

A MAJOR PROJECT REPORT  
ON  
**“MEASUREMENT OF CARBON FOOTPRINT OF MADHAV INSTITUTE  
OF TECHNOLOGY AND SCIENCE”**

Submitted to-

**MADHAV INSTITUTE OF TECHNOLOGY AND SCIENCE GWALIOR**  
(A Govt. Aided Autonomous Institute Under RGPV, Bhopal (M.P) Established in 1957)

IN PARTIAL FULFILLMENT FOR REQUIREMENT FOR THE AWARD OF THE DEGREE

OF

**BACHELOR of TECHNOLOGY  
IN  
CIVIL ENGINEERING**



**2018-2022**

Submitted By-

**PRIYAM GUPTA- 0901CE181077**

**GUIDED BY-**

**Dr. Prachi Singh**

**Assistance Professor**

**Department of Civil Engineering, MITS, Gwalior**

## CERTIFICATE

This is the certify that the project entitled “**Measurement of carbon footprint of Madhav Institute of Technology and Science**” which is being submitted by **Priyam Gupta** in partial fulfillment for the award of the Degree of Bachelor of Engineering in Civil Engineering is a record of their own work carried under my guidance and supervision.

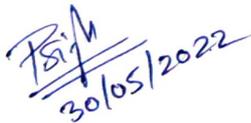
All the information in this document has been obtained and presented in accordance with academic rules and ethical conduct. To the best of your knowledge the matter presented in this project has not been submitted for the award of any other Diploma or Degree certificate.

**Date:** 26/05/2022

**Place:** Gwalior

**Guided by:**

**Forwarded by:**

  
30/05/2022

**Dr. Prachi Singh**  
Assistant Professor, Civil Engg. Dept.

  
for Prof. & Head, Civil Engg Dept

## **ACKNOWLEDGEMENT**

When it comes to properly acknowledging someone's support and assistance, it may be a challenging undertaking, chiefly when the support offered is so wholehearted and unwavering.

I am eternally grateful to my renowned guide, **Dr. Prachi Singh**, Assistant Professor of Civil Engineering Department, MITS Gwalior.

Also, I would like to thank **Dr. M.K. Trivedi**, Head of Civil Engineering Department, MITS Gwalior, and all other academics and staff members of MITS Gwalior's Civil Engineering Department for their unwavering support throughout the project.

I am really grateful to **Dr. R. K. Pandit**, Director of MITS Gwalior, for establishing an outstanding institutional environment and for giving all facilities and assistance in the preparation of my dissertation.

Last but not least, I'd want to thank my supportive family for their encouragement and cooperation during this project's duration. Thank you also to all of my friends for their encouragement and support.

**PRIYAM GUPTA**  
**(0901CE181077)**  
**DEPARTMENT OF CIVIL ENGINEERING**  
**MITS GWALIOR (M.P.)**

## ABSTRACT

This report presents the carbon footprint of Madhav Institute of Technology and Science (MITS), Gwalior for the financial year 2019-20 and 2021-22. The purpose of taking two financial years is to analyze the KgCO<sub>2</sub> equivalent before COVID 19 and during COVID19 under lockdown.

The direct emissions of institutional-based activities (scope-1) which includes GHG emissions from Diesel Generator and LPG cylinders, indirect energy emissions of imported electricity (scope-2) and other indirect emissions (scope-3) which includes GHG emissions from Air conditioners, Refrigerators, to and from motion of Students, teaching and non-teaching staff have been considered for Greenhouse gas emissions. Research boundaries, calculation methods, data selection, differences between the emissions of two financial years, and reasons for their differences have been taken for assessment.

Greenhouse gas emissions are the significant cause of climate change so this paper is an effort to measure carbon footprint and identify key areas of emissions. Total GHG emission in the financial year 2019-20 is emerged out 2178596.619 kgCo<sub>2</sub>eq and in the financial year 2021-22 is 412294.22 kgCo<sub>2</sub>eq. Scope-3 in FY 2019 is considered to be dominant over the other two scopes with 57.8%. key emission areas from all the three scopes are identified and some general and scope wise suggestive measures are provided to mitigate carbon emission and raise awareness among students, teaching & non-teaching staff, which will help to achieve Environmental and Financial sustainability.

## ABSTRACT IN HINDI

यह रिपोर्ट वित्तीय वर्ष 2019-20 और 2021-22 के लिए माधव इंस्टीट्यूट ऑफ टेक्नोलॉजी एंड साइंस (MITS), ग्वालियर के कार्बन फुटप्रिंट को प्रस्तुत करती है। दो वित्तीय वर्ष लेने का उद्देश्य यह है कि हमें COVID 19 से पहले और COVID19 के बाद, लॉकडाउन के दौरान KgCO<sub>2</sub> के समतुल्य का विश्लेषण करना है।

संस्थागत-आधारित गतिविधियों (स्कोप -1) का प्रत्यक्ष उत्सर्जन जिसमें डीजल जेनरेटर और एलपीजी सिलेंडर से जीएचजी उत्सर्जन, आयातित बिजली का अप्रत्यक्ष ऊर्जा उत्सर्जन (स्कोप-2) और अन्य अप्रत्यक्ष उत्सर्जन (स्कोप-3) शामिल हैं, जिसमें एयर कंडीशनर से जीएचजी उत्सर्जन शामिल है। ग्रीनहाउस गैस उत्सर्जन के लिए कंडीशनर, रेफ्रिजरेटर, छात्रों, शिक्षण और गैर-शिक्षण कर्मचारियों के आने-जाने पर विचार किया गया है। मूल्यांकन के लिए अनुसंधान की सीमाएं, गणना के तरीके, डेटा चयन, दो वित्तीय वर्षों के उत्सर्जन के बीच अंतर और उनके अंतर के कारणों को लिया गया है।

ग्रीनहाउस गैस उत्सर्जन जलवायु परिवर्तन का महत्वपूर्ण कारण है इसलिए यह पेपर कार्बन फुटप्रिंट को मापने और उत्सर्जन के प्रमुख क्षेत्रों की पहचान करने का एक प्रयास है। वित्तीय वर्ष 2019-20 में कुल GHG उत्सर्जन 2178596.619 kgCo<sub>2</sub>eq और वित्तीय वर्ष 2021-22 में 412294.22 kgCo<sub>2</sub>eq निकला। वित्त वर्ष 2019 में स्कोप-3 को अन्य दो क्षेत्रों के मुकाबले 57.8% के साथ प्रमुख माना जाता है। सभी तीन क्षेत्रों से प्रमुख उत्सर्जन क्षेत्रों की पहचान की जाती है और कार्बन उत्सर्जन को कम करने और छात्रों, शिक्षण और गैर-शिक्षण कर्मचारियों के बीच जागरूकता बढ़ाने के लिए कुछ सामान्य और दायरे के अनुसार सुझावात्मक उपाय प्रदान किए जाते हैं, जो पर्यावरण और वित्तीय स्थिरता प्राप्त करने में मदद करेंगे।

## List of Abbreviations

<b>ABBREVIATIONS</b>	<b>Full Form</b>
GHG	Greenhouse Gases
CF	Carbon Footprint
FY	Financial Year
LPG	Liquefied Petroleum gas
KG	Kilograms
IPCC	Intergovernmental panel on climate change
Kwh	Kilowatt hour
CNG	Compressed Natural Gas
Eq	Equivalent
CO <sub>2</sub>	Carbon dioxide
CH <sub>4</sub>	Methane
N <sub>2</sub> O	Nitrous oxide
Fig	Figure

## LIST OF CONTENT

<b>S No.</b>	<b>Topic</b>	<b>Page no.</b>
1	Introduction	1-2
2	Study Area	3-5
3	Background	6-13
	3.1 Overview	6-8
	3.2 Different Sectors affected by Climate Change	8-11
	3.3 Causes of Climate Change	11-13
4	Scope of the project	14-15
5	Methodology for GHG Quantification	16
6	Result	17-22
	6.1 Scope 1	17-19
	6.2 Scope 2	19
	6.3 Scope 3	20-22
7	Existing Facilities	23-25
	7.1 Manage the waste	23
	7.2 Greening the campus	24
	7.3 Energy efficiency	24
	7.4 Initiatives for Environment	25
8	Recommendations	27-31
	8.1 Scope 1	27-29
	8.2 Scope 2	30
	8.3 Scope 3	31
9	Conclusion	32
10	References	33

## LIST OF FIGURES

Figure No.	Title
1	<i>Human activities that generate emissions</i>
2	<i>Madhav Institute of Technology and Science</i>
3	<i>Satellite image of MITS with its longitudes and latitudes.</i>
4	<i>Existing Infrastructure of MITS Campus</i>
5	<i>Santa Barbara oil spill</i>
6	<i>Environmental Drivers</i>
7	<i>Chipko Movement</i>
8	<i>Proportion of Species in each extinction risk category</i>
9	<i>Importance of Ocean</i>
10	<i>Impact of climate change on Human Health:</i>
11	<i>Impact of climate change on Lakes and Wetlands</i>
12	<i>Human Activities That Generate Emissions</i>
13	<i>Deforestation</i>
14	<i>Human Activities that generate Emissions</i>
15	<i>Water and Energy Flow</i>
16	<i>Pie chart is showing scope 1 emissions (%) for different activities in the FY 2019-20.</i>
17	<i>Pie chart is showing scope 1 emissions (%) for different activities in the FY 2019-20</i>

18	<i>Pie chart is showing scope 1 emissions (%) for different activities in the FY 2021-22</i>
19	<i>Bar chart is showing scope 2 emissions month wise from imported electricity</i>
20	<i>Pie Chart is showing emissions (%) of scope 3 of FY 2019-2020</i>
21	<i>Scope wise result in both the financial year in bar chart format</i>
22	<i>Pie Chart shows the percentage of GHG emissions from Scope-1, Scope-2 and Scope-3 in the FY 2019-20.</i>
23	<i>School going students promoting 'SAVE EARTH'</i>
24	<i>Personal choices to reduce your contributions to climate change</i>
25	<i>Business trip going by College Convenience</i>
26	<i>Promotion of Zero Waste</i>
27	<i>LPG is a clean burning fuel</i>
28	<i>Save Energy</i>
29	<i>Air Conditioner Repair Service</i>
30	<i>Lifestyle of Electronics</i>

## LIST OF TABLES

<b>Table No.</b>	<b>Title</b>
1	Various categories taken in different scopes.
2	Category wise Scope 1 Consumption
3	Category wise Scope 3 Consumption
4	Scope wise emission for both the financial year
5	Waste Generation in the college
6	Total no. of plants in the campus

## CHAPTER-1

### INTRODUCTION

Carbon footprint refers to the emission of greenhouse gasses through direct and indirect organizational activities (Goal, 2018). Greenhouse gasses trap the heat which tries to escape to space and lead to the warming of the atmosphere also known as the greenhouse effect. Disclosure of carbon footprint by any educational institution is important to understand and identify key emission sources and then mitigation measures can be adopted for reduction of carbon footprint (Sivaram, 2015).

These days, very few educational institutions have taken a stand to disclose their carbon footprint. Madhav Institute of technology and science has taken a step forward to identify key emission sources and then mitigation measures will be adopted.

The report indicates GHG emissions assessed for Madhav Institute of technology and science for the financial year 2019-20 and 2021-22. The main objective behind taking two financial years is to find out the differences between pre COVID duration and COVID duration (Sivaram pm, 2015).

The project was carried out in three phases namely, planning, collection of data and estimation of CO<sub>2</sub> and then some suggestions for reduction of the same. Many site visits and surveys have been done to collect the required data from various departments. Survey was carried out for 2 months in which both qualitative as well as quantitative data have been collected.

The project was successfully completed due to the cooperation of various departments and supported by students, teaching and non-teaching staff (Sangwan et al. 2018).

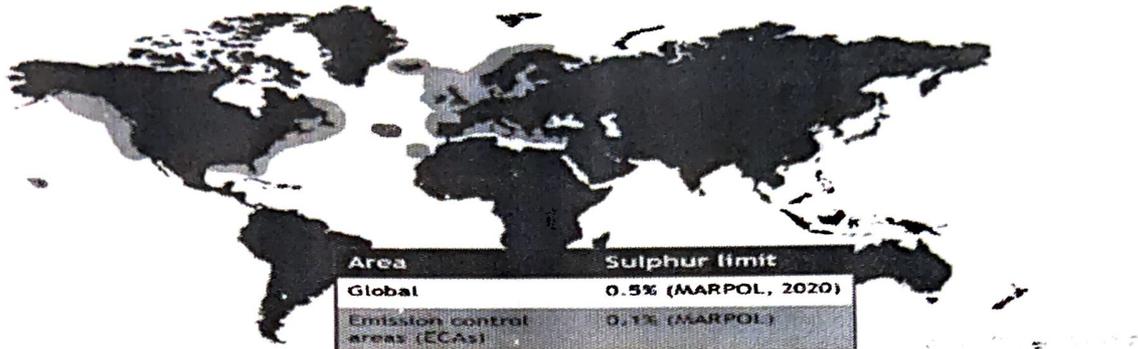
The greenhouse effect is responsible for global warming and the phenomenon linked with global warming is climate change including cyclones, non-seasonal rains, sea-level rise, landslides and many more. This leads to huge damage to life and property. Principal drivers are Population growth, economic development, urbanization, technology & innovation and climate change. Its indirect drivers are food, recreation, energy, transport, construction. Its direct drivers are Tourism, agriculture, extractive industry, shipping, coastal development, Aquaculture, capture fisheries.

---

## Human Activities that Generate Emissions

---

### Emission Control Areas



*Fig-1: Human activities that generate emissions*

India's Nationally Determined Contribution (NDCs) has committed to reducing its emission intensity per unit GDP by 33 to 35% below 2005 by 2030 under the Paris agreement. Thus to accomplish these targets, Disclosing GHG emission by various sectors and setting practical targets for reducing the same will help in achieving these targets. (Robinson et al. 2017).

This study will help students, teachers and other staff to understand the meaning of global warming, GHG emissions and carbon footprint and an educational institution's input in it. Such study will help students to build their knowledge in Environment related activities and will understand the impact of their work associated with the environment and will consequently benefit them with career opportunities in the field of climate change.

Carbon reduction in the college will give environmental benefits as well as it will promote financial savings and will also increase competition among other institutions (Sivaram, 2015).

The objective of the study is to identify Key emission sources of GHG at the campus and Compute different scopes emissions such as scope 1, scope 2 and scope 3 in the MITS and finally analyze the result and provide mitigation measures that should be cost-effective and efficient for reducing GHG emissions (Goal, 2018).

## CHAPTER-2

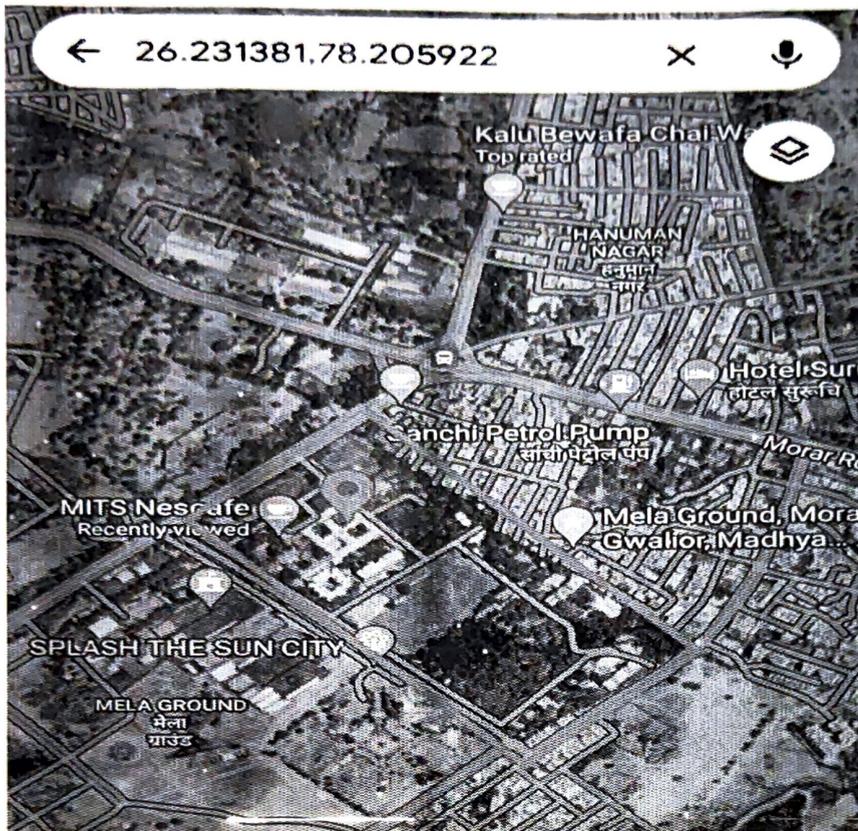
### Study Area



*Fig-2: Madhav Institute of Technology and Science*

Madhav Institute of technology and science is situated in the semi-arid region of central India. Summer temperature reaches up to 50°C while the winter temperature touches to zero. Thus there is high variation in temperature difference between summer and winter. Airport is 6.5 km away while the railway station is 5 km away from the main campus. MITS is situated approximately at the center of Gwalior and public conveniences are available to reach any corner of Gwalior. The total campus area is 44.6 acres while the academic building area is 4.2 Acres.

Campus is divided into two zones, one is residential zone with five hostels available where three is for males and two is for females and the other zone is academic one. Campus consist four major ground and several gardens. Institution has green campus with solar power plant which is a renewable form of energy for college. MITS is focusing on increasing its renewable energy capacity. There are total 47 courses which include engineering, architecture, computer application, science, management and business administration. Average population of the campus is 7285 with the number of students is 6120 and teaching and non-teaching staff is 297.



*Fig-3: Satellite image of MITS with its longitudes and latitudes.*

**Reporting Entity:** Madhav Institute of technology and science, Gwalior. The carbon footprint was carried out at the campus of MITS College which is spread over 44.6 acres of land.

**Reporting Period:** 1 April 2019 to 31 March 2020 and 1 April 2021 to 31 March 2022.

## THE EXISTING INFRASTRUCTURE OF MITS CAMPUS

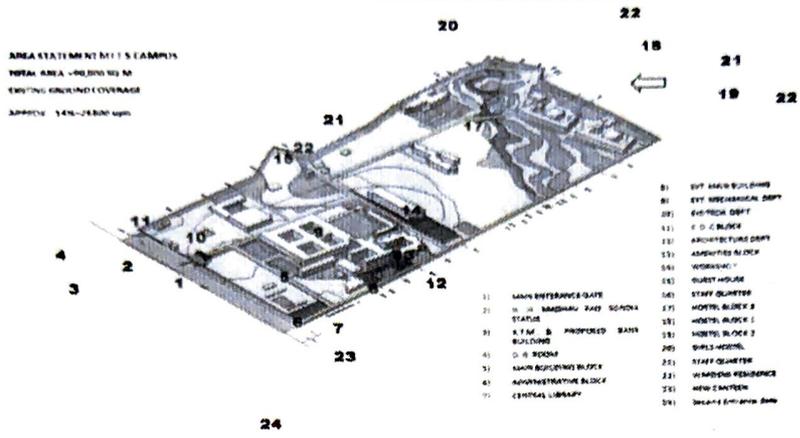


Fig-4: Existing Infrastructure of MITS Campus

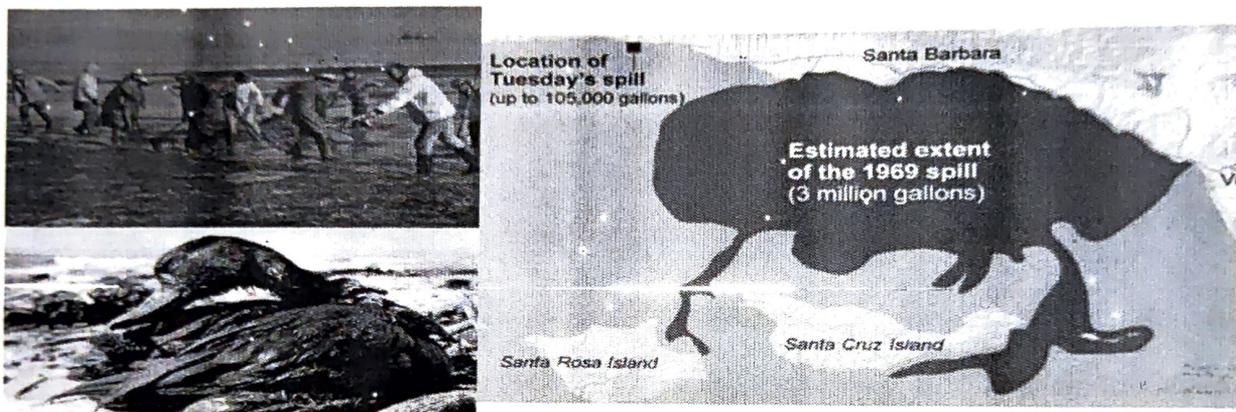
## CHAPTER-3

### BACKGROUND

#### 3.1 Overview

In the year 1962, Rachel Carson has written the book "SILENT SPRING" which has generated awareness about the environmental risks and then the following year caught the eye of public to the Santa Barbara oil spill, which has spilling of 10500 gallons at the Santa Barbara.

#### 1969 Santa Barbara Oil Spill



*Fig-5: Santa Barbara oil spill*

Then the following year leads to BHOPAL GAS TRAGEDY, CHERNOBYL INCIDENT and many more which ultimately lead to pollution and raised the global temperature.

There are five key drivers of environment as shown in figure.



*Fig-6: Environmental Drivers*

In the year 1972, for the first time, the United Nations gave serious thought to climate change at an international conference held in Stockholm, Sweden. This resulted in the formation of the United Nations Environment Programme (UNEP) whose objective is to assist developing countries in implementing environmentally sound policies and practices (Arora, 2018).

Intergovernmental Panel on Climate Change (IPCC) is an intergovernmental body under the UN that was formed in 1988 by two UN organizations, World meteorological organization (WMO) and United Nations environment programme (UNEP). IPCC gives a report that supports UNFCCC (Solanki et al, 2018).

In the year, 1973- European Environmental Action Programme

- The United States enacts the Endangered Species Act
- Chipko Movement in India



*Fig-7: Chipko Movement*

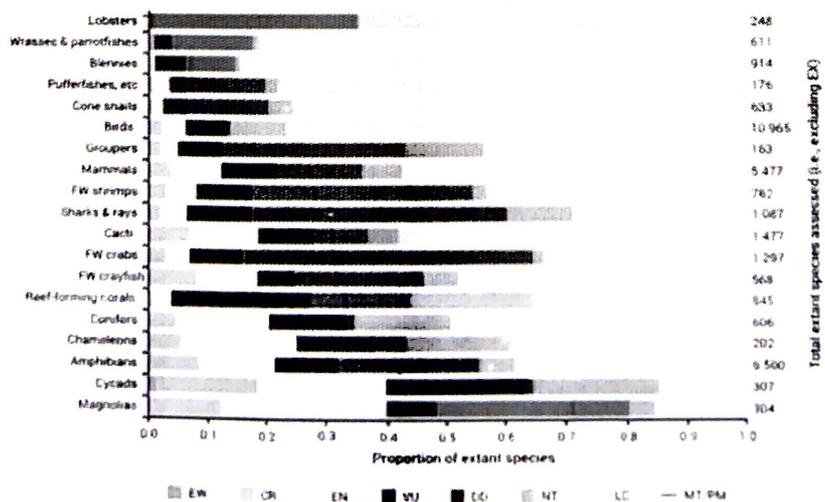
First major UN conference took place in Rio de Janeiro “United Nations Conference on Environment and Development” (UNCED) which is popularly known as Earth Summit. At the Earth Summit, the United Nations Framework Convention on climate change (UNFCCC) was opened for signature to curb greenhouse gas emissions and adapt to climate change. The UNFCCC came into force in 1994 and signed countries are called parties and meet annually at the conference of the parties (COP) (Sangwan, 2018). 21 COP took till date in which Kyoto protocols and Paris agreement are the major long-duration agreements with binding nature over the country to curb greenhouse gasses.

### 3.2 Different sectors affected by climate change are as follows-

#### 3.2.1 Impact on biodiversity- Problems associated with biodiversity is

- Mass extinction rate
- Ecosystem degradation.
- Earth mass extinction.
- Direct pressure on global biodiversity are climate change, pollution, species overexploitation, habitat loss and degradation,, invasive species, disease and their potential threats.

The proportion of species in each extinction risk category: IUCN Red List of Threatened Species



The numbers to the right of each bar represent the total number of existing species assessed for each group. EX = Extinct in the wild; CR = Critically endangered; EN = Endangered; VU = Vulnerable; LC = Least concern; NT = Not Evaluated; MT/PM = Missing/Presumed Extinct.

(Source: Source GEO-6 UNEP 2019 Pg.154)

Fig-8: Proportion of Species in each extinction risk category

### 3.2.2 Impact on Coastal ecosystem-

- Coastal **habitat** loss
- Destroy of marine life
- Marine **tourism** decreases
- Economic losses



*Fig-9: Importance of Ocean*

### 3.2.3 Impact on Humans-

- Loss of life due to disastrous activities
- diseases
- Economic losses
- Migration
- Pressure on the resources lead to malnutrition, inflation, etc

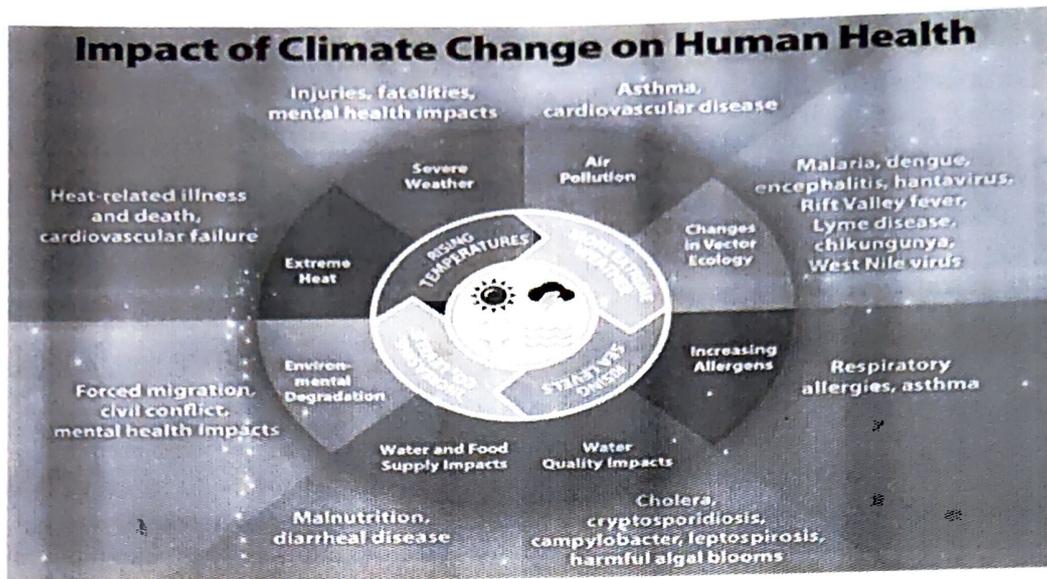


Fig-10: Impact of climate change on Human Health

### 3.2.4 Other impacts-

- Increase floods and droughts
- Loss of glaciers
- Reduction in the resilience of the ecosystem
- Change in precipitation
- salinization
- soil erosion
- cyclones and typhoons
- earthquakes
- volcano eruptions
- forest fires and heat waves
- Increase in Global temperature
- Ocean Acidification
- Burden on Resources
- Declining Vegetation
- Economic losses

## Impacts of Climate Change on Disappearing Lakes and Wetlands



Fig-11: Impact of climate change on Lakes and Wetlands.

## 3.3 Causes of Climate Change

### 3.3.1 Power Generation-

Burning of oil, coal and natural gases lead to large amount of Greenhouse gas emission. Even by raising awareness and forcing countries to generate electricity through renewable means. Most of the electricity is still generating by fossil fuels which is one of the prominent cause of increasing global temperature.

### **World Electricity Generation by Fuel (Terawatt Hours)**

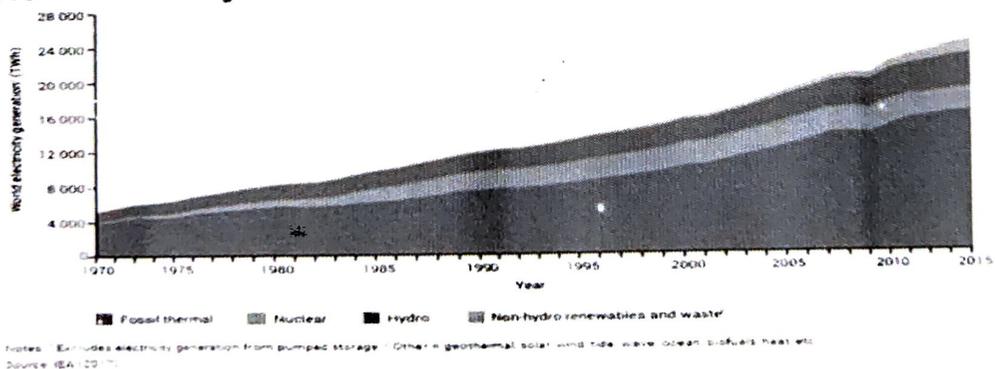
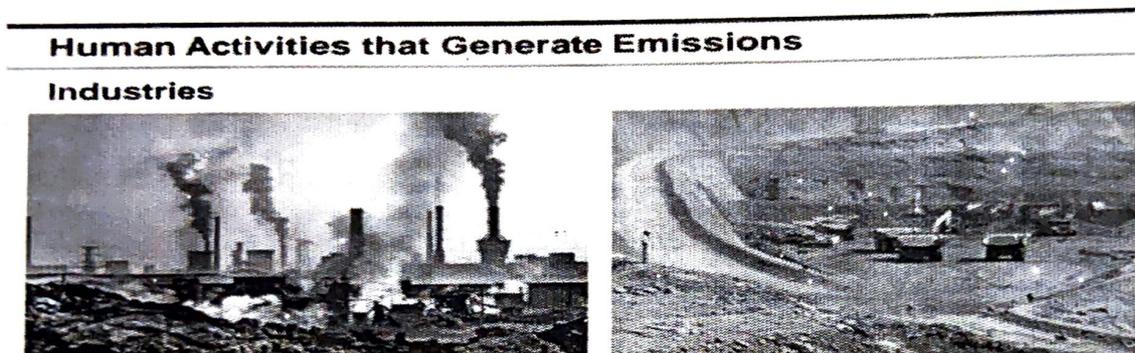


Fig-12: World Electricity generation by Fuel

### 3.3.2 Goods Manufacturization-

Energy produced for manufacturing of cement, iron, steel, electronics, plastics and other goods are mostly generated from fossil fuels. Various industrial processes and mining releases a lot amount of greenhouse gases.



*Fig-13: Human Activities That Generate Emissions*

### 3.3.3 Deforestation-

Forest is cut down to gain resources such as wood, land, medicinal purpose, pasteurization and many more lead to increase in the amount of carbon dioxide in the atmosphere because when trees are cut they release carbon dioxide which they use in their growth and deforestation lead to decrease in carbon sync thus world is more focusing on plantation.



*Fig-14: Deforestation*

### 3.3.4 Transportation-

Transportation is one of the major contributors of greenhouse gases (CO<sub>2</sub>) emission because public transportation such as buses, trains, ships, airplanes majorly work on fossil fuels and private convenience such as cars, motor vehicles also majorly work on fossil fuels based oil. Now world is preferring electric vehicles and promoting subsidies and tax rebate in purchasing such environment friendly vehicles.

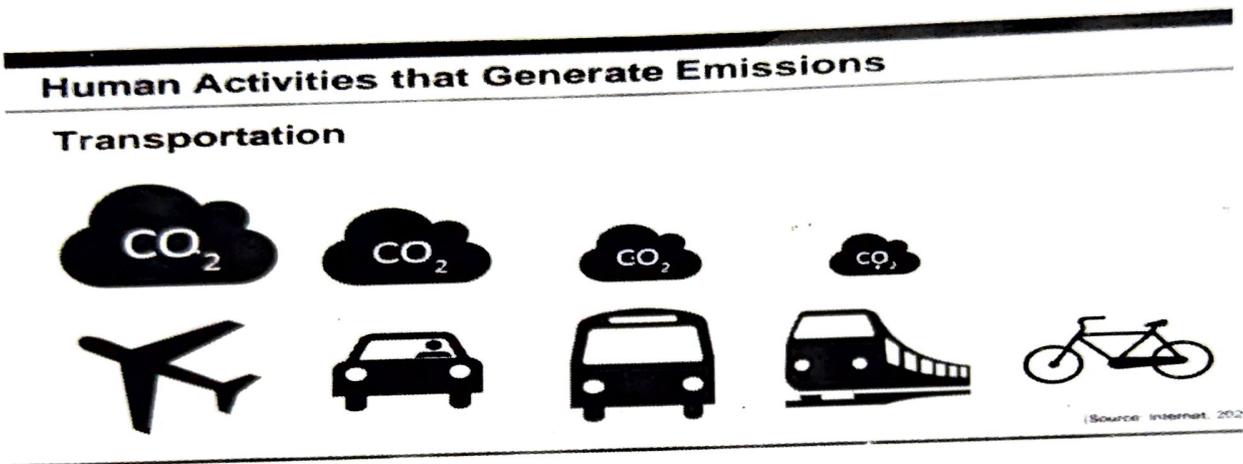


Fig-15: Human Activities that generate Emissions

### 3.3.4 Too much consumption-

Movement from one place to another place, eating food, using electronic devices, all basic living requirements that is necessary to live and sustain release greenhouse gases. Thus optimum use of electricity, vehicles, and devices is required. Otherwise this also become a big part of GHGs emission.

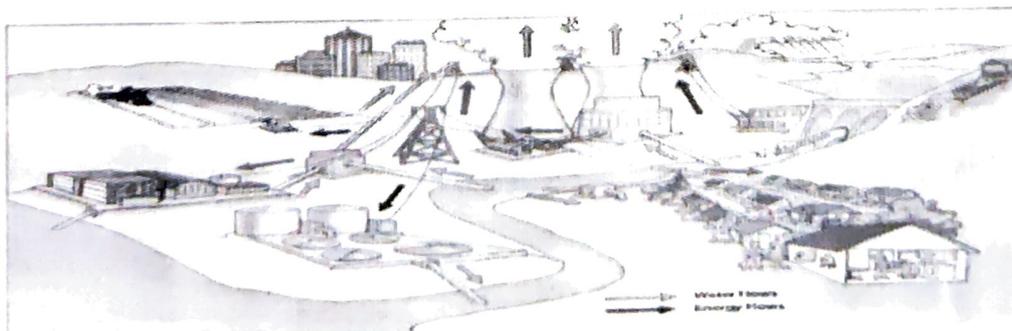
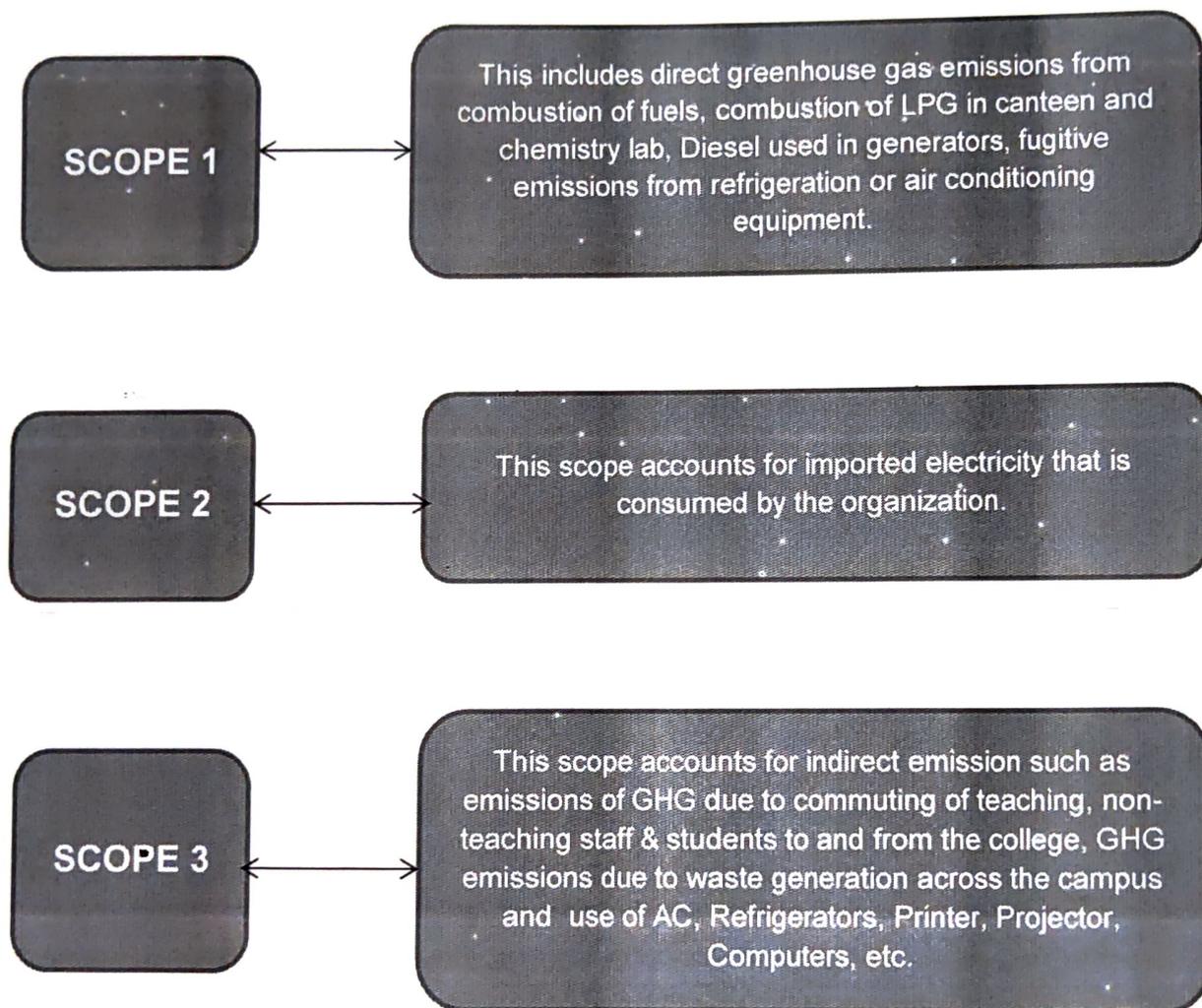


Fig-16: Water and Energy flow

## CHAPTER-4

### Scope of the project:



Definition of different scopes under the ISO-14064

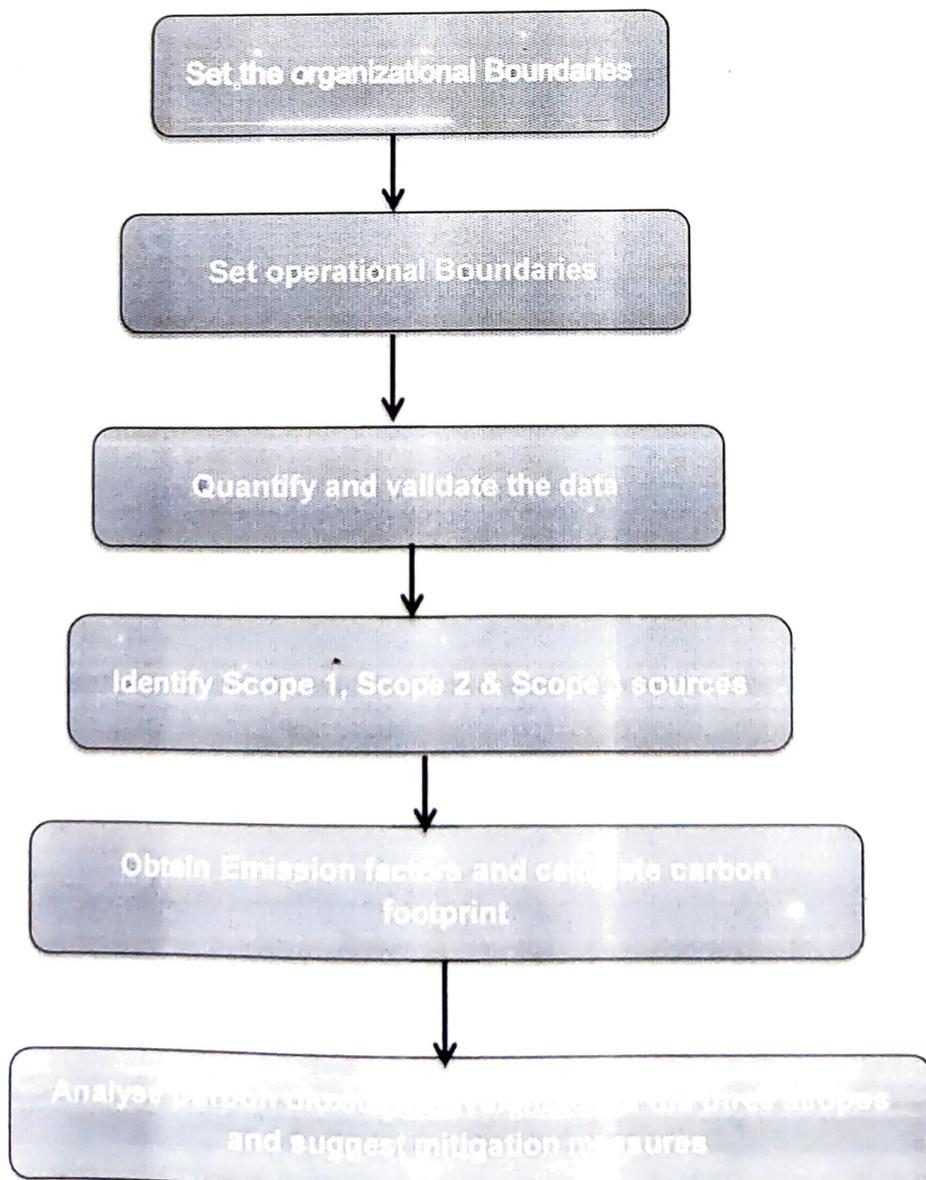
**Table-1: Various categories taken in different scopes.**

<b>CATEGORIES</b>	<b>SUBCATEGORIES</b>
<b>SCOPE 1</b>	Diesel Generator, LPG cylinders used by Girls hostels, Boys hostels & canteen.
<b>SCOPE 2</b>	Imported electricity
<b>SCOPE 3</b>	Students, teaching & non- teaching staff, computer, Air conditioner

## CHAPTER-5

### Methodology for GHG Quantification

Firstly set the organizational boundaries which include all the campus areas such as Library, Girls and Boys hostels, playgrounds, cafeteria and after selecting the boundaries, data was quantified and validated. After that, different Sources of Scope such as 1,2 &3 should be identified and listed through site visits. Emission factors were taken as per Indian standards for the calculation of Carbon Dioxide equivalent for all the three scopes and finally Carbon footprint measurement was carried out. Different Mitigation measures listed to reduce the emissions and some suggestions and recommendations are also provided to reduce carbon emissions in college (Sangwan, 2018).



## CHAPTER-6

### RESULT

#### 6.1 SCOPE 1

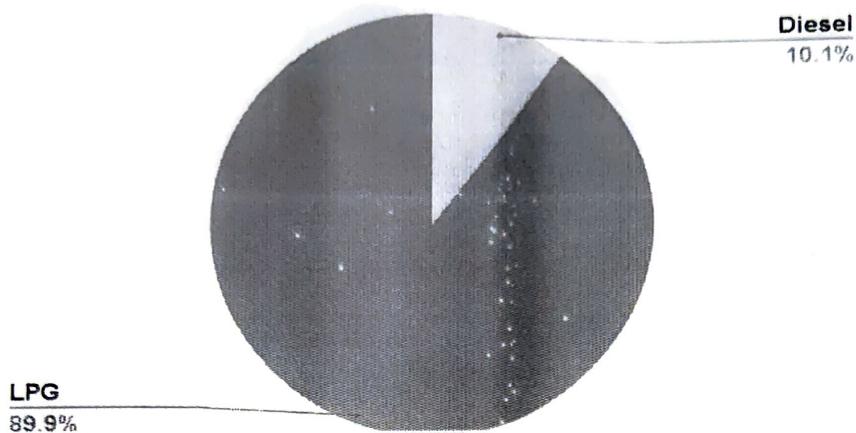
This scope accounts for LPG and diesel consumption of two financial years, one of 2019-20 and the other of 2021-22 means before lockdown and during lockdown. As the college and hostel were closed due to COVID-19 thus there was no LPG consumption in the mess till FEB-28 and the hostel reopened from March-1 thus only one month of LPG consumption was taken. Emission factor of LPG and Diesel is 2.983 and 2.653 respectively and this data is taken by the Ministry of Power.

**Table-2:** Category wise Scope 1 Consumption

<b>Financial year</b>	<b>LPG consumption</b>	<b>Diesel Consumption</b>	<b>Total</b>
2019-20	66500.002 KgCO <sub>2</sub> eq	7428.4 KgCO <sub>2</sub> eq	73928.402KgCO <sub>2</sub> eq
2021-22	1948.522 KgCO <sub>2</sub> eq	9020.2 KgCO <sub>2</sub> eq	10968.722KgCO <sub>2</sub> eq

GHG emission by Diesel has increased in the year 2021-22 because the number of generators has been increased.

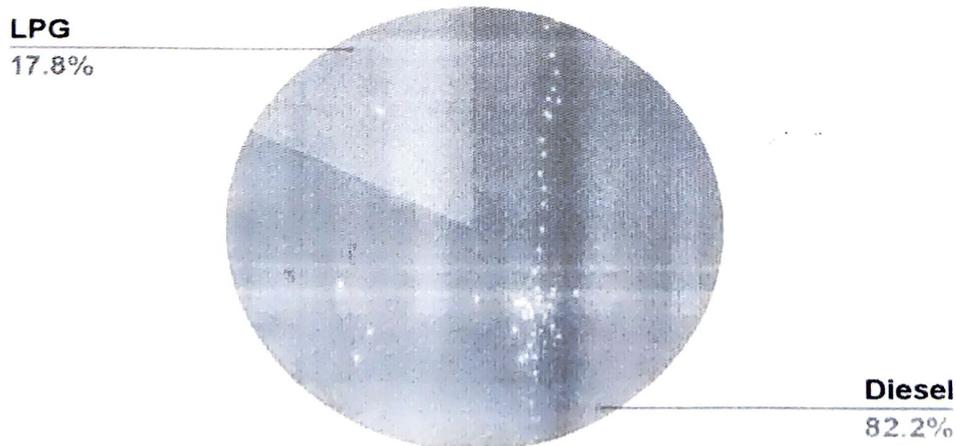
**SCOPE 1 EMISSION(%)**



*Fig-17: Pie chart is showing scope 1 emissions (%) for different activities in the FY 2019-20.*

As indicated above, maximum emission of GHGs are contributed by LPG cylinders which are used by four hostels, staff, chemistry lab, and canteen. Diesel consumption is hardly 10% as electricity supply for 24\*7, thus the Diesel generator is used for very little interval while mobile data has not been taken because the college has no vehicle of its own, thus no use of CNG.

**SCOPE 1 EMISSION(%)**



*Fig-18: Pie chart is showing scope-1 emissions (%) for different activities in the FY 2021-22.*

As due to lockdown, Hostels and canteen were shut thus there was no LPG consumption in cooking of food till February month. Hostels reopened in March, thus only one month of LPG consumption was taken.

## 6.2 SCOPE-2

This is the GHG emissions due to electricity consumption by the college as mentioned in the given table. Total electricity emission in the financial year 2019-20 was 845690.5 and in the financial year 2021-22 was 401325.5 kg co2eq. As mentioned in the table, Maximum emissions were estimated in the month of May followed by August, September. It was noticed that maximum emissions were during the active months of college and minimum during the semester break and mid-semester break. As the summer temperature reaches to 50 degrees thus use of AC, Coolers are must for healthy lifestyle.

### SCOPE-2 GHG EMISSION

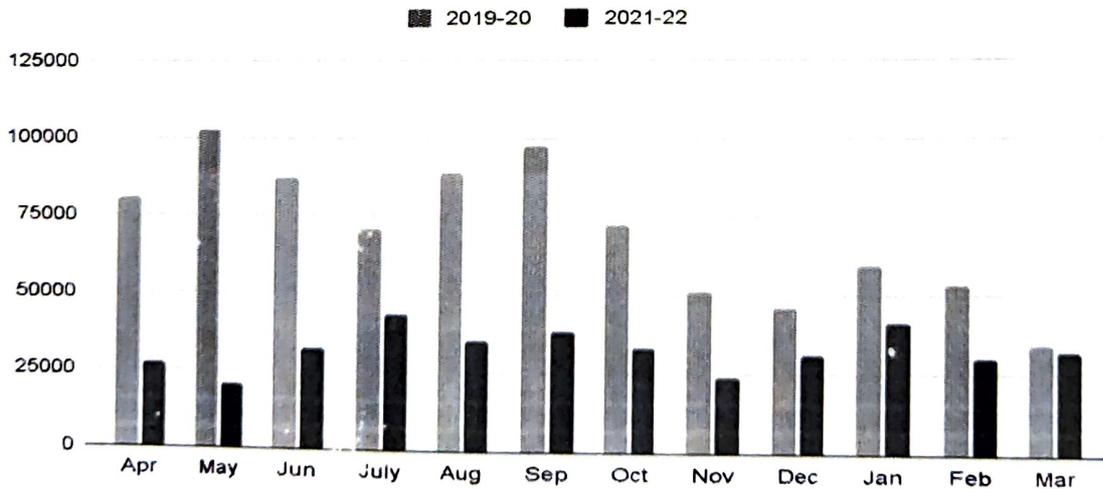


Fig-19: Bar Chart is showing scope 2 emissions month wise from imported electricity.

### 6.3 SCOPE-3

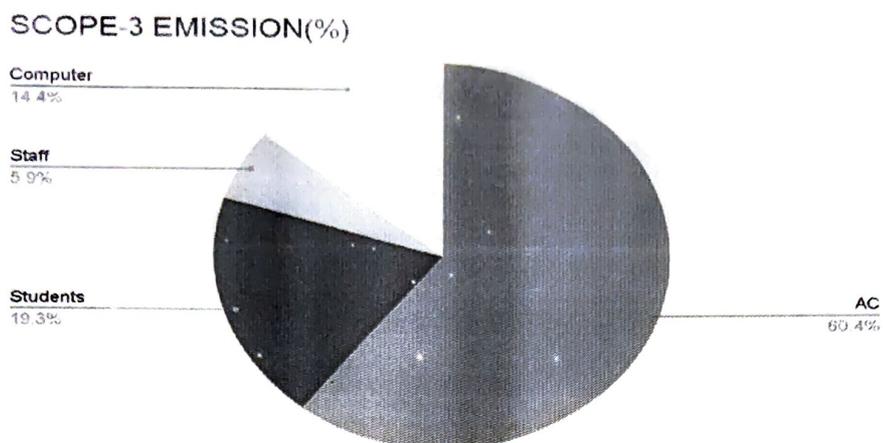
**Table-3:** Category wise Scope 3 Emission

Scope Activity	Students	Teaching & Non-teaching staff	Computer	Air conditioner
Kg CO <sub>2</sub> eq	243508.219	74695.5	180775	759999

Total GHG emission from Scope 3 is 1258977.719 kg co<sub>2</sub>eq, which is the highest among three scopes in the financial year 2019-20. As mentioned in the above table, Scope 3 is subcategorized into student's data, teaching and non-teaching staff data, computers and Air conditioner data. The strength of the college is 6120 and teaching and non-teaching staff is 297 and college has more than 200 AC, thus the kgCO<sub>2</sub> from AC is the highest.

In the year 2021-22, AC and Computers were not in use due to lockdown and classes were in online mode so no to and fro motion in the college, thus for the financial year 2021-22, scope-3 carbon emission is considered to be negligible.

Total Kg CO<sub>2</sub> equivalent emitted by the college in all three scopes is 2178596.619 kg co<sub>2</sub>eq in the financial year 2019-20. Scope-3 accounts for 57.79% while the other two scopes are less than 50. As Scope 3 is considered negligible for the financial year 2021-22, thus only scope 1 and scope 2 data is only taken to calculate total Greenhouse gases emission of this financial year. Total Kg CO<sub>2</sub>eq of 2021-22 FY is 412294.22 kg CO<sub>2</sub>eq.



*Fig-20: Pie chart is showing emissions (%) of scope-3 of FY 2019-20.*

**Table-4:** Scope wise emission for both the financial years.

Financial year	Scope 1	Scope 2	Scope 3	Total
2019-20	73928.402	845690.5	1258977.719	2178596.619
2021-22	10968.722	401325.5	-	412294.22

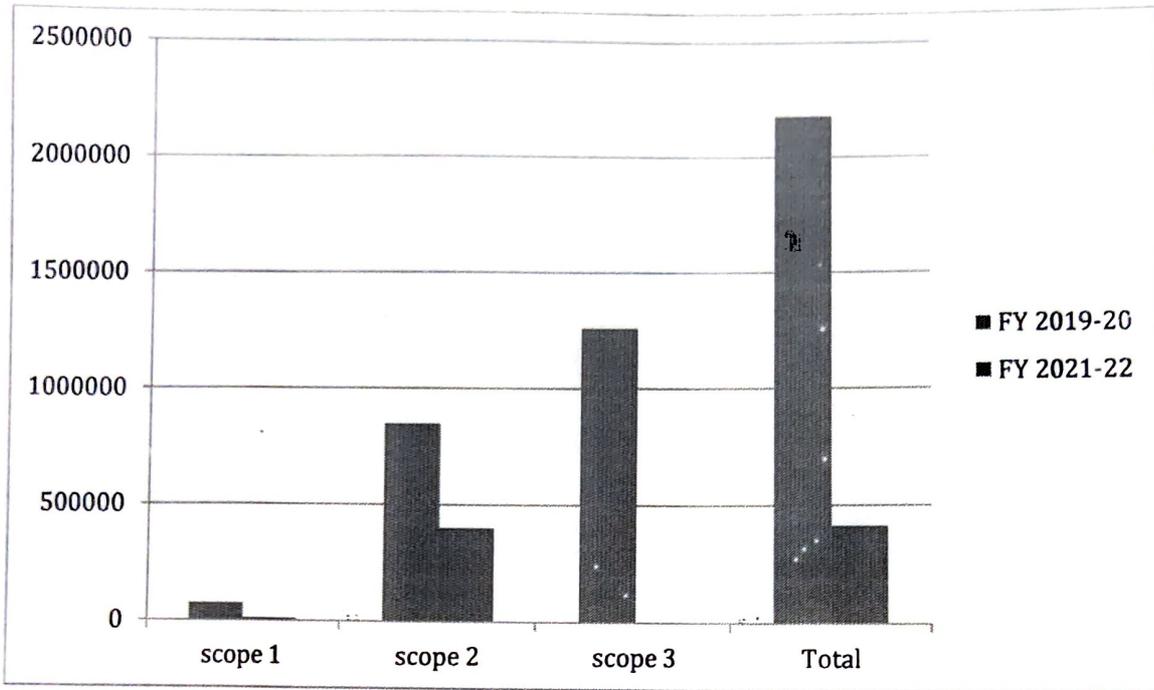


Fig-21: Scope wise result in both the financial year in bar chart format.

SCOPE WISE EMISSION(%)

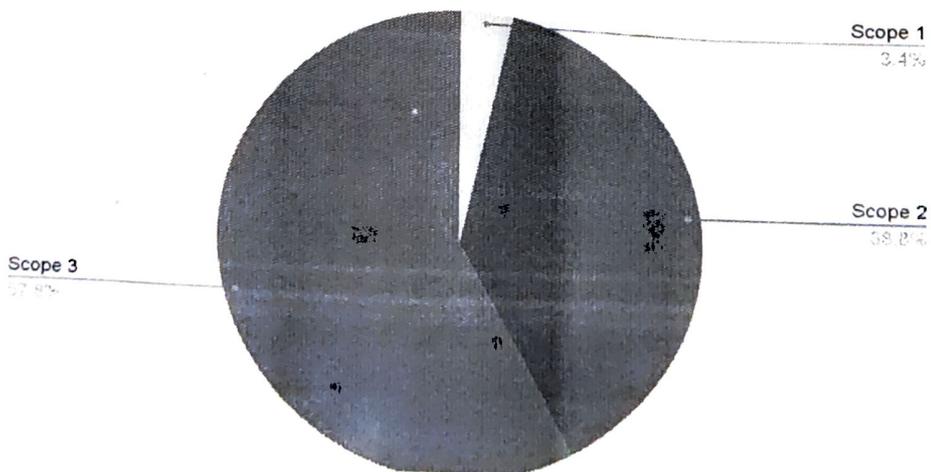


Fig-22: Pie Chart shows the percentage of GHG emissions from Scope-1, Scope-2 and Scope-3 in the financial year 2019-20.

## CHAPTER-7

### EXISTING FACILITIES

Madhav Institute of technology and science spread over 44.6 acres of land and out of which 35% of the land is covered with greeneries. MITS offers a satisfying range of facilities which contributes towards a sustainable environment. Renewable energy project such as solar power plant has been set up to avoid energy consumption based on fossil fuels. Management of bio-degradable waste and waste water is done properly by means of compost plant, STP's and waste bins. The following table is showing generation of various types of waste in kg per day.

**Table-5: Waste Generation in the college**

Type	Bio degradable	Non-Biodegradable	Hazardous	Others
Amount	20 kg	2kg	Nil	<6kg

#### 7.1 Some facilities are available to manage the waste are given below-

- 2 Compost plant
- Sewage water treated in STP's located in college campus.
- 2 types of waste bins are available at campus for biodegradable and non-biodegradable waste.
- One side printed paper is reused for internal communication purpose.

## 7.2 Greening the campus

**Table-6: Total no. of plants in the campus**

<b>Plant Type</b>	<b>Approx. Number</b>
<b>Trees</b>	More than 2000
<b>Shrubs</b>	More than 1000
<b>Grass Cover</b>	4.0 Acres

As mentioned in the above table Trees, Shrubs and Grass covers are present in sufficient numbers and it covers about 35% of the total area of campus. Along with this, more than 50 trees and 100 shrubs are planted in every financial year.

## 7.3 Energy Efficiency

- Electricity is saved by using LED bulbs.
- Solar Power Plant is installed in MITS. Monthly average of 1000-3000 units of electricity is generated through solar panels.
- Use of Natural lights and Natural ventilation is promoted.
- 95% of the total Conventional bulbs are replaced by LED lights.
- Switch off drills are used in Campus.

#### **7.4 Initiatives for Environment are given below-**

- **Biodiversity conservation-** Institute has lush green campus which provide habitat to various species.
- **Tree plantation Drivers-** Periodically plantation drivers by students and staff of campus.
- **Ground water recharge-** 12 units of Rain water harvesting system with depth 100 ft.
- **E waste management-** Collection of e-waste.
- **Solid waste management-** Garbage is lifted from campus on alternate days by local bodies.

## CHAPTER-8

### Recommendations-

After analyzing the Carbon footprint of the institute, several recommendations are provided to reduce Co<sub>2</sub> equivalent and make the college campus environmentally friendly are given below-

- Environment committee should be formed in the institute with at least 5 member of different background( one member from Administration, others from hostel, canteen, etc.) headed by one chairperson and they have to meet at least three times in a year and has to submit report of steps taken towards the green environment in a year.
- Environment committee has to set a Reduction target that has to be achieved within a defined year and carry out practice to achieve targets.
- Awareness campaigns such as conferences, meet-up, rallies and some competitions like debate, poster, painting, and quizzes will help people to carry out best practice towards the green and clean environment.



*Fig-23: School Going Students promoting 'SAVE EARTH'.*

- Posters and hoardings should be placed on the active zone of the college so that it could be eye-catching and prevent people from doing any activity which could harm the environment and yield to unwanted GHG emission.
- Inter departmental competition and awarding systems will bring competitive nature among departments and this can result in progress towards green thinking ( Goel, 2018).
- Suggestion boxes should be kept in the active zones of the institute where students, teaching and non-teaching staff can present their ideas and share their problems related to the environment which will eventually be assessed by committee and will come into practice.

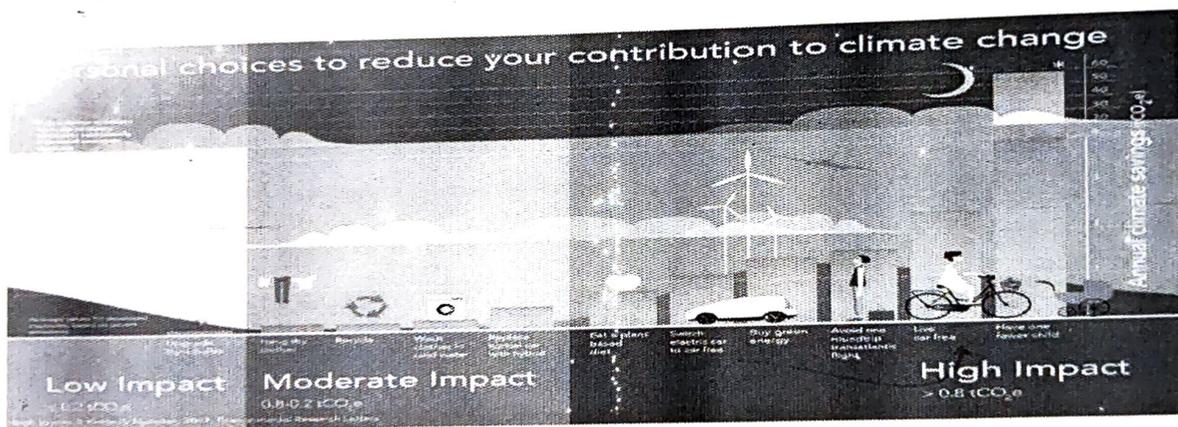


Fig-24: Personal choices to reduce your combination to climate change.

## 8.1 Scope- 1

Scope-1 accounts for the least GHG emission as it only consists of LPG consumption and Diesel Generator usage while MITS does not have any vehicle of its own. We borrow it from other colleges but business trips and site visits are minimal because many parts of the college are under construction like new academic blocks, hostels and seminars so college itself provides site visits to civil engineering students in College only.



*Fig-25: Business trip going by college convenience.*

**Some Recommendations are provided to decrease LPG consumption are as follows-**

- Food can be reheated in a microwave or induction thus can decrease in LPG consumption and Try to cook the exact amount of food by considering the number of students who are present in the hostel on the daily basis so food doesn't go to waste and this reduces LPG consumption.
- Food waste from the hostel mess and canteen should be sent to the compost pit for making manure and Biogas generated by the college should be used for small activities like cooking.( Sivaram pm.2015)



*Fig-26: Promotion of Zero Waste.*

- Diesel Generator should not be used for all the classes and buildings. It should only have connections with some conference hall, seminars and imported areas.
- Instead of using the LPG cylinders, canteen should have connection with central gas pipeline which will bring transparency in process and will give economic advantage to institute and as well as correct data can be identified through it.
- Energy reserve should be established by renewable energy which can replace diesel generator.

MITS already have solar power plant but its capacity should be increased and explore other ways of clean energy.

Due to the epidemic of COVID-19 in the financial year 2021-22, Institute was shifted to online mode which resulted in negligible LPG consumption and diesel generator, Thus scope-1 was considered negligible for this financial year.

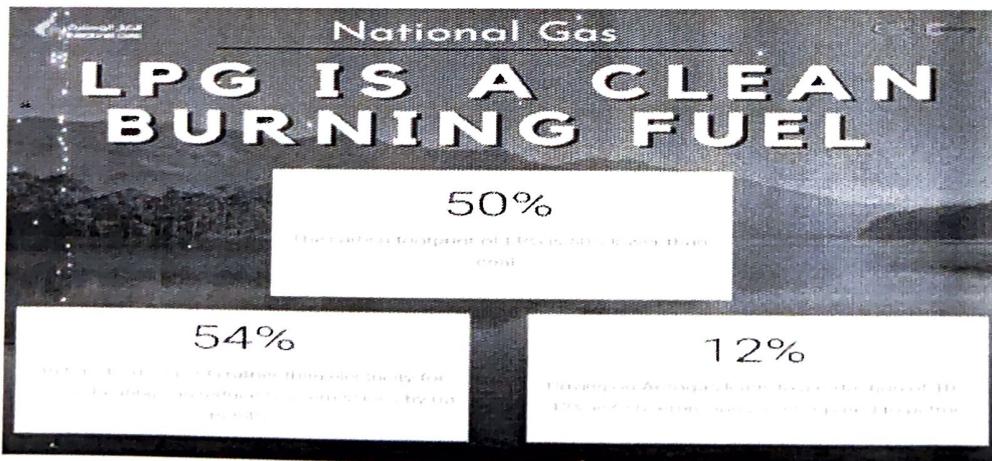


Fig-27: LPG is a clean burning fuel.

## 8.2 Scope-2

Scope-2 has the second highest GHG emissions. Some recommendations are provided to reduce emissions are as follows-

- Sub-metering systems should be set that will help to identify high energy consumption areas and then some mitigation measures will be designed to reduce the emission from there.
- Posters should be displayed in the college premises for awareness purposes which will help to understand DO's and DON'TS such as switching off the lights, fans, ACs when it is not needed.
- College should develop renewable energy setup which will help in reducing burden of imported electricity and can even sell out energy to other organization in future and this will generate awareness among other institutions also to reduce dependency over fossil fuels bases energy.

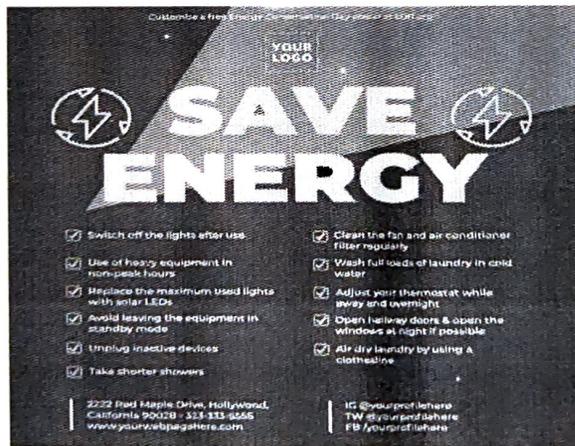


Fig-28: Save Energy

- Colleges should procure systems like computers, air conditioners, refrigerators etc by considering the latest energy efficient technologies in the markets. For example- All in One Units etc. (Goel, 2018)

Positive part- Our College already has installed a 100 KW solar plant capacity in Nov, 2019.

### 8.3 Scope-3

Scope-3 has the highest GHG emissions among three scopes. The reason behind the highest emission is that MITS has more than two hundred numbers of ACs and more than thousand numbers of Computer systems. These machines use electricity for functioning and release heat.

Some suggestions are provided to reduce emissions are as follows-



Fig-29: Air Conditioner Repair Service.

- Retrofit old air conditioners to prevent leakage and timely maintenance of Refrigerators. Air conditioners, computers and records should be maintained.
- Purchasing of new equipment should be assessed on the basis of emissions. For example- BEE star ratings should be checked for purchasing ACs and Refrigerators. (Sangwan et al, 2018)

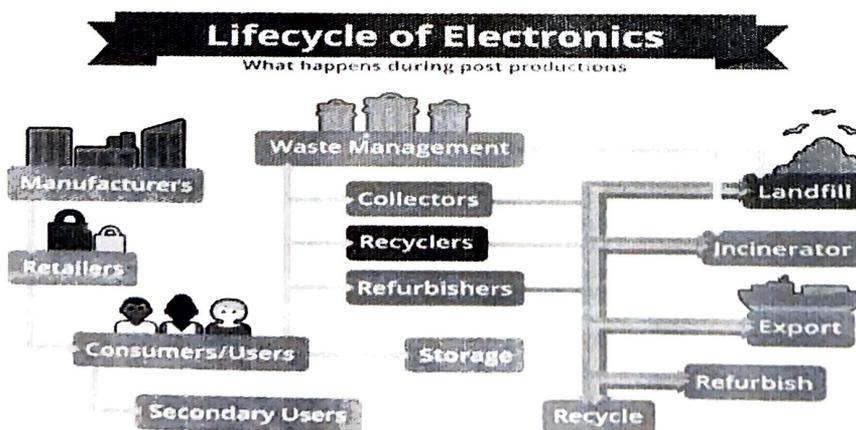


Fig-30: Lifestyle of Electronics.

## CHAPTER-9

### Conclusion

The present study computes the carbon footprint of Madhav Institute of technology and science for the financial year 2019-20 & 2021-22. One of the pioneer steps undertaken by the college to disclose its carbon footprint and some recommendations are provided scope wise as well as general to reduce its carbon emissions. The record will work as a benchmark to set reducing targets in the college and will help other educational institutions also to do the same. As we have taken two financial years but FY 2021-22 was under lockdown thus college was shifted to online mode of education and it reopened in the month of March thus CO<sub>2</sub> eq of FY 2021-22 cannot be taken as a benchmark. FY 2019-20 should be taken as a benchmark as in this duration college was fully active in the offline mode.

This paper required face to face interaction and survey which raised awareness among students, teaching and non-teaching staff other than the computation of the Carbon footprint of MITS.

This study has associated benefits of directional mitigation measures, reduction targets resulting in saving resources. Setting of the policy and objective will help the MITS to achieve both environmental and financial sustainability. This paper will encourage other educational institutions to identify their key areas of emission and report the same. This will bring informational exchange between the colleges and universities to share latest, sustainable and cost-effective technologies & processes.

Overall, this project is a step towards contributing to India's nationally determined goals and to achieve carbon neutrality by the Madhav Institute of technology and science.

## Chapter-10

### References-

- IPCC 2006, 2006 IPCC Guidelines for National Greenhouse Gas inventories, Prepared by the National Greenhouse Gas Inventories programme, Eggleston H.S., Biennia L., Miwa., Ngara T and Tanabe K. (eds). Published: IGES, Japan.
- Carbon Footprint Report of Maitre college, Poona Goal (2018-19) Available from: <http://maitreyi.ac.in/DataFiles/Tender/NWM541Maitreyi%20CF%20Report.pdf>
- Kuldeep Singh Sangwan et al. (2018). Measuring Carbon footprint of an Indian University Using Life Cycle Assessment.
- Measuring carbon footprint of an Indian University using Life cycle assessment by Kuldip Singh Sangwan, Vikrant Bhakar, Vinti Arora, Prem Solanki.
- Carbon dioxide information analysis center. Fossil Fuel CO2 Emissions.
- Government of India. India Environmental Portal.
- Olive J. Robinson et al (2017). Towards a universal carbon footprint standard: Carbon management case study at universities, Journal of cleaner production, 4435-4455.
- Sivaram (2015) carbon footprint analysis of an educational institution.
- Carbon Footprint calculation- A small introduction of ISO 14064: <https://www3.epa.gov/ttnchie1/conference/ei20/swssion5/mmittal.pdf>
- Electricity and LPG emission factor is taken from : <https://www.google.com/amp/s/greencleanguide.com/calculate-your-carbon-footprint/>
- Carbon footprint of computer is taken from: <https://circularcomputing.com/news/carbon-footprint-laptop/>
- Carbon emission of Air Conditioning – <https://ajer.org> papers

## **LIST OF PUBLICATION**

Gupta P., Shukla R. and Singh P., "Measurement of Carbon Footprint of Madhav Institute of Technology and Science, Gwalior", Journal of Architecture and Technology, (Communicated)

Civil Engineering Department

**Plagiarism Check Certificate**

This is to certify that we are students of B.Tech in Civil Engineering have checked my complete Major Project/Internship entitled "Measurement of Carbon Footprint of Madhav Institute of Technology and Science" for similarity/plagiarism using the "Turnitin software" available in the institute.

This is to certify that,

- The similarity in my minor project- II is found to be 17% (which is within the specified limit of 20%)

**The full plagiarism report along with the summary is enclosed.**

Student name: **Priyam Gupta**

Roll No.: **0901CE181077**

Guide name: Dr. Prachi Singh  
Designation: Assistant Professor  
Civil Engineering Department

for Professor & Head of  
Civil Engg. Deptt.

(Turnitin Administrator)  
Chayan Gupta



Similarity Report ID: oid.28506:17613405

PAPER NAME

Carbon Footprint- Priyam Gupta.docx

AUTHOR

priyam gupta

WORD COUNT

4536 Words

CHARACTER COUNT

24467 Characters

PAGE COUNT

41 Pages

FILE SIZE

2.8MB

SUBMISSION DATE

May 25, 2022 5:45 PM GMT+5:30

REPORT DATE

May 25, 2022 5:45 PM GMT+5:30

● **17% Overall Similarity**

The combined total of all matches, including overlapping sources, for each database.

- 13% Internet database
- 4% Publications database
- Crossref database
- Crossref Posted Content database
- 7% Submitted Works database

● **Excluded from Similarity Report**

- Bibliographic material