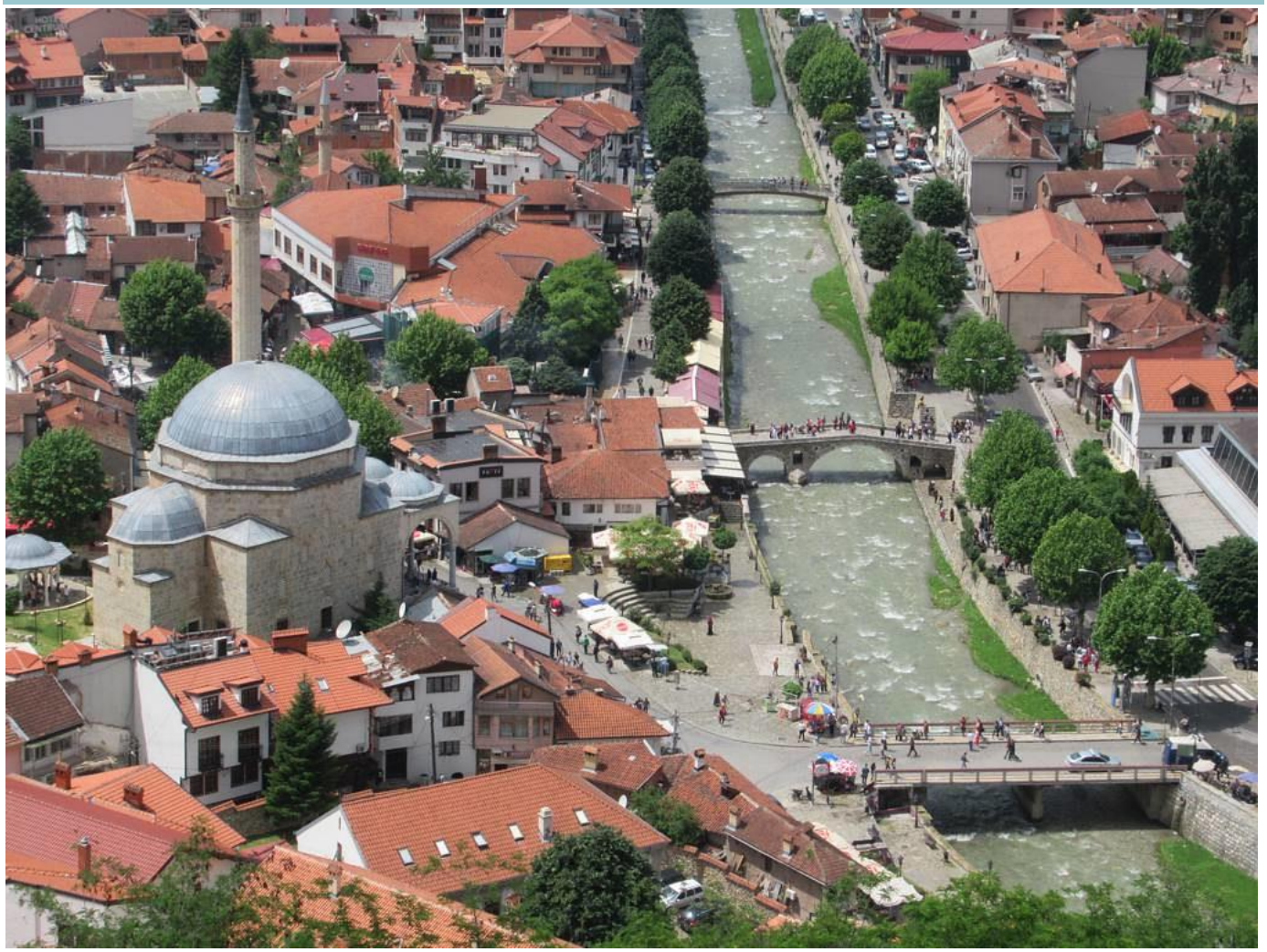
Greenhouse Gas Emissions Inventory for Prizren City



Baseline Year 2014 GHG Emissions Inventory (Report)

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Disclaimer: All information/data contained herein is obtained from authentic sources believed to be accurate and reliable. This GHG emission inventory is based on the data and information gathered by conducting the site visits and stakeholder consultation, data made available by Municipal of Prizren and secondary desktop research of information available in public domain. Reasonable skill care and diligence exercised in carrying out analysis and report preparation.

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LIST OF ACRONYMS

AD	*Activity Data*
AFOLU	*Agriculture, Forestry and Land Use*
AT&C	*Aggregated Technical and Commercial*
BOD	*Biological Oxygen Demand*
CDM	*Clean Development Mechanism*
CH4	*Methane*
CNG	*Compressed Natural Gas*
CO	*Carbon Monoxide*
CO2	*Carbon dioxide*
COD	*Chemical Oxygen Demand*
CSO	*Civil Society Organization*
DOC	*Degradable Organic Carbon*
EF	*Emission Factor*
ERO	*Energy Regulatory Office*
ERWC	*Ekoregjioni Regional Waste Company*
FO	*Furnace Oil*
FOD	*First Order of Decay*
GHGs	*Greenhouse Gases*
GNI	*gross national income*
GPC	*Global Protocol for Community-Scale Greenhouse Gas Emission Inventories*
GPG	*Good Practice Guidance*
HFCs	*Hydrofluoro Carbons*
HSD	*High Speed Diesel*
ICAO	*International Civil Aviation Organization*
IPCC	*Intergovernmental Panel on Climate Change*
IPPU	*Industrial Processes and Product Use*
KAS	*Kosovo Agency for Statistics*
KEDS	*Kosovo Electricity Distribution and Supply Company*
KEP	*Kosovo Environmental Programme*
KEPA	*Kosovo Environmental Protection Agency*
KTDP	*Kosovo tourism and development project*
LPG	*Liquefied Petroleum Gas*
LULUCF	*Land Use, Land Use Change and Forestry*
M&E	*Monitoring and Evaluation*
MCF	*Methane Conversion Factor*
MED	*Ministry of Economic Development*
MESP	*Ministry of Environment and Spatial Planning*
MIT	*Ministry of Infrastructure and Transport*
MLD	*Million Litres per day*
MRV	*Measurement, Reporting and Verification*
N2O	*Nitrous oxide*
NA	*Not Applicable*

NAMA	*Nationally Appropriate Mitigation Actions*
NE	*Not Estimated*
NF3	*Nitrogen Trifluoride*
NMHC	*Non-methane Hydrocarbons*
NMVOC	*Non-Methane Volatile Organic Compounds*
NOx	*Oxides of Nitrogen*
OX	*Oxidation factor*
PFCs	*Perfluoro Carbons*
PGGC	*Prizren Green Growth Centre*
PMDP	*Prizren Municipal Development Plan*
PNG	*Piped Natural Gas*
QA/QC	*Quality Control/Quality Check*
SF_6	*Sulphur Hexafluoride*
SO2	*Sulphur dioxide*
STP	*Sewage Treatment Plant*
t	*Tons*
T&D	*Transmission and Distribution*
tCO2eq	*Tons of Carbon dioxide equivalent*
TOR	*Term of Reference*
ULBs	*Urban Local Bodies*
UN	*United Nations*
UNDP	*United Nations Development Program*
UNESCO	*United Nations Educational, Scientific and Cultural Organization*
UNFCCC	*United Nations Framework Convention for Climate Change*
USD	*United States Dollar*
VKT	*Vehicle Kilometres Travelled*

EXECUTIVE SUMMARY

The Municipality of Prizren's base year Inventory for Greenhouse Gases (GHGs) emissions has been calculated for the base year 2014 using the revised 1996, 2000, 2003 and 2006 IPCC Guidelines for National Greenhouse Gas Inventories, the IPCC "Good Practice Guidance and Uncertainty Management in National GHG Inventories (GPG2000)" and Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC), ISO 14064 and GHG Protocol has been used for the estimation of Prizren's GHG emissions inventory.

Sectoral data for GHG emissions estimation was compiled from various sources primarily using available Kosovo data, data collected and presented during data collection process and consultations with Prizren officials, sectoral departments, Kosovo[1] Agency of Statistics, other statistical reports, studies, brochures and other Kosovo and city specific information sources. Wherein no formal data is available, are not considered in the study.

The sectors and gases assessed for the estimation of GHG emissions inventory includes the emissions by sources and removals by sinks of all anthropogenic GHGs. As per the IPCC guidelines, the inventory estimates the GHG emissions from following sectors which are relevant for Prizren:

- Energy Sector (Residential Building and Commercial & Institutional Building)
- Agriculture Sector (Agriculture - Biomass burned without energy recovery, Urea application, N2O emissions form managed soils - Direct and N2O emissions form managed soils - Indirect; and Livestock - Enteric fermentation and Manure management)
- Waste Sector (Solid waste and Waste water)
- Transport (not estimated, due to unavailability of city specific relevant data and information)
- Land use, Land Use Change and Forestry (not estimated and considered as net sink, due to unavailability of city specific data and information)
- Industrial Processes and Industrial Products Use (not estimated, due to unavailability of city specific relevant data and information)

The direct GHG emissions are estimated in this GHG inventory are:

- Carbon dioxide (CO2)
- Methane (CH4)
- Nitrous oxide (N2O)

Emissions from the following indirect GHGs are also estimated and reported in this GHG inventory:

- Oxides of Nitrogen (NOx)
- Carbon Monoxide (CO)
- Non-Methane Volatile Organic Compounds (NMVOC) and
- Sulphur dioxide (SO2)

During year 2014, Prizren City emitted total 1,370,821 tCO_2eq from the stationary energy, waste, and agriculture sectors. The summary of the emissions of GHG by each sector is summarised in the table

[1] References to Kosovo shall be understood to be in the context of UN Security Council Resolution 1244 (1999)

below. The LULUCF sector would be a net sink in countries but in the case of Prizren, Kosovo due to lack of data and information it is not clear, additionally as per Climate Change Strategy 2019- 2028 Action Plan On Climate Change 2019- 2021 for Kosovo, *land use subsector is dominated by forestry, which could be a powerful sink of atmospheric carbon. But in terms of carbon that annually flows through this sub-sector is the second largest sector in the Kosovo with about 2.750 thousands of tons of CO2. Good forest inventory and sustainable management of forests could contribute greatly to decreasing emissions.* Hence LULUCF (mainly carbon sequestration) emissions have not been accounted for this GHG inventory.

The net GHG emission in 2014 was 1,370,821 tCO_2eq. Further, there are no GHG emissions from combustion of materials of biogenic origin-CO_2 (b) (e.g., biomass, biofuel, etc. since carbon neutral fuel, hence considered zero) within the city boundary.

The total CO_2, CH_4, and N_2O emitted were 3,69,786 t, 3,241 t and 3,435 t, respectively, equalling an emission of 1,370,821 tCO2eq. Transportation sector emission of gases (CO2, CH4, N2O, are not estimated for this GHG inventory due to unavailability of data and high level of uncertainty on specific information.

In Prizren city there is no Industrial Process and Product Use (IPPU) activities with gases HFC, PFCs, SF_6 and NF3, hence there is zero emission from IPPU sector.

Table below gives the relative contribution of the various gases to the total CO2 eq. emissions from the Prizren City. The stationary energy sector/energy use emitted 3,63,318 tCO2eq, accounting for 26.50 % of the total GHG emissions during year 2014. The waste sector emitted 46,139 tCO2eq. which was 3.37% of the total GHG emissions. The agriculture, forestry, and other land use (AFOLU) sector emitted 961,364 tCO_2eq. which was 70.17% of the total GHG emissions. There is no emission estimated from transport and IPPU sector. The figure below gives the relative distribution of emissions by sector.

The emissions of CO_2 from the stationary energy sector relative to the total GHG emissions were by far the largest in 2014 (please note other CH_4 and N_2O emissions from the fuel combustions have not been calculated with reference to the GPC methodology). The waste and agriculture sector mainly accounted for the emissions of CH_4 and N_2O emissions and also CO_2 emission due to urea fertilization. The synthetic gases (HFCs, PFCs, and SF_6) would entirely be emitted from the industrial processes; however, in Prizren city there is no industries classify under IPPU sector hence the emission of these gases are considered as 0. The relative distribution for gases emitted from each sector is presented in table below.

The scope categorized greenhouse gas emissions from the Prizren City also presented in the table and table below:

The total scope-1 emissions are 10,14,681 tCO_2eq. from:

- Stationary energy (7,178 tCO_2eq.),
- Transportation (0 tCO_2eq.),
- Waste (46,139 tCO_2eq.),
- IPPU (0 tCO_2eq.) and
- AFOLU (961,364 tCO_2eq.).

The scope-2 emissions are applicable for stationary energy sector only i.e. 3,05,864 tCO2eq.

The Scope-3 emissions are 50,276 tCO2eq. mainly from

- Stationary energy (50,276 $tCO_2eq.$) and
- Transportation Sector (0 $tCO_2eq.$).

Greenhouse gas emissions Summary, by sector, for Prizren City in 2014

Greenhouse gas emissions, by sector, for Prizren City in 2014							
Sector		**Total by scope (tCO_2e)**				**Total by city-induced reporting level (tCO_2e)**	
		Scope 1 (Territorial)	**Scope 2**	**Scope 3 included in BASIC / BASIC+**	**Other Scope 3**	**BASIC**	**BASIC+**
Stationary Energy	**Energy use (all I emissions except I.4.4)**	**7,178**	**305,864**	**50,276**	**NE**	**313,042**	**363,318**
	Energy generation supplied to the grid (I.4.4)	**0**					
Transportation (all II emissions)			**0**	**0**	**0**	**NE**	**0**
Waste	**Generated in the city (all III.X.1 and III.X.2).**	**46,139**		**0**	**NE**	**46,139**	**46,139**
	Generated outside city (all III.X.3)	**0**					
IPPU (all IV emissions)		**0**			**NE**		**0**
AFOLU (all V emissions)		**961,364**			**NE**		**961,364**
Total		**1,014,681**	**305,864**	**50,276**	**NE**	**359,181**	**1,370,821**

		Sources required for BASIC reporting
		Sources required for BASIC+ reporting
		Sources included in Other Scope 3
		Sources required for territorial total but not for BASIC/BASIC+ reporting (italics)
		Non-applicable emissions

1 INTRODUCTION

1.1 PROJECT BACKGROUND

1.1.1 Project Context

Cities around the globe are rapidly growing due to increasing population resulting in escalation of energy consumption and sources of global greenhouse gas (GHG) emissions. Increasing pressure on fuels, resultant GHG emissions and its adverse impacts on environment have prompted cities around the globe to take proactive steps like identifying and accounting of GHG emissions and subsequently creating an action plan for reducing GHG emissions.

In Kosovo context, there is an incessant impetus on climate change mitigation and adaptation as Kosovo is highly susceptible to the adverse impacts of climate change considering its population, rapid urbanisation, agrarian economy, the mountain and Alps region. As per Central Intelligence Agency – US (CIA) the population in Kosovo was 1,907,592 in July 2018, which is expected to reach 2.09 million by 2030. As a result of increasing urbanisation and rapid economic growth, the cities in Kosovo are growing a parallel increase in demand for energy and infrastructure, for instance, according to Sustainable Energy Options for Kosovo – January 19, 2012 report, energy demand in Kosovo was 5636 GWh in 2010 and it is expected to rise to 8430 GWh by 2020.

The most critical element of low carbon growth is identification of sources, activities and their contribution to GHG emissions within the city boundaries as well as accounting and management of emissions at city level. To effectively manage GHG emissions, the first step is to develop GHG inventory, followed by measurement and reporting. An inventory would allow better understanding of GHG intensive sectors and GHG reduction potential. Subsequently, an effective and actionable low carbon plan can be devised to make the city liveable and sustainable.

1.1.2 About the Project

Kosovo considers climate change as a priority area and is dedicated to make its contribution to the solution of this global challenge. Even though Kosovo is not a Party to UNFCCC yet, has responsibility to respond to the requirements of the Convention and Protocol, as one of the signatories of the Energy Community Treaty. Energy Community Treaty also sets clear targets of reducing energy use while demands increase the share of renewable energies. Based on current data, Kosovo's contribution to greenhouse gas emissions globally is almost negligible; its commitment to join the global efforts to reduce the level a greenhouse gas emission has been forthcoming.

In the context of legislation on climate change, aspects related to these changes are included in the relevant environmental legislation, including Law on Environment, Law on Protection of Air Pollution and Law on Water.

It also approved the Climate Change Strategy 2018-2028, which is consistent with the expected policy framework of the EU climate and energy. Within the activities in the climate change sector, Kosovo has prepared the register (inventory) of greenhouse gases for 2008-2013.

The objective of the United National Development Program (UNDP)'s project "Support for Sustainable Prizren – Initiating Urban NAMAs (Nationally Appropriate Mitigation Actions)" is to prepare the city of Prizren for reducing the overall Green House Gases (GHG) emissions through cross-sectoral interventions at the municipal level, such as collaboration between industry, central institutions, private sector, civil society including women CSOs and academia that account for different experiences based

on gender sensitive approach. This project will contribute to creating healthy urban living conditions and achieving sustainable growth, while setting an example as a city-wide intervention for Kosovo.

The Prizren Green Growth Centre (PGGC) serves as NAMA planning and oversight office. It will also have the authority to collect data on city-wide GHGs emissions and report them, to operate the city-wide GHG inventory, to develop indicators which reflect sustainability perspectives, rather than simply measuring the progress. The work will be done in close liaison with other Kosovo agencies and offices, including Kosovo Agency of Statistics, and Kosovo Environmental Protection Agency.

The main intended beneficiaries of the project are Prizren Municipality and central institutions. More specifically, central stakeholders include KEPA, line ministries and their relevant departments and agencies, gender equality officials, governing and technical bodies responsible for implementation of the Kosovo Climate Change Strategy, while local stakeholders include municipality departments, civil society organizations (CSOs) and local communities.

Hence this assignment will provide the detailed GHG Inventory assessment, training, capacity building and institutionalization of the Prizren City of Kosovo and will also guide other cities to adopt the same.

The GHG emissions accounting and preparation of the GHG inventory for the Prizren city is an initial step to enable the Prizren city to map, track and monitor the GHG emissions within the identified boundary. The GHG emissions data will help the Prizren city in preparation of low carbon action plan. The GHG accounting project has following advantages:

- Clearly measures and communicates the ground level scenario,
- Helps in identifying and tackling the critical issues,
- Extensive stakeholder engagement - Paves way for participation of citizens, other cities and central institutions,

Thus, enabling city takes effective action on mitigating climate change impacts. It also enables the city to address the challenge of GHG mitigation in a new and innovative manner while promoting a sustainable, inclusive and climate resilient growth. In order to benefit from the GHG accounting project, the current project has the following four specific objectives, these include:

- Formulating a methodological approach for GHG accounting for the Prizren city;
- Identifying and working with appropriate local partner institutions, both for facilitating appropriate data collation as well as building local capacity for updating and reporting on the GHG emissions inventory
- Producing a city inventory report, based on an agreed methodology;
- Arranging and conducting a training workshop for the Prizren city on the methodology used and assessing the results of the GHG emissions accounting report.

1.1.3 About the Report

This report presents the GHG inventory of the Prizren City for inventory the year 2014 (decided based on more authentic and widely available data for the year of 2014). This report is divided into three sections. Section I provided the brief project background, ensuing section focuses on details of the inventory boundary and details of city selected in the study with geographic, demographic, climatic profile of the city.

Section II provides the information on the GHG inventory for the city and detailed overview of sectors considered for GHG inventory, activity data, methodology and emission factors used, detailed analysis of GHG emissions from selected sector, sub-sector, category and sub-category. A quantitative and qualitative overview of the GHG inventory for the City as per the *'Global Protocol for Community-Scale Greenhouse Gas Emission Inventories'* (GPC or GPC protocol) in details and the technical information describing the activity data collection methodology for GHG accounting.

Section III has the key findings and recommendations and a comparative assessment across the selected cities. Further, the data collection and report formats for GHG emissions data are included in the Annexure of this report. The Annexure II of the report provides details on emission factors and GWP of major GHG gases. Annexure III contains the details of TOR engagement of local partner institutions for GHG emissions accounting.

1.2 About the City – Prizren

1.2.1 Prizren City Profile

Prizren Municipality is the second largest municipality of Kosovo and the regional center in southwest Kosovo. Situated on the slopes of Sharr Mountains, the town is one of the oldest inhabited settlements in the region and also in the southeast Europe.

Due to the extent political, social and economic changes during certain time periods, Prizren has seen fluctuations in its economic, social and cultural development. But it is the Kosovo conflict and its aftermath that badly affect the future of the Municipality. Today, it faces many challenges in the management of its resources and territory. These include the impacts of economic decline, high rate of unemployment, the presence of informal economy, the lack of organized industrial and agricultural production, and the lack of investment for urban infrastructure. It also suffers from major environmental degradation. Coupled with this are low personal expectations, and continuing migration.

The municipality of Prizren is located in south-eastern Kosovo. It covers an area of approximately 640 km2 and includes Prizren city and 74 villages. According to the 2011 Kosovo Population and Housing Census, the total population is 177,781.

Table 1 : *Inventory city (Prizren) information*

Inventory city information	
Inventory boundary	City Information
Name of City	Prizren
	Kosovo
Region	Europe & Central Asia
Inventory Year	2014
Geographic Boundary	Prizren Municipal Area
Geographic Coordinate	42.2153° N, 20.7415° E
Elevation	The topography of Prizren Municipality has a wavy structure that the altitude has a range between 300 m - 2600 m. While the city center has settled on a flat surface, hilly topography is observed towards western and more distinctively towards eastern sides. Elevation of the city center is 400 m
Land Area (km2)	640 km2
Resident Population in 2014	183,595 (as per Master Plan for Solid Waste Management of Municipality of Prizren 2014 - 2023)

Total Households	26724
Income Category	Lower middle income
GNI Per Capita (US$)	3890
Climate	Continental, with Mediterranean and Alpine influences

Legislative

The municipal assembly has 41 seats distributed among eight (8) political entities, 34 members are Kosovo Albanian, four (4) are Kosovo Bosniak and three (3) are Kosovo Turk; 16 are women.

Executive

The municipality is headed by Mayor Mytaher Haskuka, elected for his first term as mayor with 50.36% of votes in the second round of the 2017 municipal elections.

It has 13 municipal departments. One (1) department is run by a woman director: tourism and economic development (KDTP), 12 departments are run by men directors: health; inspection; public services; emergency and safety; administration; education and science; culture, youth and sports; cadastre and geodesy ; urbanism and spatial planning; agriculture and rural development; labour and social welfare; and budget and finance. In the previous mandate (2013-2017), two (2) directors were women (source municipal information officer).

Economy

The economy of Prizren municipality is mainly based on agriculture, trade, construction and food processing, all private enterprises. There are some 5,400 registered private businesses operating in the municipality. There is no reliable data on the number of people employed in the private sector. The industrial zone is still under pending process of expropriation of the properties located under this zone (source: Kosovo business registration office).

Public Service

Infrastructure: The overall status of infrastructure in the municipality is assessed as good. All the main roads connecting villages with the urban centre are asphalted. Water supply is functional in Prizren city and in villages. There is no sewage system in a few villages. Power supply is still a problem, especially during the winter and in the villages (source: regional public water company "Hidroregjioni").

Health: The primary health care system includes 14 municipal family health centres and 26 health houses. It has 475 employees, including doctors, nurses and support staff; 264 women and 211 men. The regional hospital in Prizren offers services to approximately 250,000 residents. It employs 778 workers, including 155 doctors, and is equipped with emergency and intensive care units.

Education: There are 56 schools, 51 primary and lower secondary schools with 25,808 pupils and 1,877 teachers and five (5) upper secondary schools with 7,691 pupils and 373 teachers. Kindergartens are privately run. There is also a public university in Prizren "Ukshin Hoti", offering lectures in Albanian, Bosnian and Turkish languages.

Religious and Cultural Sites

Prizren municipality has 75 mosques. There are 20 Serbian Orthodox churches and monasteries. There are (5) Catholic churches, seven (7) tekkes and three (3) Protestant churches (source: Islamic community centre, Ministry of Culture, Youth and Sports and UNESCO).

A total of 184 cultural heritage sites in Prizren municipality are included in the Ministry of Culture Youth and Sport list of sites under temporary protection and six (6) under permanent protection.

Land Use Pattern

The PMDP 2025 land use analyses consist of both field survey and data obtained from institutions (below Table). Data for agricultural land map, soil classification map, water surfaces and forest areas are from the studies of Ministry of Environment and Spatial Planning dated 2004, while data such as settled areas, working environments, etc. have been produced by overlapping the results of field surveys.

Table 2 : Land Use Pattern of Prizren Municipality

Land Use	Area in Ha
Housing Sites Sub total	2502.52
Commerce + Service + Mixed Use Sub Total	340.11
Urban Facilities Sub Total	164.33
Industry Sub Total	178.79
Infrastructure Sub Total	1105.25
Military Area Sub Total	95.34
Agricultural Areas Sub Total	18495.10
Grassland	4795.46
Pasture	14096.83
Forest	20046.71
Other Areas Sub Total	1960.24
Total	**63780.68**

Source: Ministry of Agriculture, 2005; Field Survey, 2009

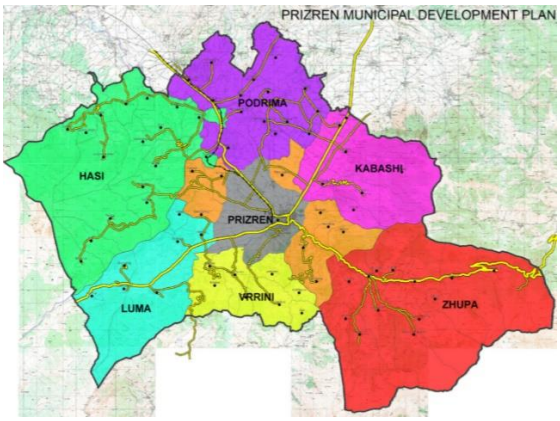


Figure 1: Geographical regions of the Prizren Municipality (PMDP 2025 Field Survey, April 2009)

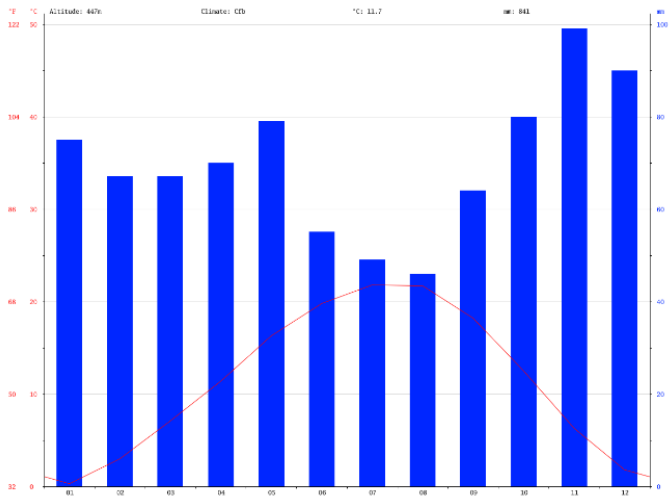
Demographics : Prizren City [2]	
Population	183,595
Municipal Area	640 km^2 [3]
Literacy rate	
Sex Ratio	49.8% females and 50.2% males

Climatic Structure

The climate of Prizren displays a continental character with a mild influence of Mediterranean climate on the lower altitudes, while a harsh alpine climate dominates in the mountains. The Mediterranean climate stems from the warm Adriatic draught that comes through the Drini i Bardhe River canyon. The soft climatic characteristics establish a good grace for rich natural resources. It helps with the cultivation of grapes, as well as other fruits and vegetables. Distance from the sea is an important indicator in climatic conditions and Prizren has 105 km distance to sea. In the summer, the climatic conditions are relatively consistent, and precipitation can be observed occasionally, while extensive rainfall occurs in the winter. Higher temperatures are observed in the autumn compared to spring. The average highest temperature in autumn is 17.6ºC. In 60% of the year the temperature is higher than 0ºC which means no frost occurs during 229 days.

The climate in Prizren is warm and temperate. Prizren is a city with a significant rainfall. Even in the driest month there is a lot of rain. According to Köppen and Geiger, this climate is classified as Cfb. The average annual temperature in Prizren is 11.7 °C. About 841 mm of precipitation falls annually.

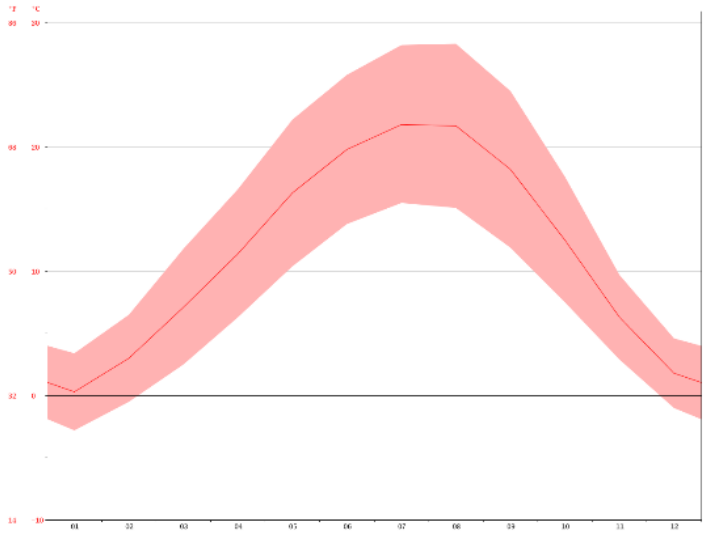
Climate graph/weather by month Prizren



The driest month is August, with 46 mm of rain. Most of the precipitation here falls in November, averaging 99 mm.

Average Temperature Prizren

[2] *Master Plan for Solid Waste Management of Municipality of Prizren 2014 - 2023*
[3] *Prizren Municipal Development Plan 2025*



July is the warmest month of the year. The temperature in July averages 21.8 °C. January is the coldest month, with temperatures averaging 0.3 °C.

Prizren weather by month/weather averages:

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	0.3	3	7.1	11.4	16.3	19.8	21.8	21.7	18.2	12.5	6.3	1.8
Min. Temperature (°C)	-2.8	-0.5	2.5	6.3	10.4	13.8	15.5	15.1	11.9	7.5	2.9	-1
Max. Temperature (°C)	3.4	6.5	11.8	16.6	22.2	25.8	28.2	28.3	24.5	17.6	9.7	4.6
Avg. Temperature (°F)	32.5	37.4	44.8	52.5	61.3	67.6	71.2	71.1	64.8	54.5	43.3	35.2
Min. Temperature (°F)	27.0	31.1	36.5	43.3	50.7	56.8	59.9	59.2	53.4	45.5	37.2	30.2
Max. Temperature (°F)	38.1	43.7	53.2	61.9	72.0	78.4	82.8	82.9	76.1	63.7	49.5	40.3
Precipitation / Rainfall (mm)	75	67	67	70	79	55	49	46	64	80	99	90

There is a difference of 53 mm of precipitation between the driest and wettest months. Throughout the year, temperatures vary by 21.5 °C.

Topographic structure

The topography of Prizren Municipality has a wavy structure that the altitude has a range between 300 m - 2600 m. While the city center has settled on a flat surface, hilly topography is observed towards western and more distinctively towards eastern sides. Elevation of the city center is 400 m. The

coordinates of Prizren are 42.2153° North, 20.7415° East. The geographic location of Prizren provides conditions suitable for the development of agriculture, stockbreeding, food industry and tourism.

Mountains and valleys

Prizren territory covers part of the following mountains: Sharr, Oshlak, Korritinik, Pashtrik and partly comprises of the flat field of Dukagjini valley. Mountainous parts over 1500 m cover approximately 15% of the entire municipal borders. The highest elevation of the Prizren Municipality is on Sharr Mountains in the eastern and southeastern sides with approximately 2600m. Sharr Mountains have borders with North Macedonia in the southeast, Municipality of Dragash/s in the North, Municipality of Shterpce/Sterpce in the east and Municipality of Suhareka/Suvareka in the northeast. Zhupa Valley, the base of Lumbardhi River, lies through these mountains towards Prizren. Pashtrik Mountains on the Albanian border in the west constitute the second highest parts with an elevation of 1950 m at the highest point.

Rivers and Other Water Surfaces

Prizren is one of the fortunate locations in Kosovo in terms of amount of water resources. The most important and longest river in Prizren is Drini i Bardhe (111 km). It enters Prizren from the north and continues towards the southwest to Albania into Adriatic Sea. The river forms a small lake inside the borders of Dobrushta Village. In hydrographic terms, the entire territory of Prizren Municipality is part of the Drini i Bardhe basin and Vardari basin, respectively the Adriatic Sea and Aegean Sea.

Geological construction

Prizren has rocks of various age and lithology. The eldest rock are from Paleozoic, Permian - Triassic, late and mid Triassic, Jurassic, Cretaceous, and Noegene and Quaternary creations. Geologic and tectonic construction of Prizren Municipality is the main indicator for expectation of occurrence of sources of minerals. This territory is known to have been a source of useful minerals in the past.

Plantation Capability of Land

The land classification according to the plantation capacities has been analyzed under five headings including vegetable planting, cereal planting, fruit planting, forests and grassy plants. The land types suitable for the mentioned plantation capacities:

- Land types suitable for vegetable plantation: brown smonica, clayey alluvium, loamy alluvium and brown alluvium.
- Land types suitable for fruit growing and vineyards: meadow loamy soil, mineral marsh loamy gley, reddish sandy loamy soil, sandy loamy alluvium soil, compact limestone and clayey alluvium.
- Land types suitable for planting cereals: brown smonica, clayey alluvium, loamy alluvium, brown alluvium.
- Land types suitable for forests: reddish sandy loamy soil, reddish sandy loamy soil, compact limestone.
- Land types suitable for grassy plants: reddish sandy loamy soil, reddish sandy loamy soil, compact limestone, meadow clayey and shallow brown soil types are.

Natural Heritage

Natural heritage has a great importance with the possibilities of tourism development, which is a key factor for economic development.

In Prizren, there are three natural reserves as, Maja e Arnetit, Oshljaku and Pisha e Madhe which are important with their plant reserves of endemic-relict specie Bosnian Pine (Pinus Heldreicheii).

The largest surface of protected areas is the National Park "Mali Sharr" which is located in Prizren Municipality. The National Park of Sharr Mountains is distinguished by botanical, fauna, ecological, touristic, recreational, sportive, educative and cultural values. The park has so rich areas with biodiversity not only in Kosovo but also in Balkans Peninsula that it represents a treasure of plant species with number of endemic, relict, rare and threatened species.

2 City Greenhouse Gas Inventory Information

This chapter presents a detailed description of the greenhouse gas (GHG) inventory of the emissions of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6) by sources and their removal by sinks, for the year 2014. The sectors covered include stationary energy, transportation, waste, industrial processes & product use (IPPU), agriculture, forestry, and other land use (AFOLU) and any other emissions occurring outside the geographic boundary as a result of city activities.

The reporting is in accordance with the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories[4] (GPC) framework (its GHG estimation process and methodology is based on IPCC 2006). The GPC framework measure and disclose a comprehensive inventory of GHG emissions and to total these emissions using two distinct but complementary approaches. One captures emissions from both production and consumption activities taking place within the city boundary, including some emissions released outside the city boundary. The other categorizes all emissions into "scopes," (Scope 1, 2 and 3) depending on where they physically occur. This GPC GHG emission inventory for city covers all emission for which reliable data are available and most appropriate methodologies have been applied in consistency with Kosovo's national GHG inventory.

Table 3: Scopes definitions for city GHG inventories

Scope	Definition
Scope-1	GHG emissions from sources located within the city boundary
Scope-2	GHG emissions occurring as a consequence of the use of grid-supplied electricity, heat, steam and/or cooling within the city boundary
Scope-3	All other GHG emissions that occur outside the city boundary as a result of activities taking place within the city boundary

[4] *The Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC) is a joint project by ICLEI-Local Governments for Sustainability (ICLEI), the World Resources Institute (WRI) and C40 Cities Climate Leadership Group (C40), with additional collaboration by the World Bank, UNEP, and UN-Habitat. http://www.ghgprotocol.org/city-accounting*

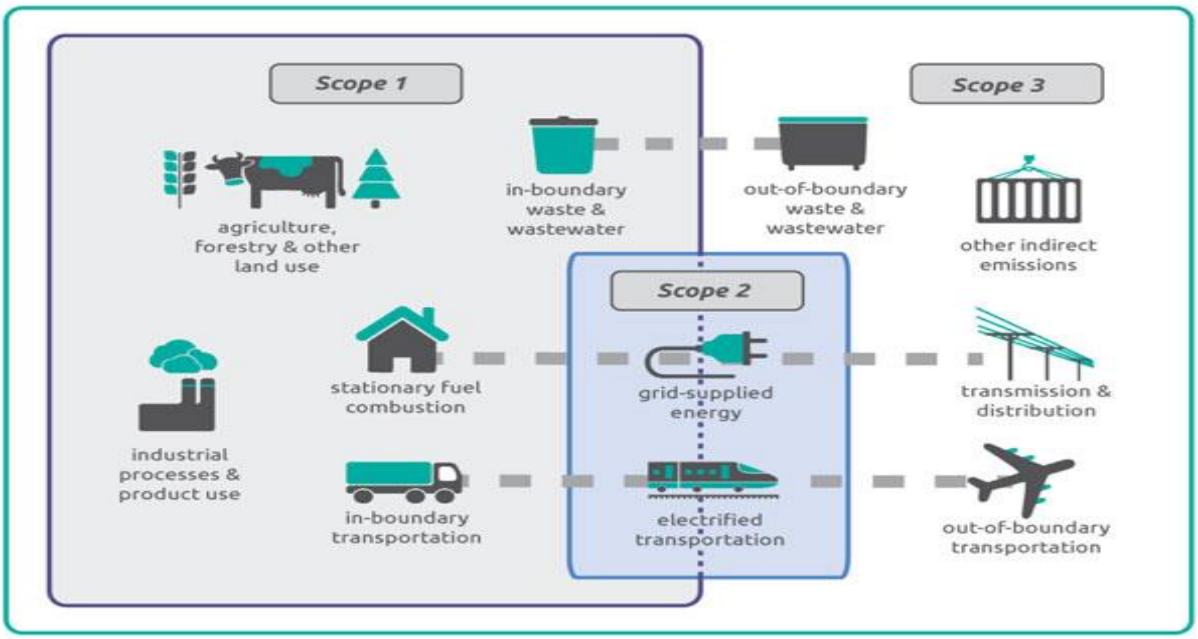


Figure 1: Sources and boundaries of city GHG emissions

The GPC requires cities to report their GHG emissions by gas, scope, sector and subsector, and considers two distinct but complementary approaches, as discussed below:

Scopes framework: This framework considers emissions by scope 1, 2 and 3. The scope 1 (or territorial emissions) allows separate accounting of all GHG emissions produced within the geographic boundary of the city, consistent with Kosovo-level GHG reporting.

City-induced framework: This framework considers GHG emissions attributable to activities taking place within the geographic boundary of the city. It covers selected scope 1, 2 and 3 emission sources representing the key emitting sources occurring in almost all cities, and for which standardized methods are generally available. The city-induced framework provides cities the option of selecting between two reporting levels: BASIC or BASIC+. GHG reporting can be carried out either considering BASIC or BASIC+ framework. While BASIC includes stationary energy (it includes - emissions from the combustion of fuels in buildings, industries, and from the conversion of primary energy sources in refineries and power plants located within the city boundary; emissions from the consumption of grid-supplied electricity, steam, heating and cooling in the city; transmission and distribution losses from grid-supplied energy; Fugitive emissions from fossil fuels extraction and processing), in-boundary transportation and in-boundary generated waste, BASIC+ is a more comprehensive approach and includes industrial processes and product use (IPPU), agriculture, forestry and other land use (AFOLU), transboundary transportation, and energy transmission and distribution losses as well.

Comprehensively, this study included all the GHG emission sectors and sub-sectors as per the BASIC+ framework, the main sector and subsector included in the GHG inventory, presented in the table below:

Table 4: GHG Emission Source (sectors and sub-sectors)

Sectors	GHG Emissions Sub-sectors
Stationery Energy	Residential buildings
	Commercial and institutional buildings and facilities

	Manufacturing industries and construction
	Energy industries
	Agriculture, forestry and fishing activities
	Non-specified sources
	Fugitive emissions from mining, processing, storage, and transportation of coal
	Fugitive emissions from oil and natural gas systems
Transportation	On-road transportation
	Railways
	Waterborne navigation
	Aviation
	Off-road transportation
Waste	Solid waste disposal
	Biological treatment of waste
	Incineration and open burning
	Wastewater treatment and discharge
IPPU	Industrial Process and Product Use
AFOLU	Agriculture, Forestry and Other Land Use

2.1 Greenhouse Gas Emissions in 2014 Inventory Year

This section presents the estimates of CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6 emitted by sources and their removal by sinks, covering the sectors of stationary energy, transportation, waste, industrial processes & product use (IPPU), agriculture, forestry, and other land use (AFOLU) and any other emissions occurring outside the geographic boundary as a result of city activities. Against this backdrop, it explains the methodology used, the QA/QC measures applied, and the results of the key source analysis while presenting a Tier-I quantification of the uncertainties associated with the estimates.

2.1.1 Activity data, emission factors, and methodological tiers used

Activity data (AD): *"Activity data is a quantitative measure of a level of activity that results in GHG emissions taking place during a given period of time (e.g. volume of gas used, kilometers driven, tonnes of waste sent to landfill, etc.)".* Activity data has been primarily collected from the Prizren municipality and associated sectoral departments and Central Institution's agencies like Kosovo Agency for Statistics also derived from the published documents of the various government departments and Central Institution of Kosovo, from industry associations, and from reputed data organizations.

Data collection: Data has been gathered from a number of sources including Prizren municipality, associated sectoral departments, Central Institution's agencies i.e. Kosovo Agency for Statistics, , national GHG inventory report, universities and research institutes, scientific and technical publications in books, journals and reports. In addition to this sector experts/relevant stakeholders has been consulted and interviews with key stakeholders has been conducted on the basis of bottom-up

approach. The formats/templates for data collection for GHG inventory have been prepared for different sectors and sub-sectors as per the GPC standard and shared with the municipality and associated sectoral departments and organization. The onsite meeting and stakeholder discussion were also adopted to collect the appropriate data for GHG inventory through the local expert hired by the UNDP. In general, the preference has been given to local and central data that is publicly available, peer-reviewed and from reputable sources. Extensive effort has been made to collect data from central institutions sources/publications wherever feasible.

Emission factors: The emission factors used in this report are a mix of default emission factors available in the IPCC publications (1996, 2000, 2003, and 2006) and country-specific emission factors. Default emission factors have been used for those gases and categories for which country-specific factors are not available. The emission factors used for the GHG inventory annexed to this report.

Methodology: The GPC does not require specific methodologies to be used to produce emissions data; rather it specifies the principles and rules for compiling a city-wide GHG emissions inventory. The most appropriate methodologies have been selected based on the purpose of this inventory, availability of data, and consistency with Kosovo's national inventory. The selection of the methodologies follows the principles of relevance, completeness, consistency, transparency and accuracy.

For a comprehensive, complete, comparable, transparent, and accurate coverage, to the extent capacities permit, the methodology used follows the IPCC Revised Guidelines 1996, supported by the IPCC Good Practice Guidance (GPG) 2000 and 2003. The LULUCF sector estimations are made using the IPCC GPG 2003. The estimation also integrates default emission factors from the IPCC 2006 Guidelines.

2.1.2 Inventory Boundary and Inventory Year

Inventory Boundary: The city boundary which shall actually be the spatial dimension or physical boundary is an important aspect for GHG inventory. For the purpose of this GHG inventory for Prizren City, administrative boundary of Prizren Municipality (revenue boundary) of the city has been considered for GHG accounting. Since, the Prizren municipality has direct administrative and operational control on various activities carried out in the city. Hence, consideration of the municipal boundary as GHG inventory boundary in more apt and provides opportunity to plan for climate change mitigation and adaptation measures effectively.

Inventory Year: As per GPC protocol, the GHG accounting needs to be carried out for a continuous period of 12 months and the city GHG emissions needs to be accounted for within a single reporting year (either a calendar year or a financial year), consistent with the time periods most commonly used by the city.

The inventory or reporting year/ base year for this study is considered as January 2014 - December 2014, provided data is available for the most of sectors/ sub-sectors. In recent past (after 2013), Ministry of Environment and Spatial Planning (MESP), Ministry of Infrastructure and Transport (MIT), Ministry of Economic Development (MED), Kosovo Environmental Protection Agency, Kosovo Agency of Statistics (KAS) of Kosovo and Municipality of Prizren City have initiated and been initiating various programmes related to cities in order to make the cities smart and sustainable e.g. Kosovo Environmental Programme (KEP). In order to design and implement these programmes, the city authorities and central institutions departments have started monitoring, documenting and collecting city specific information (including certain information required for this study) only recently. In

general, it is very challenging and difficult to get city specific information and data. Hence, the January 2014-December 2014 has been selected as a base year for the GHG accounting exercise (due to availability of more authentic data compare to other years during this assessment study period).

2.1.3 Quality Assurance and Quality Control

QA/QC plan was developed, which took into account, other than the quality of the data, the cycle of inventory preparation and adherence to that plan. All contributors to the city inventory were also explained the QC procedure checklist in line with the general inventory level QC procedures of the UNFCCC GPG 2000 and IPCC GPG, 2000. The consultant completed the checklists during the period of data collection and GHG inventory preparation.

Two levels of QC checks were conducted Local Expert and International Expert cum Team leader to ascertain the QA/QC procedure. The general QA/QC checks for all inventory preparations include cross-checking the reliability of the activity data collected from the primary and secondary sources for proper documentation and record; cross-checking for transcription errors in the activity data; consistency, completeness, and integrity of the database; documentation and reporting of the rationale of assumptions used for activity data; documentation and reporting of gaps in the database; consistency in labelling of units in ensuing calculations; and completeness checks on the reported data sets for designated years.

The entire QA/QC process is envisaged to be strengthened further by making the data sources as well as the process compliant to standard QA/QC procedures, which are modified for inventory preparation.

This QA/QC will be a part of the Verification process, for further details refer Section 3 of this report.

2.2 Greenhouse gas emissions in 2014 – A Summary

During year 2014, Prizren City emitted total 13,70,821 tCO2eq from the stationary energy, waste, and agriculture sector. The summary of the emissions of GHG by each sector is summarised in the table below. The LULUCF sector would be a net sink in countries but in the case of Prizren, Kosovo due to lack of data and information it is not clear, additionally as per Climate Change Strategy 2019- 2028 Action Plan On Climate Change 2019- 2021 for Kosovo, *land use subsector is dominated by forestry, which could be a powerful sink of atmospheric carbon. But in terms of carbon that annually flows through this sub-sector is the second largest sector with about 2.750 thousands of tons of CO2. Good forest inventory and sustainable management of forests could contribute greatly to decreasing emissions.* Hence LULUCF (mainly carbon sequestration) emissions have not been accounted for this GHG inventory.

The net GHG emission in 2014 was 1,370,821 tCO_2eq. Further, there are no GHG emissions from combustion of materials of biogenic origin-CO_2 (b) (e.g., biomass, biofuel, etc. since carbon neutral fuel, hence considered zero) within the city boundary.

The total CO_2, CH_4, and N_2O emitted were 369,786 t, 3,241 t and 3435 t, respectively, equalling an emission of 1,370,821 tCO_2eq. Please note, Transportation sector emission of gases (CO2, CH4, N2O, are not estimated for this GHG inventory due to unavailability of data and high level of uncertainty on specific information.

In Prizren city there is no Industrial Process and Product Use (IPPU) activities with gases HFC, PFCs, SF_6 and NF3, hence there is zero emission from IPPU sector

Table-5 below gives the relative contribution of the various gases to the total CO_2 eq. emissions from the Prizren City. The stationary energy sector/energy use emitted 363,318 tCO2eq, accounting for 26.50% of the total GHG emissions during year 2014, because in this case the stationary energy sector includes GHG estimations only from fuel combustion for heating in Commercial, Institutional buildings and Utilities sub-sector and grid electricity consumption only in residential building, commercial & institutional building and Industry (controlled by the Municipality) and associated transmission & distribution losses. There is no fossil fuel based power generation activity within the city and we do not have specific data on other sub-sectoral fuel combustion and electricity consumption. The waste sector emitted 46,139 tCO_2eq. which was 3.37% of the total GHG emissions (it includes solid waste disposal and waste water treatment). The agriculture, forestry, and other land use (AFOLU) sector emitted 961,364 tCO_2eq. which was 70.13% of the total GHG emissions (It includes Livestock- entric fermentation and manure management; Biomass burned without energy recovery; Urea application; N2O emissions from managed soils- Direct & Indirect), since Prizren is majorly agriculture based economy . There is no emission estimated from transport sector due to unavailability of data, and in Prizren there is no IPPU activities hence zero emission form the IPPU sector. The figure-3 below gives the relative distribution of emissions by sector.

The emissions of CO_2 from the stationary energy sector relative to the total GHG emissions were by far the largest in 2014 (please note other CH_4 and N_2O emissions from the fuel combustions have not been calculated with reference to the GPC methodology). The waste and agriculture sector mainly accounted for the emissions of CH_4 and N_2O emissions and also CO_2 emission due to urea fertilization. The synthetic gases (HFCs, PFCs, and SF_6) would entirely be emitted from the industrial processes; however in Prizren city there is no industries classify under IPPU sector hence the emission of these gases are considered as 0. The relative distribution for gases emitted from each sector is presented in Figure below.

The scope categorized greenhouse gas emissions from the Prizren City also presented in the table and figure below:

The total scope-1 emissions are 1,014,681 tCO_2eq. from:

- Stationary energy (7,178 tCO_2eq.),
- Transportation (0 tCO_2eq.),
- Waste (46,139 tCO_2eq.),
- IPPU (0 tCO_2eq.) and
- AFOLU (961,364 tCO_2eq.).

The scope-2 emissions are applicable for stationary energy sector only i.e. 305,864 tCO2eq.

The Scope-3 emissions are 50,276 tCO2eq. mainly from

- Stationary energy (50,276 tCO_2eq.) and
- Transportation Sector (0 tCO_2eq.).

Table 5: Greenhouse gas emissions Summary, by sector, for Prizren City in 2014

Greenhouse gas emissions, by sector, for Prizren City in 2014							
Sector		**Total by scope (tCO_2e)**				**Total by city-induced reporting level (tCO_2e)**	
		Scope 1 (Territorial)	**Scope 2**	**Scope 3 included in BASIC/ BASIC+**	**Other Scope 3**	**BASIC**	**BASIC+**
Stationary Energy	**Energy use (all I emissions except I.4.4)**	**7,178**	**305,864**	**50,276**	**NE**	**313,042**	**363,318 (27%)**
	Energy generation supplied to the grid (I.4.4)	**0**					
Transportation (all II emissions)			**0**	**0**	**0**	**NE**	**0**
Waste	**Generated in the city (all III.X.1 and III.X.2).**	**46,139**		**0**	**NE**	**46,139**	**46,139 (3%)**
	Generated outside city (all III.X.3)	**0**					
IPPU (all IV emissions)		**0**			**NE**		**0**
AFOLU (all V emissions)		**961,364**			**NE**		**961,364 (70%)**
Total		**1,014,681**	**3,05,864**	**50,276**	**NE**	**359,181**	**1,370,821**

		Sources required for BASIC reporting
		Sources required for BASIC+ reporting
		Sources included in Other Scope 3
		Sources required for territorial total but not for BASIC/BASIC+ reporting (italics)
		Non-applicable emissions

Table 6: GHG Emissions Report, by sector, by gas, for Prizren City in 2014

GPC ref No.	Scope	GHG Emissions Source (By Sector and Sub-sector)	Gases (in tonnes)								
		Total	CO_2	CH_4	N_2O	HFC	PFC	SF_6	NF_3	Total CO_2e	CO_2 (b)
			369,786	**3,241**	**3,435**	**0**	**0**	**0**	**0**	**1,370,821**	**0**
I		**STATIONARY ENERGY**	**363,318**	**0**	**0**	**0**	**0**	**0**	**0**	**363,318**	**0**
I.1		**Residential buildings**	227,114	0	0	0	0	0	0	227,114	0
I.1.1	**1**	**Emissions from fuel combustion within the city boundary**	66	0	0	0	0	0	0	66	0
I.1.2	**2**	**Emissions from grid-supplied energy consumed within the city boundary**	197,347	0	0	0	0	0	0	197,347	0
I.1.3	**3**	**Emissions from transmission and distribution losses from grid-supplied energy consumption**	29,701	0	0	0	0	0	0	29,701	0
I.2		**Commercial and institutional buildings and facilities**	62,469	0	0	0	0	0	0	62,469	0
I.2.1	**1**	**Emissions from fuel combustion within the city boundary**	7,111	0	0	0	0	0	0	7,111	0
I.2.2	**2**	**Emissions from grid-supplied energy consumed within the city boundary**	44,428	0	0	0	0	0	0	44,428	0
I.2.3	**3**	**Emissions from transmission and distribution losses from grid-supplied energy consumption**	10,929	0	0	0	0	0	0	10,929	0
I.3		**Manufacturing industries and construction**	73,734	0	0	0	0	0	0	73,734	0
I.3.1	**1**	**Emissions from fuel combustion within the city boundary**	0	0	0	0	0	0	0	0	0
I.3.2	**2**	**Emissions from grid-supplied energy consumed within the city boundary**	64,089	0	0	0	0	0	0	64,089	0
I.3.3	**3**	**Emissions from transmission and distribution losses from grid-supplied energy consumption**	9,645	0	0	0	0	0	0	9,645	0
I.4		**Energy industries**	0	0	0	0	0	0	0	0	0

I.4.1	1	Emissions from energy used in power plant auxiliary operations within the city boundary	0	0	0	0	0	0	0	0	0
I.4.2	2	Emissions from grid-supplied energy consumed in power plant auxiliary operations within the city boundary	0	0	0	0	0	0	0	0	0
I.4.3	3	Emissions from transmission and distribution losses from grid-supplied energy consumption in power plant auxiliary operations	0	0	0	0	0	0	0	0	0
1.4.4	1	Emissions from energy generation supplied to the grid	0	0	0	0	0	0	0	0	0
I.5		Agriculture, forestry and fishing activities	0	0	0	0	0	0	0	0	0
I.5.1	1	Emissions from fuel combustion within the city boundary	0	0	0	0	0	0	0	0	0
I.5.2	2	Emissions from grid-supplied energy consumed within the city boundary	0	0	0	0	0	0	0	0	0
I.5.3	3	Emissions from transmission and distribution losses from grid-supplied energy consumption	0	0	0	0	0	0	0	0	0
I.6		Non-specified sources	0	0	0	0	0	0	0	0	0
I.6.1	1	Emissions from fuel combustion within the city boundary	0	0	0	0	0	0	0	0	0
I.6.2	2	Emissions from grid-supplied energy consumed within the city boundary	0	0	0	0	0	0	0	0	0
I.6.3	3	Emissions from transmission and distribution losses from grid-supplied energy consumption	0	0	0	0	0	0	0	0	0
I.7		Fugitive emissions from mining, processing, storage, and transportation of coal	0	0	0	0	0	0	0	0	0
I.7.1	1	Emissions from fugitive emissions within the city boundary	0	0	0	0	0	0	0	0	0
I.8		Fugitive emissions from oil and natural gas systems	0	0	0	0	0	0	0	0	0
I.8.1	1	Emissions from fugitive emissions within the city boundary	0	0	0	0	0	0	0	0	0
II		TRANS PORTATION	0	0	0	0	0	0	0	0	0

II.1		**On-road transportation**	0	0	0	0	0	0	0	0	0
II.1.1	**1**	**Emissions from fuel combustion on-road transportation occurring within the city boundary**	0	0	0	0	0	0	0	0	0
II.1.2	**2**	**Emissions from grid-supplied energy consumed within the city boundary for on-road transportation**	0	0	0	0	0	0	0	0	0
II.1.3	**3**	**Emissions from portion of transboundary journeys occurring outside the city boundary, and transmission and distribution losses from grid-supplied energy consumption**	0	0	0	0	0	0	0	0	0
II.2		**Railways**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
II.2.1	**1**	**Emissions from fuel combustion for railway transportation occurring within the city boundary**	0	0	0	0	0	0	0	0	0
II.2.2	**2**	**Emissions from grid-supplied energy consumed within the city boundary for railways**	0	0	0	0	0	0	0	0	0
II.2.3	**3**	**Emissions from portion of transboundary journeys occurring outside the city boundary, and transmission and distribution losses from grid-supplied energy consumption**	0	0	0	0	0	0	0	0	0
II.3		**Waterborne navigation**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
II.3.1	**1**	**Emissions from fuel combustion for waterborne navigation occurring within the city boundary**	0	0	0	0	0	0	0	0	0
II.3.2	**2**	**Emissions from grid-supplied energy consumed within the city boundary for waterborne navigation**	0	0	0	0	0	0	0	0	0
II.3.3	**3**	**Emissions from portion of transboundary journeys occurring outside the city boundary, and transmission and distribution losses from grid-supplied energy consumption**	0	0	0	0	0	0	0	0	0
II.4		**Aviation**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
II.4.1	**1**	**Emissions from fuel combustion for aviation occurring within the city boundary**	0	0	0	0	0	0	0	0	0
II.4.2	**2**	**Emissions from grid-supplied energy consumed within the city boundary for aviation**	0	0	0	0	0	0	0	0	0

II.4.3	**3**	**Emissions from portion of transboundary journeys occurring outside the city boundary, and transmission and distribution losses from grid-supplied energy consumption**	0	0	0	0	0	0	0	0	0
II.5		**Off-road transportation**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
II.5.1	**1**	**Emissions from fuel combustion for off-road transportation occurring within the city boundary**	0	0	0	0	0	0	0	0	0
II.5.2	**2**	**Emissions from grid-supplied energy consumed within the city boundary for off-road transportation**	0	0	0	0	0	0	0	0	0
III		**WASTE**	**0**	**1,568**	**8**	**0**	**0**	**0**	**0**	**46,139**	**0**
III.1		**Solid waste disposal**	**0**	**1,532**	**0**	**0**	**0**	**0**	**0**	**42,883**	**0**
III.1.1	**1**	**Emissions from solid waste generated within the city boundary and disposed in landfills or open dumps within the city boundary**	0	1,532	0	0	0	0	0	42,883	0
III.1.2	**3**	**Emissions from solid waste generated within the city boundary but disposed in landfills or open dumps outside the city boundary**	0	0	0	0	0	0	0	0	0
III.1.3	**1**	***Emissions from waste generated outside the city boundary and disposed in landfills or open dumps within the city boundary***	0	0	0	0	0	0	0	0	0
III.2		**Biological treatment of waste**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
III.2.1	**1**	**Emissions from solid waste generated within the city boundary that is treated biologically within the city boundary**	0	0	0	0	0	0	0	0	0
III.2.2	**3**	**Emissions from solid waste generated within the city boundary but treated biologically outside of the city boundary**	0	0	0	0	0	0	0	0	0
III.2.3	**1**	***Emissions from waste generated outside the city boundary but treated biologically within the city boundary***	0	0	0	0	0	0	0	0	0
III.3		**Incineration and open burning**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
III.3.1	**1**	**Emissions from solid waste generated and treated within the city boundary**	0	0	0	0	0	0	0	0	0
III.3.	**3**	**Emissions from solid waste generated within the city boundary**	0	0	0	0	0	0	0	0	0

2		**but treated outside of the city boundary**									
III.3.3	**1**	***Emissions from waste generated outside the city boundary but treated within the city boundary***	0	0	0	0	0	0	0	0	0
III.4		**Wastewater treatment and discharge**	**0**	**37**	**8**	**0**	**0**	**0**	**0**	**3,256**	**0**
III.4.1	**1**	**Emissions from wastewater generated and treated within the city boundary**	0	37	8	0	0	0	0	3,256	0
III.4.2	**3**	**Emissions from wastewater generated within the city boundary but treated outside of the city boundary**	0	0	0	0	0	0	0	0	0
III.4.3	**1**	***Emissions from wastewater generated outside the city boundary but treated within the city boundary***	0	0	0	0	0	0	0	0	0
IV		**INDUSTRIAL PROCESSES and PRODUCT USES (IPPU)**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
IV.1	**1**	**Emissions from industrial processes occurring within the city boundary**	0	0	0	0	0	0	0	0	0
IV.2	**1**	**Emissions from product use occurring within the city boundary**	0	0	0	0	0	0	0	0	0
V		**AGRI CULTURE , FORESTRY and OTHER LAND USE (AFOLU)**	**6,468**	**1,672**	**3,427**	**0**	**0**	**0**	**0**	**961,364**	**0**
V.1	**1**	**Emissions from livestock within the city boundary**	0	1,656	3,401	0	0	0	0	947,566	0
V.2	**1**	**Emissions from land within the city boundary**	0	0	0	0	0	0	0	0	0
V.3	**1**	**Emissions from aggregate sources and non-CO2 emission sources on land within the city boundary**	6,468	17	26	0	0	0	0	13,797	0
Vi		**OTHER SCOPE 3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
VI.1	**3**	**Other Scope 3**	0	0	0	0	0	0	0	0	0

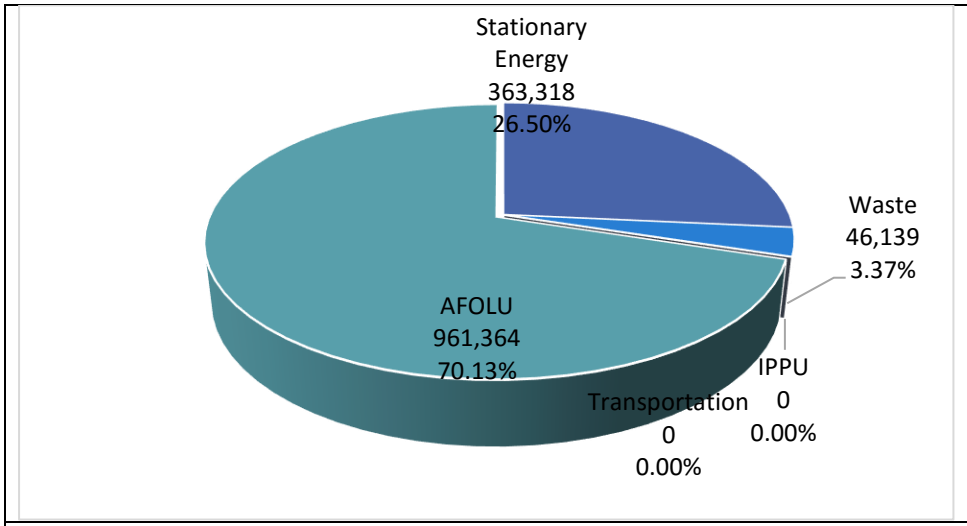


Figure 2: *Greenhouse gas emission distribution, by sector in 2014 (Figures in t CO2 eq.)*

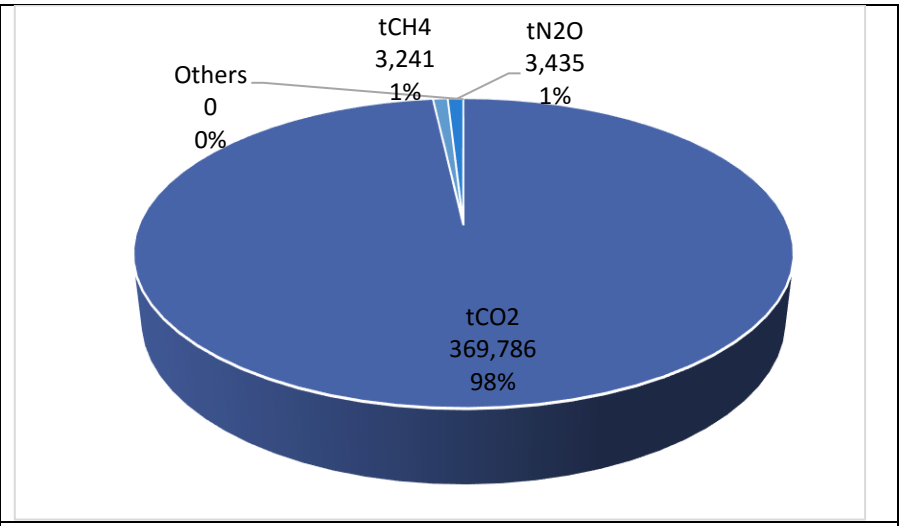


Figure 3: *Distribution of emissions, by gas, in 2014 (tons)*

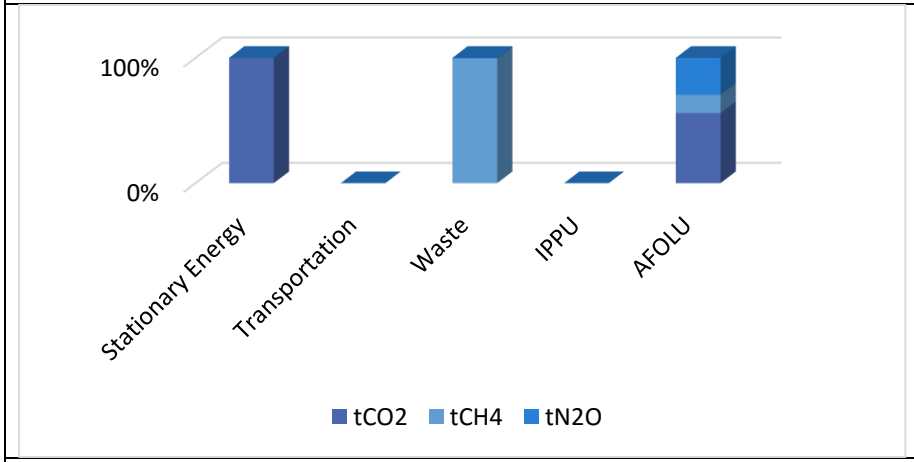


Figure 4: *Relative contributions of the individual sectors to greenhouse gas emissions,*

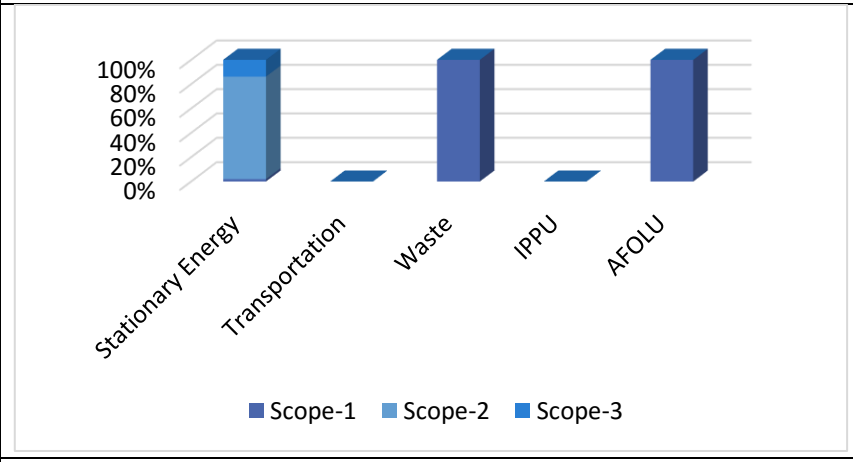


Figure 5: *Greenhouse gas emission distribution, by scope in 2014*

2.3 STATIONARY ENERGY

Stationary energy sources are one of the largest contributors to a city's GHG emissions. The Stationary Energy sector has been divided into nine sub-sectors. Seven of these nine produce emissions from both energy production and consumption, while the remaining two relate to fugitive emissions from fuel related activities. Sub-sectors defined under the stationary energy sectors are: (1) Residential buildings, (2) Commercial and institutional buildings and facilities, (3) Manufacturing industries and construction, (4) Energy industries, (5) Agriculture, forestry, and fishing activities, (6) Non-specified sources, (8) Fugitive emissions from mining, processing, storage, and transportation of coal and (9) Fugitive emissions from oil and natural gas systems. Emissions from the energy sector consist of the following:

Table 7: Energy Sector –Types, Scopes and Emission Sources

Type	Scope	Emission Source
Emissions from fuel combustion and fugitive emissions in the city	Scope-1	Emissions from sub-sectors mainly Residential buildings, Commercial and institutional buildings and facilities, Manufacturing industries and construction, Agriculture, forestry, and fishing activities. The main emission sources includes fuel consumption is mainly for cooking purpose like LPG, Kerosene, CNG/PNG, firewood, Cow dung, biomass, others; (B) Diesel Consumed for Electricity Generation; (C) Diesel Consumed for water pumping; (D) Auxiliary Operations etc.
Emissions from the consumption of grid-supplied electricity, steam, heating and cooling in the city	Scope-2	Emissions from national grid-supplied energy consumption by the sub-sectors. There are no centralised distribution system for steam, heating and cooling system within the city boundary.
Distribution losses from grid-supplied electricity, steam, heating and cooling in the city	Scope-3	Emissions from transmission and distribution losses from grid-supplied energy consumption by sub-sectors.

2.3.1 Methodology, activity data, and emission factors

The GPC along with IPCC Revised Guidelines were adopted for estimating the emissions from the above categories. The activity data in terms of consumption of various fossil fuels has been obtained from Prizren Municipality, Kosovo Agency for Statistics and associated sectoral departments, which keep track of these activities. The emission factors from IPCC have been used in estimating the GHG emissions from the combustion of fossil fuels. The stationary energy sector accounts for GHG emissions mainly from fossil fuel combustion. There is no mining, processing, storage, and transportation of coal and oil and natural gas systems present within the city boundary hence fugitive emissions are considered zero. Further there are no energy industry/power plants or energy

generation industry and non- specified sources within the city boundary hence no emissions considered from these sub-sectors. Kosovo does not have unified grid covering all the cities, there are no Kosovo specific main emission factors calculated and published by the Kosovo Energy Regulatory Office (ERO) on annual basis in accordance with the relevant CDM methodologies.

Kosovo is part of the Regional Energy Community and is connected with the regional system through interconnections with Serbia, North Macedonia, Montenegro and Albania. Kosovo is a key point in Southeast Europe because of its geographic position in the centre of the region. Electrical energy transmission system is connected with neighbouring systems in 400 kV level, except with Albania with whom, this connection is going to start to build in the near future.

Since Kosovo is thermal energy dominated electricity generation country and it's near regional similar nature countries are Serbia, Montenegro and North Macedonia. Hence we have calculated the Kosovo's Grid Emission Factor as an average Combined Margin Grid Emission Factor of the near region similar power generation nature countries (having major power generation from Thermal Power plants) i.e. Serbia, Montenegro, North Macedonia, in t CO2/MWhr.

2.3.2 Overview of GHG Emissions from Stationery Energy Sector

The stationary energy sector in 2014 emitted 3,63,318 tCO_2eq, which was 26.50% of the total GHG emissions from Prizren City (excluding LULUCF), of the total GHG emissions from the stationary energy sector, Scope 1 emissions are 7,178 tCO2eq, Scope 2 emissions are 3,05,864 tCO2eq and scope 3 emissions are 50,276 tCO2eq, presented below:

Table 8: Stationery Energy GHG Emissions Source (Sub-sector)

Sub-Sectors	Scope	Source of Emissions	Total $tCO_2eq.$
Residential buildings	Scope 1	Emissions from fuel combustion within the city boundary	66
	Scope 2	Emissions from grid-supplied energy consumed within the city boundary	197,347
	Scope 3	Emissions from transmission and distribution losses from grid-supplied energy consumption	29,701
Commercial and institutional buildings and facilities	Scope 1	Emissions from fuel combustion within the city boundary	7,111
	Scope 2	Emissions from grid-supplied energy consumed within the city boundary	44,428
	Scope 3	Emissions from transmission and distribution losses from grid-supplied energy consumption	10,929
Manufacturing industries and construction	Scope 1	Emissions from fuel combustion within the city boundary	0
	Scope 2	Emissions from grid-supplied energy consumed within the city boundary	64,089
	Scope 3	Emissions from transmission and distribution losses from grid-supplied energy consumption	9,645
Energy industries	Scope 1	Emissions from energy used in power plant auxiliary operations within the city boundary	0
	Scope 2	Emissions from grid-supplied energy consumed in power plant auxiliary operations within the city boundary	0
	Scope 3	Emissions from transmission and distribution losses from grid-supplied energy consumption in	0

		power plant auxiliary operations	
	Scope 1	Emissions from energy generation supplied to the grid	0
Agriculture, forestry and fishing activities	Scope 1	Emissions from fuel combustion within the city boundary	0
	Scope 2	Emissions from grid-supplied energy consumed within the city boundary	0
	Scope 3	Emissions from transmission and distribution losses from grid-supplied energy consumption	0
Non-specified sources	Scope 1	Emissions from fuel combustion within the city boundary	0
	Scope 2	Emissions from grid-supplied energy consumed within the city boundary	0
	Scope 3	Emissions from transmission and distribution losses from grid-supplied energy consumption	0
Fugitive emissions	Scope 1	Emissions from fugitive emissions within the city boundary	0
	Scope 1	Emissions from fugitive emissions within the city boundary	0

Due to unavailability of data and high uncertainty the stationary energy sector's GHG emissions has been calculated only for emissions from fuel combustion within the city boundary for residential buildings, emissions from grid-supplied energy consumed within the city boundary for residential building, commercial and institutional buildings and facilities, industries and emissions from transmission and distribution losses from grid-supplied energy consumption.

The GHG emission from stationary energy sector is mainly includes Carbon di-oxide (CO_2) gas within all 3 scopes. The scope 1 emissions attributed by the fossil fuel combustion within the city boundary accounted for 2% of the total tCO_2eq emissions from stationary energy sector, scope 2 emissions attributed by electricity consumption accounted 84% followed by the 14% scope 3 emissions from transmission and distribution (T&D) losses.

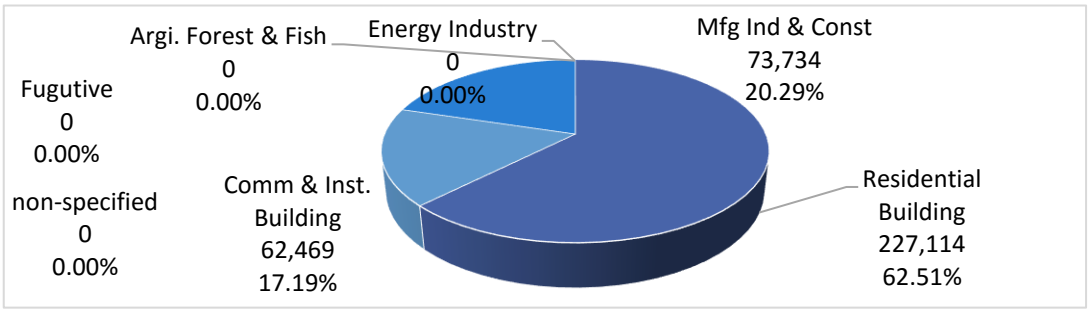


Figure 6 *Stationary Energy GHG Emission Distribution, by Sub-Sectors in 2014*

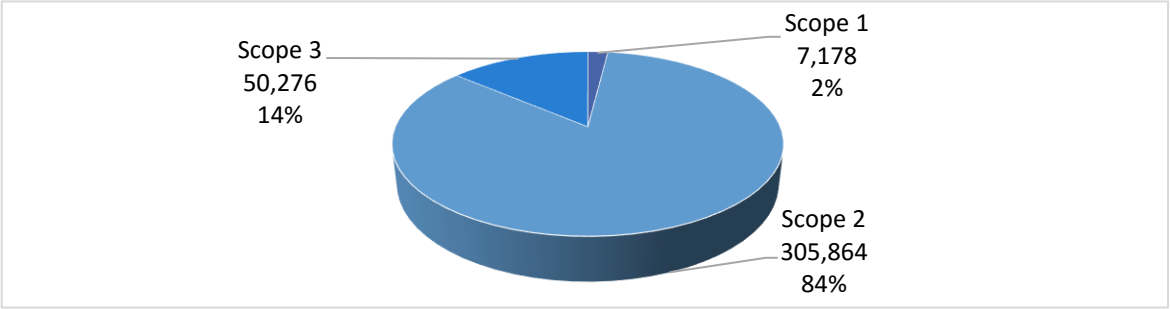


***Figure 7**: Stationary Energy GHG Emission Distribution, by scope in 2014*

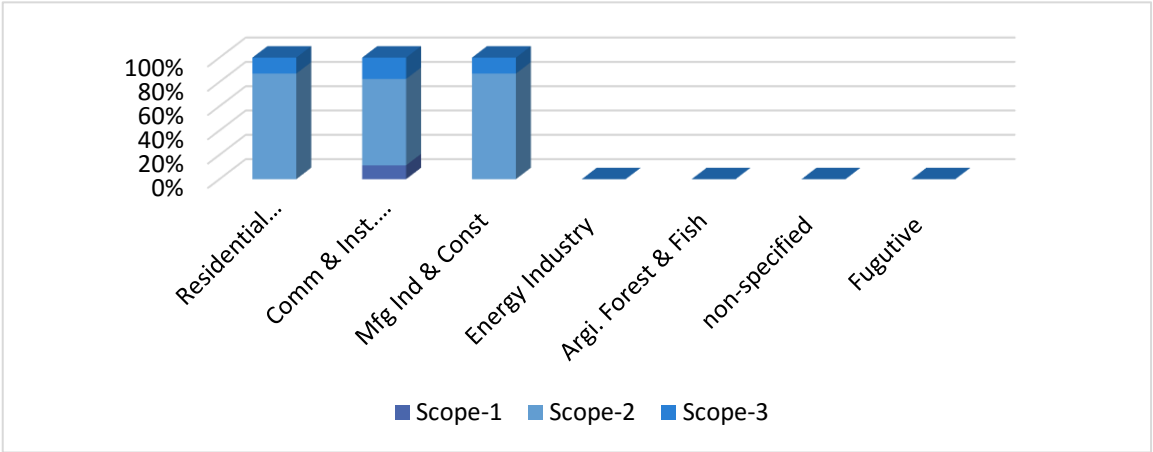


***Figure 8** : Stationary Energy GHG Emission Distribution, by sector and scope in 2014*

2.3.3 Residential Buildings

The residential building sub-sector in 2014 emitted 227,114 tCO2eq, which is 63% of the total GHG emissions from the stationary energy sector, this 227,114 tCO_2eq emission is from LPG used in residential sectors for cooking purpose under Scope 1, grid electricity consumption by residential buildings under Scope 2 and associated grid electricity transmission and distribution losses under Scope3.

Due to unavailability and high uncertainty of data, emissions from other fuels used (i.e. firewood, diesel, pellet, lignite, heating oil) for cooking and heating under scope 1, grid electricity consumption under scope 2 and emissions from T&D losses of grid electricity under Scope-3 for energy industries, Agriculture, forestry and fishing activities and non-specified sources were not estimated under this 2014 year's GHG inventory assessment.

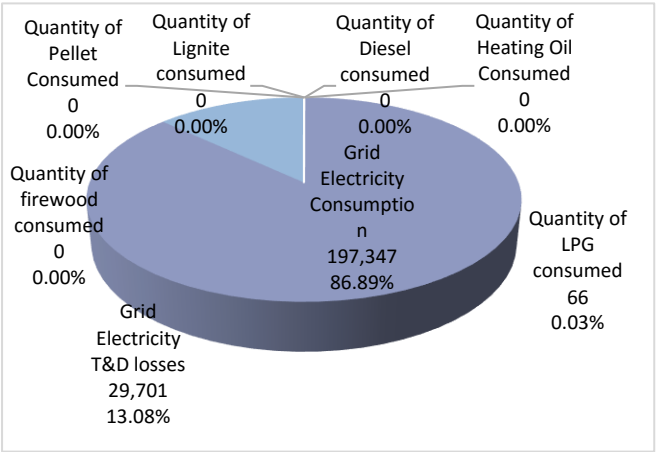


Figure 9: *Residential Building GHG Emission Distribution, by category in 2014*

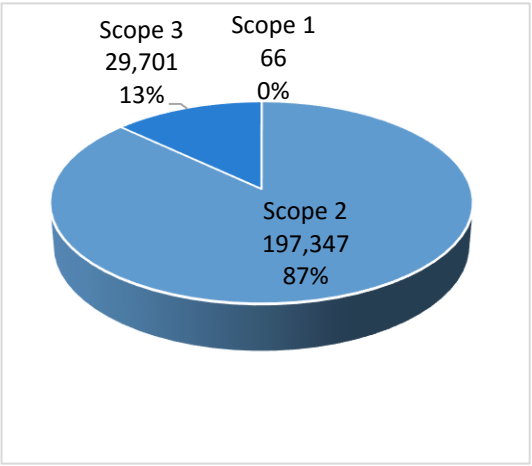


Figure 10*: Residential Building GHG emission distribution, by scope in 2014*

The GHG emission has been estimated for residential building sub-sector includes emissions from energy use in households mainly include emissions from LPG fuel combustion for cooking purpose and grid electricity consumption and its associated T&D losses.

In Prizen City during year 2014, 201.1 million kWh grid electricity was used by the residential buildings with 15% T&D losses and 22.25 Tonnes of LPG was consumed in the Prizen City. LPG is mainly used for cooking purpose followed by electricity and firewood, there is no CNG/PNG gas distribution system and cow dung is nearly zero. LPG is distributed by the authorised gas distributing agency. Firewood is mainly used for house/building heating purpose followed by district heating sources (lignite, heating oil, pellet and diesel) and electricity.

The institution is promoting the use of cleaner fuel for cooking purposes.

In Prizren City, electricity is supplied by the Kosovo Electricity Distribution and Supply Company J.S.C (KEDS) based in Pristina to all the customers (Domestic, non-domestic/commercial, Industrial, Public utility and Agriculture). The distribution grid covers the entire city area and surroundings. The details of the consumers and electricity consumption during the period 2014 are presented in the table below:

Table 9: Electricity Consumers in Prizren City (2014)

Category	Consumers (No)	Electricity Consumption (million kWh)
Domestic	0	201.1
Non-Domestic	0	40.5
Industrial	0	65.3
Public Utilities (Water & Street Lighting)	1903	4.8

Agriculture	0	0

The electricity consumption by the residential buildings accounted as domestic category and monitored and recorded periodically (hourly, daily and monthly). The emissions from transmission and distribution losses from grid-supplied electricity consumption has been calculated from the average annual aggregated technical and commercial (AT&C) losses of electric power transmission and distribution losses in Kosovo for inventory year 2014 which is 15.05% (as per international source Indexmundi for different countries data).

There is no availability of data for electricity generation by different sources/fuels and electricity consumption in Agriculture sub-sector with number of consumers.

2.3.4 Commercial and Institutional Buildings and Facilities

The commercial and institutional buildings and facilities sub-sector in 2014 emitted 62,469 tCO2eq, which is 17% of the total GHG emissions from the stationary energy sector. Of this, 7,111 tCO2eq from fuel combustion for building heating purpose under Scope-1; 44,428 tCO2eq from grid electricity consumption under scope-2, 10,929 tCO2eq from T&D losses of grid electricity under Scope-3 was emitted.

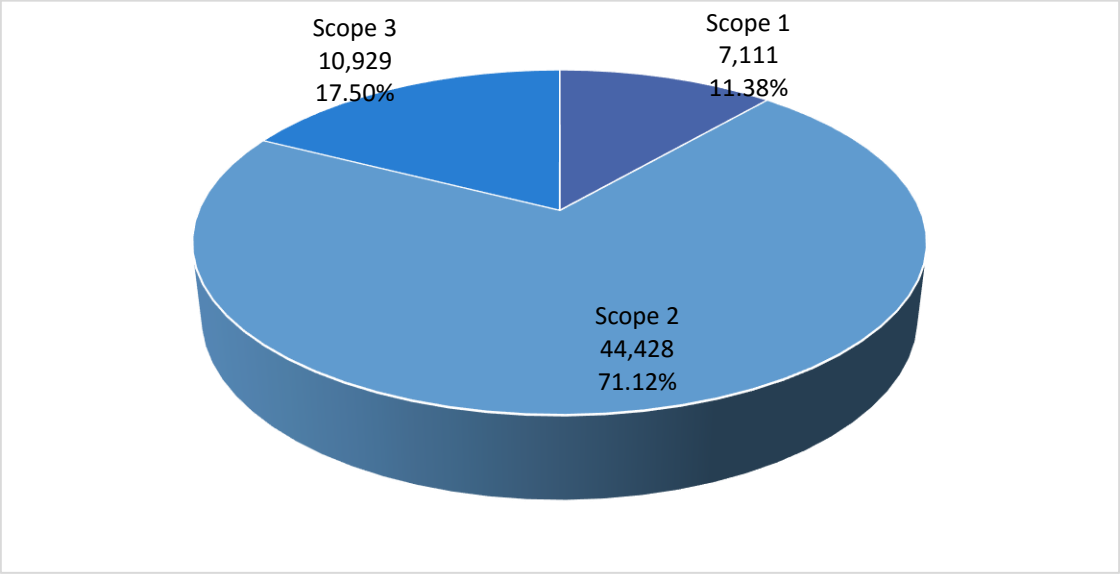


Figure 11: *Commercial and institutional buildings and facilities GHG emission distribution, by category and scope in 2014 (in tCO2eq)*

The emissions from commercial and institutional buildings and facilities sub-sector includes all emissions from energy use (fuel and electricity) in hotels, restaurants, retail outlets, shopping complexes, office buildings; institutional buildings, such as schools, hospitals, police stations, local and central institution offices; and facilities, such as street lighting on highways, secondary roads and pedestrian areas, parking, mass transit, docks, navigation aids, fire and police protection, water supply, waste collection and treatment (including drainage), and public recreation areas.

In Prizren City, the GHG emissions from commercial and institutional buildings and facilities are calculated using top-down approach from fuel consumption and electricity consumption by the non-domestic consumers and public utilities (water works and street light). Firewood, diesel, lignite, heating oil and pellet are fuels used for commercial purposes mainly for heating and other

commercial purpose, further there is no availability of Kerosene, CNG/PNG, Cow dung, Char coal, LPG and any other fuel data for use in commercial and institutional buildings and facilities.

In year 2014, 3570.89 tonnes of firewood, 61.80 tonnes of diesel, 106.95 tonnes of pellet, 132.20 tonnes of heating oil and 2073.57 tonnes of lignite for building heating purpose and 4.823 million units of electricity used by commercial and institutional buildings and facilities mainly for lighting purpose. The other GHG emission inventory parameters such as T&D losses and diesel consumption for electricity generation discussed in the previous section are applicable for this sub-sector as well.

2.3.5 Manufacturing Industries and Construction

The manufacturing industries and construction sub-sector in 2014 emitted 73,734 tCO2eq, which is 20% of the total GHG emissions from the stationary energy sector. 64,089 tCO2eq from grid electricity consumption under scope-2, 9,645 tCO2eq from T&D losses of grid electricity under Scope-3 was emitted; there were no data available for fuel consumption under this sub-sector hence scope 1 is zero.

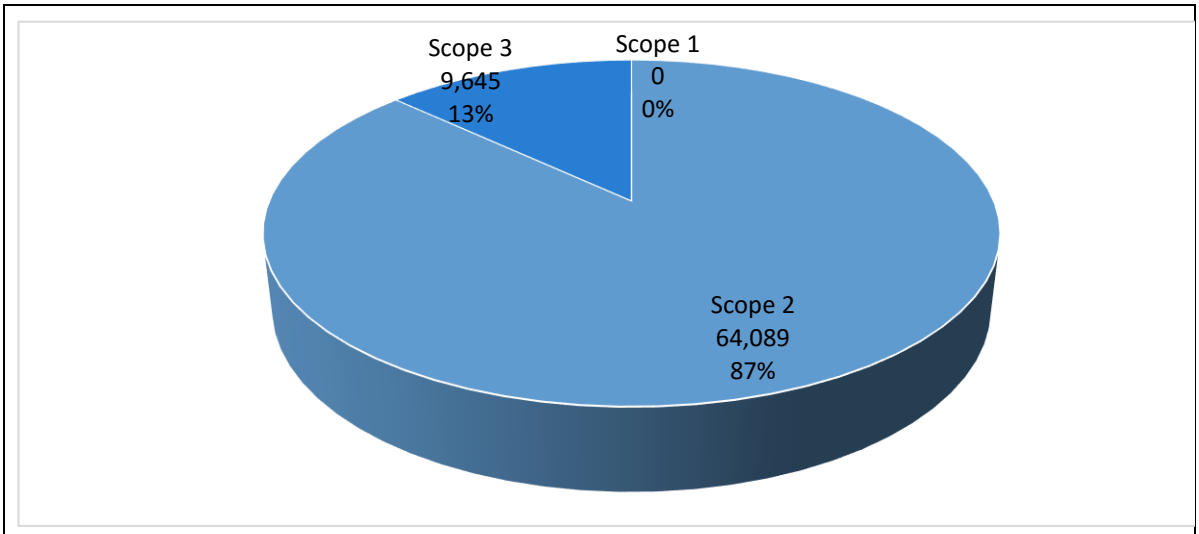


Figure 12: *Manufacturing industries and construction GHG emission distribution, by scope in 2014 (in tCO2eq)*

The GHG emissions from manufacturing industries and construction sector would include emissions from energy use in industrial facilities and construction activities, except those included in energy industries sub-sector. This would also include combustion for the generation of electricity and heat for own use in these industries like fuel combustion occurs in stationary equipment, including boilers, furnaces, burners, turbines, heaters, incinerators, engines, flares, etc.

In Prizren City, data and information are not available on fuel consumption (HSD, FO and LPG etc.). The LPG consumption in manufacturing industries would be mainly for heating purposes and for small industrial application.

2.3.6 Energy Industries

The GHG emissions from energy industries includes all emissions from energy production and energy use in energy industries including the energy used in power plant auxiliary operations within the city boundary, grid-supplied energy consumed in power plant auxiliary operations within the city

boundary and transmission and distribution losses from grid-supplied energy consumption in power plant auxiliary operations.

In Prizren City, there was no energy industry available during the inventory year 2014; hence GHG emissions from this sub-sector are zero.

2.3.7 Agriculture, Forestry and Fishing Activities

The Agriculture, forestry and fishing activities sub-sector GHG emission has not been estimated due to unavailability of data. Hence GHG emissions from this sub-sector are zero.

2.3.8 Non-specified sources

The GHG emissions from non-specified sources includes all remaining emissions from facilities producing or consuming energy not specified elsewhere. In Prizren City GHG inventory for year 2014 included all the sectors and sub-sector using energy (fuel and electricity) in the above sections hence GHG emissions from this sub-sector is zero.

2.3.9 Fugitive Emissions from Fuel

The fugitive emissions includes all intentional and unintentional emissions from the extraction, processing, storage and transport of fuel to the point of final use; mainly from mining, processing, storage, and transportation of coal and all oil and natural gas activities occurring in the city. The primary sources of these emissions may include fugitive equipment leaks, evaporation losses, venting, flaring and accidental releases. In Prizren city, no such activities are occurring hence the fugitive emissions are considered as zero.

2.4 TRANSPORTATION

City transportation systems are designed to move people and goods within and beyond city borders. Transportation sector covers all journeys by road, rail, water and air, including inter-city and transboundary transportation including international travel. Transport vehicles and mobile equipment or machinery produce GHG emissions directly by combusting fuel or indirectly by consuming grid-delivered electricity. Transportation sector GHG emissions are a vital metric that shows the impact of transportation policies (local, regional and national) on infrastructure decisions and mitigation projects over time.

Transport sector are second largest contributors to a city's GHG emissions after stationary energy. Transportation sector has been divided into five sub-sectors are: (1) on-Road Transportation, (2) Railways, (3) Waterborne Navigation, (4) Aviation, (5) off-road transportation. GHG emissions from the transport sector consist of the following:

Table 10: Transportation Sector –Types, Scopes and Emission Sources

Type	Scope	Emission Sources
Emissions from fuel combustion occurring within the city boundary: All GHG emissions from the transport of people and freight occurring within the city boundary.	Scope-1	• **On-road transportation**: including electric and fuel powered cars, taxis, buses, etc. • **Railway:** including trams, urban railway subway systems, regional rail transport,

Emissions from grid-supplied energy consumed within the city boundary: All GHG emissions from the generation of grid-supplied electricity used for electric-powered vehicles.	Scope-2	national and international rail systems, etc. • **Waterborne navigation:** including sightseeing ferries, domestic inter-city vehicles, or international water–borne vehicles. • **Aviation:** including helicopters, domestic inter-city flights, and international flights, etc. • **Off-Road Transportation:** including airport ground support equipment, agricultural tractors, chain saws, forklifts, snowmobiles, etc.
Emissions from portion of transboundary journeys occurring outside the city boundary: The out-of-city portion of all transboundary GHG emissions from trips that either originate or terminate within the city boundaries.	Scope-3	

2.4.1 Methodology, Activity Data, and Emission Factors

The GPC does not prescribe a specific methodology for calculating transportation sector emissions due to variations in data availability, existing multiple transportation models, and variability of purposes. Further, collecting accurate data for transportation activities, calculating specific emissions for different modes and allocating these emissions to scopes are particularly challenging process, hence to accommodate variations in data availability, existing transportation models, and inventory purposes, the GPC offers flexibility in calculating emissions from transportation.

Different methodology and activity data is used for GHG emission calculation from each sub-sector i.e. on-Road Transportation, Railways, Waterborne Navigation, Aviation, off-road transportation. Top-down and bottom-up approaches are used as per the availability for activity data and suitability of emission factor. The approach used for each sub-sector and scope wise GHG emission for a city discussed in the transportation sector GHG emission overview section.

Activity data for each sub-sector are obtained from the different local and central institution departments and public/private sector. The fuel emission factors from IPCC and UNFCCC are used in estimating the GHG emissions from the combustion of fossil fuels. The grid emission factor is used for calculation GHG emissions from electricity consumption/use.

2.4.2 Overview of GHG Emissions from Transportation Sector

The transportation sector GHG emission has not been estimated due to unavailability of data and high data uncertainty. Hence GHG emissions from this sector are zero. However here we have explained the approach for estimation of GHG emission from Transport sector. The transportation sector summarised:

Table 11: Transportation Sector GHG Emissions Source (Sub-sector)

Scope	Transportation Sector GHG Emissions Source (Sub-sector)	GHG Emissions (tCO_2e)
TRANS PORTATION		
On-road transportation		**Not estimated**
1	**Emissions from fuel combustion on-road transportation occurring within the city boundary**	
2	**Emissions from grid-supplied energy consumed within the city**	

	boundary for on-road transportation	
3	**Emissions from portion of transboundary journeys occurring outside the city boundary, and transmission and distribution losses from grid-supplied energy consumption**	
Railways		**Not applicable**
1	**Emissions from fuel combustion for railway transportation occurring within the city boundary**	
2	**Emissions from grid-supplied energy consumed within the city boundary for railways**	
3	**Emissions from portion of transboundary journeys occurring outside the city boundary, and transmission and distribution losses from grid-supplied energy consumption**	
Waterborne navigation		**Not applicable**
1	**Emissions from fuel combustion for waterborne navigation occurring within the city boundary**	
2	**Emissions from grid-supplied energy consumed within the city boundary for waterborne navigation**	
3	**Emissions from portion of transboundary journeys occurring outside the city boundary, and transmission and distribution losses from grid-supplied energy consumption**	
Aviation		**Not applicable**
1	**Emissions from fuel combustion for aviation occurring within the city boundary**	
2	**Emissions from grid-supplied energy consumed within the city boundary for aviation**	
3	**Emissions from portion of transboundary journeys occurring outside the city boundary, and transmission and distribution losses from grid-supplied energy consumption**	
Off-road transportation		**Not estimated**
1	**Emissions from fuel combustion for off-road transportation occurring within the city boundary**	
2	**Emissions from grid-supplied energy consumed within the city boundary for off-road transportation**	

The GHG emission from transportation sector is mainly includes Carbon di-oxide (CO_2) gas within all 3 scopes. The scope 1 emissions attribute by the fossil fuel combustion within the city boundary accounted, scope 2 emissions attribute by electricity consumption for transportation sector and scope 3 emissions from transboundary journeys occurring outside the city from transportation sector.

Not estimated	
Figure 13: *Transportation Sector GHG Emission Distribution, by Sub-Sector in 2014*	
Not estimated	*Not estimated*
Figure 14: *Transportation Sector GHG Emission Distribution, by scope in 2014*	***Figure 15:*** *Transportation Sector GHG Emission Distribution, by sector and scope in 2014*

2.4.3 On-road Transportation

The on-road transportation sub-sector GHG emission has not been estimated due to unavailability of data. Under this sub-sector emission comes from fuel combustion by on-road transportation

occurring within the city boundary under Scope-1 and transboundary journeys occurring outside the city boundary, under scope-3. There was no emission from grid-supplied energy consumed within the city boundary for on-road transportation, under scope-2.

Not estimated	*Not estimated*
***Figure 16**: On-Road Transportation GHG Emission Distribution, by category in 2014*	***Figure 17:** On-Road Transportation GHG emission distribution, by scope in 2014*

The sub-category of on-road transportation sector contributes to GHG emissions for Prizren City is presented in the table below:

Table 12: On-Road Transportation Sub-category

Scope	Type	Remarks
Scope-1	Emissions from fuel combustion on-road transportation occurring within the city boundary	Emission from Petrol and Diesel sold in Prizren City, but no activity data is available.
Scope-2	Emissions from grid-supplied energy consumed within the city boundary for on-road transportation	No electricity used for on-road transportation in Prizren City
Scope-3	Emissions from portion of transboundary journeys occurring outside the city boundary	Emission from public transportation Buses originates from Prizren, but no activity data is available.

Fuel sales method is applied to calculate scope-1 or on-road transportation emissions within the city boundary, based on the total fuel sold within the city boundary. The activity data on the volume of fuel sold within the city boundary is obtained from the coordinator of the petroleum companies. The road transport sector is the largest consumer of commercial fuel energy within the transportation system in Prizren City. Road transport is characterized by heterogeneous petrol-fuelled light vehicles and diesel-fuelled heavier vehicles. The distribution of petrol and diesel use in the road transport sector is shown in Table and based on the consumption of fuel the road transport sector GHG emissions can be estimated.

Table 13: Fuel Sold in Prizren City for Transportation in Year 2014 (in Metric Tonnes)

Transportation Fuel Consumption -2014			
Fuel Type	**Petrol**		**Diesel**
	Retail	**Direct**	**Retail**
Company A			
Company B			
Company C			
Total for Prizren City			

The grid-supplied electricity has not been used for the on-road transportation in Prizren City (since there are no electric vehicles operational in the city; however the e-vehicles ownership is increasing for private and public transportation in other European Cities, hence for future preparedness we should also focus on this level of data). Hence the scope-2 emissions from on-road transportation in Prizren is considered zero.

Induced activity method is applied to calculate the scop-3 or transboundary on-road transportation emissions. This method seeks to quantify transportation emissions induced by the city, including trips that begin, end, or are fully contained within the city (usually excluding pass-through trips). The method relies on model to assess the number and length of all on-road trips occurring. This yields a vehicle kilometers travelled (VKT) from the origin and destination of each trip for each identified vehicle. It also requires information on vehicle fuel intensity (or efficiency) and fuel emission factors. For simplicity, 100% of the only departing on-road trips can be accounted.

To estimate the scope-3 emissions from portion of transboundary journeys occurring outside the city boundary, the activity data is number and frequency of public transportation 'bus'/vehicle operating from the Prizren city to various destination, can be obtained from the MIS of the Transport Department. This yields a vehicle kilometers travelled (VKT) by the buses from Prizren to destination for each trip and annually. The vehicle fuel intensity (or Mileage) is obtained from the transport or the concern department, desk research and stakeholder discussion however mileage depends on multiple parameters.

The transportation sector has been subjected to emission norms In European Countries, started adopting European emission norms and implemented fuel regulations for vehicles.; which cover the norms for CO, oxides of nitrogen (NOx), non-methane volatile organic compounds (NMVOC), hydrocarbon, and particulate matter. However, over the period of time the vehicular emission is increasing rapidly due to multiple factor including growth in economy, purchase power and change in transportation models. Urban transportation has become a challenge for Cities and solution lies in adopting multiple transportation system and futuristic design of on-road urban transportation system and adoption of new innovative low carbon/GHG emitting technologies.

2.4.4 Railways

There are no Railways in the Prizren City. Hence this is not applicable for this GHG Inventory of Prizren city. However for understanding purpose we have briefly explained this sub-sector here. GHG emissions incur during the length of railway transit within the city boundary for railway lines that have stops in the city boundary under Scope-1 and portion of transboundary journeys occurring outside the city boundary under Scope-3. Emissions from grid-supplied energy consumed within the city boundary for railway, under scope-2 (since railway traction electricity is not provided by the city electricity distribution system).

The GHG emissions from railways include emissions from use of energy through combustion of fuels or electricity (electric traction) to transport people and goods. The rail transit is further divided into four sub-categories viz urban train/subway systems, regional commuter rail transport, national rail system and international rail systems, for passenger or freight. The sub-category of railways contributes to GHG emissions from a City are summarised in the table below:

Table 14: On-Road Transportation Sub-category

Scope	Type	Remarks
Scope-1	Emissions from fuel combustion for railway transportation occurring within the city boundary	Emission incurred during the length of railway transit within the city boundary for trains those have stops in the city boundary i.e. no. of trains per day.
Scope-2	Emissions from grid-supplied energy consumed within the city boundary for railways	Nil, since electricity to railway is not provided by the city electricity distribution system.
Scope-3	Emissions from portion of transboundary journeys occurring outside the city boundary	Emission from no. of trains originating from the city to different cities. The entire distance covered by the originating train is used for conservative estimation.

2.4.5 Waterborne Navigation

Prizren City does not have waterborne navigation transportation system; hence emission from this sub-sector has not been calculated. However, Prizren (river) attracts tourists due to its scenic beauty. The fuel consumption for these activities is included in fuel (petrol and Diesel) consumption within the city boundary. Hence, the emission from waterborne navigation are included elsewhere and considered zero. Further, no grid electricity consumed for waterborne navigation.

2.4.6 Aviation

There is no aviation activity in the Prizren city, hence the GHG emissions from this sub-sector has not been estimated. However for understanding purpose we briefly explained the sub-sector. GHG emission from civil aviation, or air travel, includes emissions from airborne trips occurring within the geographic boundary and emissions from flights departing airports that serve the city. Airports located within a city, or under local jurisdiction, typically service the greater region in which the city exists. These complexities make it challenging to properly account for and attribute aviation emissions. Hence for simplicity, scope 3 includes all emissions from departing flights. Cities may report just the portion of scope 3 aviation emissions produced by travellers departing the city, in line with the origin and destination model described with the induced activity method. Further, as per IPCC international air travel shall not be included hence only domestic departure flights from the city airport is considered.

The total GHG emissions from aviation sector for a City accounts under scope-3, mainly contributed by GHG emissions from portion of transboundary journeys occurring outside the city boundary. Scope-1 (emissions from fuel combustion for aviation occurring within the city boundary) and scop-2 (emissions from grid-supplied energy consumed within the city boundary for aviation) emissions from aviation sector. The type of aviation sub-sector GHG emissions from a City are summarised in the table below:

Table 15: Aviation Sub-category

Scope	Type	Remarks
Scope-1	Emissions from fuel combustion for aviation occurring within the city boundary	Nil, since no aviation activity within city boundary in Prizren.
Scope-2	Emissions from grid-supplied energy consumed within the city boundary for aviation	Nil, since grid supplied electricity is not used for aviation activity.
Scope-3	Emissions from portion of transboundary journeys occurring outside the city boundary	Nil, since no flights departing and no of passenger travelled from the city to different cities.

The International Civil Aviation Organization (ICAO) Carbon Emissions calculator can be used for GHG emission from transboundary aviation. ICAO carbon emissions calculator methodology employs a distance-based approach (distance from airports of origin and destination airport) to estimate an individual's aviation emissions using data currently available on a range of aircraft types.

The ICAO methodology has been designed to require a minimum amount of input information from the user regarding the particulars of the flight concerned. It employs industry averages for the various factors which contribute to the calculation of the emissions associated with the individual passenger's air travel. As passengers' aviation emissions are affected by continuously changing variables specific to each flight, it is necessary to develop average factors to account for the effect of these flight parameters. The ICAO Carbon Emission Calculator requires that the airports of origin and destination for a direct through flight (i.e. a flight which does not have a change of the flight number). This is then compared with the published scheduled flights to obtain the aircraft types used to serve the two airports concerned and the number of departures per aircraft. Each aircraft is then mapped into one of the fifty equivalent aircraft types in order to calculate the fuel consumption for the trip based on the great circle distance between the airports involved in the journey. The passenger load factors, and passenger to cargo ratios, obtained from traffic and operational data collected by ICAO, are then applied to obtain the proportion of total fuel used which can be attributed to the passengers carried. The system then calculates the average fuel consumption for the journey weighted by the frequency of departure of each equivalent aircraft type. This is then divided by the total number of economy class equivalent passengers, giving an average fuel burn per economy class passenger. The result is then multiplied by 3.16 in order to obtain the amount of CO_2 emissions attributed to each passenger travelling between those two airports.

In a City, portion of transboundary journeys occurring outside the city boundary are summarised in the following table:

Table 16: Transboundary Journey Aviation Emissions

Aviation transboundary journeys					
From	**Destination**	**Distance (km)**	**kg CO2 Emission/ Passenger**	**Passenger**	**tonnes of CO2 emissions**

2.4.7 Off-road transportation

There is not data and information available for this sub-sector activity, hence GHG emissions for this sub-sector activity has not been estimated.

The off-road transportation emissions are not calculated separately for the City. The information on fuel and electricity consumption by Off-road vehicles are not available. However; the fuel consumption by off-road vehicles is included in fuel (petrol and Diesel) consumption within the city boundary. Hence, the emission from Off-road vehicles are included elsewhere and considered zero. Further, no grid electricity consumed for Off-road vehicles.

2.5 Waste Sector

Cities produce solid waste and wastewater (together referred to collectively as "waste") that may be disposed of and/or treated at facilities inside the city boundary, or transported to other cities for treatment. Waste disposal and treatment produces GHG emissions through aerobic or anaerobic decomposition, or incineration. The waste sector includes the GHG emission estimates from the two categories: Solid waste disposal and Waste water handling and broadly classified in to two parts waste generated in the city and waste generated outside city. The GHG (CO_2, CH_4, and N_2O) emission accounted for the waste management activities (1) Solid waste[5] disposal in landfills or dump sites, including disposal in an unmanaged site, disposal in a managed dump or disposal in a sanitary landfill, (2) Biological treatment of solid waste, (3) Incineration and open burning of waste and (4) Wastewater treatment and discharge. The GHG emissions from waste and wastewater consist of following:

Table 17: Waste Sector –Types, Scopes and Emission Sources

Type	Scope	Emission Source
Emissions from waste treated inside the city	Scope-1	• All GHG emissions from treatment and disposal of waste within the city boundary regardless whether the waste is generated within or outside the city boundary.
Emissions from the use of	Scope-2	• Not applicable (shall be accounted under)

[5] *Municipal solid waste (MSW) only, Industrial waste, Clinical waste, Hazardous waste or any other waste not considered for this GHG Inventory*

grid- electricity for waste treatment		Stationary Energy - commercial and institutional buildings and facilities
Emissions from waste generated by the city but treated outside the city	Scope-3	• All GHG emissions from treatment of waste generated by the city but treated at a facility outside the city boundary.

2.5.1 Methodology, Activity Data, and Emission Factors

The GPC along with IPCC Revised Guidelines were adopted for estimating the emissions from the above categories. The quantification of GHG emissions from solid waste disposal and treatment is determined by two main factors: the mass of waste disposed and the amount of degradable organic carbon (DOC) within the waste, which determines the methane generation potential.

The quantity (mass) of waste generated by the city during the inventory year, type/method of waste treatment and solid waste disposed in landfills/open dumps are obtained from municipalities. Alternatively, national default values for waste generation rates based upon a tonnes/capita/year basis and default breakdowns of fraction of waste disposed in landfills (SWDS), incinerated, composted (biological treatment), and unspecified (landfill methodology applies here). The emission factors from IPCC have been used.

Methane emissions from landfills continue several decades after waste disposal. Waste disposed in a given year thereby contributes to GHG emissions in that year and in subsequent years. Likewise, methane emissions released from a landfill in any given year include emissions from waste disposed that year, as well as from waste disposed in prior years. The First order of decay (FOD) method has been used for estimating methane emissions from solid waste disposal.

First order of decay (FOD) assigns landfill emissions based on emissions during that year. It counts GHGs actually emitted that year, regardless of when the waste was disposed. The FOD model assumes that the degradable organic component (DOC) in waste decays slowly over a few decades, during which CH_4 and CO_2 are released. If conditions are constant, the rate of CH_4 production depends solely on the amount of carbon remaining in the waste. As a result, CH_4 emissions are highest in the first few years after waste is initially deposited in a disposal site, then gradually decline as the degradable carbon in the waste is consumed by the bacteria responsible for the decay. FOD model requires historical waste disposal information that is not readily available. Hence to reduce complexity of this model, and based on availability of data single phase model based on bulk waste (solid waste) generated during inventory year used for GHG emission calculation.

2.5.2 Overview of GHG Emissions from Waste Sector

The waste sector in 2014 emitted 46,139 tCO_2eq which was 4.52% of the total GHG emissions from Prizren City. Of the total GHG emissions from the waste sector, Scope 1 emissions from solid waste disposal are 42,883 tCO_2eq (93%), and from waste water disposal are 3,256 tCO_2e (7%). There are no Scope 2 and scope 3 emissions from waste sector. The summary of waste sector GHG emission presented below:

Table 18: Waste Sector GHG Emissions Source (Sub-sector)

Sub-Sectors	Scope	Source of Emissions	Total CO_2e
Solid waste	Scope 1	Emissions from solid waste generated within the city	42,883

disposal		boundary and disposed in landfills or open dumps within the city boundary	
	Scope 3	Emissions from solid waste generated within the city boundary but disposed in landfills or open dumps outside the city boundary	0
	Scope 1	Emissions from waste generated outside the city boundary and disposed in landfills or open dumps within the city boundary	0
Biological treatment of waste	Scope 1	Emissions from solid waste generated within the city boundary that is treated biologically within the city boundary	0
	Scope 3	Emissions from solid waste generated within the city boundary but treated biologically outside of the city boundary	0
	Scope 1	Emissions from waste generated outside the city boundary but treated biologically within the city boundary	0
Incineration and open burning	Scope 1	Emissions from solid waste generated and treated within the city boundary	0
	Scope 3	Emissions from solid waste generated within the city boundary but treated outside of the city boundary	0
	Scope 1	Emissions from waste generated outside the city boundary but treated within the city boundary	0
Wastewater treatment and discharge	Scope 1	Emissions from wastewater generated and treated within the city boundary	3,256
	Scope 3	Emissions from wastewater generated within the city boundary but treated outside of the city boundary	0
	Scope 1	Emissions from wastewater generated outside the city boundary but treated within the city boundary	0

The GHG emissions from waste sector is mainly includes CH_4 and N_2O gas within all scope 1 emissions from solid waste and waste water disposal. The scope 1 emissions from solid waste and waste water disposal attributed by the waste generated within the city boundary that is treated/disposed within the city boundary. The total CH_4 emission from solid waste disposal was 1,532 ton and CH_4 and N_2O emission from waste water sector was 37 and 8 tonnes respectively.

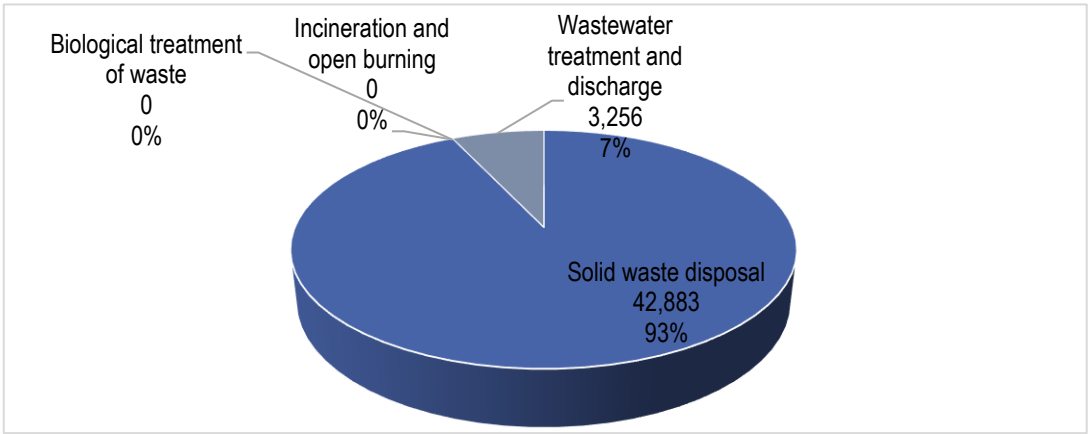


Figure 18: *Waste Sector GHG Emission Distribution, by Sub-Sector in 2014*

Table 19: Greenhouse gas emissions from the waste sector in 2014 (expressed in tonnes)

	CO_2	CH_4	N_2O	CO_2 eq.
Solid waste disposal	0	1,532	0	42,883
Biological treatment of waste	0	0	0	0
Incineration and open burning	0	0	0	0
Wastewater treatment and discharge	0	37	8	3,256
Total Waste	**0**	**1,568**	**8**	**46,139**

2.5.3 Solid Waste Disposal

The solid waste sub-sector in 2014 was the largest emission source of CH_4 emissions and emitted 1,532 tCH_4 i.e. 42,883 tCO_2eq, which is 93% of the total GHG emissions from the waste sector. As discussed above the entire emission from solid waste comes under scop-1 emissions i.e. from solid waste generated within the city boundary and disposed in landfills or open dumps within the city boundary.

In Prizren City, systematic collection, transportation, disposal and monitoring of waste is not carried out like most of the European cities. This inability of Prizren Municipality is also similar to most of the Kosovo Urban Local Bodies (ULBs), mainly due to lack of adequate capacity, institutional, financial constraints and absence of skilled resources. However, Prizren Municipal Corporation has taken various initiatives to scientific disposal and monitoring of waste collection, handling and disposal; a Master Plan for Solid Waste Management of Municipality of Prizren 2014 - 2023 was prepared in year 2015. This master plan has been used as basis for data for solid waste GHG emission calculations. However data has been scaled up as per the scaling methodology prescribed in the GPC.

In 2014, the total waste generation from Prizren City is about 128.2 MT/day (46,793 MT/for year 2014). The waste collection in the city is the responsibility of the Prizren Municipality. The Prizren Municipality along with Ekoregjioni Regional Waste Company (ERWC) and three private companies has initiated door to door collection in all the wards of the city. The waste transportation is carried out by ERWC using its own fleet of vehicles. The waste is collected from the wards and disposed-off at the Landovica disposal site.

In the Landovica Landfill there is no separating, composting or controlled incineration in closed areas. The only methodology is - waste collection is brought to the landfill and then waste is crushed or pressured if a certain height level is reached. After the waste is crushed to maintain a certain level, soil is applied on top. Bones are not allowed in the Landovica Landfill, and if waste transportation trucks are found to have bones in them, they get sent back to the Zhur Landfill. The waste from the regional hospital of Prizren is treated on the site using the adequate methodology and equipment for such hazardous waste. After that waste is processed, ERWC picks up the waste.

At present, there are no waste processing technologies available in Prizren. The waste is being dumped at the Landovica dumpsite in an unscientific manner. The dumpsite has been in operation since 2004 with total 61.775 acres of land. The existing landfill site is now proximal to urban developed areas of Prizren. The solid waste data used for GHG emission from Prizren city presented in the table below:

Table 20: Solid Waste Data for Prizren City

Parameter	Unit	Value
Waste generated outside of the city boundary and treated within the boundary	Ton/day	0
Waste generated and treated within the city's boundary (Year 2014)	Ton/day	128.2
Waste collected within the city's boundary (Year 2014)	Ton/day	112.18
Waste generation Projection for Year 2023	Ton/day	157
Waste generated inside the boundary and treated outside of the boundary	Ton/day	0
Solid waste generated in the city disposed in landfills or open dumps year 2014	Ton/year	40,943.88
Solid waste generated outside the city disposed in landfills or open dumps	Ton	0.00
Solid waste generated in the city that is treated biologically	Ton	0.00
Solid waste generated outside the city that is treated biologically	Ton	0.00
Solid waste generated in the city incinerated or burned in the open	Ton	0.00
Solid waste generated outside the city incinerated or burned in the open	Ton	0.00

The poor solid waste management practices lead to the release of CH_4. CH_4 is produced and released into the atmosphere as a by-product of the anaerobic decomposition of solid waste, whereby methanogenic bacteria break down organic matter in the waste. The FOD method assumes that carbon in waste decays to produce CH_4 and CO_2. This means that emission of CH_4 from waste deposited in a disposal site is higher in the first few years after deposition and then gradually declines as the degradable carbon is used up. It is assumed that in 50 years, CH_4 emission comes down to insignificant level. However, in the absence of data, this model is applied for the inventory year only.

For the estimation of GHG emission from solid waste disposal in landfill site, MCF for uncategorised disposal site is taken to be 0.6. Oxidation factor (OX) for unmanaged and uncategorized solid waste disposal is assumed to be 0. Methane generation rate constant (k) is taken as 11, Fraction of CH_4 in generated landfill gas (F) is taken to be 0.5, and no CH_4 recovery is assumed. Fraction of DOC that that is ultimately degraded (DOCf) is taken to be 0.6. The Degradable organic carbon in year of deposition, fraction (0.1559 tonnes C/tonnes waste) and Methane generation potential (Lo, 0.0374064) was calculated to obtain the total CH_4 emissions (in tonnes) from waste disposal. Based on these assumptions, and using the first order decay method as given in the IPCC 2006 Guidelines for this sector, the total GHG emissions from this sector is estimated to be 1,532 tCO2eq.

Prizren Municipality has taken various initiatives to scientifically manage the municipal solid waste.

There are few spots where people can dispose their plastic bottles. Around 300 waste bins (120 litres) have been distributed in households. Also, 1200 households have been supplied with composting bins for organic waste. This is expected to increase to 4000 containers by 2023. The municipality officials have also distributed leaflets and CDs with instructions on how to use them. Some private businesses use waste separation (possibly cans and paper) with their own channels, however, the municipality has no info or data on this.

No, incineration of solid waste in open areas is prohibited by law. That is applicable for the relevant waste management companies as well.

The Municipality of Prizren has initiated the composting practice at the household level. They have distributed 1,200 household composter bins and they plan to distribute 4,000 household compost bins by 2023 under this initiative. By 2023, they predict that 1,916 tons/year of organic waste will be composted through this project. However, they predict that by 2023 the total Municipal Solid Waste will be 57,307 tons/year, wherein 45% or 27,788.15 tons is organic waste. Therefore, the project that might result in 1,916 tons/year composted organic waste will account for only 7.42% of the future total organic waste.

2.5.4 Biological Treatment of Waste

"Not Occurring" - In Prizren City, solid waste was not treated biologically, hence GHG emission under this sub-sector is considered zero for inventory year 2014.

2.5.5 Incineration and Open Burning

"Not Occurring" - In Prizren City, solid waste was not incinerated and open burned, hence GHG emission under this sub-sector is considered zero for inventory year 2014.

2.5.6 Waste Water (Treatment and Discharge)

The waste water sector in Prizren city during 2014 emitted 36.76 tCH_4 and 8.40 tN_2O i.e. total 3,256 tCO_2eq, which is 7% of the total GHG emissions from the waste sector. As discussed above the entire emission from wastewater comes under scop-1 emissions i.e. from wastewater generated and treated within the city boundary.

Waste water originates from a variety of domestic, commercial, and industrial sources, and may be treated on site (uncollected), sewer to a centralized plant (collected) or disposed of untreated in nearby areas or via an outfall. However, there are no major industries in Prizren city. Hence, wastewater generated from Prizren city comes under domestic category. Waste water becomes a source of CH_4 when treated or disposed of anaerobically. It can also be a source of N_2O emissions due to the protein content in the domestically generated waste water; while CO_2 from wastewater treatment is considered to be of biogenic origin and not estimated and reported.

Systematic collection treatment and disposal of wastewater is a challenge for most of the cities including Prizren. Further, there is no regular monitoring system available for the wastewater generated and discharged, in the absence of the recorded data the GHG emission calculate from waste water sector is based on the Master Plan for Solid Waste Management of Municipality of Prizren 2014 – 2023 and discussion with officials of municipal corporation.

The Prizren Municipal Development Plan 2025 (PMDP) informs that:

- The overall surface covered with water supply system is 13.5 km2 and the average consumption of water per capita per day is 150 L (Prizren Municipal Profile, 2007). Most of the existing network is

older than 40 years and there is an ongoing work for development and improvement of the sewage and water system.

Although water resources of the municipality are rich and adequate with the melting of snow especially in spring, the amount of the water decreases in summer and autumn. 60% of the municipality is settled in lower parts where water supply is based on gravitation. 40% of the areas need to get water via water pumps which is problematic because of the power cut.

The regional water company, K.R.U "Hidroregjioni Jugor" Sh.A, manages water and sewage in most areas. The water quality control is conducted on daily basis by National Hygienic Institute. With the installation of two chlorination stations near water wells, the quality of water has improved over past years.

- The existing sewage network is 136,493 km according to the Prizren Municipal Profile dated 2007 and covers most areas of Prizren municipality. Many projects have been implemented after the war in terms of construction of sewage system to build appropriate facilities in order to protect rivers from pollution. But still, it is one of the main problems that the sewage is discharged into rivers and in some parts directly to open space without purification.

According to the data obtained from PMDP's field survey and interview with the village leader, the villages with properly working sewage networks are Atmaxha and Krusha e Vogel. They are connected to the main network without any discharge to nature. Mamusha, Zojzi and Zhuri villages have precipitation system before discharging.

In Inventory year 2014 the population of 183,595 was generating about 46.58 MLD of waste water, for which the total of 136,493 km sewerage network system. There are no STP systems in the city but Prizren is establishing its first STP, which will have initial capacity to treat wastewater from 50,000 households. This is expected to be functional by end of 2019 or start of 2020.

However, municipal authority informed that presently total wastewater generation is about 17 million m3 / year (including both domestic and discharge from industrial area). Waste water is discharged in rivers such as Lumbardh and Drini i Bardhe.

The anthropogenic pressure and inflow of raw sewage in these rivers have made the river water quality to deteriorated condition. There is need to monitors the BOD/COD of these water bodies on periodic intervals. In the absence of any wastewater treatment plant the entire waste water generated from the Prizren City has been considered for GHG emissions. The waste water data used for GHG emission from Bhopal city presented in the table below:

Table 21: Waste Water Data

Data/Parameters	Unit	Value
Total Waste Water generated from City	MLD	46.58
Total Waste Water generated outside the City	MLD	0

Wastewater and sewage treatment (STPs)	MLD	0
Wastewater's source		Domestic
Wastewater's organic content	BOD/COD	60/150
Wastewater treated from other cities within the city's boundaries	MLD	0

For the estimation of GHG emission from wastewater treatment and disposal, City-specific per capita BOD in inventory year taken as 60 g/person/day, Correction factor for additional industrial BOD discharged into sewers (I) taken 1.25, Default value 0.6 kg CH_4/kg BOD taken for Maximum CH_4 producing capacity, MCF for untreated system - Sea, river and lake discharge is taken to be 0.1. Annual per capita protein consumption is taken to be 20.81 kg/person/year. Based on these assumptions, and using GPC method as given in the IPCC 2006 Guidelines for this sector, the CH_4 and N_2O emissions are calculated as 36.76 tCH_4 and 8.40 tN_2O i.e. total 3,256.15 tCO_2eq.

The Prizren Municipality is planning to develop, improve and increase the collection and treatment capacities of the sewerage facilities as a long term measure to cover the entire population within a planning horizon till 2023 AD.

2.6 Industrial Process And Other Product Use (IPPU)

Cities also houses non-energy related industrial activities and consume products. Hence, GHG emissions are produced from a wide variety of non-energy related industrial activities and emissions are releases from industrial processes that chemically or physically transform materials. In addition, certain products used by industry and end-consumers, such as refrigerants, foams or aerosol cans, also contain GHGs which can be released during use and disposal.

In Prizren City, during 2014 there was no specified industrial activity took place. Hence there was no emission from industrial processes occurring within the city boundary. Further, no information available on the GHG emitting product use, further in the absence of any major industry and industrial consumers the product use emissions are considered as Zero.

2.7 Agriculture, Forestry and Other Land Use (AFOLU)

Emissions from the Agriculture, Forestry and Other Land Use (AFOLU) sector are produced through a variety of pathways, including livestock (enteric fermentation and manure management), land use and land use change (e.g., forested land being cleared for cropland or settlements), and aggregate sources and non-CO_2 emission sources on land (e.g., fertilizer application and rice cultivation). Given the highly variable nature of land-use and agricultural activity across geographies, GHG emissions from AFOLU are amongst the most complex categories for GHG accounting. GHG emissions category and type are presented in the following table:

Table 22: AFOLU Sector GHG Emission Sector, Scope and Category

Type	Scope	Emission Source
In-boundary emissions from agricultural activity, land use and land use change within the city boundary	Scope-1	• Emissions from livestock within the city boundary • Emissions from land within the city boundary • Emissions from aggregate sources and non-CO_2 emission sources on land within the city boundary
Emissions from use of grid-supplied energy in buildings and vehicles in farms or other agricultural areas	Scope-2	• Not Applicable, since reported under stationary energy
Other out-of-boundary emissions	Scope-3	• Not Applicable, since emissions from land-use activities outside the city (not includes in GPC)

2.7.1 Methodology, Activity Data, and Emission Factors

The GPC along with IPCC Revised Guidelines were adopted for estimating the emissions from the above categories. AFOLU are amongst the most complex categories for GHG accounting, since the AFOLU sector data is highly variable nature mainly of land-use and agricultural emissions across geographies. The IPCC guidelines divides AFOLU activities into three categories: (1) Livestock, (2) Land, and (3) Aggregate sources and non-CO2 emissions sources on land.

Multiple methodologies are available to quantify AFOLU emissions. GPC and IPCC also provides the guidance like IPCC Tier 1 methodologies, involve using default IPCC data, while Tier 2 methodologies involve using country-specific data. The AFOLU emission in this GHG inventory uses the city and country-specific data (wherever available), and if not, default IPCC data has been used.

2.7.2 Overview of GHG Emissions from AFOLU Sector

The Agriculture, Forestry and Other Land Use (AFOLU) sector in 2014 emitted 961,364 tCO_2eq, which was 94.20% of the total GHG emissions from Prizren City. Of the total GHG emissions from the AFOLU sector, entire emission comes under scope 1, there were no scope-2 and scope-3.

Table 23: AFOLU Sector GHG Emissions Source (Sub-sector)

Sub-Sectors	Scope	Source of Emissions	Total CO_2e
Livestock	Scope-1	Emissions from livestock within the city boundary	9,47,566
Land	Scope-1	Emissions from land within the city boundary	0 (not estimated)
Agriculture	Scope-1	Emissions from aggregate sources and non-CO_2 emission sources on land within the city boundary	13,797

The GHG emissions from AFOLU sector is mainly includes CO_2 (56%), N_2O (30%) and CH_4 (14%) emissions within all sub-category. The land use, land-use change, and forestry (LULUCF) sector was a net sink (assumed, due to lack of data and information), hence not included in this GHG inventory. The AFOLU emissions from different sub-sector presented in the figure below:

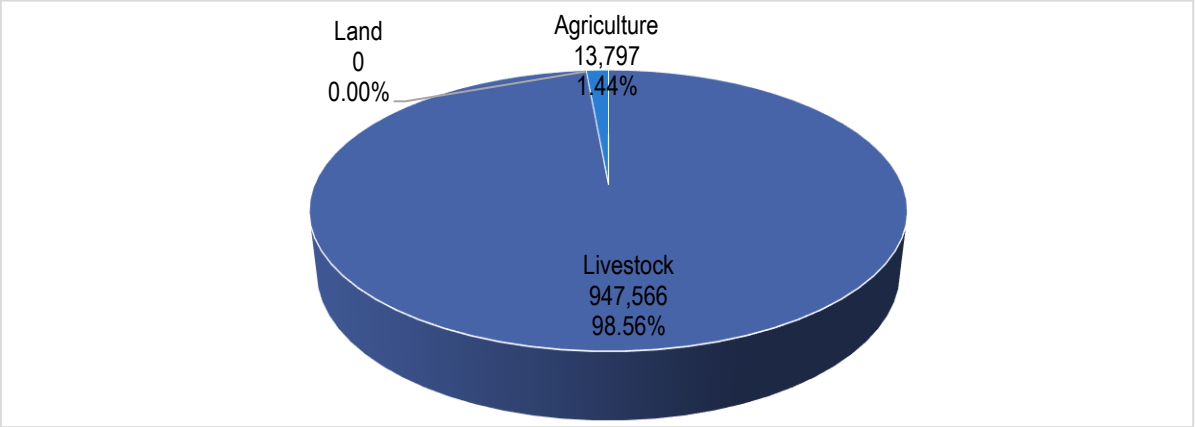


Figure 19: *AFOLU GHG Emission Distribution, by Sub-Sector in 2014*

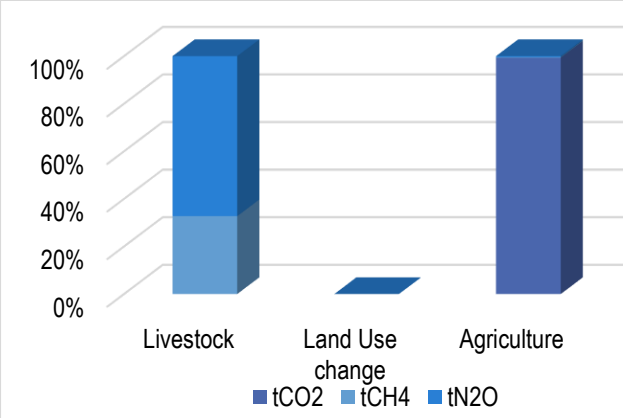


Figure 20: *AFOLU Sector GHG Emission Distribution, by sector and Gas in 2014*

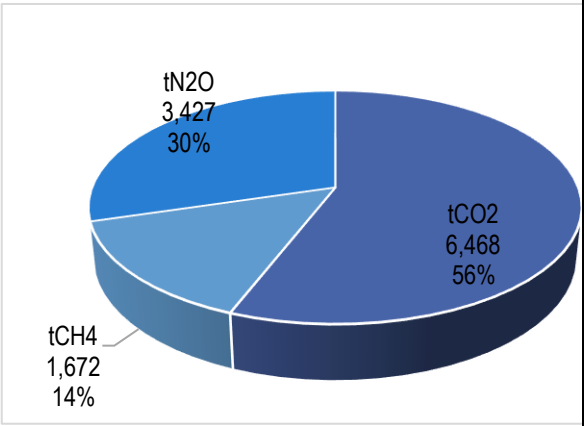


Figure 21: *AFOLU Sector Emission Distribution, by Gas in 2014*

2.7.3 Livestock

The Livestock sub-sector in 2014 emitted 947,566 tCO_2eq, which is 99% of the total GHG emissions from the AFOLU sector. Of this, 40,328 tCO_2eq from enteric fermentation and 907,239 tCO_2eq from manure management. The entire emission from livestock comes under scope-1 emissions and gases emitted are mainly N_2O (67%) and CH_4 (33%).

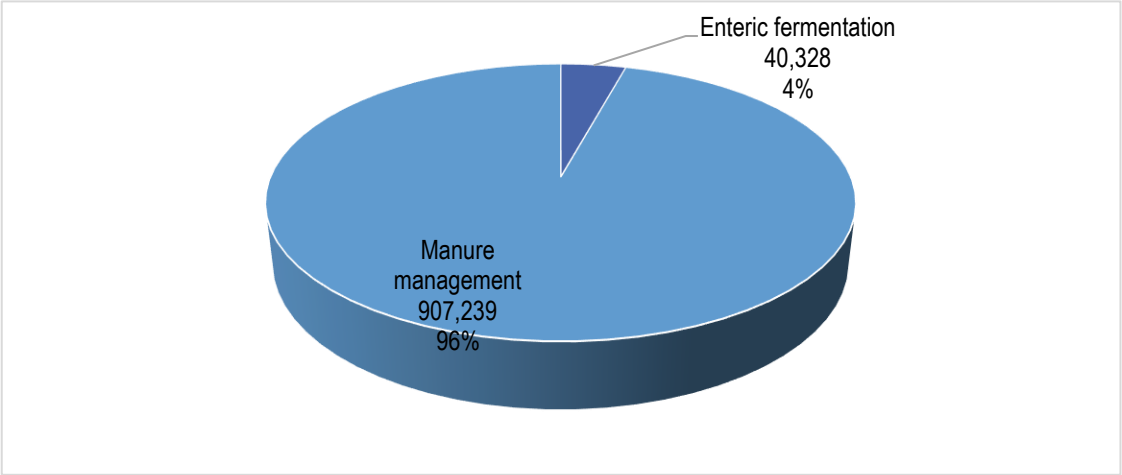


Figure 22: *Livestock GHG Emission Distribution, by sub-category in 2014*

2.7.4 Enteric Fermentation

The emission from livestock includes emits CH_4 through enteric fermentation, and both CH_4 and N_2O through management of their manure. Livestock emission from enteric fermentation is driven primarily by the number of animals, type of digestive system, and type and amount of feed consumed. Methane emissions can be estimated by multiplying the number of livestock for each animal type by an emission factor.

Activity data or no of livestock in Prizren, obtained from the Kosovo Agency of Statistics (KAS) for year 2014. Further, Prizren city specific livestock data was not available. Taking a conservative approach the livestock numbers for Prizren municipality has been used for GHG emission estimation for enteric fermentation and manure management. Table below presents the livestock considered for Prizren city and enteric fermentation:

Table 24: Livestock GHG Emission - Enteric fermentation (2014)

Sl. No.	Species / Livestock category	Number of animals (head)	Emission factor for enteric fermentation (kg of CH4 per head per year)	CH4 emissions in tonnes
1	Cows	19,252	68.50	1,318.76
3	Sheep	22,809	5.00	114.05
4	Goats	1,493	5.00	7.47
10	Poultry	111,006	Not Available	0.00
	Total	**154,560**		**1,440.27**

The inventory estimations using Tier-I approach with IPCC default emission factors and livestock population of Prizren Municipality as per KAS resulted in total emission of 40,328 tCH_4 from enteric fermentation.

2.7.5 Manure management

Not much systematic management of manure from livestock is done in Kosovo. CH_4 is produced by the decomposition of manure under anaerobic conditions, during storage and treatment, whilst direct N_2O emissions occur via combined nitrification and denitrification of nitrogen contained in the manure. The main factors affecting CH_4 emissions are the amount of manure produced and the portion of the manure that decomposes anaerobically. The former depends on the rate of waste production per animal and the number of animals, and the latter on how the manure is managed.

The emission of N_2O from manure during storage and treatment depends on the nitrogen and carbon content of manure, and on the duration of the storage and type of treatment. The term "manure" is used here collectively to include both dung and urine (i.e., the solids and the liquids) produced by livestock.

Table 25: Livestock GHG Emission –Manure Management (2014)

Sl. No.	Species / Livestock category	Number of animals (head)	Emission factor for manure management (kg of CH4 per head per year)	CH4 emissions in tonnes	N2O emissions in tonnes
1	Cows	19,252	11	211.77	3,400.42
3	Sheep	22,809	0.1	2.28	0.33
4	Goats	1,493	0.11	0.16	0.04
10	Poultry	111,006	0.01	1.11	0
	Total	**154,560**		**215.33**	**3,400.79**

As discussed above no manure management takes place in Kosovo cities, hence N_2O emission from unmanaged manure estimated for the livestock population in Prizren Municipality. The estimation of N_2O emissions from manure management systems involves multiplying the total amount of N excretion (from all livestock categories) in each type of manure management system by an emission factor for that type of manure management system.

The inventory estimations using same Tier-I approach with IPCC default emission factors and livestock population from KAS resulted in total emission of 215.33 tCH_4 and 3,400.79 tN_2O from manure management.

2.7.6 Land Use

The IPCC divides land-use into six categories: forest land; cropland; grassland; wetlands; settlements; and others. Emissions and removals of CO_2 are based on changes in ecosystem C stocks and are estimated for each land-use category. This includes both land remaining in a land-use category as well as land converted to another use. C stocks consist of above-ground and below-ground biomass, dead organic matter (dead wood and litter), and soil organic matter. The land use emission shall be estimated by multiplying net annual C stock change for different land-use (and land-use change). At least, 20 year land use data shall be used to determine the land use change. However, for Prizren city this information is not available, hence emissions are considered as zero.

2.7.7 Aggregate sources and non-CO2 emissions sources on land

GHG emissions from aggregate sources and non-CO_2 emissions sources on land includes emissions from rice cultivation, fertilizer use, liming, and urea application, burning of agriculture crop residue and agriculture soils.

In Prizren City, during year 2014, this sub-sector emitted 13,797 tCO_2eq, which is 1% of the total GHG emissions from the AFOLU sector. Of this, 581 tCO_2eq (4%) from Biomass burned without energy recovery, 6,468 tCO_2eq (47%) from Urea application and 4,958 tCO_2eq (36%) from direct and 1,790 tCO_2eq (13%) from indirect N2O emission from managed soils. There is no liming activity and rice cultivation in Prizren City hence emission these emissions are zero. The entire emission from this sector comes under scope-1 emissions and gases emitted are mainly CO_2 (99.35%), CH_4 (0.26%) and N_2O (0.40%).

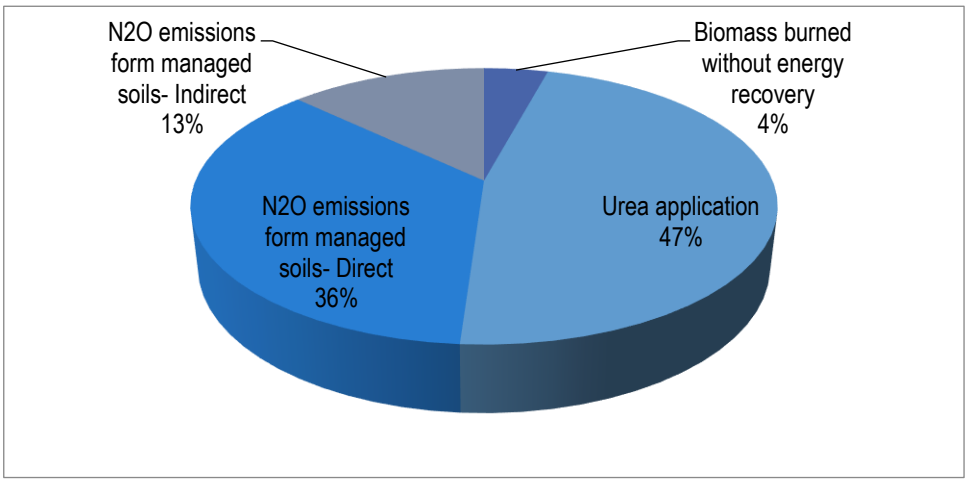


Figure 23: *Aggregate sources and non-CO2 emissions sources on land GHG Emission Distribution in 2014*

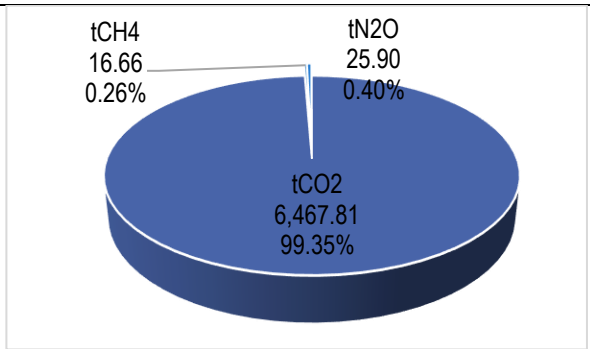


Figure 24: Aggregate sources and non-CO2 emissions sources on land GHG Emission by gas in 2014

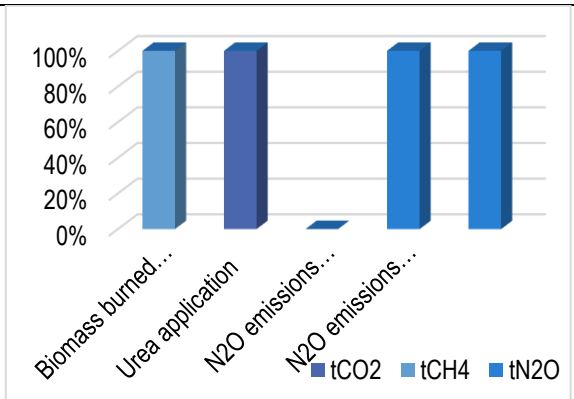


Figure 25 : Aggregate sources and non-CO2 emissions sources on land GHG Emission by Gas in 2014

2.7.8 Burning of Agriculture Crop Residue

Crop residue is burned in the fields in many European countries including Kosovo, producing CO, CH_4, N_2O, NOx, NMHCs, SO_2, and many other gases. In this GHG inventory reported only CH_4 and N_2O. The

estimation of emission of targeted species was arrived at by estimating the amount of biomass actually burnt in the field using the IPCC Revised Inventory Preparation Guidelines.

- Crop production figures, by agriculture department, for 2014 were used as the basic activity data. Ratio of the residue to economic yield was taken from IPCC 2006.
- Factions of residues burnt in the field were taken from IPCC 2006.
- Emission ratio was calculated using emission factors from IPCC (2006) National Inventory Preparation Guidelines.

Based on this, the total emission estimated from this category for 2014 was 16.66 tCH4 and 0.43 tN2O, equalling 580.93 tCO2 eq.

Table 26: Non- CO2 GHG emissions from biomass burning, 2014

Non- CO_2 GHG Emissions from Biomass Burning						
GHG emissions from biomass burning	**Residue (Ton)**	**Residue Burning (Ton)**	**tCO**	**tCH_4**	**tN_2O**	**tNOx**
Wheat - Residue	17,472	4,368	318.27	9.34	0.2422	8.65
Corn - Residue	15,250	3,812.5	246.93	7.25	0.1879	6.71
Barley	54	13.5	1.0	0.03	0.0007	0.0267
Oats	40.3	10.08	0.8	0.02	0.0006	0.0209
Rye	38.4	9.60	0.7	0.02	0.0005	0.0194
Total	**32,854.7**	**8,213.68**	**567.66**	**16.66**	**0.43**	**15.43**

2.7.9 Urea Application

The use of urea ($CO(NH_2)_2$) as fertilizer leads to emissions of CO_2 that were fixed during the industrial production process. Urea in the presence of water and urease enzymes is converted into ammonium (NH_4+), hydroxyl ion (OH), and bicarbonate (HCO_3–). The bicarbonate then evolves into CO_2 and water.

In Prizren City, CO_2 emission from urea fertilization application for year 2014 was 6,467.81 tCO_2eq. This has been calculated from the amount of urea fertilization, tonnes urea during year 2014. In the absence of direct quantity of urea application, estimated from crop production and specific urea consumption per crop in Kosovo (provided by the KSA).

Table 27: Crop Production and Urea Application, 2014

Crop Production and Fertiliser Application	Fert. Application -Irrigated land		Urea Application - Unirrigated		Production (Avg)	Cultivated Area (2015-16)		Total Production	Total Urea Application
Crop	**N-kg/hectare**	**Urea-kg/hectare**	**N-kg/hectare**	**Urea-kg/hectare**	**kg/hectare**	**Irrigated (ha)**	**Un-irrigated (ha)**	**kg**	**kg**
Wheat	71.325	475.5			7073.7	1,900		13,440,000	903,450
Corn	71.325	475.5			8472.2	1,800		15,250,000	855,900
Vegetables	148.875	992.5			25000.0	950		23,750,000	942,875
Barley	71.325	475.5			3000.0	15		45,000	7,133
Oats	71.325	475.5			2066.7	15		31,000	7,133
Rye	71.325	475.5			2400.0	10		24,000	4,755
Fodder	55.65	371.0			6689.2	1,850		12,375,000	686,350
Others	165	1100.0			3500.0	240		840,000	264,000
Fruit	43.575	290.5			9300.0	2,096		19,495,311	608,966
Meadow/ Pasture	48.3	322.0			2800.0	14,097		39,471,124	4,539,179
Total			**0**	**0**		**22,973.10**	**0**	**124,721,435**	**8,819,741**

2.7.10 Direct N2O from Managed Soils

Agricultural emissions of N_2O result directly from the soils to which N is added/released and indirectly through the volatilization, biomass burning, leaching and runoff of N from managed soils. Direct emissions of N_2O from managed soils are estimated separately from indirect emissions, though using a common set of activity data.

2.7.11 Indirect N2O from Managed Soils

N_2O emissions also take place through volatilization of N as NH_3 and oxides of N (NOx), and leaching and runoff from agricultural N additions to managed lands. Activity data used is the same as the data used to estimate direct N_2O from managed soils.

Table 28: Direct and In-direct N_2O Emissions from Urea Application

CO_2 emissions from urea fertilization Application				
CO_2 emissions from urea fertilization		**tCO_2e**	**6467.81**	
Amount of urea fertilization	M	8,819.74	11,457.27	
Emission factor	EF	0.2	0.2	IPCC Default Value
Direct N2O from managed soils (N2ODirect)		tN2O	**18.71**	
Amount of synthetic fertilizer N applied to soils	FSN	1,322.96	5,270.34	
Indirect emission from NH3 deposition on soil from Urea		**tN_2O**	**2.08**	
Emissions from Leaching of fertilizers		**tN_2O**	**4.68**	
Total N2O Emissions from fertilizers		**tN_2O**	**25.47**	
Emission factors of Fertilizers – IPCC 2006				
N_2O emission from applied fertilizer	Efdirect	Direct emission of N2O kg / kg N	0.0100	IPCC Default values
Indirect Emissions - Atmospheric Deposition, Urea or Other fertilizers		N2O kg / kg N	0.01	
Indirect Emissions – Leaching		N2O kg / kg N	0.0075	
Fraction of gas loss through volatilized N from Urea application	Vgaslos s	%	0.1	
Fraction of gas loss through volatilized N from Other fertilizer application		%	0.2	
Fraction of leaching loss of N applied fertilizer		%	0.3	

2.8 Other Scope 3

The other scope 3 includes all other emissions occurring outside the geographic boundary as a result of city activities and collectively referred to as Other Scope 3. However, as per GPC for this GHG inventory, no scope 3 emissions are applicable and considered for Prizren Municipality.

2.9 Uncertainty Analysis and Management

Uncertainties are generally associated with the activity data, emission factors being measured or extracted from the literature, and assumptions based on expert judgement. In this GHG Inventory for Prizren City, the Tier-I approach has been used as given in GPC protocol and IPCC Good Practice Guidance 2000.

All the data sources used and assumptions made for estimating GHG emissions, whether through scaling, extrapolation, or models, has been referenced to ensure full transparency. The IPCC "tier" approach and GPC references are provided within each emission source category sections. Further to identifying the method used to calculate emissions, the evaluation of the quality of both the activity data and the emission factors used. The category of quality data and emission factor is assessed as high, medium or low, based on the degree to which data reflect the geographical location of the

activity, the time or age of the activity and any technologies used, the assessment boundary and emission source, and whether data have been obtained from reliable and verifiable sources.

Table 29: Data Quality Analysis

Data Quality	Activity Data	Emission Factor
High (H)	Detailed activity data	Specific emission factors
Medium (M)	Modelled activity data using robust assumptions	More general emission factors
Low (L)	Highly-modelled or uncertain activity data	Default emission factors

This methodology uses qualitative estimation of uncertainties by source category. However, the use of the error propagation equation, and simple combination of uncertainties by source category to estimate overall uncertainty for one year and the uncertainty in the trend has not used but may be applied during regular monitoring of GHG emissions. However, the percentage of uncertainties associated with the activity data has been discussed with the concern persons of Prizren and sector experts who has done the estimation and is based on their expert judgement. The default or standard emission factors have been used for GHG emission assessment hence emission factor uncertainties are related to the standard deviation of the measured emission factors are not applicable.

It might be pointed out here that a lot of work requires to be done for a more advanced level of uncertainty analysis, as direct linkages need to be established by the GHG inventory management with the activity data generators, who can provide the statistical analysis of the uncertainties associated with their own data sets.

2.10 Exclusions in the Assessment

Due to unavailability of city specific data and information and high uncertainty following sectoral, sub-sectoral and categories GHG emissions have not been estimated and hence considered as zero in this base year 2014 GHG emissions inventory of the Prizren city:

GPC ref No.	Scope	GHG Emissions has not been estimated for following Sector and Sub-sector
I		STATIONARY ENERGY
I.1		Residential buildings
I.1.1	1	Emissions from other fuel combustion within the city boundary (excluding LPG data, we got LPG data and estimated emissions for only LPG consumption for cooking)
I.3		Manufacturing industries and construction
I.3.1	1	Emissions from fuel combustion within the city boundary
I.4		Energy industries
I.4.1	1	Emissions from energy used in power plant auxiliary operations within the city boundary
I.4.2	2	Emissions from grid-supplied energy consumed in power plant auxiliary

		operations within the city boundary
I.4.3	3	Emissions from transmission and distribution losses from grid-supplied energy consumption in power plant auxiliary operations
1.4.4	1	Emissions from energy generation supplied to the grid
I.5		Agriculture, forestry and fishing activities
I.5.1	1	Emissions from fuel combustion within the city boundary
I.5.2	2	Emissions from grid-supplied energy consumed within the city boundary
I.5.3	3	Emissions from transmission and distribution losses from grid-supplied energy consumption
I.6		Non-specified sources
I.6.1	1	Emissions from fuel combustion within the city boundary
I.6.2	2	Emissions from grid-supplied energy consumed within the city boundary
I.6.3	3	Emissions from transmission and distribution losses from grid-supplied energy consumption
I.7		Fugitive emissions from mining, processing, storage, and transportation of coal
I.7.1	1	Emissions from fugitive emissions within the city boundary
I.8		Fugitive emissions from oil and natural gas systems
I.8.1	1	Emissions from fugitive emissions within the city boundary
II		TRANS PORTATION
II.1		On-road transportation
II.1.1	1	Emissions from fuel combustion on-road transportation occurring within the city boundary
II.1.2	2	Emissions from grid-supplied energy consumed within the city boundary for on-road transportation
II.1.3	3	Emissions from portion of transboundary journeys occurring outside the city boundary, and transmission and distribution losses from grid-supplied energy consumption
II.2		Railways
II.2.1	1	Emissions from fuel combustion for railway transportation occurring within the city boundary
II.2.2	2	Emissions from grid-supplied energy consumed within the city boundary for railways
II.2.3	3	Emissions from portion of transboundary journeys occurring outside the city boundary, and transmission and distribution losses from grid-supplied energy consumption
II.3		Waterborne navigation
II.3.1	1	Emissions from fuel combustion for waterborne navigation occurring within the city boundary
II.3.2	2	Emissions from grid-supplied energy consumed within the city boundary for waterborne navigation
II.3.3	3	Emissions from portion of transboundary journeys occurring outside the city boundary, and transmission and distribution losses from grid-supplied energy consumption
II.4		Aviation
II.4.1	1	Emissions from fuel combustion for aviation occurring within the city boundary
II.4.2	2	Emissions from grid-supplied energy consumed within the city boundary for aviation
II.4.3	3	Emissions from portion of transboundary journeys occurring outside the city

		boundary, and transmission and distribution losses from grid-supplied energy consumption
II.5		**Off-road transportation**
II.5.1	**1**	**Emissions from fuel combustion for off-road transportation occurring within the city boundary**
II.5.2	**2**	**Emissions from grid-supplied energy consumed within the city boundary for off-road transportation**
IV		**INDUSTRIAL PROCESSES and PRODUCT USES (IPPU)**
IV.1	**1**	**Emissions from industrial processes occurring within the city boundary**
IV.2	**1**	**Emissions from product use occurring within the city boundary**
V		**AGRI CULTURE , FORESTRY and OTHER LAND USE (AFOLU)**
V.2	**1**	**Emissions from land within the city boundary**

2.11 Mitigation Measures for GHG Emissions

The Municipality of Prizren has taken some initiatives at city level which will reduce GHG emissions up to some extent.

Following table shows the planed mitigation measures by the Prizren with predicted CO2 emissions reductions:

Table 30: Planned GHG Emissions' reduction mitigation measures in the Prizren City

Actions	Responsible institution	Implementation timeline	Costs and funding sources (Euros)	Predicted CO2 reductions (tonnes/Year)
Objectives: Reducing energy consumption in public buildings				
Renovation of administration buildings	Administration directorate	Jan 2021 - Dec 2021	37,400.00 € Municipality budget, Energy efficiency fund, donors	91.08
Renovation of public buildings related to education, science, and technology	Education directorate	Jan 2019 - Dec 2020	1,314,244.00 € Municipality budget, Energy efficiency fund, donors	115.67
Renovation of public health buildings	Health directorate	Jan 2020 - Dec 2020	129,000.00 € Municipality budget, Energy efficiency fund, donors	9.23
Total			**1,480,644**	**215.98**

3 MEASUREMENT, REPORTING AND VERIFICATION

In developing national GHG inventories, Parties should use, at a minimum, the Revised Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories (hereinafter referred to as the Revised IPCC Guidelines). These guidelines are complemented by the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (2000) and the IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry (2003) (hereinafter referred to as the IPCC good practice guidance for LULUCF).

In choosing which methodology to apply, Parties should consider the availability of data. The IPCC inventory methodologies are divided into various levels or tiers. Generally, the higher the number designating the tier, the more detailed the methodology and the more accurate the emission estimates. Tier 1 represents the minimum, or default, methodology. If sufficient data are available, a Party can try to apply a higher tier. Tiers 2 and 3 involve more elaborate methods which could be either source category specific or technology based. These methods require more detailed data and/or measurements for their application. In the case where a national methodology exists and is consistent with the IPCC Guidelines, it is highly advisable to use this methodology, but it should be fully documented, in order to allow the reader to understand why it is better than the default proposed by the IPCC.

Party shall, as appropriate and to the extent possible, provide in its GHG inventory, on a gas-by-gas basis and in units of mass, estimates of anthropogenic emissions of carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O) by sources and removals by sinks. Parties are encouraged to provide information on anthropogenic emissions by sources of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF6) and of other GHGs such as carbon monoxide (CO), nitrogen oxides (NOx) and non-methane volatile organic compounds (NMVOCs). Other gases not controlled by the Montreal Protocol, such as sulphur oxides (SOx), included in the IPCC guidelines may be included at the discretion of the Parties.

Parties wishing to report on aggregated GHG emissions and removals expressed in CO2 equivalent should use the global warming potentials (GWP) provided by the IPCC in its Fifth Assessment Report based on the effects of GHGs over a 100-year time horizon.

Figure 30 shows the main elements of the GHG inventory cycle. It is crucial that, based on its national circumstances, a country starts by setting up proper institutional arrangements, which will allow for the smooth and regular development of GHG inventories. Subsequently, during the GHG inventory development phase, it is equally important to fully and systematically document all the data and the methods used. Quality assurance (QA) and quality control (QC) will apply in parallel, while an archiving system (both for electronic and hard copy versions of the information stored) will need to be created and maintained. The key category analysis will be applied in order to help party prioritize their efforts, as well as the use of their resources, and a national inventory improvement plan will pave the way for the next GHG inventory which will address some of the limitations identified in the current one.

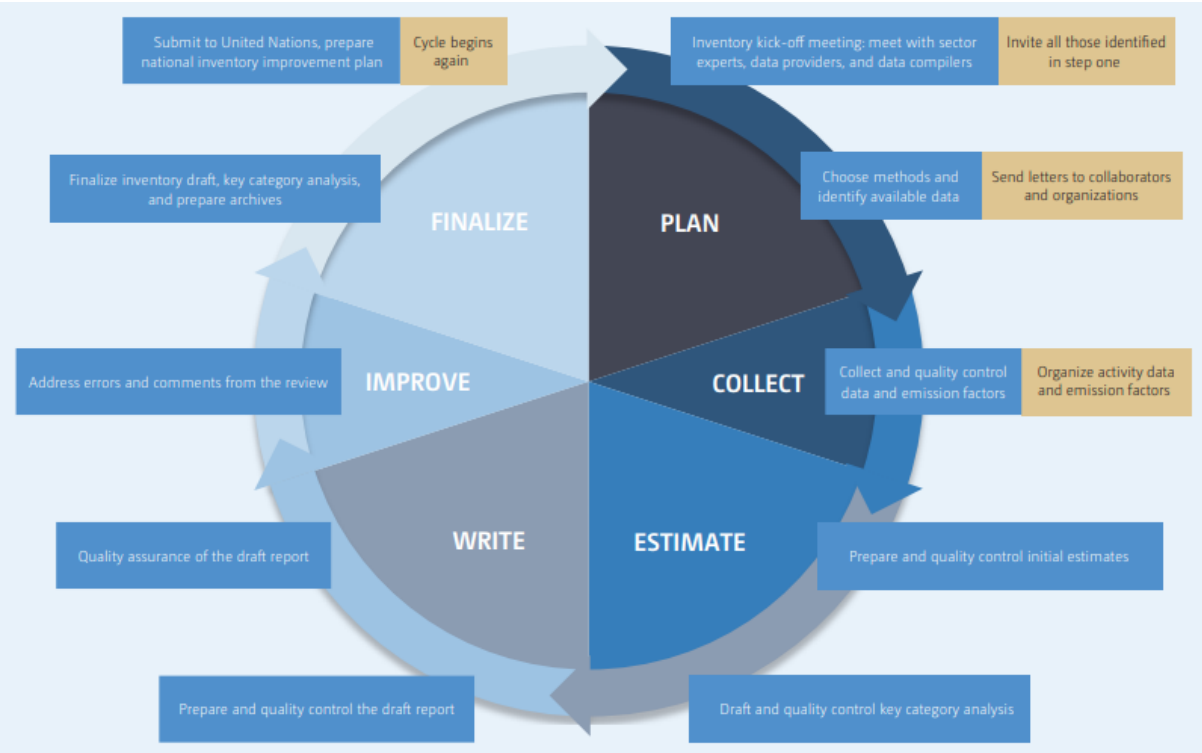


Figure 26 : The GHG inventory cycle

Overall the Prizren city level MRV framework shall follow the Kosovo National level GHG Emissions' MRV framework, because ultimately all the city level inventories shall go to the national level to be used and considered into national level estimations, planning and communication at national and international level.

The data collection (**M**easurement and **R**eporting) will be done via proposed and finalised data templates (as per IPCC 2006, GPC and best practice standards), refer Annexure 1 and 2.

The **V**erification of the measured data will be done through a proper QA/QC approach

QA/QC plan was developed, which took into account, other than the quality of the data, the cycle of inventory preparation and adherence to that plan. All contributors to the city inventory were also explained the QC procedure checklist in line with the general inventory level QC procedures of the UNFCCC GPG 2000 and IPCC GPG, 2000 (Annexed). The consultant completed the checklists during the period of data collection and GHG inventory preparation.

Two level of QC checks were conducted GHG experts, Sector expert and Team lead to ascertain the QA/QC procedure. The general QA/QC checks for all inventory preparations include cross-checking the reliability of the activity data collected from the primary and secondary sources for proper documentation and record; cross-checking for transcription errors in the activity data; consistency, completeness, and integrity of the database; documentation and reporting of the rationale of assumptions used for activity data; documentation and reporting of gaps in the database; consistency in labelling of units in ensuing calculations; and completeness checks on the reported data sets for designated years.

The activity data sources such as the various departments, industry associations, and the remote sensing agency, however, were not directly approached with the QA/QC list. The entire process is

envisaged to be strengthened further by making the data sources as well as the process compliant to standard QA/QC procedures, which are modified for inventory preparation.

This Verification approach will also use the Uncertainty Analysis and Management as mentioned in the Section 2.9 of this report.

Following table shows general inventory level QC procedure and checklist:

Table 31: General inventory level QC procedure and checklist

General Inventory Level QC Procedure and Checklist			
QC Activity	**Procedures**	**QC - Level 1**	**QC - Level 2**
Check that assumptions and criteria for the selection of activity data and emission factors are documented	- Cross-check descriptions of activity data and emission factors with information on source categories and ensure that these are properly recorded and archived.		
Check for transcription errors in data input and reference	- Confirm that bibliographical data references are properly cited in the internal documentation. - Cross-check a sample of input data from each source category (either measurements or parameters used in calculations) for transcription errors.		
Check that emissions are calculated correctly	- Reproduce a representative sample of emissions calculations. - Selectively mimic complex model calculations with abbreviated calculations to judge relative accuracy.		
Check that parameter and emission units are correctly recorded and that appropriate conversion factors are used.	- Check that units are properly labelled in calculation sheets. - Check that units are correctly carried through from beginning to end of calculations. - Check that conversion factors are correct. - Check that temporal and spatial adjustment factors are used correctly.		
Check the integrity of database files	- Confirm that the appropriate data processing steps are correctly represented in the database. - Confirm that data relationships are correctly represented in the database. - Ensure that data fields are properly labelled and have the correct design specifications. - Ensure that adequate documentation of database and model structure and operation are archived.		
Check for consistency in data between source categories	- Identify parameters (e.g. activity data, constants) that are common to multiple source categories and confirm that there is consistency in the values used for these parameters in the emissions calculations.		

Check that the movement of inventory data among processing steps is correct	- Check that emissions data are correctly aggregated from lower reporting levels to higher reporting levels when preparing summaries. - Check that emissions data are correctly transcribed between different intermediate products.		
Check that uncertainties in emissions and removals are estimated or calculated correctly.	- Check that qualifications of individuals providing expert judgement for uncertainty estimates are appropriate. - Check that qualifications, assumptions and expert judgements are recorded. Check that calculated uncertainties are complete and calculated correctly. - If necessary, duplicate error calculations or a small sample of the probability distributions used by Monte Carlo analyses.		
Undertake review of internal documentation	- Check that there is detailed internal documentation to support the estimates and enable duplication of the emission and uncertainty estimates. - Check that inventory data, supporting data, and inventory records are archived and stored to facilitate detailed review. - Check integrity of any data archiving arrangements of outside organisations involved in inventory preparation.		
Check methodological and data changes resulting in re-calculations	- Check for temporal consistency in time series input data for each source category. - Check for consistency in the algorithm/method used for calculations throughout the time series.		
Undertake completeness checks	- Confirm that estimates are reported for all source categories and for all years from the appropriate base year to the period of the current inventory. - Check that known data gaps that result in incomplete source category emissions estimates are documented		
Compare estimates to other or previous estimates (as applicable)	For each source category, current inventory estimates should be compared to previous estimates. If there are significant changes or departures from expected trends, re-check estimates and explain any difference.		

4 INSTITUTIONAL ARRANGEMENT FOR PRIZREN CITY

At central level Kosovo Agency of Statistics (KAS) collects and manages the data of GHG emissions, and all cities' sectoral data for GHG emissions shall report to the KAS for transparency, completeness, consistency and ease to use. Hence the proposed institutional arrangement for Prizren city level GHG emissions data measurement, reporting and verification shall also follow the same level central institutional structure.

Kosovo Agency of Statistics is a professional institution which deals with collection, processing and publication of official statistical data. As such acts since 1948 and has passed through several historical stages, structured according to Kosovo regulation of those times. On 2 August 1999, the Agency has resumed his professional work (after nine years of interruption of all statistical series detrimental to the interest of Kosovo), as an independent institution under the Ministry of Public Administration. Since 12.12.2011 the Agency operates in the frames of the Prime Minister's Office. Office is funded by the Kosovo Consolidated Budget, but also by donors for specific projects and for technical professional support.

The mission of the agency is to meet the needs of users with qualitative statistical data, objective, in time and space so that users have reliable base to conduct regular analysis in the interest of planning and project development at the municipal and central level. To support Kosovo institutions, scientific institutes, research academies, businesses in order to provide proper information for decision-makers and other users in Kosovo.

Utilizing this existing arrangement for the National level MRV is prudent. A combination of a guided top-down and bottom-up approaches is appropriate for this city level GHG emissions MRV system. In this approach, the KAS shall provide guidelines on the process and procedures for city level GHG emissions MRV. The lead sectoral agencies shall develop their own MRV systems according to the guidelines provided by KAS.

A systematic flow of data shall be established, with data coming mainly from the private sector through the Prizren, and to the offices of the lead sectoral (agriculture, waste, Industry, transport, forestry and energy) departments in the Prizren. These offices, through their own M&E or MRV systems, regularly report to Prizren head office. Prizren will then report to the Prizren Green Growth Centre (PGGC) and then PGGC will report to the Sectoral Departments of the KAS.

Cross cutting recommendations from all lead sectoral departments to include representatives from the Gender Assessment Focal Point System per identified key sectors in committees and institutional structures. This will ensure that proper attention on relevant gender issues are captured and reflected in program documents.

The following institutional arrangement for Prizren city level GHG emissions MRV is proposed:

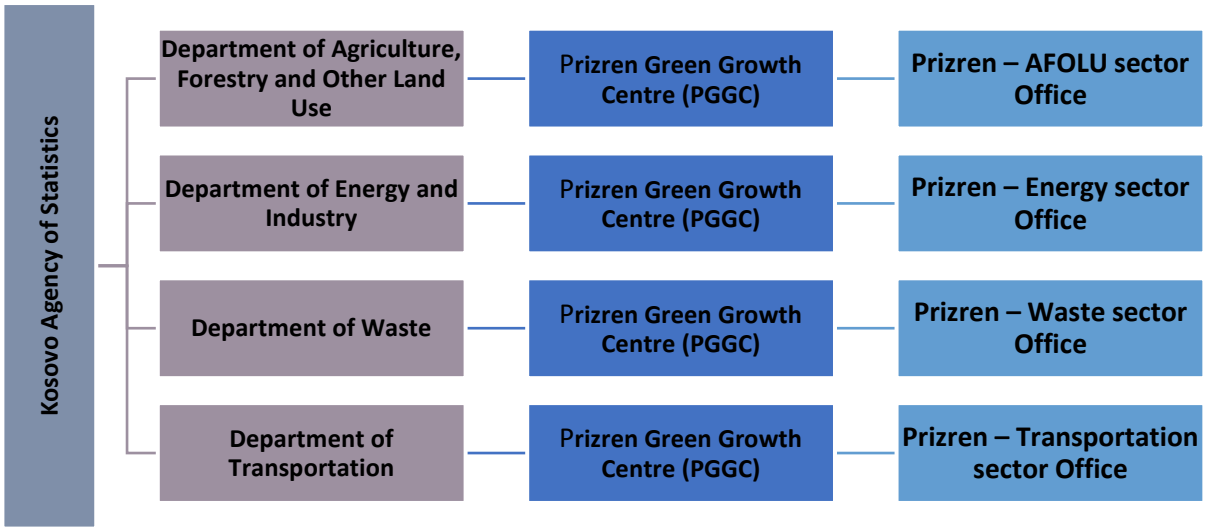


Figure 27 : *Proposed Institutional arrangement for the GHG inventory*

Further this proposed institutional arrangement for Prizren city level GHG emissions MRV shall follow the National level MRV framework (that shall be based on the UNFCCC and Paris Agreement' Article 13 Enhanced Transparency Framework (ETF)).

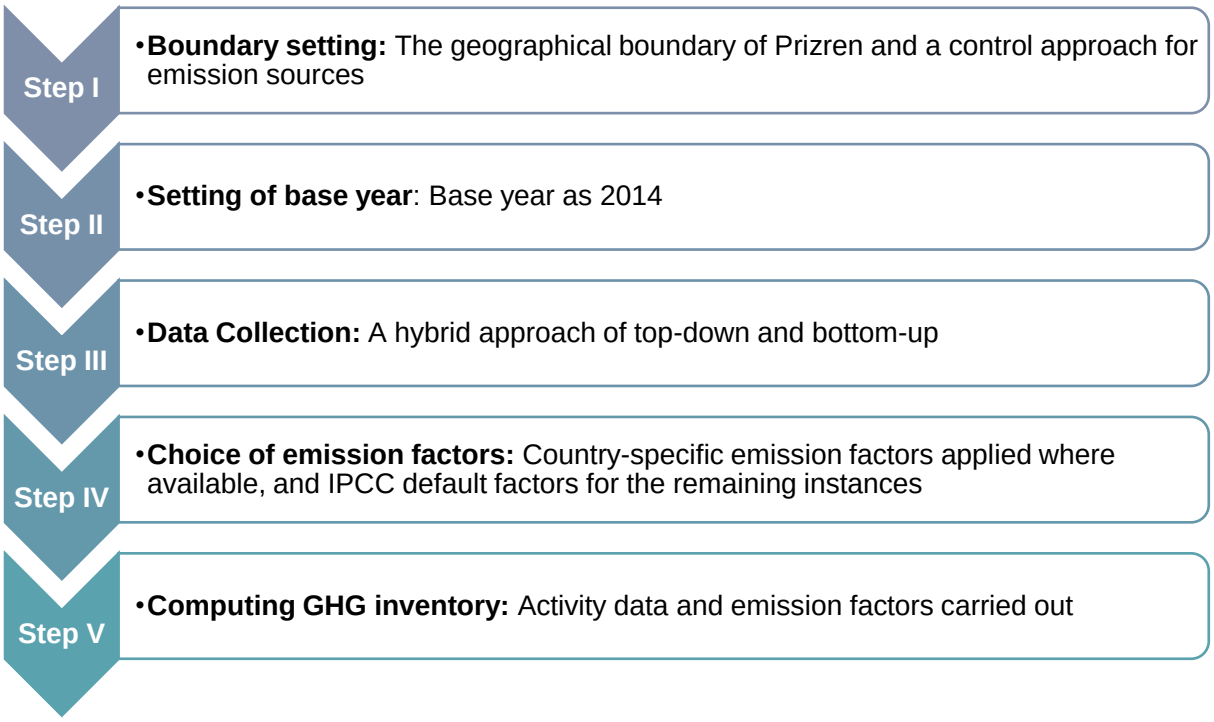
If Kosovo makes itself prepared for climate change actions under and as per the Paris Agreement (PA) then Kosovo can request UNFCCC to become a signatory of the Paris Agreement, and can avail globally available technology know-how transfer, capacity building, hand-holding and climate finance.

ANNEXURE 1- DATA MEASUREMENT AND REPORTING

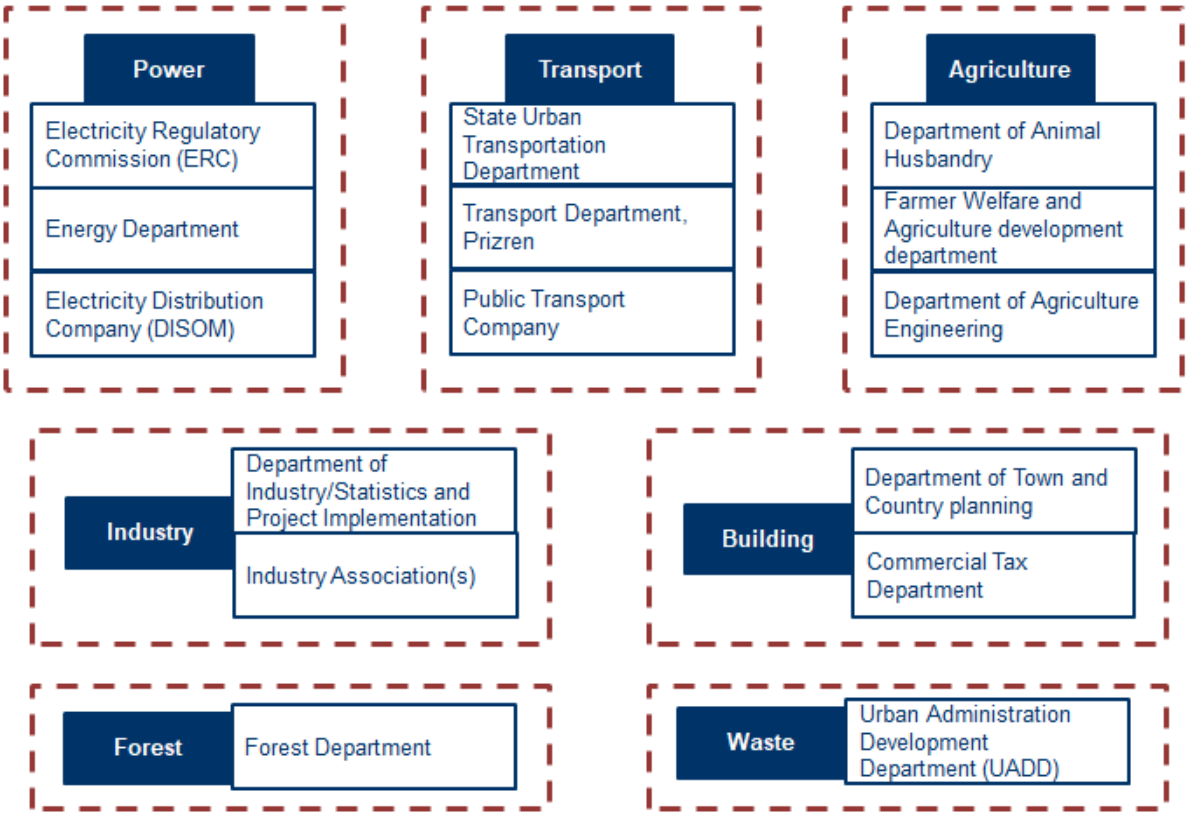
Calculation Methodology Used

- Activity data (AD): "*Activity data is a quantitative measure of a level of activity that results in GHG emissions taking place during a given period of time (e.g. volume of gas used, kilometers driven, tonnes of waste sent to landfill, etc.)*". Activity data been collected from the local government departments & agencies & from the published documents.
- Emission factors: used are a mix of default emission factors of IPCC publications (1996, 2000, 2003, and 2006) and other authentic international country-specific factors.
- Methodology:
    - The GPC does not require specific methodologies. It specifies the principles and rules for compiling a city-wide GHG emissions inventory.
    - The most appropriate methodologies have been selected based on the
        - purpose of this inventory,
        - availability of data, and
        - consistency with Kosovo's inventory.
    - The selection of the methodologies follows the principles of relevance, completeness, consistency, transparency and accuracy (as per ISO 14064, IPCC and GPC).
    - IPCC Revised Guidelines 1996 supported by the IPCC Good Practice Guidance (GPG) 2000 and 2003. The estimation also integrates some of the default emission factors from the IPCC 2006 Guidelines.

The methodology and calculations of GHG emissions in Prizren are based on the Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories, ISO 14064 and the GHG Protocol of WRI-WBCSD etc.



Stakeholder Mapping



Inventory City Information

Inventory city information	
Inventory boundary	City Information
Name of City	
Country	
Region	
Inventory Year	
Geographic Boundary	
Geographic Coordinate	
Elevation	
Land Area (km2)	
Resident Population	
Total Households	
Income Category	
GNI Per Capita (US$)	
Climate	
Other information	

1.) Stationary Energy Sector

Calculation Approach

Emissions from energy consumed in establishments like buildings- residential, commercial and industrial, consumption of energy for agriculture and allied activities as well as the fugitive emissions.

Scope 1: Emissions from fuel combustion and fugitive emissions in the city

$E_{Residential,\ cooking\ purpose} = (FC_{LPG} \times NCV_{LPG} \times EF_{LPG}) + (FC_{Kerosene} \times NCV_{Kerosene} \times EF_{Kerosene}) + (FC_{CNG/PNG} \times NCV_{CNG/PNG} \times EF_{CNG/PNG}) + (FC_{Firewood} \times NCV_{Firewood} \times EF_{Firewood}) + (FC_{Other\ Fuel} \times NCV_{Other\ Fuel} \times EF_{Other\ Fuel})$

Scope 2: Emissions from the consumption of grid-supplied electricity, steam, heating and cooling in the city

$E_{Residential,\ Diesel\ for\ Electricity\ Generation} = (FC_{Diesel} \times NCV_{Diesel} \times EF_{Diesel})$

Scope 3: Distribution losses from grid-supplied electricity, steam, heating and cooling in the city

$E_{T\&D} = EC_{Energy\text{-}Consumption} \times MF_{Gridloss} \times EF_{Grid}$

Above mentioned scope wise calculations can be repeated for other sub-sectors' fuel, electricity consumption and T&D losses i.e. Commercial, Public Utilities, Institutions, Industrial, Agriculture and other.

Data Sources

a.) *Electricity Consumption (for the inventory boundary)*

Source: Electricity Distribution Company

- *Residential*
    - *Commercial*
    - *Industrial*
    - *Agriculture*
    - *Public Utilities such as intra-city local trains/metro trains, street lighting*
    - *Others*
- *Total Consumers*
- *% T&D Loss*

b.) *Fuel Consumption Data*

Source: City/State level Coordinator for Oil & Gas Companies, Fuel Supply companies, Fuel usage etc.

- *Total LPG consumption (Residential, Commercial, Transport etc.)*
- *Total CNG/PNG Consumption (Residential, Commercial, Transport etc.)*
- *Total Kerosene consumption (Residential, Commercial etc.)*
- *Biomass consumption (Residential, Commercial etc.)*
- *Total Diesel Consumption for electricity generation / Pump sets (Residential, Commercial etc.)*
- *Total Diesel and other fuel used for heating (Residential, Commercial etc.)*
- *Total Diesel Consumption for Transport*
- *Total Petrol Consumption for Transport*
- *Naphtha Consumption in Industries*
- *LDO/HSD Consumption in Industries*
- *Furnace Oil Consumption in Industries*
- *Quantity of Natural Gas/ LPG consumption in (Residential, Commercial etc.)*
- *Quantity of Coal/ Pet/lignite/pellet Coke consumption for (Residential, Commercial etc.)*

Data collection and reporting template

GPC ref No.	Scope			GHG Emissions Source (By Sector and Sub-sector)	Unit	Data Quality	Source of Data
						AD	
I				STATIONARY ENERGY			
I.1				Residential buildings			
I.1.1	1			Emissions from fuel combustion within the city boundary			
		A		Fuel consumed for Cooking Purpose			
			I	Quantity of LPG consumed	Tonnes		
			ii	Quantity of Kerosene consumed	Tonnes		
			iii	Quantity of CNG/PNG consumed	Tonnes		
			iv	Quantity of firewood consumed	Tonne		

					s		
			v	Quantity of Diesel consumed	Tonnes		
			vi	Quantity of Pellet Consumed	Tonnes		
			vii	Quantity of Heating Oil Consumed	Tonnes		
			viii	Quantity of Lignite consumed	Tonnes		
		B		Diesel Consumed for Electricity Generation	KL		
I.1.2	2			Emissions from grid-supplied energy consumed within the city boundary			
		A		Electricity Consumed	kWh		
I.1.3	3			Emissions from transmission and distribution losses from grid-supplied energy consumption			
		A		T&D Losses	%		
		A		T&D Losses	kWh		
I.2				Commercial and institutional buildings and facilities			
I.2.1	1			Emissions from fuel combustion within the city boundary			
		A		Fuel for Cooking Purpose			
			i	Quantity of LPG consumed	Tonnes		
			ii	Quantity of Kerosene consumed	Tonnes		
			iii	Quantity of CNG/PNG consumed	Tonnes		
				Quantity of firewood consumed	Tonnes		
				Quantity of Diesel consumed	Tonnes		
				Quantity of Pellet Consumed	Tonnes		
				Quantity of Heating Oil Consumed	Tonnes		
				Quantity of Lignite consumed	Tonnes		
		B		Diesel Consumed for Electricity Generation	KL		
I.2.2	2			Emissions from grid-supplied energy consumed within the city boundary			
		A		Electricity Consumed	kWh		
I.2.3	3			Emissions from transmission and distribution losses from grid-supplied energy consumption			
		A		T&D Losses	%		
		A		T&D Losses	kWh		
I.3				Manufacturing industries and construction			
I.3.1	1			Emissions from fuel combustion within the city			

				boundary			
		A		Fuel Consumed in Utilities			
				Solid Fuel			
			i	Quantity of Coal consumed	Tonnes		
			ii	Quantity of Pet-Coke consumed	Tonnes		
			iii	Quantity of Biomass consumed	Tonnes		
			iv	Quantity of Other Fuel consumed	Tonnes		
				Liquid Fuel			
			v	Quantity of HSD consumed	KL		
			vi	Quantity of FO consumed	KL		
			vii	Quantity of Naphtha consumed	KL		
			viii	Quantity of LDO consumed	KL		
				Gaseous Fuel			
			ix	Quantity of Natural Gas consumed	Tonnes		
			x	Quantity of LPG consumed	Tonnes		
I.3.2	2			Emissions from grid-supplied energy consumed within the city boundary			
		A		Electricity Consumed	kWh		
I.3.3	3			Emissions from transmission and distribution losses from grid-supplied energy consumption			
		A		T&D Losses	%		
		A		T&D Losses	kWh		
I.4				Energy industries			
I.4.1	1			Emissions from energy used in power plant auxiliary operations within the city boundary			
		A		Fuel Consumed in Utilities/Power Plant			
				Solid Fuel			
			i	Quantity of Coal consumed	Tonnes		
			ii	Quantity of Pet-Coke consumed	Tonnes		
			iii	Quantity of Biomass consumed	Tonnes		
			iv	Quantity of Lignite consumed	Tonnes		
			vi	Quantity of Other Fuel consumed	Tonnes		
				Liquid Fuel			
			viii	Quantity of HSD consumed	KL		

			vi	Quantity of FO consumed	KL		
			vii	Quantity of Naphtha consumed	KL		
				Gaseous Fuel			
			ix	Quantity of Natural Gas consumed	cubic meter		
			ix	Quantity of Coke Oven Gas consumed	cubic meter		
I.4.2	2			Emissions from grid-supplied energy consumed in power plant auxiliary operations within the city boundary			
		A		Electricity Consumed	kWh		
I.4.3	3			Emissions from transmission and distribution losses from grid-supplied energy consumption in power plant auxiliary operations			
		A		T&D Losses	%		
		A		T&D Losses	kWh		
1.4.4	1			Emissions from energy generation supplied to the grid			
I.5				Agriculture, forestry and fishing activities			
I.5.1	1			Emissions from fuel combustion within the city boundary			
		A		Diesel Consumed for water pumping	KL		
I.5.2	2			Emissions from grid-supplied energy consumed within the city boundary			
		A		Electricity Consumed	kWh		
I.5.3	3			Emissions from transmission and distribution losses from grid-supplied energy consumption			
		A		T&D Losses	%		
		A		T&D Losses	kWh		
I.6				Non-specified sources			
I.6.1	1			Emissions from fuel combustion within the city boundary	Tonnes		
I.6.2	2			Emissions from grid-supplied energy consumed within the city boundary	kWh		
I.6.3	3			Emissions from transmission and distribution losses from grid-supplied energy consumption			
I.7				Fugitive emissions from mining, processing, storage, and transportation of coal			
I.7.1	1			Emissions from fugitive emissions within the city boundary	Tonnes		
		A		Quantity of Coal Produced	Tonnes		
I.8				Fugitive emissions from oil and natural gas systems			
		A		Quantity of Natural Gas transported	cubic meter		
I.8.1	1			Emissions from fugitive emissions within the city boundary	Tonnes		

2.) Transportation Sector

Calculation Approach

On-Road Transportation Emissions

- *This category includes vehicles such as buses, cars, trucks, motorcycles, on-road waste collection and transportation vehicles etc*
- *ASIF Framework: The ASIF ("Activity", "mode Share", "Intensity" and "Fuel") framework relates travel activity, the mode share, energy intensity of each mode, fuel, and vehicle type, and carbon content of each fuel to total emissions.*
- *Fuel sales method: This method calculates on-road transportation emissions based on the total fuel sold within the city boundary. In theory, this approach treats sold fuel as a proxy for transportation activityhicles (e.g. compactor trucks), etc*
    - *Calculating fuel sales emissions requires multiplying activity data (quantity of fuel sold) by the GHG-content of the fuel by gas (CO_2, CH_4, N_2O).*
    - *ERoad-transport,y = SEvehicle x NVehicles*

Railway Transportation Emissions

- *Railways (powered by a locomotive) typically uses energy through combustion of diesel fuels or electricity (electric traction).*
- *Scope 1 emissions (emissions from direct combustion of fossil fuels) incurred during the length of railway transit within the city boundary for railway lines that have stops in the city boundary. Based on available data and local circumstances, cities may either include or omit emissions from pass-through rail trips that do not stop in the city boundary.*
    - $E_{Rail\text{-}transport,\ Fuel,\ y} = FC_{Rail} \times NCV_{Fuel} \times EF_{Fuel}$
- *Scope 2 emissions Grid-supplied electricity used to power rail-based transportation systems is accounted for at points of supply, regardless of trip origin or destination*
- *Scope 3 emissions Transboundary railway emissions (from either direct fuel combustion or grid-supplied electricity charged outside the city) can be allocated based on type of railway service and geographic range.*

Data Sources

a.) *Vehicle details*

Source: Transport Department / RTO etc.

- *Goods carriage*
    - *Multi Axled Articulated*
    - *Medium & heavy truck lorries*
    - *LCV (Four wheelers + Three wheelers)*
- *Buses (30+1)*

    - *State Transport Corporation (ordinary +deluxe)*
    - *Private (Ordinary + deluxe)*
- *Mini-buses (Up to 12+1, 12+1 to 30+1)*
- *Motor cabs*
- *Tempo (6+1 , Above 6+1)*
- *Auto rickshaw*
- *Two wheelers (Moped , Motor cycles/scooters)*
- *Cars , Jeeps*
- *Tractors, Trailers*
- *Other vehicles*

b.) Fuel Consumption Data

Source: Source: City/State level Coordinator for Oil & Gas Companies, Fuel Supply companies, Fuel usage etc.

- *Total Diesel Consumption for Transport*
- *Total Petrol Consumption for Transport*
- *Total fuel consumption for railways*

Source: DISCOM

- *Electricity supplied for railways traction use*

Source: Railways

- *Rail routes by destination*
- *Number of trains*
- *Length of railways track in the city*
- *Average number of halting and originating trains*
- *Fuel mileage of rails*

Data collection and reporting template

Aviation transboundary journeys		
Months	**Departure**	**Passenger**
Dec-14	**0**	**0**

Aviation transboundary journeys					
From	**Destination**	**Distance (km)**	**kg CO2 Emission/ Passenger)**	**Passenger**	**tonnes of CO2 emissions**

Transboundary Train Journeys						
Fro	**Destinati**	**Distance**	**Zon**	**Frequency/**	**SEC-Elect. (kWh/1000**	**tonnes of CO2**

m	on	(km)	e	Year	GT km)	emissions

Emission from Trains Stops		
No of Trains Stops at Stations	No	
Length of Rail in City	kM	
Specific Energy Consumption by Train for Central Zone	kWh/1000 GT km	
Emissions from No of Trains stops at Prizren Junction Station	**tCO2e**	

Transboundary Road Journeys						
From	**To**	**Frequency**	**Distance (Kms)**	**Total Distance (Kms)**	**Diesel Consumption (litre)**	**Annual tonnes of CO2 emissions**
Vehicle fuel intensity (Mileage)	**Km/litre**					

3.) <u>Waste Sector</u>

Calculation Approach

- *Waste is categorized into four types:*
  - *Municipal Solid Waste*
  - *Sludge*
  - *Industrial Waste*
  - *Other Waste*
- *First Order of Decay Model*
- *First order of decay (FOD) assigns landfill emissions based on emissions during that year. It counts GHGs actually emitted that year, regardless of when the waste was disposed.*
- $E_{CH4} = \{\Sigma x\ [\ MSWX \times L0(x) \times ((1 - e{-}k) \times e{-}k\ (t - x))] - R(t)\} \times (1 - OX)$

	Notation	Parameter	Unit	Source
A	*X*	*Landfill opening year or earliest year of historical data available*	-	*Municipal Corporation and Urban Development departments*
B	*T*	*Inventory Year*	-	*Municipal Corporation and Urban Development departments*
C	MSW_x	*Total municipal solid waste disposed at Solid Waste Disposal Site in year x*	*tonnes*	*Municipal Corporation and Urban Development departments*

D	*R*	*Methane collected and removed in inventory year*	*tonne s*	*Municipal Corporation and Urban Development departments*
E	*L0*	*Methane generation potential*		*Default*
F	*K*	*Methane generation rate constant, which is related to the time taken for the Degradable Organic Carbon in waste to decay to half its initial mass (the "half-life")*		*Default*
G	*Ox*	*Oxidation Factor*		*0.1 for Well-managed landfills; 0 for unmanaged landfills*

Data Sources

Source: Municipal Corporation, City Health Officer, Public Health Engineering Department

- *Total solid waste generated in the City Total waste water generated in City*
- *Total industrial waste water generated*
- *Characteristics of waste generated*
- *Waste generated in the city and treated in the city*
- *Waste generated in the city and treated outside*
- *Waste generated outside city boundary and treated inside*
- *BOD of waste water discharged*
- *COD of waste water discharged*
- *Methane recovered*
- *Landfill opening year*
- *Waste water disposal method*

Data collection and reporting template

Parameter	Symbol/Formula	Unit	Value	Remarks
Total Solid Waste (MSW) generated from City	A	Ton		
Waste disposed at managed sites (landfill)	B	Ton		
Waste disposed at un-managed sites (landfill, open dumping)	C=A-B	Ton		
No of landfill		Number		
Biogas digester (1) Capacity		Ton/Day		
Composting plant (1) Capacity		Ton/day		
Number of illegal dumsites		Number		
Landfill data	**Symbol/Formula**	**Unit**	**Value**	**Remarks**
Name/Location and Address				
Site opening year/Life				
Total Capacity / Area				
Density Conversion		Mg/m3		

Current waste in place		Ton		
Site closing year				
Solid Waste Treatment	**Symbol/Formula**	**Unit**	**Value**	**Remarks**
Quantity of MSW biologically Treated		Ton		
MSW Composted		Ton		
Anaerobic digestion of organic waste		Ton		
MSW Incinerated (Controlled)		Ton		
MSW Open burning		Ton		
MSW Composition	**Symbol/Formula**	**Unit**	**Value**	**Remarks**
Fraction of solid waste that is Kitchen& garden waste	A	%		
Fraction of solid waste that is paper	B	%		
Fraction of solid waste that is plastic	C	%		
Fraction of solid waste that is Wood	D	%		
Fraction of solid waste that is textiles	E	%		
Fraction of solid waste that is rubber	F	%		
Fraction of solid waste that is glass	G	%		
Fraction of solid waste that is inserts	H	%		
Fraction of solid waste that is Others	I	%		
Degradable organic carbon (DOC)	DOC			

Data/Parameters	**Symbol/Formula**	**Unit**	**Value**	**Remarks**
Total Waste Water generated from City		MLD		
Wastewater and sewage treatment (STPs)		MLD		
Wastewater's source				
Wastewater's organic content		BOD/COD		
Wastewater treated from other cities within the city's boundaries		MLD		
CH4 generation from wastewater treatment				
Parameters	**Symbol/Formula**	**Unit**	**Value**	**Remarks**
Organic component removed as sludge in inventory year,	Si	kg COD/yr or kg BOD/yr		
Amount of CH4 recovered in inventory year	Ri	kg CH4/yr		
Organic content in the wastewater - in inventory year	TOWi	kg BOD/yr		
Emission factor kg CH4 per kg BOD or kg CH4 per kg COD	EFi			
City's population in inventory year (person)	P	Person		

City-specific per capita BOD in inventory year,	BOD	g/person/day		
Correction factor for additional industrial BOD discharged into sewers	I			
Maximum CH4 producing capacity	Bo	kg CH4/kg BOD		
Methane correction factor (fraction)	MCFi			
Fraction of population in income group i in inventory year (70%)	Ui			
Degree of utilization (ratio) of treatment/discharge pathway or system, j, for each income group fraction i in inventory year	Ti,j			
Indirect N2O emissions from wastewater effluent				
Parameters	**Symbol/Formula**	**Unit**	**Value**	**Remarks**
Total population served by the water treatment plant	P	Person		
Annual per capita protein consumption,	Protein	kg/person/yr		
Factor to adjust for non-consumed protein	FNON-CON			
Fraction of nitrogen in protein	FNPR	kg N/kg protein		
Factor for industrial and commercial co-discharged protein into the sewer system	FIND-COM			
Nitrogen removed with sludge	NSLUDGE	kg N/yr		
Emission factor for N2O emissions from discharged to wastewater in kg N2O-N per kg N2O	EFEFFLUENT	kg N2O-N per kg N2O		

4.) <u>Agriculture, Forestry and Other Land Use (AFOLU)</u>

Calculation Approach

- *AFLOU activities are divided into three categories:*
  - *Livestock*
  - *Land*
  - *Aggregate sources and non-CO_2 emissions sources on land*

As per GPC, the Agriculture, Forestry and Other Land Use (AFOLU) is reported in BASIC+ framework. GPC mandates that cities shall report all GHG emissions resulting from the AFOLU sector within the city boundary in scope 1.

- *Livestock Emissions: CH_4 is emitted by livestock production through enteric fermentation. Management of the livestock manure too leads to the emission of CH_4 and N_2O. CO_2 emissions from livestock are not estimated because annual net CO_2 emissions are assumed to be zero—the CO_2 photosynthesized by plants is returned to the atmosphere as respired CO_2.*
  - *CH_4 emission from enteric fermentation: $E_{CH4} = N_{Species/Livestock} \times EF_{Enteric}$*
  - *CH_4 emission from manure management: $E_{CH4} = N_{Species/Livestock} \times EF_{Manure\ Management}$*

- *N2O emissions from manure management:* $E_{N2O} = [\Sigma_s [\Sigma_T (N_T \times N_{ex(T)} \times MS_{T,S})] \times EF_S] \times 44/28$

Data Sources

a.) *Agriculture Related Data*

Source: Farmer Welfare and Agriculture Department etc.

- *Various types of crops cultivated, for instance*
- *(Maize, Rice/Paddy, Wheat, Groundnut)*
- *Area under cultivation for rice/paddy (Irrigated /Rain-fed)*
- *Gross irrigated area (Maize, Rice/Paddy Wheat, Groundnut etc.)*
- *Crop production (for last 5 years)*
- *Type of fertilizers (Urea, Manure ,etc) used and quantity*
- *Urea Application rate*
- *Diesel consumption (Number of diesel pumps, Operating hours)*
- *Tractors registered in last 10 years*

b.) *Livestock Related Data*

Source: Department of Animal Husbandry and Livestock etc.

Cattle population as per latest census:

- *Cows*
- *Buffalo*
- *Sheep*
- *Goats*
- *Horses*
- *Mules*
- *Assess*
- *Camels*
- *Swine*

c.) *Land Use Related Data*

Source: Town Planning Department etc.

Total area covered under and change in area for 2014 and 1995-96 (for last 20 years from the Inventory year): Forest land, Cropland, Grassland, Wetlands, Settlements, Other

Data collection and reporting template

Land use, Land-use Change and Forestry			
Type	**Description**	**Area (ha)**	**Sources**
Forest land	All lands more than 1 ha in area, with a tree canopy density of more than 10%.		
Cropland	Includes all croplands or net sown area and fallow land area		
Grasslands	The areas covered with grassy and herbaceous growth as well as degraded forest with less than 10% tree canopy density.		

Other land	Includes all non-vegetated areas, snow, surface waterbody.			
Settlement	Includes the major built-up areas and human habitations.			
			Area of Forest/Biomass Stocks (ha)	
Tropical	Plantations	*Acacia spp.*		
		Eucalyptus spp.		
		Tectona grandis		
		Pinus spp		
		Pinus caribaea		
		Mixed Hardwoods		
		Mixed Fast-Growing Hardwoods		
		Mixed Softwoods		
	Other Forests	Moist		
		Seasonal		
		Dry		
	Other (specify)			
Temperate	Plantations	Douglas fir		
		Loblolly pine		
	Commercial	Evergreen		
		Deciduous		
	Other			
Boreal				
			A	
Non-Forest Trees (specify type)			Number of Trees	

Crop Production and Fertiliser Application	**Fertiliser Application**		**Urea Application - Unirrigated**		**Production (Avg)**	**Cultivated Area (2014)**		**Total Production**	**Total Urea Application**
Crop	N-kg/hectare	Urea-kg/hectare	N-kg/hectare	Urea-kg/hectare	kg/hectare	Irrigated (ha)	Un-irrigated (ha)	kg	kg
Wheat									
Corn									

Vegetabes									
Barley									
Oats									
Rye									
Fodder									
Others									
Fruit									
Meadowy/Pasture									

Constant Factors	Wheat	Corn	Barley	Oats	Rye	Sugarcane	Jute	Millets	Source
Residue to crop ratio									
Dry Matter Fraction									
Combustion Factor									

Liming				
Amount of calcic limestone (CaCO3) or dolomite (CaMg(CO3)2),	M	tonnes per year		
Emission factor, tonne of C per tonne of limestone or dolomite	EF			
Urea fertilization Application				
Amount of urea fertilization	M	tonnes urea per year		
Emission factor	EF	tonne of C per tonne of urea		
Amount of synthetic fertilizer N applied to soils	FSN	tonnes N per year		
Emission factors of Fertilizers				
N20 emission from applied fertilizer	Efdirect	Direct emission of N2O kg / kg N		
Indirect Emissions - Atmospheric Deposition, Urea or Other fertilizers		N2O kg / kg N		
Indirect Emissions – Leaching		N2O kg / kg N		
Fraction of gas loss through volatilized N from Urea application	Vgaslos s	%		
Fraction of gas loss through volatilized N from Other fertilizer application		%		
Fraction of leaching loss of N applied fertilizer		%		

Global warming potential (GWP) and Emission Factors

Global warming potential (GWP) values relative to CO2				
Industrial designation or common name	**Chemical formula**	**Second Assessment Report (SAR)**	**Fourth Assessment Report (AR4)**	**Fifth Assessment Report (AR5)**
Carbon dioxide	CO_2	1	1	1
Methane	CH_4	21	25	28
Nitrous oxide	N_2O	310	298	265
Source: IPCC AR5 Report				

Average Combined Margin Grid Emission Factor of the near region similar power generation nature countries (having major power generation from Thermal Power plants) i.e. Serbia, Montenegro, North Macedonia , in t CO2/MWhr	
Average	**Combined Margin EF (Average)**
Montenegro	0.984
Serbia	1.099
North Macedonia	0.861
Average Grid EF for Kosovo	0.98131
Source: IGES Grid Emission Factor v10.4	

CO2 Emission Factor for Fuels	Emission Factor	Calorific Value	Emission Factor	Density	Emission Factor
Type of Fuel	**KgCO2/TJ**	**TJ/Gg**	**tCO2/Ton**	**kg/m3**	**tCO2/KL**
Kerosene	71,900	43.8	3.15	820	2.58
Liquefied Petroleum Gases (LPG)	63,100	47.3	2.98		
Petrol	69,300	44.3	3.07	739	2.27
Diesel	74,100	43	3.19	840	2.68
Compressed natural gas (CNG)	56,100	48	2.69		
Furnace/Fuel Oil (FO)	77,400	40.4	3.13	893	2.79
Lignite	101,000	11.9	1.20		
Pellet	100,000	10.9	1.09		
Wood	100,000	10.9	1.09		
Source: IPCC 2006					

Diesel Emission Factor For Transport Sector			
Default CO2 Emission Factor	74,100	kg/TJ	Source: IPCC Table 3.2.1
Net Calorific Value	43	TJ/Gg	Source: IPCC Table 1.2
Density of Diesel	0.840	kg/Litre	Source: HPCL/IOCL
Emission Factor for Diesel	3.19	kg of CO2/kg	
Emission Factor for Diesel	2.68	kg of CO2/Litre	
Petrol Emission Factor For Transport Sector			
Default CO2 Emission Factor	69,300	kg/TJ	Source: IPCC Table 3.2.1

Net Calorific Value	44.3	TJ/Gg	Source: IPCC Table 1.2
Density of Petrol	0.740	kg/Litre	Source: IOCL
Emission Factor for Petrol	3.06999	kg of CO2/kg	
Emission Factor for Petrol	2.27	kg of CO2/Litre	
CNG Emission Factor For Transport Sector			
Default CO2 Emission Factor	56,100	kg/TJ	Source: IPCC Table 3.2.1
Net Calorific Value	44.2	TJ/Gg	Source: IPCC Table 1.2
Emission Factor for CNG	2.48	kg of CO2/kg	
LPG Emission Factor For Transport Sector			
Default CO2 Emission Factor	56,100	kg/TJ	Source: IPCC Table 3.2.1
Net Calorific Value	47.3	TJ/Gg	Source: IPCC Table 1.2
Emission Factor for LPG	2.65	kg of CO2/kg	