installation of Solar panel and street lights**



FIG.11. Students project on solar candle



- Grey water recycling – on progress
- Green Campus Initiatives (Paper cups usage in the campus are banned)

Mitigation strategies planned by the college towards achieving carbon neutrality in the forthcoming years:

The college will initiate tangible actions to begin the work of moving toward carbon near neutrality campus by implementing the below mentioned offsets. It is found that the maximum release of green house gas is through the use of electricity. In this view, the following mitigation strategies were planned for efficient energy usage.

1. Energy Star procurement Policy: Purchase of energy star certified appliances in all areas for which such ratings exist and wherever practical.
2. Possible energy efficiency strategies:
 - i. Conversion of all T5 tube lights (20,000 hr lamp life) to **LED lights**.
 - ii. Routing the electricity generated by solar plant in Pandian hostel to the administration block for the month of May and June.
 - iii. Fixing up off sub-meters in the hostel blocks, administrative block and college blocks.
 - iv. Maintaining the temperature of the air conditioners at 24⁰ C in all the places within the college.
 - v. Increasing the carbon sequestration by planting more number of plants.
 - vi. Awareness creation regarding energy saving and GHG emission, among the campus community.
3. Installation of solar panels
4. Exporting excess electricity generated on campus to the common grid.
5. Installation of methane captures systems for sewage treatment plants and solid waste.
6. Installation of windmills / purchase of wind energy.

ABBREVIATIONS:

LDC	LADY DOAK COLLEGE
CES	CENTRE FOR ENVIRONMENTAL STUDIES
GHG	GREEN HOUSE GAS

REFERENCES:

1. Baseline Protection Initiative. 2002. Baseline Protection Initiative—Reference Manual. National Climate Change Process, Government of Canada, April 2002.
2. Bosi, M. 2000. An Initial View on Methodologies for Emission Baselines: Electricity Generation Case Study. OECD and IEA Information Paper, June 2000.
3. CO₂e.com. 2001. “Glossary.” <http://www.CO2e.com/common/glossary.asp#C>.
4. www.wri.org

REPORT PREPARED BY:

1. Dr.S.GUNASEELI

CO-ORDINATOR

CENTRE FOR ENVIRONMENTAL STUDIES

LADY DOAK COLLEGE, MADURAI

2. Mrs. PRIYATHARSINI RAJENDRAN

JOINT CO-ORDINATOR

CENTRE FOR ENVIRONMENTAL STUDIES

LADY DOAK COLLEGE, MADURAI

3. Dr.MU. SIVAGAMA SUNDARI

ASSISTANT PROFESSOR

DEPARTMENT OF BIOTECHNOLOGY

LADY DOAK COLLEGE, MADURAI

4. Miss.R.INDUMATHI

ASSISTANT PROFESSOR

DEPARTMENT OF BIOTECHNOLOGY

LADY DOAK COLLEGE, MADURAI