BANGLADESH BANK HEAD QUARTER
MOTIJHEEL, DHAKA, BANGLADESH

CARBON FOOTPRINT MEASUREMENT REPORT 2014

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DISCLAIMER

Future Carbon has gone to all reasonable lengths to ensure that the primary information provided by Bangladesh Bank is correct but Future Carbon takes no responsibility for any inaccuracies that this information might contain. This report, in its entirety, is both material and complete and is intended for Bangladesh Bank's internal use only. Information may, however, be extracted for reporting purposes, such as for submission into international and/or national greenhouse gas registries and sustainability reporting. It can also be presented for third-party verification purposes.

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We are thankful to Bangladesh Bank for giving Future Carbon the opportunity and providing necessary guidance to carry out the Carbon Footprint Assessment of Bangladesh Bank's Head Quarter.

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UNITS OF MEASURES

Acr	Acre
BDT	Bangladeshi Taka
BTU	British Thermal Unit
BTU/h	British Thermal Unit per Hour
cc	Cubic Centimeter
cft	Cubic Feet
CO_2	Carbon Dioxide
ft	Feet
ft^2	Square Feet
Kg	Kilogram
Km	Kilometer
kWh	Kilowatt-Hour
kWh/m^2-year	Kilowatt-hour per square meter per year
$ktCO_2e$	Kilo ton Carbon Dioxide Equivalent
Ltr	Litre
m	Meter
m^2	Square Meter
m^3	Cubic Meter
mile	Mile
ml	Milliliter
MWh	Megawatt-Hour
pc	Piece
tCO_2e	Tons of Carbon dioxide equivalent
tCO_2e/ m^2	Tons of Carbon dioxide equivalent emissions per square meter
TR	Tons of Refrigerant

ABBREVIATIONS AND GLOSSARY OF TERMS

A/C	Air-conditioning
Baseline year	A historical year used to compare preceding year's emissions.
BPDB	Bangladesh Power Development Board
Building Envelope	The building envelope is the physical separator between the interior and exterior of a building. Components of the envelope are typically: walls, floors, roofs, fenestrations and doors. Fenestrations are any opening in the structure: windows, skylights, clerestories, etc.
Building Fabric	The building fabric is the shell of the building and includes floors, walls, roofs, windows and doors. A building's non process heating and cooling requirements are greatly influenced by the building fabric choices and their heat transfer characteristics.
Carbon sequestration	Carbon sequestration describes long-term storage of carbon dioxide or other forms of carbon to either mitigate or defer global warming and avoid dangerous climate change. It has been proposed as a way to slow the atmospheric and marine accumulation of greenhouse gases, which are released by burning fossil fuels.
CFC	Chlorofluorocarbon
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent – standardization of all greenhouse gases to reflect the global warming potential relative to carbon dioxide.
CDP	Carbon Disclosure Project
DECC	United Kingdom Department of Energy and Climate Change
DEFRA	United Kingdom Department of Environment, Food and Rural Affairs.
Direct emissions	Greenhouse gas emissions from facilities/sources owned or controlled by a reporting company, e.g. generators, blowers, vehicle fleets.
Establishment	A business organization, public institution, or household
Emission factors	Specific value used to convert activity data into greenhouse gas emission values. Presented in specific units, e.g. $kgCO_2$/km travelled.
FTEs	Full-time employees
Fugitive Emissions	Fugitive emissions are emissions of gases or vapors from pressurized equipment due to leaks and other unintended or irregular releases of gases, mostly from industrial activities. As well as the economic cost of lost commodities, fugitive emissions contribute to air pollution and climate change.
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GHG Protocol	Greenhouse Gas Protocol – uniform methodology used to calculate the carbon footprint of an organization.
GWP	Global Warming Potential – an indication of the global warming effect of a greenhouse gas in comparison to the same weight of carbon dioxide.
HCFC	Hydro chlorofluorocarbon
HQ	Head Quarter
HVAC	HVAC (heating, ventilating, and air conditioning; also heating, ventilation, and air conditioning) is the technology of indoor and vehicular environmental comfort. Its goal is to provide thermal comfort and acceptable indoor air quality.
IEA	International Energy Institute
IPCC	International Panel on Climate Change

Indirect emissions	Greenhouse gas emissions from facilities/sources that are not owned or controlled by the reporting company, but for which the activities of the reporting company are responsible, e.g. purchasing of electricity.
ISO	International Standard Organization
Leakage Rate	Refrigerant loss per square meter per second
Operational boundary	Determination of which facilities or sources of emissions will be included in a carbon footprint calculation.
Organizational boundary	Determination of which business units of an organization will be included in a carbon footprint calculation
Optional information	Information relating to emissions that are recommended but not compulsory under the GHG Protocol, e.g. emissions from air travel
Per-capita	Average per person
REB	Rural Electrification Board
Refrigerator	An appliance or compartment that is artificially kept cool and used to store food and drink. Modern refrigerators generally make use of the cooling effect produced when a volatile liquid is forced to evaporate in a sealed system in which it can be condensed back to liquid outside the refrigerator.
Refrigerant	A refrigerant is a substance or mixture, usually a fluid, used in a heat pump and refrigeration cycle
Renewable Energy	Energy from a source that is not depleted when used, such as wind or solar power.
Relevant emissions	Emissions generated as a result of the business activities of the reporting company
Required information	Information relating to emissions that are compulsory under the GHG Protocol, namely direct emissions and indirect emissions from purchased electricity.
Sensor	A device that detects or measures a physical property and records, indicates, or otherwise responds to it.
Sustainability	In ecology, sustainability is the capacity to endure; it is how biological systems remain diverse and productive indefinitely. Long-lived and healthy wetlands and forests are examples of sustainable biological systems. In more general terms, sustainability is the endurance of systems and processes.
Scope 1 emissions	Emissions resulting from equipment owned or controlled by a reporting company
Scope 2 emissions	Emissions resulting from consumption of electricity purchased by a reporting company
Scope 3 emissions	Emissions resulting from other activities of a reporting company, such as commuting travel, business air travel, paper consumption.
SREDA	Sustainable & Renewable Energy Development Authority
US EPA	United State Environmental Protection Agency
UNEP	United Nations Environment Programme
UNCSD	United Nations Conference on Sustainable Development
WB	World Bank
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute
VRF	Variable Refrigerant Flow
VRV	Variable Refrigerant Volume is innovative climate control technology that allow for changes in temperature in different parts of a building at different times of day.

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EXECUTIVE SUMMARY

This is Bangladesh Bank HQ's first annual report on carbon footprint measurement as a part of their sustainability commitment to produce and publish own carbon footprint.

This report provides a brief insight of the establishment's energy usage and net Green House Gas (GHG) Emission in terms of tCO_2e (tons of Carbon Dioxide emission).

GHG EMISSIONS SUMMARY

Base Year: **2014**
Reporting period: **01 Jan 2014 – 31 Dec 2014**
Reporting Year: **2015**
Carbon footprint calculation conducted on: **Bangladesh Bank Head Quarter**
Methodology: **Greenhouse Gas Protocol – Corporate Accounting and Reporting Standard**

Table I: GHG Footprint Site Information

Location covered by report:	Corporate Head Quarter
Total area covered by report (m^2):	21,881.55
Total floor area covered by report (m^2):	90,256.51
Total Bangladesh Bank HQ's employees covered by report:	2,695
Percentage Bangladesh Bank HQ's employees covered by report:	100%

Table II: GHG Emissions Reporting Activities

Scope 1	Scope 2	Scope 3
Fuel Combustion	No Scope 2 Activities	Business Travel
Company Owned and Controlled Vehicle		Logistics Transportation
Refrigerant Leakage		Waste Disposal
		Chemical and Toiletries

BANGALDESH BANK HQ'S CARBON DIOXIDE EQUIVALENT (CO_2E) EMISSIONS

Scope 1 Direct Emissions	*Metric tons of CO_2e*
Fuel Combustion	164.02
Company Owned Vehicle	200.73
Refrigerant Leakage	9,137.64
Total Scope 1 Emissions	***9,502.39***

Scope 2 Indirect Emissions	*Metric tons of CO_2e*
Purchased Electricity	5,395.56
Total Scope 2 Emissions	5,395.56
Total Scope 1 and 2 Emissions	***14,897.95***

Scope 3 Indirect Emissions	*Metric tons of CO_2e*
Business Travel	680.33
Staff Commuting	265.53
Logistic Transportation	26.71
Purchased Materials	67.39

Chemical and Lubricants	140.61
Total Scope 3 Emissions	1,180.57
Total Scope 1, 2 and 3 Emissions	16,078.52
Total Emissions Reduction	(-) 47.08
Total Reporting (Net) Emissions	***16,031.44***

This report has been prepared in accordance with *Greenhouse Gas Protocol – Corporate Accounting and Reporting Standard*; Emissions have been calculated using *DEFRA's 2013 Emissions Factors* and compliant with *ISO 14064-1*. The carbon footprint assessment boundary was set around those activities which Bangladesh Bank has 'operational control' and emission sources attributed to one or more of the following categories:

- Scope 1 Emissions: Direct GHG Emissions from company owned or controlled assets
- Scope 2 Emissions: Indirect GHG Emissions from purchased electricity, heat, steam and cooling
- Scope 3 Emissions: Other indirect GHG Emissions from the operation of the organization

Table III: GHG Emissions

Emissions Scope	Metric tons of CO_2e	Full Time Employee (FTE)	Emissions/FTE (tCO_2e)
Total Scope 1 Emissions	9,502.39	2,695	3.53
Total Scope 2 Emissions	5,395.56	2,695	2.00
Total Scope 1 and 2 Emissions	14,897.95	2,695	5.53
Total Scope 3 Emissions	1,180.57	2,695	0.44
Total Emissions Reduction	47.08	2,695	0.0175
Total Reporting Emissions	16,031.44	2,695	5.95

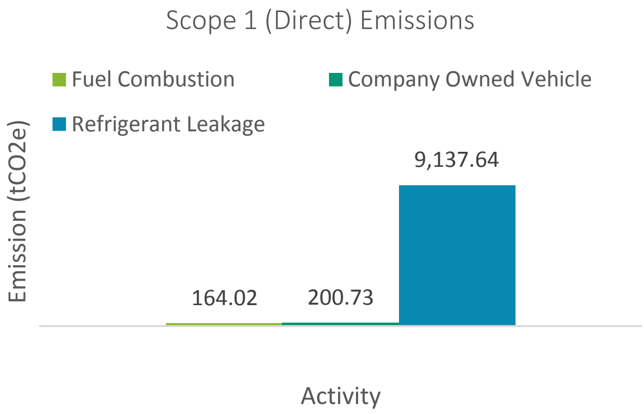
The Gross Emission for the total establishment is given below:

Table IV: Reporting Net GHG Emissions

Scope	Emissions (tCO_2e)	Net Emissions (tCO_2e)
Scope 1	(+) 9,502.39	
Scope 2	(+) 5,395.56	(+) 16,031.44
Scope 3	(+) 1,180.57	
Carbon Reduction	(-) 47.08	

Although this assessment has been conducted in accordance with the Greenhouse Gas (GHG) Protocol, this report is lacking certain compulsory and voluntary information as required by the GHG Protocol. This includes activities accounting for air-conditioning and refrigeration gas refills (Scope 1), employee commuting, travel claims/allowances, and other third party production of consumed materials, outsourced activities and end-use of products (all Scope 3).

SCOPE 1 (DIRECT) EMISSIONS



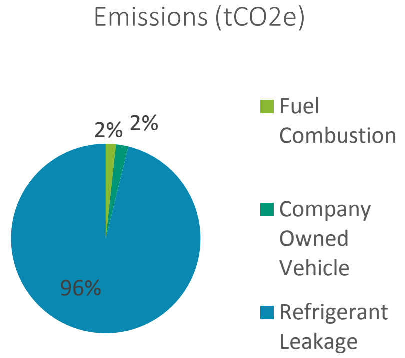
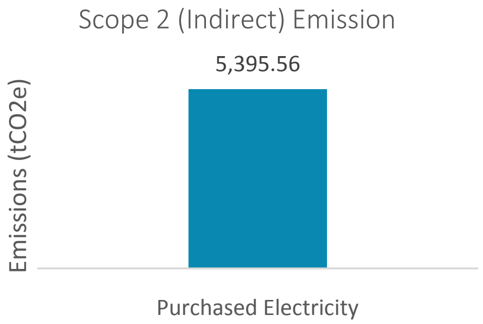


Figure I: Scope 1 (Direct) Emissions

SCOPE 2 (INDIRECT) EMISSIONS



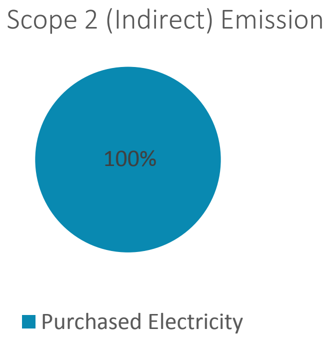
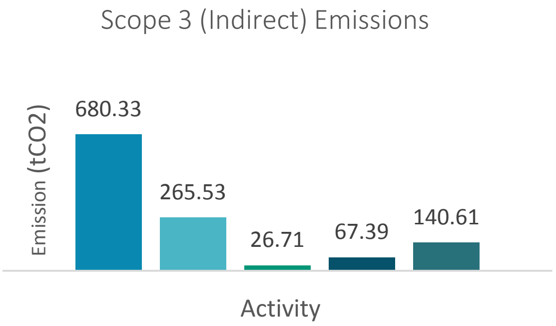


Figure II: Scope 2 (Indirect) Emissions

SCOPE 3 (INDIRECT) EMISSIONS



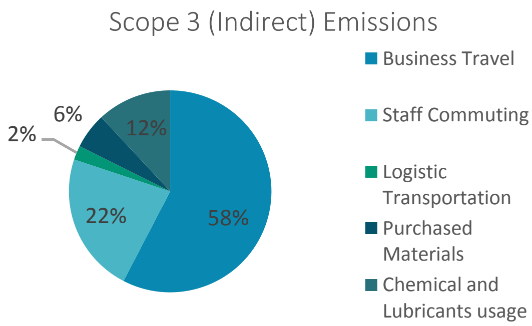


Figure III: Scope 3 (Indirect) Emissions

ALL SCOPES AND GROSS EMISSIONS

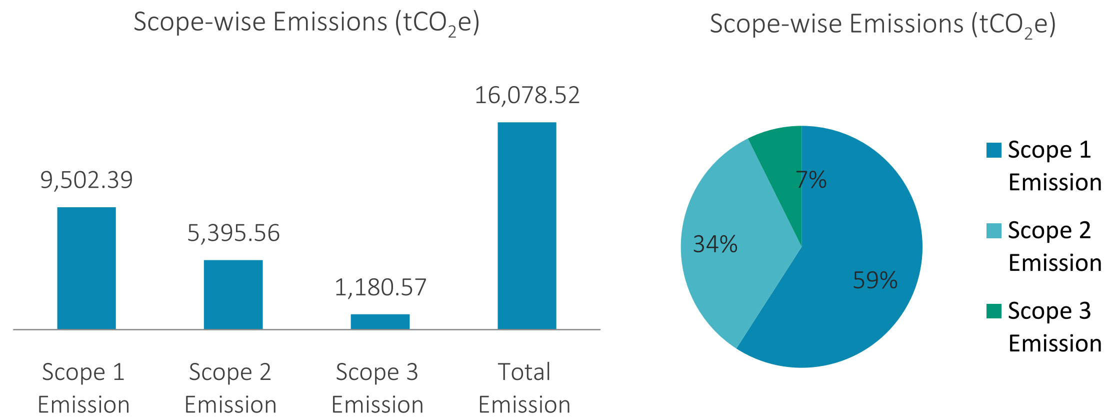


Figure IV: Reporting Emissions

REPORTING NET EMISSIONS FOR THE YEAR OF 2015

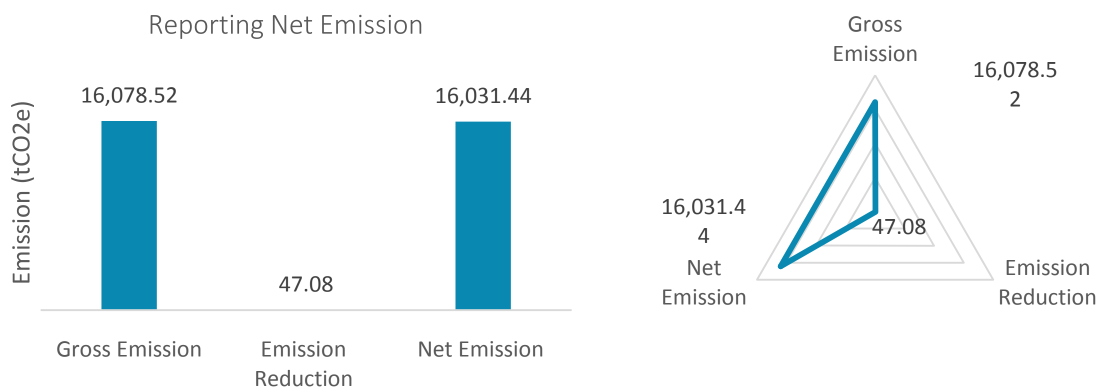


Figure XI: Reporting Net Emissions

Table V: Per unit area GHG Emissions

Total Reporting Emissions (tCO_2e)	16,031.44
Total Site Area (m^2)	21,881.55
Total Floor Area (m^2)	90,256.51
Per Sq. meter Project Emissions/ (tCO_2e/ m^2)	0.73
Per Sq. meter Building Emissions/ (tCO_2e/ m^2)	0.18
Resulting Emissions/ m^2 (tCO_2e/ m^2)	**0.73**

COMPARISON WITH THE BASE YEAR EMISSIONS

Base Year for GHG Emissions Calculation: **2014**

Reporting Year for GHG Calculation: **2015**

Comparison: **Yet to conduct GHG Emissions for the year 2015**

SECTION 01

INTRODUCTION

1. INTRODUCTION

Future Carbon is pleased to present Bangladesh Bank's 2014 Carbon Footprint Report, which is the first ever carbon footprint measured and calculated by Bangladesh Bank.

This carbon footprint report has been prepared in full accordance with the Greenhouse Gas Protocol (GHG); the most widely used international carbon calculation methodology, compatible with other GHG standards such as ISO-14064, which also allows for direct integration with national and international greenhouse gas (GHG) registries.

A carbon footprint is the total greenhouse gas (GHG) emissions caused directly and indirectly by an individual, organisation, event or product, and is expressed as a carbon dioxide equivalent (CO_2e). A carbon footprint accounts for all six Kyoto GHG emissions:

- Carbon Dioxide (CO_2)
- Methane (CH_4)
- Nitrous Oxide (N_2O)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulphur hexafluoride (SF_6)

1.1 CARBON DIOXIDE EQUIVALENT (CO_2E)

Carbon dioxide equivalent (CO2e) is the unit of measurement which allows different greenhouse gases to be compared on a like for like basis relative to one unit of CO2. CO2e emissions are calculated by multiplying the emissions of each of the six greenhouse gases by its 100-year Global Warming Potential (GWP).

The emitting activities covered in this carbon footprint report for 2014 includes direct emissions resulting from Bangladesh Bank owned or controlled equipment and assets, also emissions from purchased electricity (referred to as Scope 1and 2 emissions respectively); and selected indirect emissions resulting from Bangladesh Bank's operation (referred to as Scope 3 emissions). It is important to highlight that under the GHG Protocol, the reporting of both direct emissions and indirect emissions, resulting from purchased electricity, are compulsory. All other indirect emissions (scope 3 emissions) are reported on a voluntary basis. As many voluntary emissions as possible, dependent on reliable data, have been reported on.

1.2 THE GHG PROTOCOL

The GHG Protocol is a multiple-stakeholder partnership of business, NGOs and governments led by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). It is the best source of information about corporate GHG accounting and reporting, and draws on the expertise and contributions of individuals and organizations from around the world. The GHG Protocol is the most widely used standard for mandatory and voluntary GHG Programmes and is compatible with other international GHG standards such as ISO-14064. It is also analogous to the generally accepted financial accounting standards for the consistent accounting reporting purposes of companies.

Future Carbon has gone to all reasonable lengths to ensure that the primary information provided by Bangladesh Bank is correct but Future Carbon takes no responsibility for any inaccuracies that this information might contain. This report, in its entirety, is both material and complete and is intended for Bangladesh Bank's internal use only. Information may, however, be extracted for reporting purposes, such as for submission into international and/or national Greenhouse Gas registries and sustainability reporting. It can also be presented for third-party verification purposes.

SECTION 02

REQUIRED INFORMATION

2.1 COMPANY DESCRIPTION

Bangladesh Bank, the central bank and apex regulatory body for the country's monetary and financial system, was established in Dhaka as a body corporate vide the Bangladesh Bank Order, 1972 (P.O. No. 127 of 1972) with effect from 16th December, 1971. At present it has ten offices located at Motijheel, Sadarghat, Chittagong, Khulna, Bogra, Rajshahi, Sylhet, Barisal, Rangpur and Mymensingh in Bangladesh; total manpower stood at 5,807 (officials 3,981, subordinate staff 1,826) as on March 31, 2015.

Corporate headquarter of Bangladesh Bank is located at Motijheel, Dhaka which consists of four establishments: HQ Main Building, Motijheel Office, HQ 1st Adjacent Building and HQ 2nd Adjacent Building. Total area of Bangladesh Bank HQ premises is 235,531square feet, total floor area is 971,513square feet and total manpower of this facility is 2695 including all sorts of officials and subordinate staff as of December 2014.

Bangladesh Bank performs all the core functions of a typical monetary and financial sector regulator, and a number of other non-core functions. The major functional areas include but not limited to:

- Formulation and implementation of monetary and credit policies
- Regulation and supervision of banks and non-bank financial institutions
- Promotion and development of domestic financial markets
- Management of the country's international reserves
- Issuance of currency notes
- Regulation and supervision of the payment system
- Acting as banker to the government
- Money Laundering Prevention
- Collection and furnishing of credit information
- Implementation of the Foreign exchange regulation Act
- Managing a Deposit Insurance Scheme

Carbon Footprint Assessment of Bangladesh Bank is an initiative of Sustainable Finance Department. Sustainable Finance Department was established on April 04, 2013 with a view to develop sustainable banking (i.e. green banking, CSR and financial inclusion) framework and to integrate it into core business operation of banks and financial institutions through efficient and effective implementation of green banking, CSR and financial inclusion. Sustainable Finance Department is committed to bring sustainable economic development and energy efficiency in Banking and Financial sectors of Bangladesh to maximize the resource utilization and to reduce the investment risk. This noble initiative will encourage the relevant sectors to achieve sustainable development within their operational control.

2.2 INVENTORY BOUNDARIES

2.2.1 ORGANIZATIONAL BOUNDARIES

Definition: Organisational Boundaries

Organizational boundaries determine which business units (core, subsidiaries, franchises, etc.), facilities, or physical places of operation, owned or controlled by the reporting company, are included *in the carbon footprint. The more complex the company structure, the more important are the boundaries of an organizations for the clear definition and scope of the report.*

For corporate reporting of GHG emissions, two distinct approaches can be taken: Equity Share Approach and Control Approach. The Equity Share Approach accounts for emissions based on financial ownership or economic interest in an operation. The control approach accounts for emissions based on operational or financial control of an operation.

Future Carbon has chosen to use the Operational Control Approach for the purposes of consolidating and reporting GHG emissions. The reason for choosing this approach is:

2.3 OPERATIONAL CONTROL

Bangladesh Bank has full operational control over the sources that lead to the greenhouse gas emissions and it is for this reason that Operational Control was chosen for the organizational boundary. Using this approach, this Carbon Footprint Report includes emissions from the following operations:

Table 1: List of Facilities and Facility Address

Facility Name	Facility Address
Bangladesh Bank HQ Main Building	Motijheel, Dhaka
Bangladesh Bank HQ Motijheel Office Building	Motijheel, Dhaka
Bangladesh Bank HQ 1st Adjacent Building	Motijheel, Dhaka
Bangladesh Bank HQ 2nd Adjacent Building	Motijheel, Dhaka

2.2.1 OPERATIONAL BOUNDARIES

Definition: Operational Boundaries

Operational boundaries determine the business activities of the reporting company that generate emissions, which of these activities should be included in the calculation, and how these activities should be classified (i.e. direct or indirect emissions).

Greenhouse Gas (GHG) emissions resulting from the following activities have been calculated:

- Equipment and vehicles owned or controlled by Bangladesh Bank that consume petrol
- Equipment and vehicles owned or controlled by Bangladesh Bank that consume diesel
- Equipment owned or controlled by Bangladesh Bank that consume LPG
- Equipment owned or controlled by Bangladesh Bank that consume LNG
- Equipment owned or controlled by Bangladesh Bank that consume Natural Gas
- Equipment owned or controlled by Bangladesh Bank that consume kerosene
- Equipment owned or controlled by Bangladesh Bank that consume oil
- Consumption of purchased electricity
- Business travel in commercial airlines
- Business travel in rental cars
- Business travel in overnight accommodation
- Transportation of inbound and outbound documents
- Transportation of inbound and outbound logistics

- Consumption of office paper and other stationaries
- Consumption of chemicals and lubricants
- Consumption of anti-mosquito and anti-insect spray
- Consumption of liquid soap and other toiletries

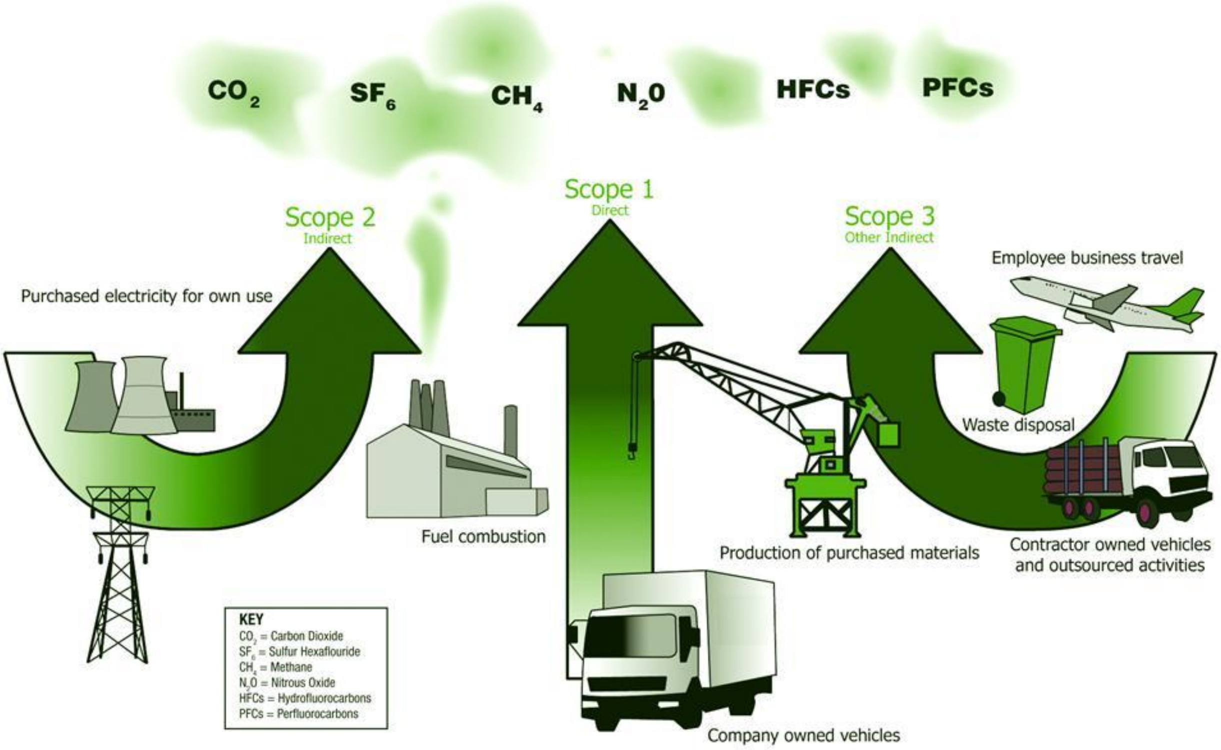


Figure 1: GHG Emissions Operational Boundaries

The GHG Protocol requires carbon footprint calculations to include all direct emissions under Scope 1, and indirect emissions from purchased electricity under Scope 2 as compulsory reporting. Other activities under indirect emissions, Scope 3 are voluntarily reported. Kindly refer to *Fig. 1* for a diagram to illustrate direct and indirect emissions and the different scopes of reporting.

Definition: Scope 1 Emissions
Emissions from sources owned or controlled by the reporting company, e.g. generators, refrigeration, air-conditioning units.

Definition: Scope 2 Emissions
Emissions associated with the consumption of purchased electricity, heat or steam from a source that is not owned or controlled by the reporting company, e.g. an electricity utility like DESCO.

Definition: Direct and Indirect Emissions
Under the GHG Protocol, emissions are categorised as 'direct' when they are generated from activities or sources within the reporting company's organisational boundary and which the company owns or controls. 'Indirect' sources are those emissions related to the company's activities that are emitted from sources owned or controlled by another company, e.g. purchased electricity, rental cars, commercial airlines or paper.

Table 2: List of Reported Activities

Scope 1	Scope 2	Scope 3
Fuel Combustion	Purchased Electricity	Business Travel

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Company Owned and Controlled Vehicle	Staff Commuting
Refrigerant Leakage	Logistic Transportation
	Purchased Material
	Chemical and Lubricants

2.2.2 RECOMMENDED IMPROVEMENTS

It is recommended that Bangladesh Bank incorporate the following activities in their future data collection:

- Air-conditioning and refrigeration gas refills and maintenances to be recorded
- Fuel used in owned equipment to be recorded separately from fuel used in transport vehicles
- Emissions from car rentals used for business purpose to be recorded as total kilometres instead of payment given
- Employee commuting in public transport or own transport
- Travel claims and/or travel allowances as litres of fuel or total kilometres claimed
- Logistics inventory be recorded and monitored

2.3 REPORTING PERIOD

The reporting period for this Carbon Footprint report is:1st January 2014 to 31st December 2014 (inclusive)

2.4 BASE YEAR

Definition: *A base year allows for like to like comparisons over time and allows tracking progress to a given target. In addition, a company may undergo significant structural changes such as mergers and divestments that will significantly alter a company's emissions profile making like to like comparisons difficult. In order to maintain consistency or a like to like comparison over time, recalculating base year and previous emissions may be required if a company undergoes significant structural changes. In order to determine when a recalculation is necessary a company chooses a base year re-calculation threshold. Base year and previous year emissions are not re-calculated for organic growth and decline.*

The base year of Bangladesh Bank for the purposes of reporting Greenhouse Gas Emissions is: 2014

The reason for this to be chosen as the base year is because it is the first year that the carbon footprint of the organization has been chosen to be calculated.

2.5 BASE YEAR RE-CALCULATION POLICY

Definition: *A base year re-calculation policy sets a threshold trigger for when the organization will recalculate the base year following a merger or acquisition. The base year is not recalculated due to organic business growth or decline.*

2.6 CALCULATION METHOD

Definition: *Two calculation methods are accepted for the purpose of calculating GHG emissions. Direct Monitoring and Measurement requires the use of scientific equipment at the point of discharge. Emissions Factors applies a multiplier to the amount of resources consumed.*

Future Carbon has chosen to use the Emission Factor method for the purposes of calculating GHG emissions. Future Carbon has made all efforts possible to use the best available emissions factors available at the time and has cited the source of all emission factors used. Greenhouse Gas Protocol Corporate Reporting Standard has been followed to conduct the assessment. GHG Protocol and DEFRA Emissions Factors have been applied to calculate relevant GHG Emissions.

GHG Emission= Activity X Emission Factor

The reason for choosing Emission Factor Method is that scope-wise resources consumption data have been used to obtain GHG Emissions from all the relevant activities.

2.6.1 EMISSION FACTORS

Emission factors convert activity data (e.g. amount of fuel used, kilometers driven, and kilowatt hours of purchased electricity) into a value indicating carbon dioxide equivalent (CO_2e) emissions generated by that particular activity. Default values are used by the GHG Protocol to assist businesses that are unable to develop accurate customized values. These default values are representative averages based on the most extensive data sets available and are largely identical to those used by the Intergovernmental Panel on Climate Change (IPCC), the premier authority on greenhouse gas accounting practices at the global level. The GHG Protocol recommends, however, that businesses should use customized values whenever possible, as industrial processes or the composition of fuels used by businesses may differ with time and by region. This report largely uses the latest emission factors provided by the UK government's Department of Environment, Food and Rural Activities (Defra), June 2013. These have been adopted by the GHG Protocol as de facto emission factors and are updated on a regular basis. In reporting emissions generated by the consumption of electricity purchased in Bangladesh from DESCO, the emissions factor provided by the Department of Environment, Ministry of Environment and Forestry, Government of Bangladesh (2013) has been used to provide local context accuracy.

SECTION 03

INFORMATION ON BANGLADESH BANK HEADQUARTER'S EMISSIONS

3.1 SCOPE 1 EMISSIONS

Fuel Combustion: Bangladesh Bank HQ facility uses various types of fuels by various processes which includes but not limited to-electricity generation (diesel generator), kitchen, gizzard, etc. Mainly used fuels are diesel, octane, petrol, natural gas and kerosene. However, all the fuel usage data are not available and all the figures used to calculate onsite fuel combustion emissions were provided by Bangladesh Bank authority. Fuel usage data have been provided in appendix.

Total Fuel Combustion Emissions: 164.02 tCO_2e

Company Owned and Controlled Vehicle: Bangladesh Bank has provided a list of vehicles which are company owned. Annual approximate distance traveled has been provided though specific engine capacity, brand, model and fuel used data lacked in some aspects. However, considering the data available in hand, emissions from company owned vehicle have been calculated. Vehicle data have been listed in appendix.

Total Company Owned and Controlled Vehicle Emissions: 200.73 tCO_2e

Refrigerant Leakage (Fugitive) Emission: Bangladesh Bank has provided a detailed list of air-conditioning units used by the facility which includes air-conditioning capacity, refrigerant used and number of units. However, exact refrigerant leakage rate, air-conditioning units' brand and model are not available. Considering the available data, necessary estimations have been made to carry out the emissions from refrigerant leakage. It is worth mentioning that most of the split and window type air-conditioning units use outdated refrigerant having a high Global Warming Potential (GWP). It is also to be noted that considering all the units' age, periodic maintenance takes place and medium leakage rate has been considered.

Total Refrigerant Leakage (Fugitive) Emissions: 9,137.64 tCO_2e

3.1.2 TOTAL SCOPE 1 EMISSIONS

Total Fuel Combustion Emissions + Total Company Owned and Controlled Vehicle Emissions +Total Refrigerant Leakage (Fugitive) Emissions

=164.02 tCO_2e + 200.73 tCO_2e + 9,137.64 tCO_2e

=9,502.39 tCO_2e

Total Scope 1 Emissions: 9,502.39 tCO_2e

Table 3: Scope 1 Emissions Summary

Activity	Emissions (tCO_2e)	Total Scope 1 Emissions (tCO_2e)
Fuel Combustion	164.02	
Company Owned Vehicle	200.73	9,502.39
Refrigerant Leakage	9,137.64	

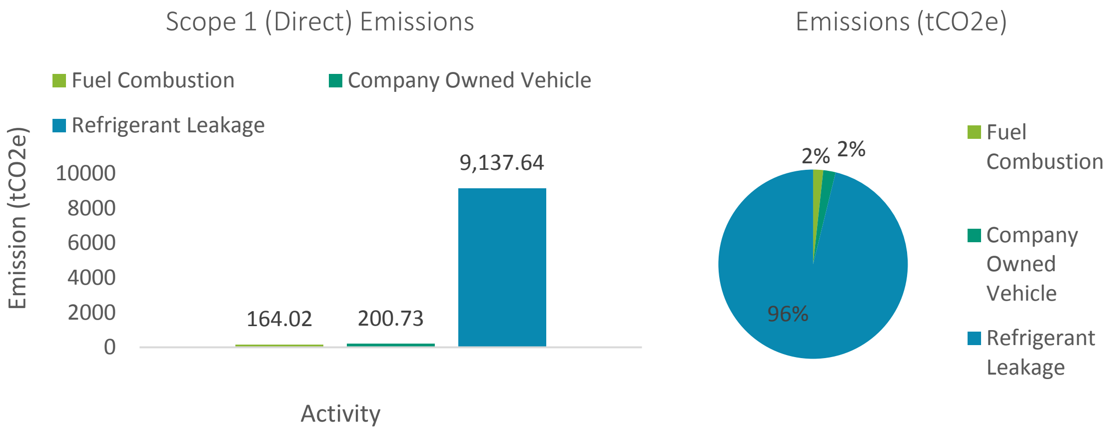

Figure 2: Activity-wise Scope 1 (Direct)Emissions

3.2 SCOPE 2 EMISSIONS

Purchased Electricity: Electricity used by Bangladesh Bank HQ is purchased from grid electricity generated by Bangladesh Power Development Board (BPDB). Country specific grid electricity emission factor has been used to calculate emissions from purchased electricity.

Total Emissions from Purchased Electricity: 5,395.56 tCO_2e

Table 4: Scope 2 Emissions Summary

Activity	Emissions (tCO_2e)	Total Scope-wise Emissions (tCO_2e)
Purchased Electricity	5,395.56	5,395.56

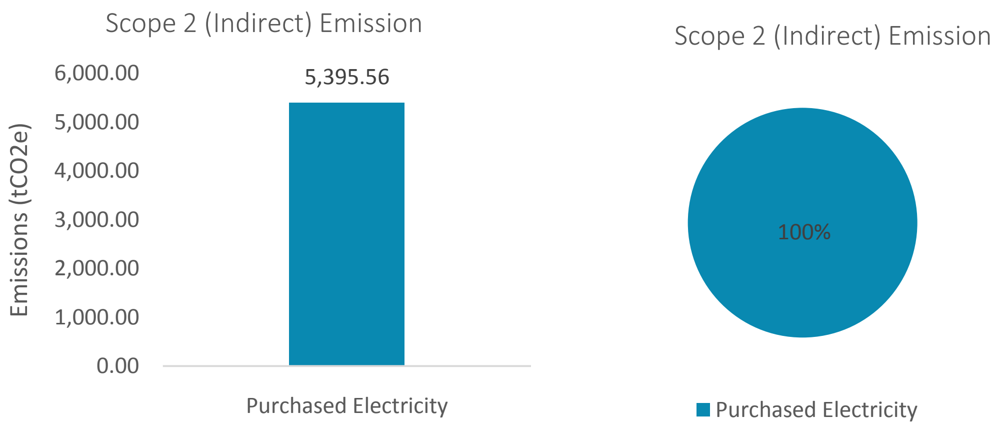

Figure 3: Activity-wise Scope 2 Emissions

3.3 SPECIFIC EXCLUSIONS

The following exclusions of emission sources (and their explanations) are described below:

Scope 1: Direct emissions:

- Air-conditioning and refrigeration gas refills– information not currently available.
- Employee commuting in company-owned or controlled vehicles – information not available or insufficiently differentiated to properly ascribe fuel combustion to specific activities.

- Car rentals (fuel use as Scope 1) – under discussion as to whether to include.

Scope 3: Indirect emissions:

- Employee commuting in cars, trains or buses – information not available.
- Travel claims by employees using private vehicles for business purposes – information not available.
- Outsourced activities such as shipping, courier services and printing services – partial information not sufficient for this report.
- End use of products by the reporting company – information not available.
- Water consumption-No information available.
- Emissions resulting from the generation and disposal of waste – no information available and not deemed accurate enough for reporting purposes.

SECTION 04

OPTIONAL INFORMATION UNDER THE GHG PROTOCOL

4.1 RELEVANT SCOPE 3 EMISSIONS

Definition: Scope 3 Emissions

Scope 3 emissions are indirect emissions, other than purchased electricity, which can be described as relevant to the activities of the reporting company. Under the GHG Protocol it is not compulsory to report them. Certain GHG reporting registries, however, require that some Scope 3 emissions be reported under different circumstances.

Air Travel and the Multiplier Effect

The GHG Protocol uses emissions factors for air travel based on size of aircraft, occupancy levels and fuel consumption proposed by the UK government's Defra paper. It should be highlighted that these assumptions now cater for the increased global warming effects of aviation that are higher than the impact of CO2 emissions alone - "due to water vapour, sulphate or soot particles, indirect effects of nitrogen oxide emissions on the concentration of ozone and methane, or through the induced formation of clouds".

As a result of excessive emissions during take-off and landing, different factors are used in calculating emissions of short-, medium- and long-haul flights, in accordance with the GHG Protocol. Many organizations then multiply these emissions by a multiplier factor to provide a more realistic quantification of the global warming effect of aviation emissions. This report does include a multiplier effect within the emission factor for air aviation emissions.

The IPCC Aviation and the global Atmosphere 8.2.2.3 states that 9-10% should be included to take into account non direct routes (i.e. not along the straight line distances between destinations) and delays/circling. Airline industry representatives have indicated that the percentage uplift for short-haul flights should be higher and for long-haul flights will be lower; however specific data is not currently available to provide separate factors. An 8% uplift factor has been used for all flights in this report as per Defra 2013.

4.2 SCOPE 3 EMISSIONS

Business Travel: According to the travel details provided by Bangladesh Bank it seems like that this facility has an extensive amount of travel activities. Business travel includes both domestic and international. Provided information lacks essential factors like specific destination (airport), duration of travel and class of travel, etc. However, necessary estimations have been made considering conservation approach. Travel information received from the authority has been listed in appendix.

Total Emissions from Business Travel: 680.33 tCO_2e

Staff Commuting: Bangladesh Bank is the central reservoir bank in the country, 2,695 manpower directly and dedicatedly employed for the head quarter of this facility. Most of the employee avail mass transport service available in the country which is bus service. Employees annual travel distance provided by the authority has been attached in the appendix.

Total Emissions from Staff Commuting: 265.53 tCO_2e

Logistics Transportation: As the central bank of the country, Bangladesh Bank uses an enormous amount of logistics and these inbound and outbound logistics are being shipped via local and international parcel and courier services. However, logistics transportation information lacks clarity and exact amount of both inbound and outbound logistics are not available. Necessary estimations have been made based on provided data and calculation has been carried out considering conservation approach.

Total Emissions from Logistics Transportation: 26.71 tCO_2e

Purchased Materials: Bangladesh Bank has provided a detailed list of purchased stationery goods and papers used by the HQ facility which includes paper, ballpoint pen, pencil, various office stationeries, etc. However, type of goods, brand and exact quantity are missing in some aspects. Required estimations must have been made based on information available considering conservation approach. Summary of the office stationary items have been listed in the appendix.

Total Emissions from Purchased Materials: 67.39 tCO_2e

Chemical and Lubricants usage: Bangladesh Bank authority has provided a list of chemicals used by the facility to run the operation which includes anti-mosquito spray, air freshener, anti-odour substances, liquid soap, anti-septic, anti-bacterial and anti-fungal reagent and other lubricants which are used to serve necessary purposes. In some aspects some essential information are not available which have been estimated methodically. Provided list of chemicals and lubricants are listed in appendix.

Total Emissions from Chemicals and Lubricants usage: 140.61 tCO_2e

4.3.1 TOTAL SCOPE 3 EMISSIONS

Total Emissions from Business Travel +Total Emissions from Staff Commuting+ Total Emissions from Logistics Transportation+ Total Emissions from Purchased Materials +Total Emissions from Chemicals and Lubricants usage

= 680.33 tCO_2e + 265.53 tCO_2e + 26.71 tCO_2e + 67.39 tCO_2e + 140.61 tCO_2e

= 1,180.57 tCO_2e

Total Scope 3 Emissions: 1,180.57 tCO_2e

Table 5: Scope 3 Emissions Summary

Activity	Emissions (tCO_2e)	Total Scope 3 Emissions (tCO_2e)
Business Travel	680.33	
Staff Commuting	265.53	
Logistic Transportation	26.71	1,180.57
Purchased Materials	67.39	
Chemical and Lubricants usage	140.61	

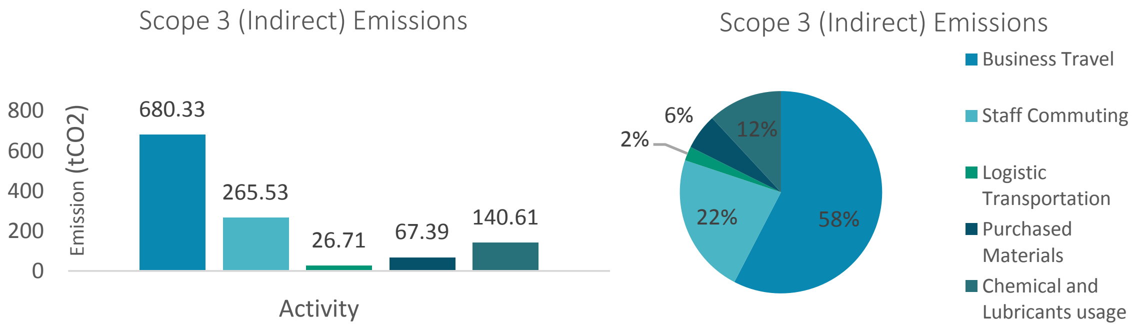

Figure 4: Activity-wise Scope 3 Emissions

4.4 EMISSIONS FROM GHG NOT COVERED BY THE KYOTO PROTOCOL

While the GHG Protocol's Scope 1, 2 and 3 emissions are strictly for GHGs that fall under the international Kyoto Protocol on the control of climate change, provision is made for separate reporting on GHGs that might be under consideration by other international treaties such as the Montreal Protocol.

Bangladesh Bank did not record the usage of any Non-Kyoto Protocol GHGs during the 2014 financial year.

4.5 OUTSIDE OF SCOPES

Outside of scopes, factors should be used to account for the direct CO_2 impact of burning biomass and biofuels. The emissions are labeled 'outside of scopes' because the scope 1 impact of these fuels has been determined to be a net '0' (since the fuel source itself absorbs an equivalent amount of CO_2 during the growth phase as the CO_2 is released through combustion). Full reporting of any fuel from a biogenic source should have the 'outside of scopes' CO_2 value documented to ensure complete accounting for the emissions created. Bangladesh Bank did not report any outside of scopes emissions in this report.

4.6 EMISSION REDUCTION

Bangladesh Bank HQ facility has installed 35 kW peak solar panel for electricity generation. Specific solar panel rating and daily operational hours have not been provided. However standard and conservative approach have been applied for calculating GHG emission reduction from this activity.

Total Emission Reduction for deployment of Renewable Energy: (-) 47.08 tCO_2e

4.7 INFORMATION ON OFFSETS

Bangladesh Bank has installed 35 kW peak solar panel as a commitment to mitigate the emissions created by their activities and in near future they are going to implement another 108 kW peak solar panel to generate clean electricity.

4.8 REDUCTION STRATEGIES

Bangladesh Bank has installed a total amount of 35 kW peak PV solar panel as a commitment to reduce GHG emissions and it has a plan to implement another 108 kW peak PV solar panel within very short period of time.

4.9 VERIFICATION

Verification is an objective assessment of the accuracy and completeness of reported GHG information and the conformity of this information to pre-established GHG accounting and reporting principles. Although the practice of verifying corporate GHG inventories is still evolving the emergence of widely accepted standards, such as the GHG Protocol Corporate Standard and the forthcoming GHG Protocol Project Quantification Standard, should help GHG verification become more uniform, credible, and widely accepted.

Verification involves an assessment of the risks of material discrepancies in reported data. Discrepancies relate to differences between reported data and data generated from the proper application of the relevant standards and methodologies. In practice, verification involves the prioritization of effort by the verifier towards the data and associated systems that have the greatest impact on overall data quality. Any accredited third party must be engaged to verify GHG Emissions according standard method.

4.9.1 RELEVANCE OF GHG PRINCIPLES

The primary aim of verification is to provide confidence to users that the reported information and associated statements represent a faithful, true, and fair account of a company's GHG emissions. Ensuring transparency and verifiability of the inventory data is crucial for verification. The more transparent, well controlled and well documented a company's emissions data and systems are, the more efficient it will be to verify. As outlined in earlier, there are a number of GHG accounting and reporting principles that need to be adhered to when compiling a GHG inventory. Adherence to these principles and the presence of a transparent, well-documented system (sometimes referred to as an audit trail) is the basis of a successful verification.

4.9.2 GOALS

Before commissioning an independent verification, a company should clearly define its goals and decide whether they are best met by an external verification. Common reasons for undertaking verification include:

- Increased credibility of publicly reported emissions information and progress towards GHG targets, leading to enhanced stakeholder trust.
- Increased senior management confidence in reported information on which to base investment and target setting decisions.
- Improvement of internal accounting and reporting practices (e.g., calculation, recording and internal reporting systems, and the application of GHG accounting and reporting principles), and facilitating learning and knowledge transfer within the company.
- Preparation for verification requirements of GHG programs.

SECTION 05

TOTAL EMISSIONS

5.1 EMISSIONS BY SCOPE

The total emissions breakdown by Scopes are as follows:

Table 6: Scope 1 Activities and GHG Emissions

Activity	Emissions (tCO_2e)	Total Scope 1 Emissions (tCO_2e)
Fuel Combustion	164.02	
Company Owned Vehicle	200.73	9,502.39
Refrigerant Leakage	9,137.64	

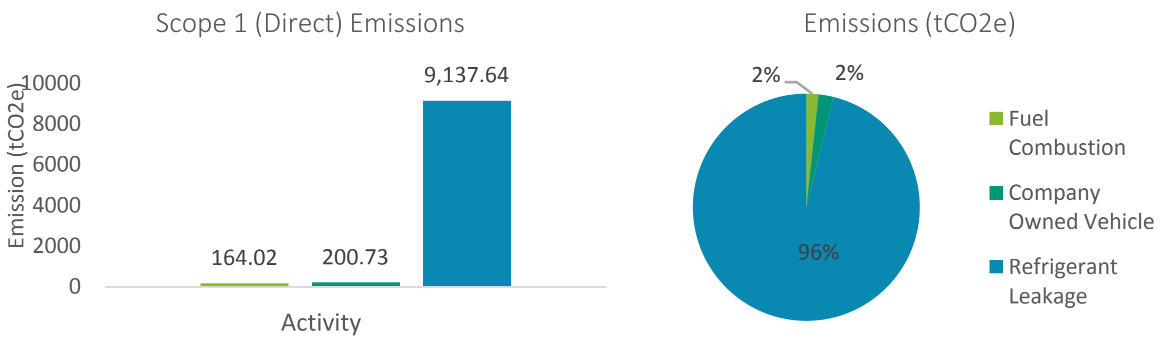

Figure 5: Scope 1 Emissions Breakdown

Table 7: Scope 2 Activities and GHG Emissions

Activity	Emissions (tCO_2e)	Total Scope-wise Emissions (tCO_2e)
Purchased Electricity	5,395.56	5,395.56

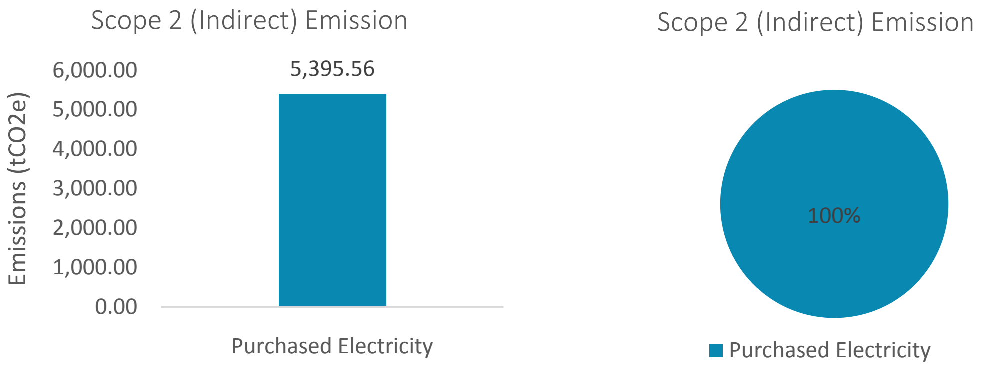

Figure 6: Scope 2 Emissions Breakdown

Table 8: Scope 3 Activities and GHG Emissions

Activity	Emissions (tCO_2e)	Total Scope-wise Emissions (tCO_2e)
Business Travel*	680.33	
Staff Commuting	265.53	
Logistic Transportation*	26.71	1,180.57
Purchased Materials*	67.39	

Chemical and Lubricants usage*	140.61

* These activities lack accurate information.

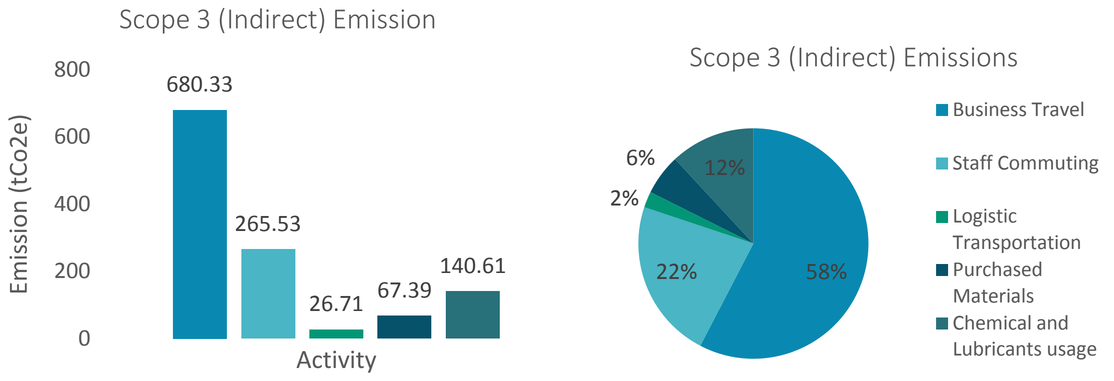

Figure7: Scope 3 Emissions Breakdown

5.2 GROSS EMISSIONS

Table 9: Gross GHG Emissions

Scope	Emissions (tCO_2e)	Total Emissions (tCO_2e)
Scope 1	9,502.39	
Scope 2	5,395.56	16,078.52
Scope 3	1,180.57	

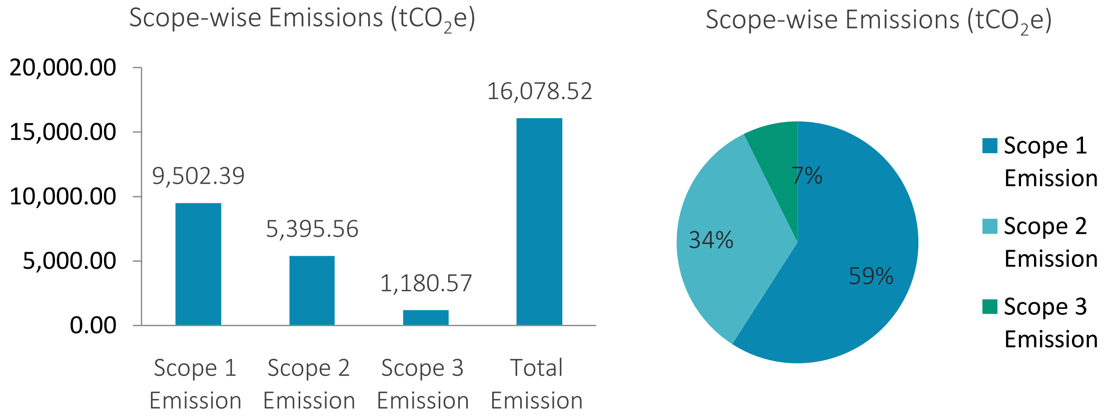

Figure 8: Gross All Scopes Emissions

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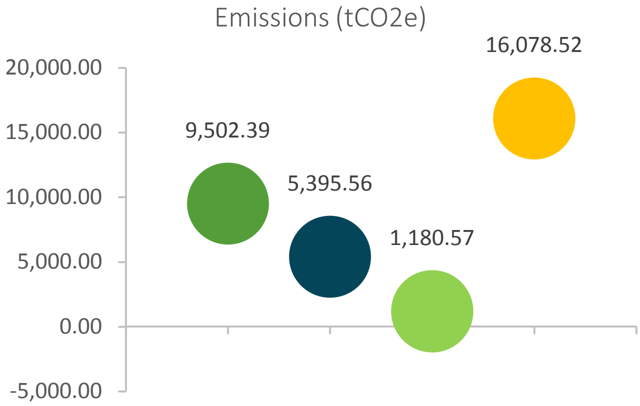


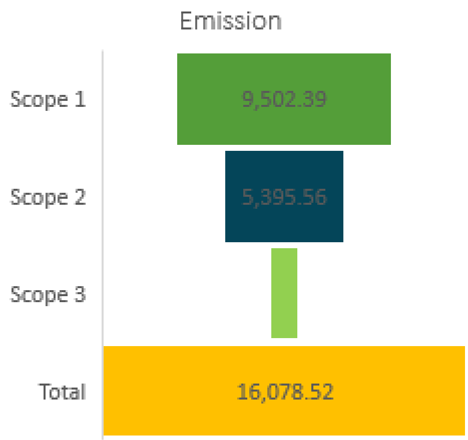


Figure 9: Gross Emission Summary

5.3 NET EMISSION

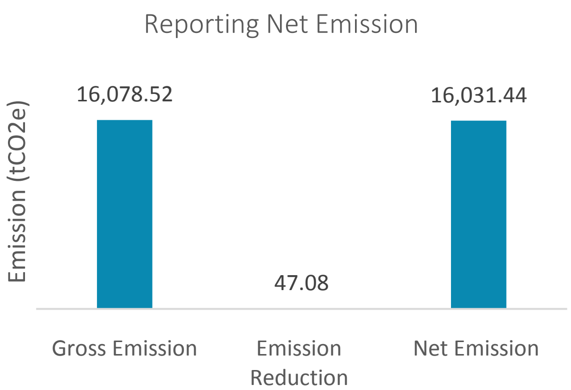
Table 10: Net Emissions

Gross Emission (tCO_2e)	Emission Reduction (tCO_2e)	Net Emission (tCO_2e)
(+) 16,078.52	(-) 47.08	16,031.44

Total Emissions for Bangladesh Bank in the reporting period of (2014) is: 16,031.44 tCO_2e

Table 11: Reporting Year and Net Emissions

Reporting Year	Net Emissions (tCO_2e)
2014	16,031.44



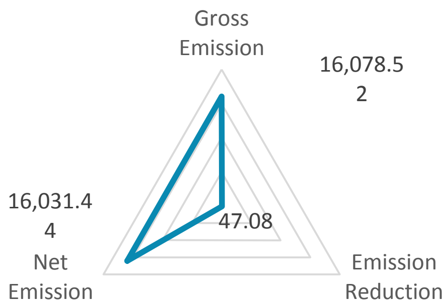


Figure 10: Reporting Emission Summary

SECTION 06

RESULT

6.1 RESULTING EMISSIONS

This report provides the amount of emission in terms of tCO_2e for Bangladesh Bank HQ. Total emissions for this establishment is 16,078.52 tCO_2ewhich is the sum of Scope 1, Scope 2 and Scope 3 emissions. 47.08 tCO_2e has been reduced by deploying renewable energy means (PV Solar Panel). The amount of CO_2 captured by the establishment's forestry component hasn't been accounted as there is no specific information about the plantations.

Net Carbon Footprint of the establishment is + 16,031.44 tCO_2ewhich means the Net Emission for the year 2014 is ***+16,031.44 tCO_2e***. This Net Emission also could be reduced to minimum level if carefully selected offsetting is considered for the future operation.

Table 12: Overall Activities and associated Emissions

Scope	Activity	Emissions (tCO_2e)	Scope-wise Total Emissions (tCO_2e)	Total (Net) Emissions (tCO_2)
Scope 1	Fuel Combustion	164.02	(+)9,502.39	(+) 16,031.44
	Company Owned Vehicle	200.73		
	Refrigerant Leakage*	9,137.64		
Scope 2	Purchased Electricity	5,395.56	(+) 5,395.56	
Scope 3	Business Travel*	680.33	(+) 1,180.57	
	Staff Commuting	265.53		
	Logistic Transportation*	26.71		
	Purchased Materials*	67.39		
	Chemical and Lubricants usage*	140.61		
Emission Reduction	PV Solar Panel		(-) 47.08	

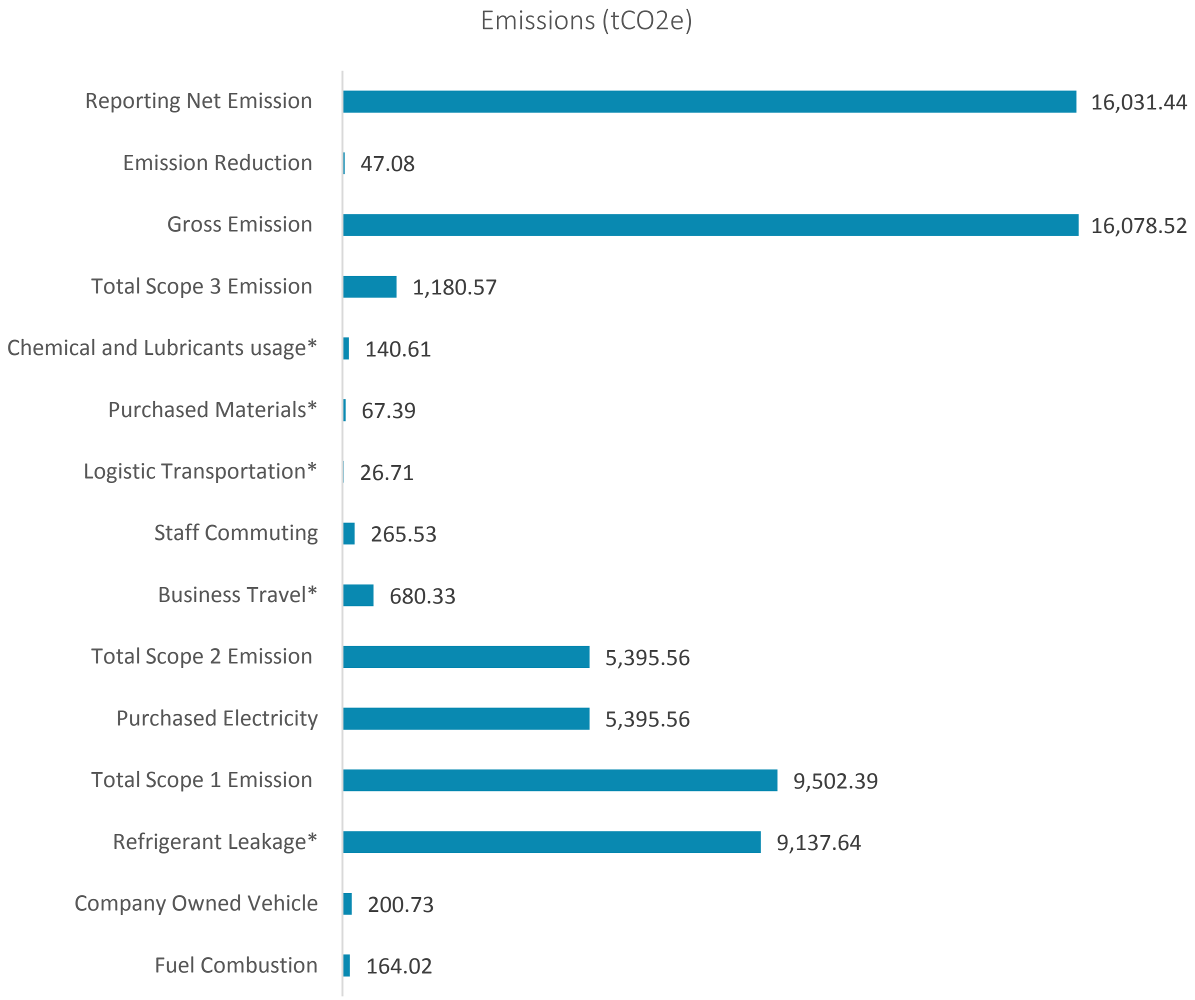


Figure 11: Emissions from all activities

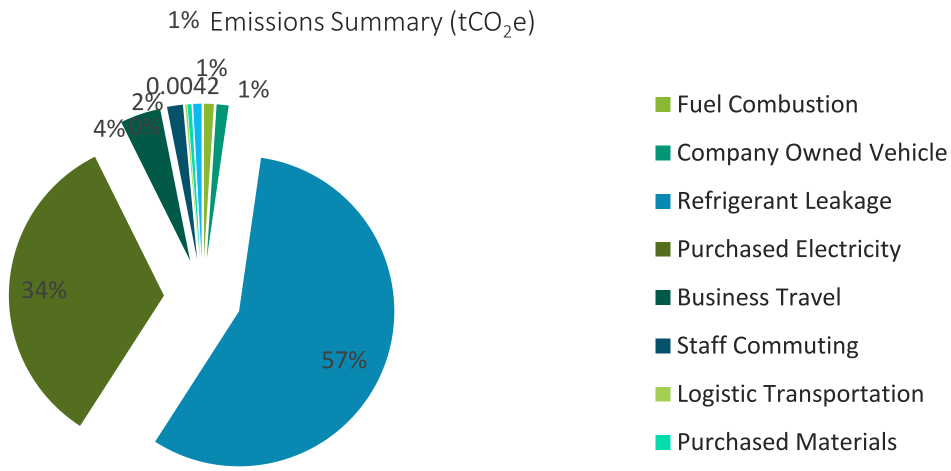


Figure 12: Emissions share from different Activities

SECTION 07

FURTHERRECOMMENDATIONS

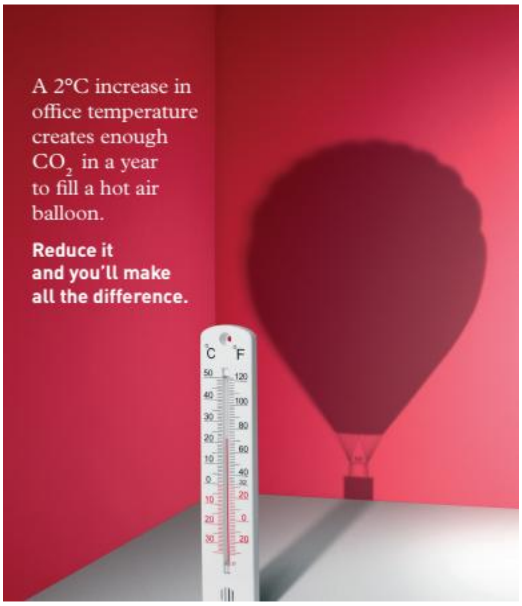
7.1 FURTHER IMPROVEMENT OPPORTUNITIES

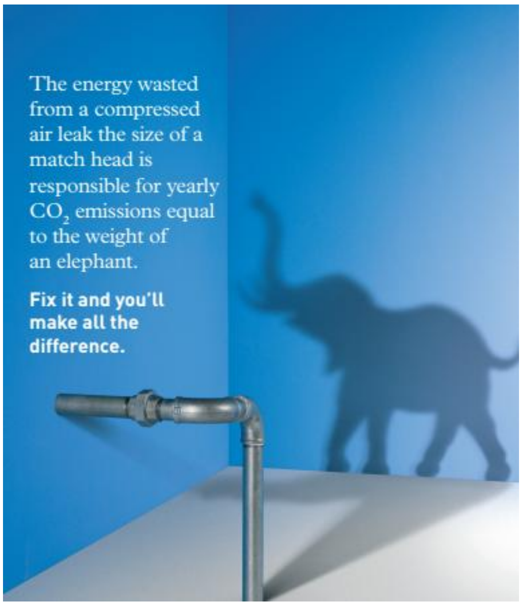
The following measures would help to reduce further emissions and these factors would also make the establishment more energy efficient. These measures are also indicative parameters for a Sustainable and Green Business Operation.

- Verify Carbon Footprint using internationally recognized Protocols like ISO:14064-1
- Develop a Comprehensive Bill of Materials
- Develop a Process Map
- Collect Emissions Data methodically
- Building in-house Conservation Capability
- Day light utilization for Building Facilities
- Use Energy Rated/Star Electronic Devices
- Set your Air-conditioning unit into Eco-Friendly mode
- Use Natural Ventilation instead of artificial Ventilation
- Distribution Centers with Solar Power
- Plants with Solar Panels
- Waste Heat for Water Warming
- “Green Design” for Buildings
- On-Site Power Co-Generation
- Methane Gas from Landfills and Waste Water to generate Electricity
- Gap Analysis (Screening Map)
- Gap Filling
- Calibrate and Communicate

7.2 FEW ENERGY SAVINGS TECHNOLOGY OVERVIEW

A (Building Energy Management System) BEMS is based on a network of controllers and offers closer control and monitoring of building services performance, including heating, ventilation and air conditioning. This is shown on a computer screen in real time and allows settings to be changed quickly and easily. BEMS can reduce total energy costs by 10% or more so they are well worth





considering.

Figure 13: Energy wastage for incorrect temperature settings and leakage

7.2.1 APPROPRIATE INTERNAL TEMPERATURES

A good starting point is to know the recommended temperatures for specific areas in hospitality businesses and use that as a guide.

7.2.2CONTROLLING SYSTEMS

Ensure controls match building occupancy Check that the system is operating only during hours when staff and customers need heating, ventilation and cooling. Requirements will vary throughout the day. Use programmable time switches to help automate this process so that nobody forgets – and ensure time settings are reviewed every month or so to check that they are correct. Many systems function inefficiently because someone made a short-term adjustment and then forgot about it.

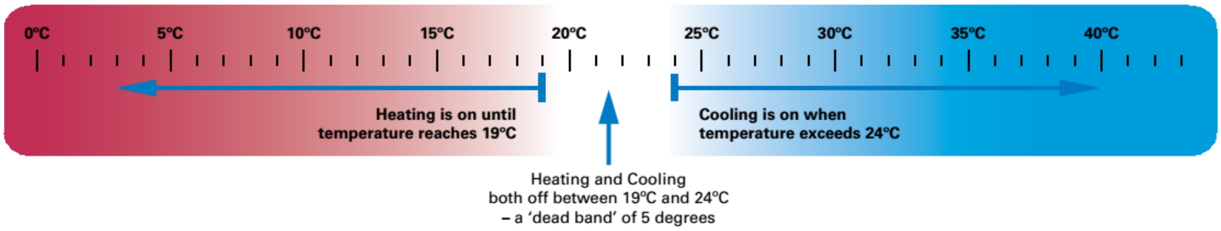


Figure 14: Recommended Temperature Scale

7.2.3RECOVER HEAT FROM EXHAUST AIR

It costs money to heat the air inside a building and it may be possible to reclaim some of that energy. The simplest way to recover heat from exhaust air is to simply re-circulate a proportion of the exhaust air along with incoming fresh air to maintain air quality. The ratio of re-circulated air to incoming fresh air will be dependent on the air quality requirements and this can be controlled using an indoor air quality sensor.

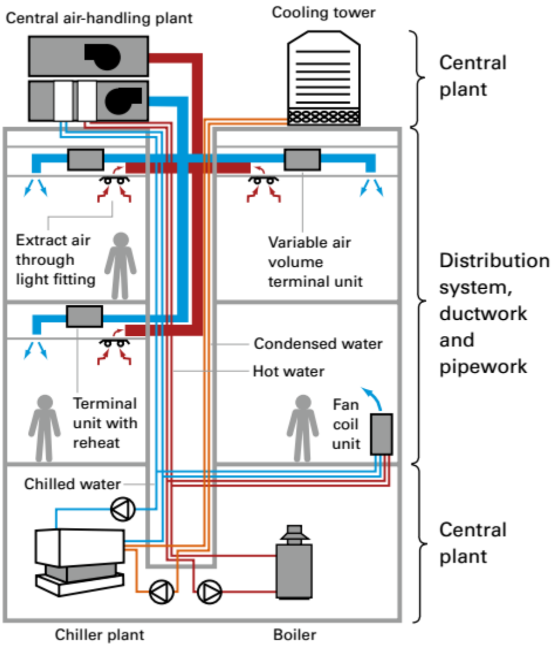
7.2.4VARIABLE SPEED DRIVES (VSDS)

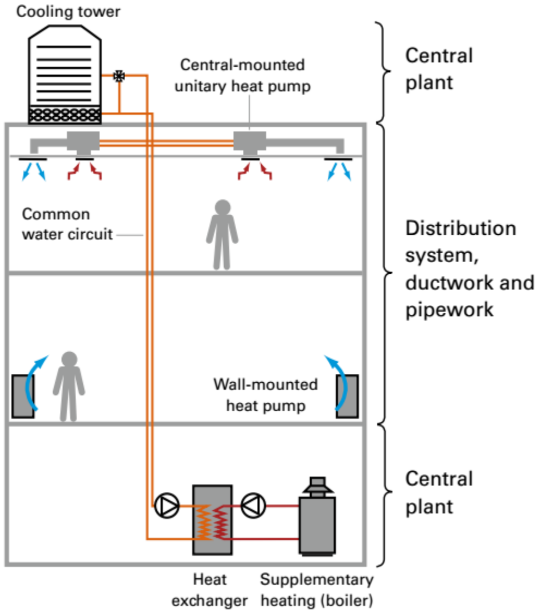
In most ventilation systems in commercial buildings, fans often do not need to operate at full speed all of the time. VSDs can help to reduce costs by enabling the output speed of the fans to match requirements at different times of the day. This reduction in speed saves energy and there are corresponding heating and cooling cost savings too.

7.2.5 ENERGY EFFICIENT CENTRALISED AIR SYSTEMS

Centralised systems are often based around a packaged air handling unit (AHU), which typically contains heating and cooling coils, a humidifier, filter and fan to move the air. The incoming air is drawn into the AHU and passed over the coils to heat or cool the air as required. This 'conditioned' air is then supplied by ductwork to the rooms within the building. The equipment is normally located in central plant rooms but may be roof-mounted.

The chillers (the refrigeration equipment) provide chilled water for the cooling coil(s) within the AHU. The chiller may be water cooled (with a cooling tower) or cooled by outside air. Hot water for the heating coils is provided by boilers, which may be located in another plant room. Heating and cooling can be distributed to the occupied spaces via air ducts, or through pipes that provide heated and cooled water to terminal units in each room. When outside air is cooler than the internal





temperature, fresh air can be introduced and chilling is not required. In the most of the commercial facility, temperatures

Fig 15: (a) A typical Centralised System and (b) A Partially Centralised Air Conditioning System

are often below 19ºC, so exploit this 'free cooling' to minimise the need for refrigeration. A typical Centralised air conditioning system schematic is shown below.

7.2.6 PARTIALLY CENTRALISED SYSTEMS

A central AHU provides the common factor in partially centralised systems although further conditioning in the room may be locally controlled. These systems can supply a high level of localised control making them flexible to individual user's needs. If controlled correctly, this results in energy savings by ensuring that heating and cooling only operate where required. A partial AC unit would save a significant amount of energy and would minimize GHG emissions level which occurs due to fugitive emission. A typical partially centralised system is shown below:

7.2.7 LOCAL SYSTEMS

Local systems are not linked to any centralised plant and only provide cooling in the immediate space where they are placed. They are commonly used to serve a single zone or small proportion of a building. They may or may not provide ventilation depending on their level of sophistication. Local systems are often used to provide 'comfort cooling' and can be useful where some areas require cooling for a different period from the rest of the building. For example, using them can allow the main centralised system to be turned off outside working hours.

Variable refrigerant flow systems (VRF) are essentially sophisticated split systems. The difference is their ability to provide heating or cooling on an individual basis. This is particularly useful in applications such as office blocks, hotels and large retail stores etc., which may need cooling in some areas and heating in others. VRF systems can be very flexible and energy efficient when used as a heat pump, that is, for heating and cooling. Where air conditioning is necessary, using VRF for heating and cooling incurs a marginal extra cost but could save the cost of a separate boiler plant.

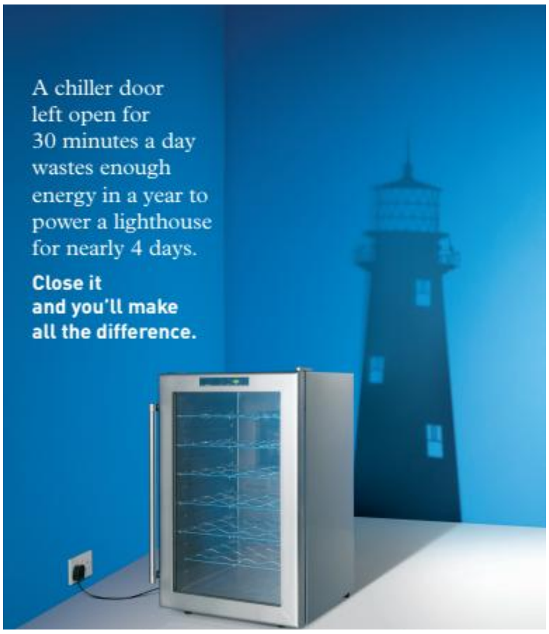
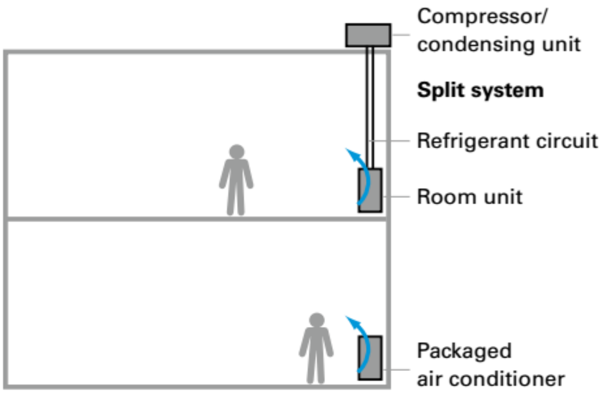


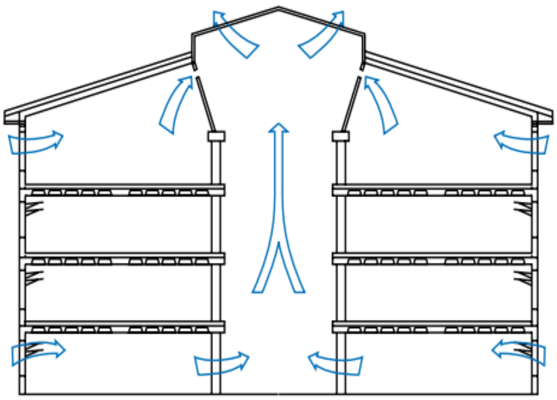
Figure 16: Energy wastage in HVAC and Refrigeration System

7.2.8 LOW ENERGY NIGHT COOLING

There are a number of strategies and technologies that have the potential to reduce energy consumption and costs associated with the use of air conditioning. Many of these are tried and tested, but application will depend on the individual circumstances presented in a building, as well as the requirements of occupants.

Night cooling is an established technique where cool night air is passed through the building to remove heat that has accumulated during the day. When the building fabric has cooled, it will absorb more heat, meaning lower internal temperatures the following day. Generally, an exposed ceiling slab is required to provide sufficient storage of cooling energy. The movement of cool night air may be





natural or fan-assisted. This free cooling of the building reduces energy consumption otherwise used by mechanical cooling and ventilation, leading to cost savings.

Figure 17: (a) A Local Air Conditioning System and (b) a cross ventilation system

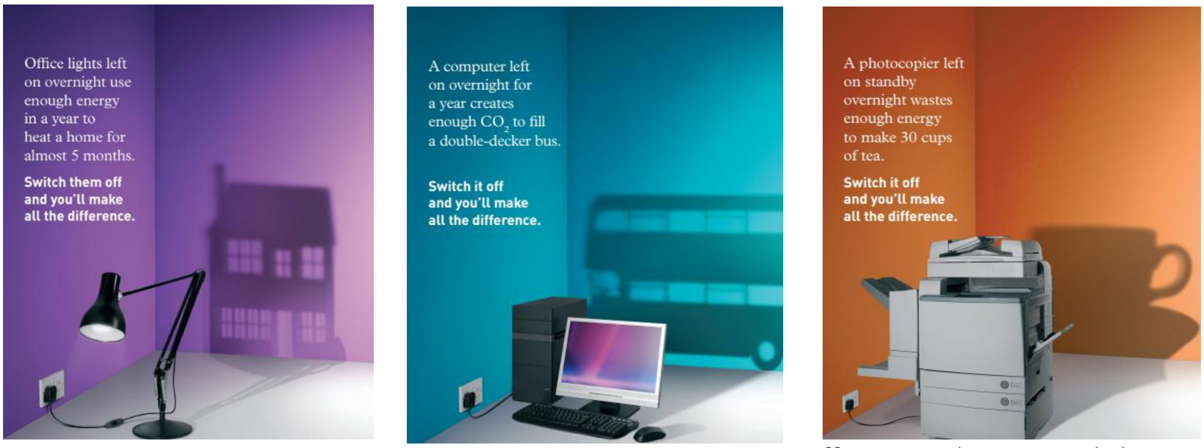
7.2.9 NATURAL VENTILATION AND FREE COOLING

As simple as it sounds, natural ventilation and free cooling relies on natural airflow between openings on opposite sides of a room or building – or rising warm air being replaced with cooler air sucked in through windows or vents. This technique relies on moving air through a building under the natural forces caused by outside wind pressure and the buoyancy effects of temperature differences. The most effective air paths are simple and generous.

It may be possible to use windows and doors to provide good levels of natural ventilation, allowing mechanical ventilation to be switched off or turned down to save money. When opening vents, doors and windows, always consider security implications. Stack ventilation and wind scoops can also be utilised– these are more sophisticated natural ventilation techniques, often integrated with a simple yet effective structural design. They generally have to be designed into new buildings but are often well worth the effort in terms of cost savings and comfort for occupants.

7.2.10LIGHTING

Lighting is a fundamental element of any business and its expense has always been accepted as inevitable. Yet by implementing lighting controls and efficient luminaires, lighting energy costs can sometimes be reduced by up to 50%.



Effective and attractive lighting is essential for customer comfort and satisfaction as well as for the health and safety of staff and visitors. Judicious use of energy efficient lighting and controls can enhance all aspects of operation in providing:

Figure 18: Energy wastage in Lighting, Computing and Photocopying

- General lighting to communal areas such as receptions and corridors.
- Theme or mood lighting for pubs, bars, restaurants and in guest bedrooms.
- Security and safety lighting.
- External lighting for car parks and signage.

7.2.11 'SWITCH OFF' POLICY

Promote a 'switch off' policy on lighting, so that only lighting that is being used is left on. Raise staff awareness by placing stickers above light switches and posters in staff areas. Lights in unoccupied areas should be switched off, but remember to consider health and safety implications particularly in corridors and stairwells. If in doubt, always seek professional advice.

7.2.12 MAINTENANCE

Lighting is essential for providing a pleasant guest experience so it is important to keep windows, skylights and light fittings clean. Without regular maintenance, light levels can fall by up to 30% in 2-3 years. Employees should be encouraged to report failing lamps and these should be replaced immediately. This will help maintain the desired light output and in turn, provide a safer, more attractive environment for both staff and customers. When checking lights also ensure that timers are set to match trading hours and that occupancy sensors are clean.

7.2.13 INSTALL LOW-ENERGY LIGHTING

Modern low-energy bulbs are attractive and provide very good light output. Upgrade any standard light bulbs to compact fluorescent lamps (CFL) which use 75% less energy, produce less unwanted heat and last 8-10 times longer, or LEDs, which use up to 80% less energy and provide around 50,000 hours of use. Replace blackened, flickering, dim or failed fluorescent tubes with triphosphor coated ones (this is stated on the packaging). Triphosphor, or multi-phosphor, coatings provide a more natural, brighter light for the whole life of the tube. If the tubes are 38mm (1.5 inch), they should be replaced with slimmer 26mm (1 inch) tubes.

7.2.14 OCCUPANCY SENSORS

Most hospitality businesses will benefit from occupancy sensors. These help to ensure lights only operate when there is somebody there to require them. Sensors can achieve savings of 30% to 50% on lighting costs and are especially useful in:

- Storerooms, offices and back of house areas.
- Toilets.
- Cellars.
- Function rooms and banqueting suites.
- Areas where lighting is zoned.

Occupancy sensors can also be used to lower light levels in corridors when guests are not present, which can be an effective cost-saving measure. Always maintain minimum light levels so as not to compromise health and safety standards.

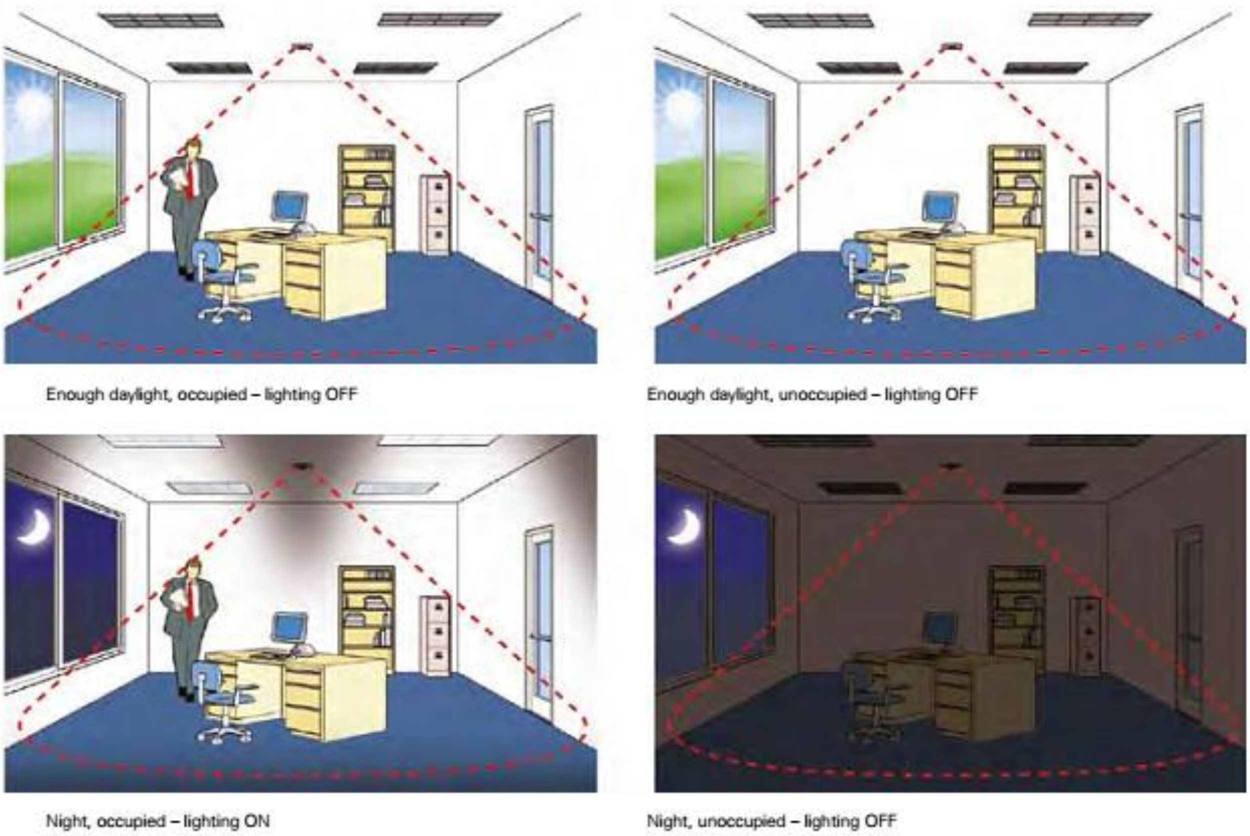


Figure 19: Recommended and Suggested Occupancy Sensor

7.2.15 DAYLIGHT SENSORS

Light sensors or 'photocells' can be used to control artificial lighting when there is sufficient natural daylight. As daylight hours vary throughout the year, sensors help to provide closer control and can achieve substantial savings. They can be particularly useful externally for lighting car parks or signage and can often pay back their costs in less than a year. Photocells can also be combined effectively with time switches to ensure even more precise control. Contact the Carbon Trust to find out more.

7.2.16 BUILDING FABRIC

Improving building fabric makes sense for many reasons – it saves energy, increases guest comfort and can improve the appearance of the business. Around two thirds of heat from a typical hospitality building is lost through the building fabric (walls, floors and ceilings). It therefore makes good sense to make improvements in this area during a major refurbishment project, and/or prior to replacing or upgrading any existing heating system.

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Improving building fabric can result in:

- Better temperature control – it can lower ventilation costs and prevent overheating.
- Improved comfort for customers – the guest experience can be enhanced by providing a more comfortable environment through reducing draughts, solar glare, overheating and noise.

- Lower capital expenditure – a more efficient, well-insulated building needs smaller heating and cooling systems.
- Good investment – better insulation can increase a building's value and attractiveness to staff, guests and prospective buyers of the business.

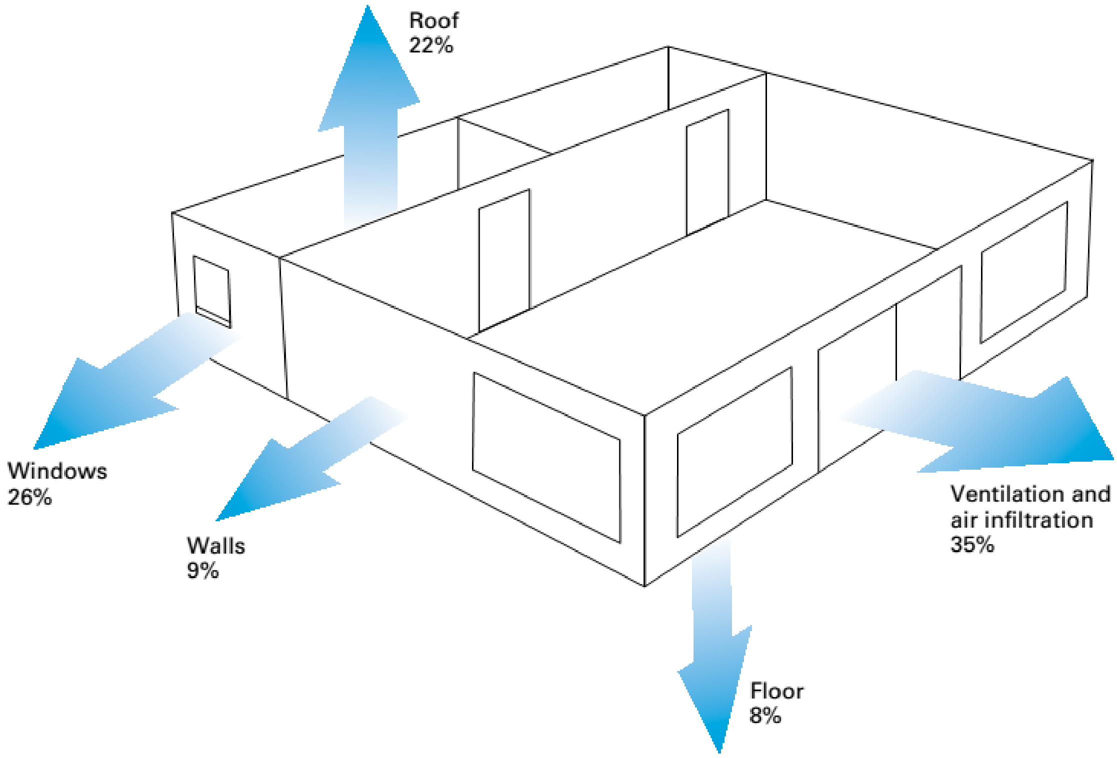


Fig 20: Heat loss from a typical building

7.2.17AVOID 'BLINDS DOWN AND LIGHTS ON' IN OFFICE SPACES

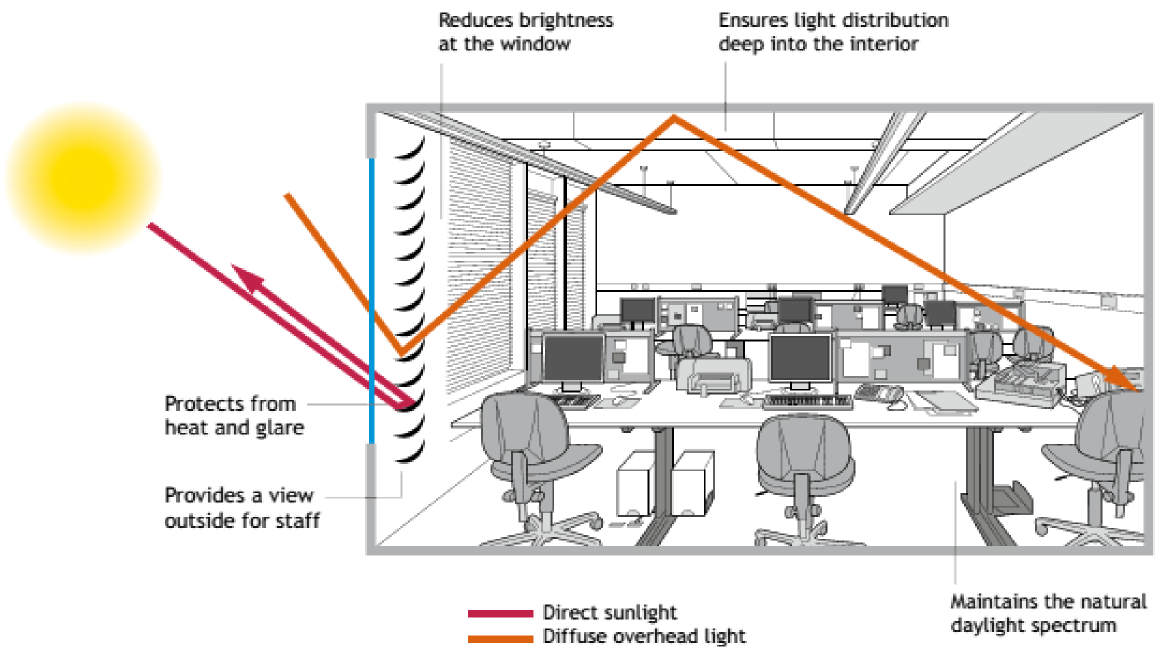


FIG 21: RECOMMENDED DAYLIGHT UTILIZATION SCHEME

7.2.18REDUCING YOUR WATER CONSUMPTION

Most businesses now recognize that water is a scarce resource. When you save money by reducing your water consumption, you also reduce your wastewater charges, achieving a financial benefit. Don't forget that there is also a carbon cost to the supply and transfer of water. Measure and monitor your water use, make staff aware of the importance of water saving, and invest in simple products to help reduce your consumption.

7.2.19 RENEWABLE ENERGY DEPLOYMENT OPPORTUNITIES

Installing renewable energy sources in the vicinity of this site has an immense potentiality to save energy costs. Typically, a hotel can save up to 40% of energy cost by deploying various means of renewable energy technologies like PV Solar, Solar Thermal, Solar Water heating system and solar shading in the building considering the solar energy available in Bangladesh. In this country, average solar radiation is 4.5 $kWh/m^2/day$ which means there is very good opportunities for the hotel to implement solar technology in various energy consuming process to reduce the use of conventional fuel based energy which will lead to reduction of GHG emissions and will ensure the green business growth to achieve energy and environmental sustainability.

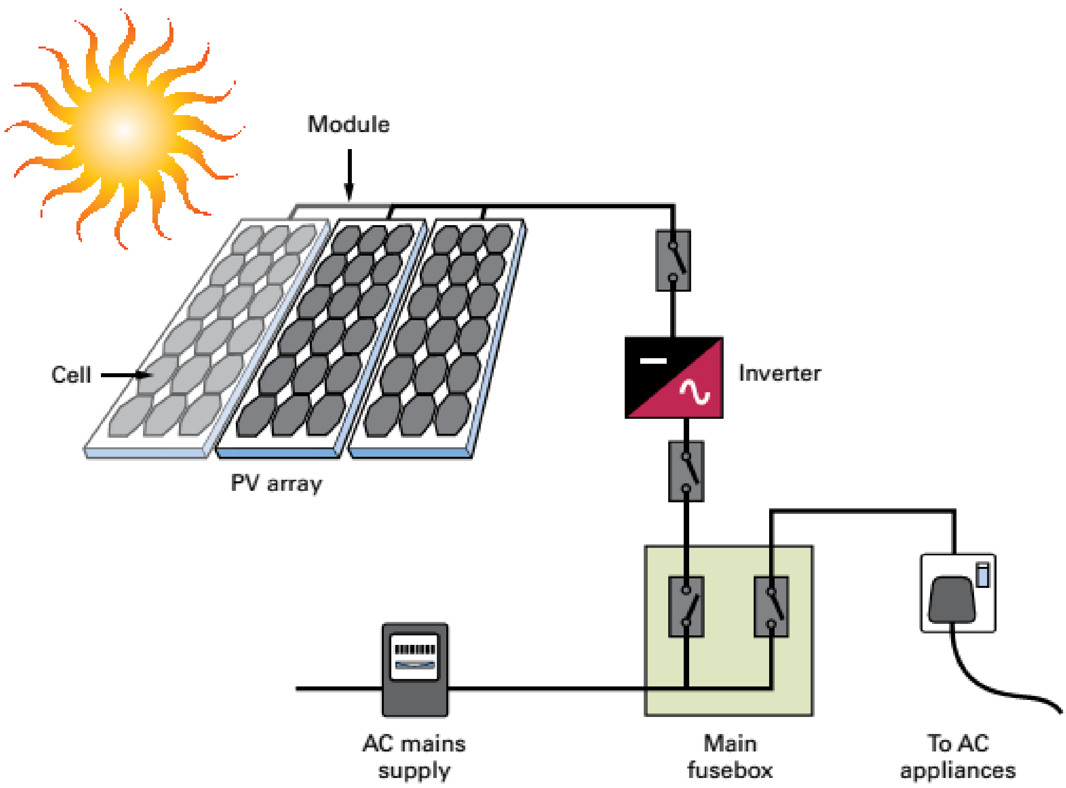
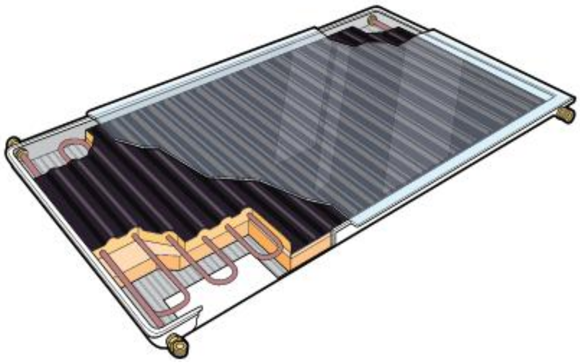


Figure 22: A Typical Solar PV Module

7.2.20 SOLAR THERMAL

Solar thermal systems use the sun's energy to provide hot water. The technology is well established, but its success depends on a number of locations and orientation based factors and it is usually economically viable only when installed in buildings with a sufficiently high hot water demand.

Solar thermal (or solar hot water) systems use solar collectors to absorb energy from the sun and transfer it, using heat exchangers, to heat water. Solar thermal systems can be used to provide hot water at temperatures of between 55ºC and 65ºC. This is a relatively mature technology and many installations date back to the 1970s.



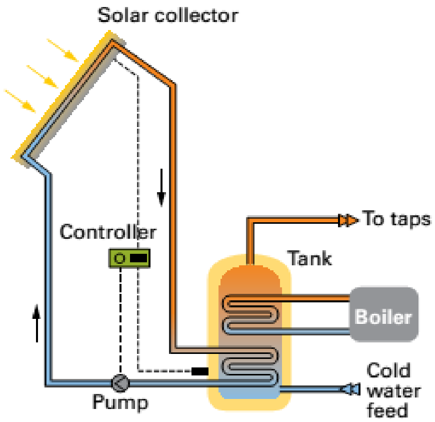


Figure 23: A Typical Solar Thermal Technology

7.2.12 GROUND SOURCE HEAT PUMPS (GSHP)

Ground-source heat pumps (GSHPs) take low-level heat from solar energy stored in the earth and convert it to high-grade heat by using an electrically driven or gas-powered heat pump containing a heat exchanger.

A fluid (usually a mixture of water and antifreeze) is circulated through pipes in a closed loop system buried in the ground, picks up heat from the ground and then passes through the heat exchanger in the heat pump, which extracts the heat from the fluid. Heat pumps deliver heat most efficiently at about 30°C which is commonly used to supply space heating to buildings. GSHPs can also be driven in reverse to provide comfort cooling. GSHPs cover a wide range of capacities, from a few kW to many hundreds of kW that heat, and/or cool, many types of building, from homes to large, multistory buildings. The measure of efficiency of a heat pump is given by the Coefficient of Performance (COP), which is defined as the ratio of the heat output to the energy input. COPs of three or more are generally achievable with GSHP systems. This means that the heat pump output is at least three times the input.

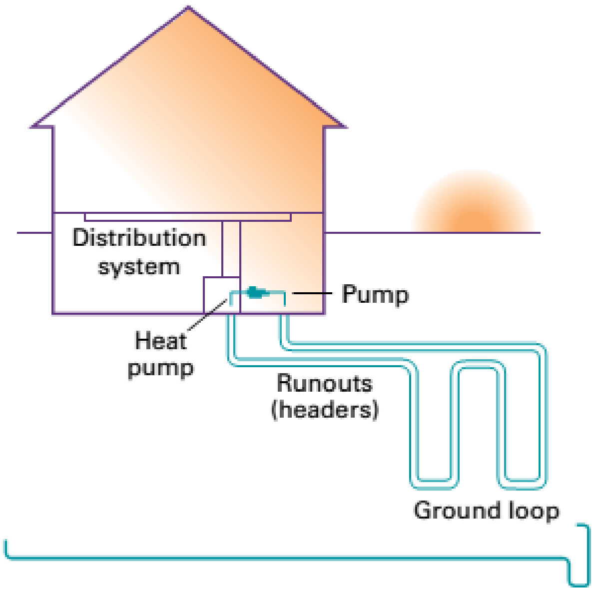


Figure 24: A Typical GSHP Scheme

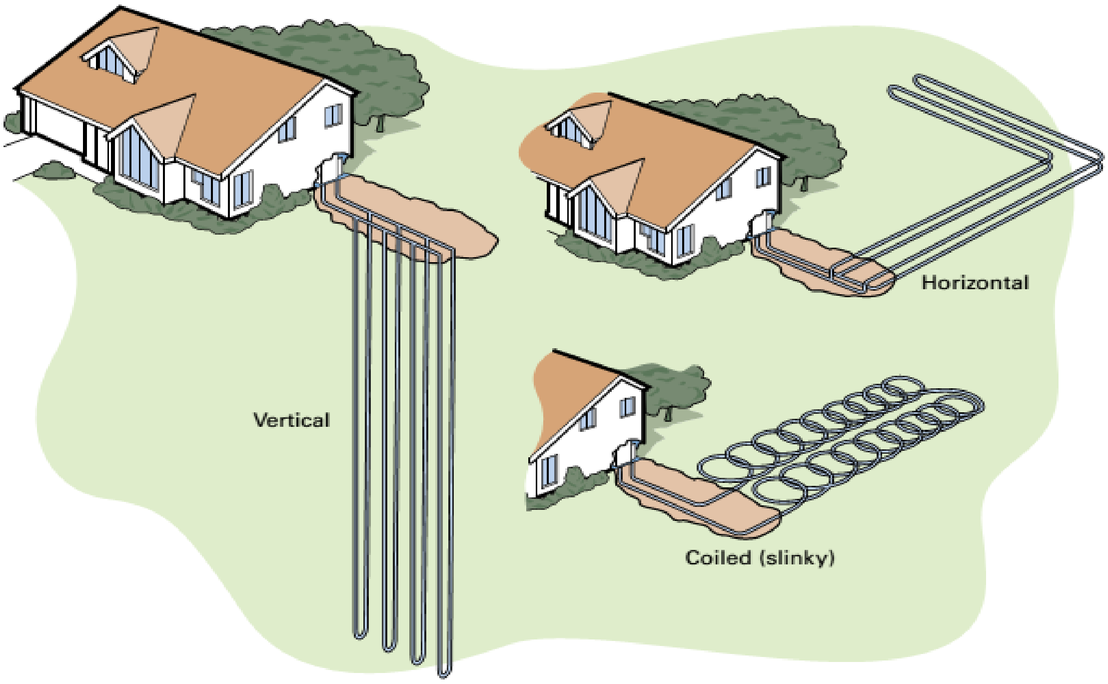


Figure 25: Atypical GSHP ground pipe layouts

7.2.13 AIR SOURCE HEAT PUMPS (ASHP)

Air-source heat pumps (ASHPs) work on a similar principle to GSHPs, but source the low-level heat from the air, using an air source collector, located outside of the building. ASHPs are an alternative to GSHPs where lack of space is an issue. Installation of an ASHP involves sitting an external unit and drilling holes through the building wall. Some degree of additional pipe work may also be required.

ASHPs can also be used for cooling, removing the heat from the area to be cooled and extracting it to the external air. The diagram below shows the operation of an ASHP for heating and cooling. The basic steps for deciding if an ASHP is appropriate for a site are the same as those for a GSHP system, without the need for a ground survey. They may require planning permission as the sitting of an external unit is required. Air source heat pumps are not considered permitted development, as the heat pump is outside and the fans create noise, which can be an issue.

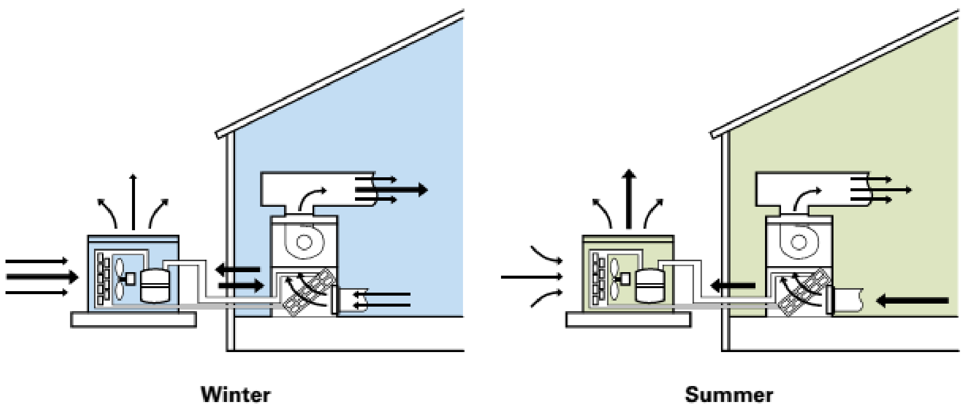


Figure 26: A Typical ASHP operation in winter and summer

SECTION 08

DISCUSSION AND COMPARIOSN

8.1 DISCUSSION

Calculated net GHG Emissions for Bangladesh Bank HQ is + 16,031.44 tCO_2e.This facility employs 2,695 manpower and all the emissions originated by various operational activities centered this manpower. Calculated per capita Emissions per year of Bangladesh Bank HQ is 5.95 tCO_2e which is slightly higher than World Per Capita Emissions (4.6 tCO_2e). Per Capita CO_2 Emissions for Bangladesh is 1.8 tCO_2e. According to a number of peer reviewed reports, in the medium and long term, a world-wide average emission of maximum 2 tons of carbon dioxide (CO_2) per person per year must be targeted. This amount is nowadays considered to be the maximum allowed quantity for a sustainable living on earth. The following data regarding to Carbon Footprint Emissions stated by World Resource Institute (WRI) provides a comprehensive idea about sustainable value of per capita CO_2 emissions:

- The average of all industrialised nations is about 11 tons of carbon dioxide (CO_2) per person per year
- The International Energy Institute (IEA) predicts a further increase of the worldwide CO_2 emissions by 55% within the next 25 years if no immediate actions to stop global warming are put in place. However, even in their alternative scenario where "Vigorous new policy measures already being contemplated" are introduced, IEA predicts a growth of the CO_2 emissions by 28% compared to 2004.

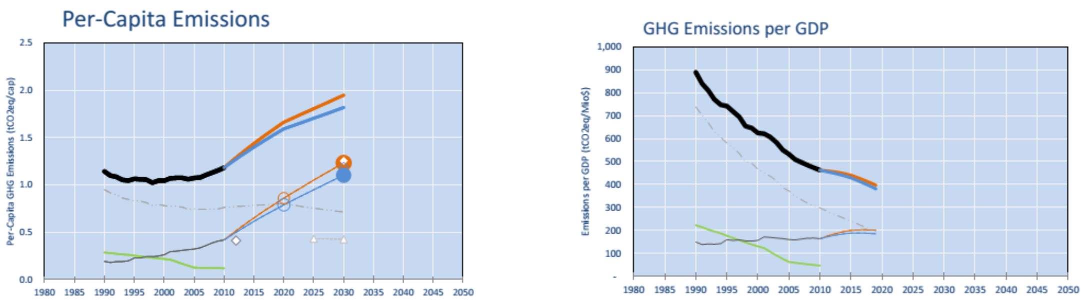


Figure 27: Per Capita and Per GDP GHG Emissions

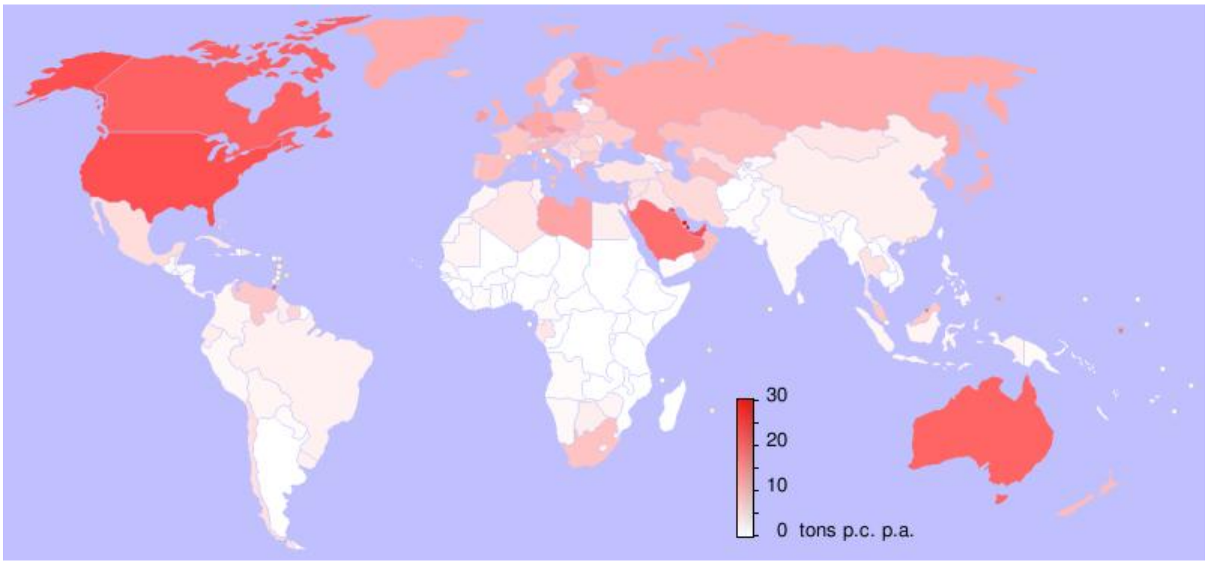


Figure 28: CO_2 emission per capita per year per country

8.1 COMPARISON

Table 13: GHG Emissions Comparison[1]

Region/Establishment	Per Capita Emissions (tCO_2e)
World Average Emissions	4.6
Asia & Oceania	3.53
North America	14.19
Europe	7.14
Eurasia	8.22
Central & South America	2.57
Africa	1.13
Sustainable Average Emissions	2.0
Bangladesh Average Emissions	0.4
Bangladesh Bank Average Emissions	5.95

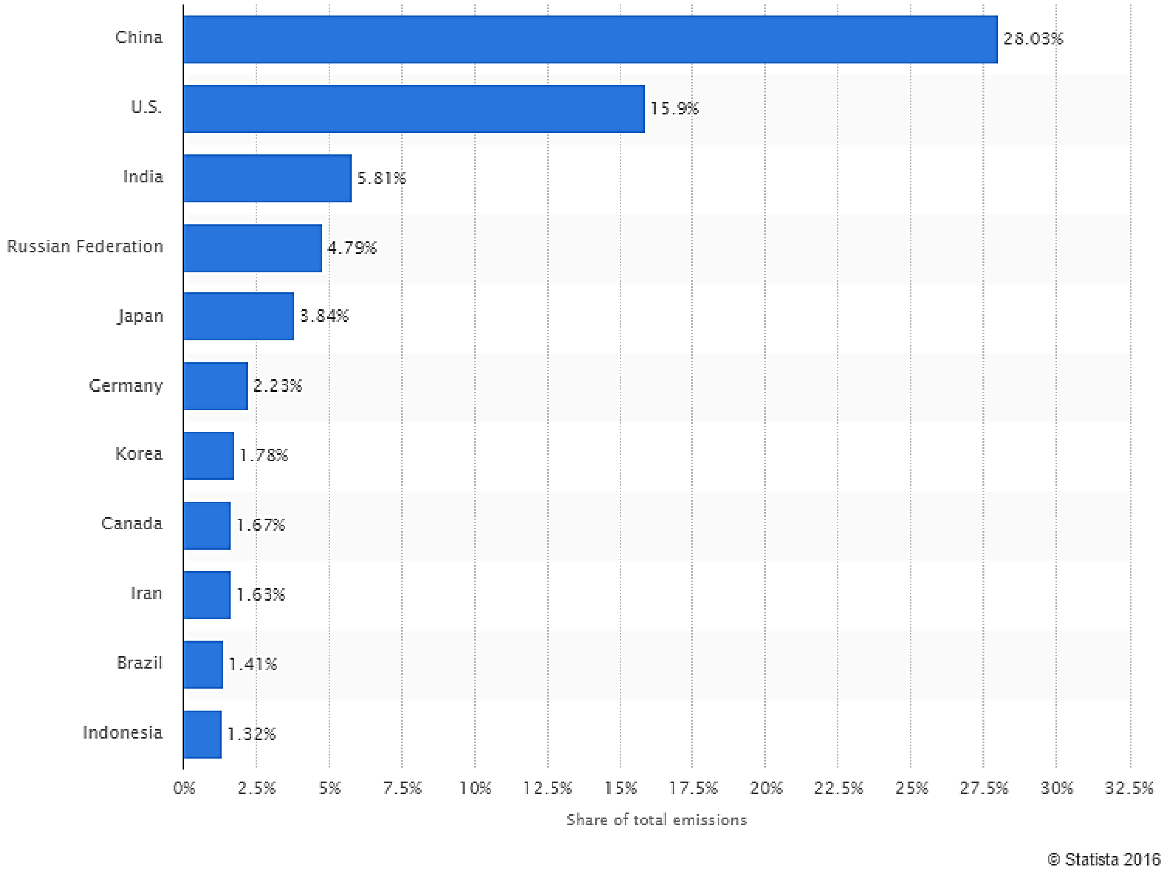


Figure 29: World's top GHG Emitters

[1] *http://www.theguardian.com/news/datablog/2011/jan/31/world-carbon-dioxide-emissions-country-data-co2*

8.2 PER CAPITA GHG EMISSION COMPARISON OF SIMILAR ESTABLISHMENTS/INDUSTRY

Table 14: Per Capita GHG Emissions Level of Banks and Financial Institute around the world[2]

Institutions	Per Capita Emissions (tCO_2e)
Bangladesh Bank HQ, Bangladesh	5.95
European Investment Bank, European Council	6.85
Barclays Bank PLC, Great Britain	6.28
Lloyds Banking Group, UK	4.46
Rand Merchant Bank, South Africa	10.9

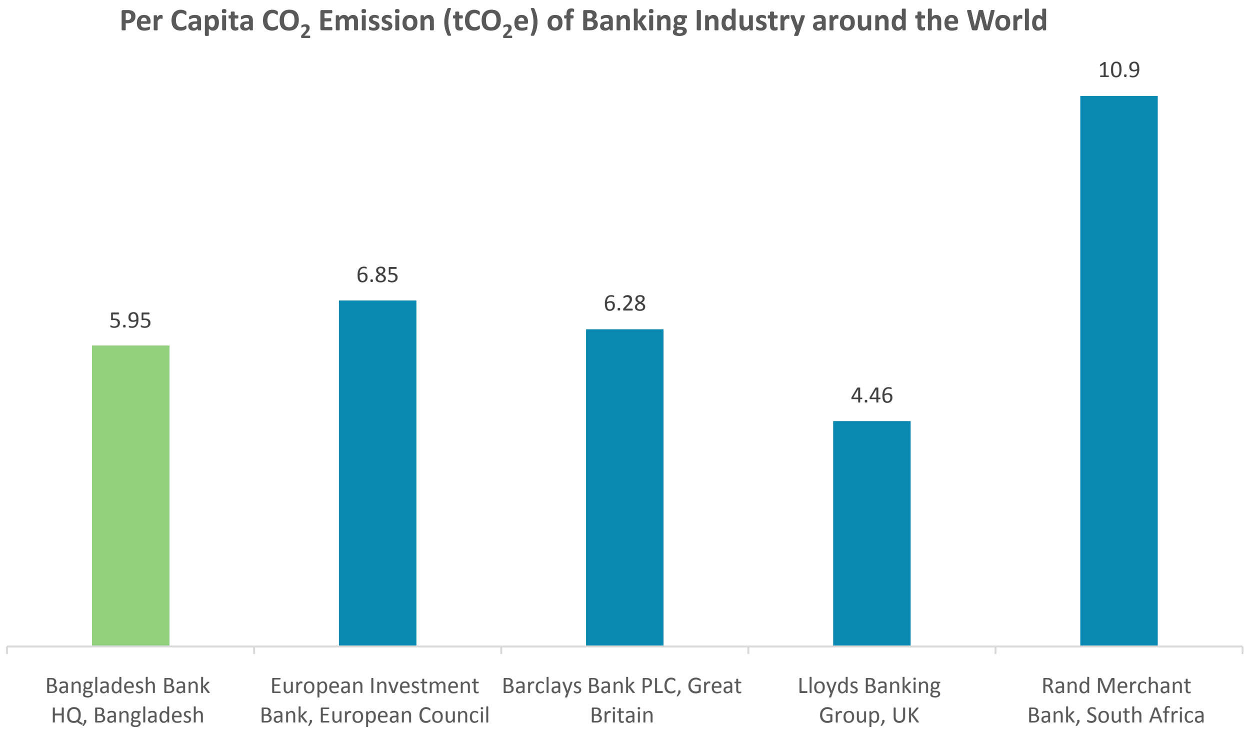


Figure 30: CO_2 Emissions of Banking Industry around the world

[2] *Please see the reference documents pdf links in the appendix.*

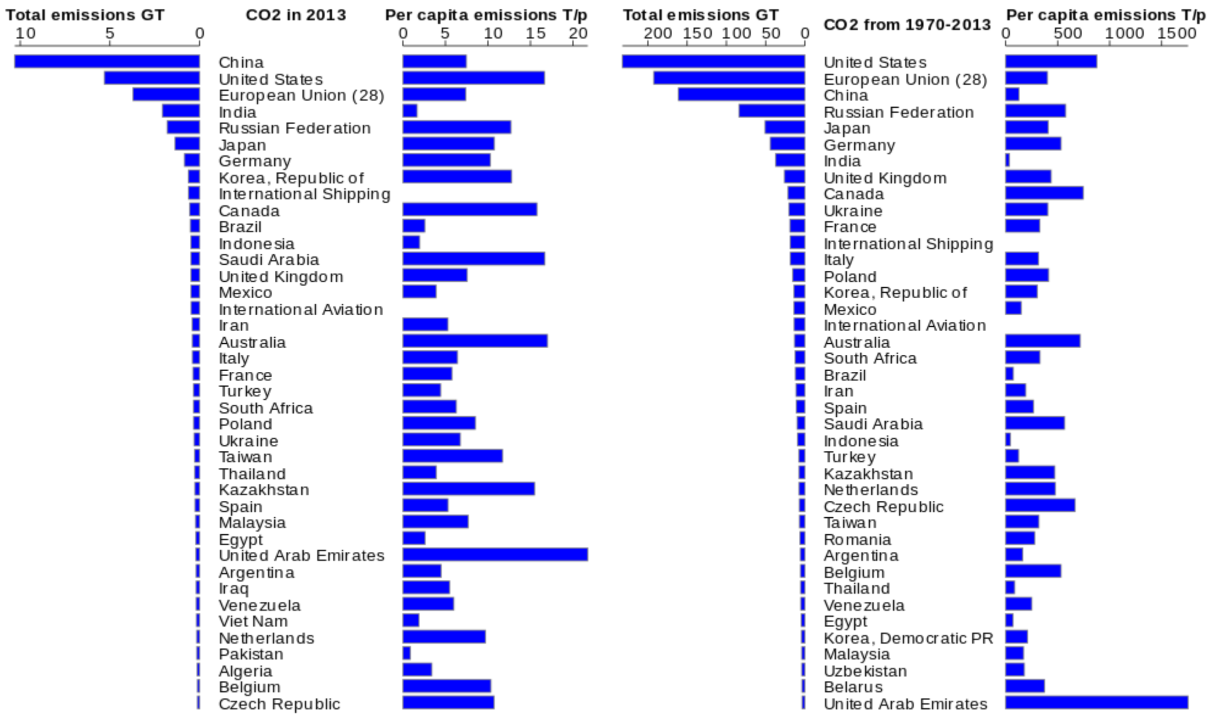


Figure 31: Per Capita CO_2 emissions of leading economy of the year 2013 and from the year 1970-2013

SECTION 09

CONCLUSION

9.1 CONCLUSION

Carbon footprint of a business or any establishment gives an insight of energy and resource usage within the defined organizational boundary. Net GHG Emissions of Bangladesh Bank Head Quarter facility is 16,031.44tCO_2e and per capita GHG Emissions for this facility is 5.95 tCO_2e which is higher than world average and a bit higher than Bangladesh average. It is obvious from the comparison of previous section that the per capita CO_2emissionof corporate entities are supposed to be higher than the country-wise per capita CO_2 emission level because of various integrated facilities for customers and various stakeholders which cannot be accounted due extreme complexity of data acquisition. And it is evident that the average per capita CO_2 of Bangladesh Bank HQ is quite in line with the various banks and financial institutions around the world and some time it's emission level is lower than some reputed banks and financial entities. However, GHG emissions of this facility could be reduced to the minimum level by deploying energy efficient plug loads and especially minimizing air-conditioning units' leakage rate. Deploying renewable energy means, utilizing day light saving scheme and digitalization of the central activities also could play a vital role to mitigate significant amount of GHG emissions. However, this assessment will help the authority to make this establishment energy efficient and sustainable in terms of resource allocation.

SECTION 12

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SECTION 13

APPENDIX

13.1APPENDIX

Table 15: Fuel Combustion Data

Fuel Type	Consumed Amount (Annually)
Diesel	3,600 Litres
Octane	1,520 Litres
Natural Gas (CNG)	12,207 m^3
Natural Gas	73,600 m^3
Kerosene	2,198 Litres

Table 16: Company Owned Vehicle Data

Vehicle Type	Distance Travelled	Fuel Consumed (Annually)
Medium Car	252,000 kilometers	252,000 m^3

Table 17: Refrigerant Leakage Data

Location	No. of Units	A/C Type	Capacity (BTU/h)	Capacity (TR)	Refrigerant	Amount of Refrigerant (Kg)
Main Building	75	Split	2,976,000	248	R 22	28.122704
Main Building	36	Window	864,000	72	R 22	8.164656
Main Building	2	Central	8,400,000	700	R 134a	79.3786
1st Adjacent Building	41	Split	1,386,000	115.5	R 22	13.097469
1st Adjacent Building	12	Window	288,000	24	R 22	2.721552
2nd Adjacent Building	40	Split	1,962,000	163.5	R 22	18.540573
2nd Adjacent Building	1	Window	24,000	2	R 22	0.226796
2nd Adjacent Building	3	Central	23,400,000	1950	R 134a	221.1261
2nd Adjacent Building	1	Central	7,200,000	600	R 123	68.0388

Table 18: Purchased Electricity Data

Electricity Connection Type	Consumed Amount (Annually)
Grid electricity	8,053,070 kWh

Table 19: Business Travel

Travel Type	Distance Travelled (km)
Domestic	395,884
International	3,720,123

Table 20: Staff Commuting Data

Vehicle Type	Distance Travelled (km)
Local Bus	1,152,000

Table 21: Logistic Data

Types	Cost (BDT)	Equivalent Amount in Kg
Telegram	1,142,640	1,142.65
Postage	900,000	5,142.85

Table 22: Purchased Materials

Items	Amount (kg)
Offset Papers	11,968
Pen	415
Printed Books and Registers	3,320
Miscellaneous	9

Table 23: Chemical and Lubricants Usage Data

Item	*Contain*	*Amount*
Anti-Mosquito/insect spray	*475 ml container per cane*	*3,084 pcs*
Air Freshener/ anti-odor spray/chemical	*300 ml container per cane*	*3,515 pcs*
Liquid Soap	*1000 ml container per Bottle*	*2,347 pcs*
Antiseptic/Anti-bacterial/fungal Chemical	*50 grams per packet*	*271 pcs*
Toilet Paper	*Small roll (Basshundhara)*	*10,604 pcs*
Facial Tissue Paper	*120 × 2 ply (240 pcs)*	*4,124 pcs*
Paper Napkin (Paper Hand Tissue)	*250 pcs 1 ply*	*941 pcs*
Lubricants	*N/A*	*88 Litres*