First Biennial Update Report on Climate Change




Ministry of Environment and Natural Resources Protection of Georgia

First Biennial Update Report on

Climate Change

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The First Biennial Update Report of Georgia to the UNFCCC was prepared by a large group of decision makers, experts and other stakeholders, representing: the Ministry of Environment and Natural Resources Protection of Georgia and its Environmental Information and Education Center; The Think Tank "World Experience for Georgia"; Ilia State University and Institute of Energy and Sustainable Development at the University; independent national and international experts.

We would like to recognize the partners who have contributed to the projects outlined in this publication, the United Nations Development Programme in Georgia (www.ge.undp.org) and the Global Environment Facility (www.thegef.org) for their support and financial contribution to these projects.

Abbreviations

AA - EU-Georgia Association Agreement

AD - Activity Data

AWDS - Animal Waste Disposal Site

BAU - Business as usual scenario of development

BOD - Biological Oxygen Demand

BTC - Baku-Tbilisi-Ceyhan oil pipeline

BUR - Biennial Update Report

CDM - Clean Development Mechanism

CER - Certified Emission Reductions

COD - Chemical Oxygen Demand

COP - Conference of Parties (of the UNFCCC)

CRF - Common Reporting Format

DCFTA - Deep and Comprehensive Free Trade Area

DNA - Designated National Agency

DOC - Degradable Organic Carbon

EBRD - European Bank of Reconstruction and Development

EEC - Energy Efficiency Center

EF - Emission Factor

EIA - Environmental Impact Assessment

EIEC - Environmental Information and Education Center

EU - European Union

FAOSTAT - Food and Agriculture Organization Statistics Office

FBUR - First Biennial Update Report

FEWS - Fuel efficient wood stove

GAM - Global Average Method

GDP - Gross Domestic Product

GEF - Global Environment Facility

GEOSTAT - National Statistics Office of Georgia

GHG - Green House Gases

GNERC - Georgian National Energy and Water Supply Regulatory Commission

GPG - Good Practice Guidelines

HPP - Hydro Power Plant

IEA - International Energy Agency

INDC - Intended Nationally Determined Contribution

IPCC - Intergovernmental Panel on Climate Change

IPMVP - International Performance Measurement and Verification Protocol

KfW - German Development Bank

LEDS - Low Emission Development Strategy

LEDSCC - Low Emission Development Strategy's Coordination Committee

LEPL - Legal Entity of Public Law

LRT - Light Rail Transport

LULUCF - Land Use, Land Use Change and Forestry

MCF - Methane Correction Factor

MoENRP - Ministry of Environment and Natural Resources Protection of Georgia

MRV - Measurement Reporting and Verification

MSW - Municipal Solid Waste

NAMA - Nationally Appropriate Mitigation Action

NEAP - National Environmental Action Programmes

NEEAP - National Energy Efficiency Action Plan

NG - Natural Gas

NMVOC - Non-Methane Volatile Organic Compounds

NSMGP - North-South Main Gas Pipeline

QA/QC - Quality Control and Quality Assurance

SCP - South Caucasus gas Pipeline

SD - Sustainable Development

SEAP - Sustainable Energy Action Plans

SNC - Second National Communication

SWH - Solar water heater

TG-MRV - Technical Group on MRV

TNA - Technology Needs Assessment

TNC - Third National Communication

UNDP - United Nations Development Programme

UNFCCC - United Nations Framework Convention on Climate Change

USAID - United States Agency for International Development

WEG - Think Tank "World Experience for Georgia"

WREP - Western Route Export Pipeline

C - Carbon

CaO - Lime

CH_4 - Methane

CO - Carbon Oxide

CO_2 - Carbon Dioxide

HFC - Hydrofluorocarbons

N_2O - Nitrous Oxide

PFC - Perfluorocarbons

SF_6 - Sulphur Hexafluoride

SO_2 - Sulphur Dioxide

Units

Gg - Gigagram (10^9 gram=1000 ton)

hl - Hectoliter (100 Litre)

PJ - Peta Joule (10^{15} Joule)

TJ - Tera Joule (10^{12} Joule)

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Foreword

As Party to the United Nations Framework Convention on Climate Change (UNFCCC), Georgia is fully committed to the objectives of the Convention. Georgia acknowledges that warming of the climate system is unequivocal and delay in reducing greenhouse gas (GHG) emissions significantly will increase the risk of more severe climate change impacts.

Georgia has been actively mobilizing national resources and international support to ensure low carbon and climate resilient development.

As part of its commitments under the UNFCCC, Government of Georgia ensures regular reporting of climate change related trends and developments in the form of national communications and biennial update reports.

In this regard, the Ministry of Environment and Natural Resources Protection of Georgia has the honour to submit Georgia's First Biennial Update Report (BUR) under the UNFCCC.

This document following to the biennial update reporting guidelines for developing countries according to the Decision 2/CP.17, represents the information on national circumstances and institutional arrangements appropriate to development for national climate related reports such as National Communications (NCs), BURs, etc. The first BUR covers the main results of the inventory of GHG emissions by source and removals by sinks for the period from 1990 to 2013, with estimation of emissions in 2012 and 2013 and recalculations of emissions in 2010 and 2011. Moreover, the report presents information related to the mitigation actions in the country including the description of their effects; the financial support received in order to strengthen climate change related activities. In addition, the document based on the analysis of constraints and gaps describes the related financial, technical and capacity needs of Georgia in climate change mitigation field. Furthermore, the first BUR encloses the description of the domestic MRV (measurement, reporting and verification) system including the vision of its future development.

Finally, I would like to express my sincere gratitude to the United Nations Development Programme and Global Environment Facility for support provided in the process of preparation of presented first BUR document.

Gigla Agualashvili

Minister of Environment and
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1 CHAPTER - Executive Summary

Georgia's First Biennial Update Report (FBUR) on Climate Change consolidates updates on national circumstances and inventory of Greenhouse Gas (GHG) emissions for 2010-2013 period and provides transparency for the country's progress with mitigation actions and constraints and gaps, and related financial, technical and capacity needs as well as support received during last 5 years in climate change filed. The FBUR also provides a brief overview of proposed design of Domestic Measurement, Reporting and Verification (MRV) System, respective institutional arrangements, the implementation plan and analysis of the identified gaps on the road to MRV system establishment and the required support for overcoming them. The FBUR builds on the findings and recommendations of the Third National Communication (TNC) to the UNFCCC (submitted in 2016) and captures information from the outcomes of on-going complementary projects in the country. The ultimate goal of the FBUR is to assist Georgia with the mainstreaming and integration of climate change consideration into national and sectorial policies and to continue to strengthen institutional and technical capacities with climate change mitigation and sustainable development.

1.1 National Circumstances

Georgia is a democratic semi-presidential republic. Georgia has strongly articulated pro-western policy discourse directed towards its integration into EU and NATO structures. In June 2014 the EU and Georgia signed an Association Agreement which includes membership in the Deep and Comprehensive Free Trade Area (AA/DCFTA).

Georgia is located in the mountainous south Caucasus region, south-east part of Europe. It plays an important role in the Caucasus region because of its geopolitical location – connecting the North, South, East and Western countries. Through the sea ports on the Black Sea, Georgia connects to the wider world. Georgia is the transportation hub for the South Caucasus region (Georgia, Armenia, and Azerbaijan) and Central Asia (Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, and Turkmenistan) providing the routs to Russia, Turkey and Europe via the Black Sea.

Georgia's climate is extremely diverse. There are two main climate zones, subtropical and continental. Western Georgia has heavy rainfall throughout the year, while in the eastern Georgia, precipitation decreases with distance from the sea. The southeastern regions are the driest areas.

Negative consequences of climate change are already visible in Georgia. The main indicators of the process are increasing temperatures, shrinking glaciers, sea level rise, reduction and redistribution of river flows, decreasing snowfall and an upward shift of the snowline. More extreme weather events like flooding, landslides, forest fires and coastal erosion are also becoming more frequent.

Georgia is rich in fresh water resources. This is due to the mountainous territory of the country and abundant levels of precipitation. There are over 26 thousands water streams in Georgia, 99.5% of which are short rivers with a length less than 25 km. The country has almost all types of mineral waters and over 2 thousand mineral and thermal springs. Forests occupy 40% of the country's territory and 97% of Georgian forests are situated on mountain slopes.

According to the National Statistics Office of Georgia, the 2015 population was 3,730 thousand people. Population data excludes the occupied territories of the Abkhazian Autonomous Republic and the Tskhinvali region. The average life expectancy is 69 years for men and 73 years for women.

Georgia is a lower middle income country with nominal GDP per capita of 3,676 USD in 2014. Georgia made significant progress in strengthening its investment environment. Georgia is the top improver since 2005 both in Eastern Europe and Central Asia and globally in the Doing Business index. Its main economic activities include cultivation of agricultural products (grapes, citruses, other fruits, and hazelnuts), mining of manganese, steel and ferric alloy production, production of chemicals, copper, and gold. Georgia is also a producer of alcoholic and nonalcoholic beverages, metals, machinery small-scale industries etc. The country imports nearly all its needed supplies of natural gas and oil products.

The nominal Gross Domestic Product (GDP) in 2014 was worth 16,508 mln. USD. This value represents 0.03 percent of the world economy. For the period 2010-2013 the largest contributions to the real GDP growth, with compound annual growth rates, have the following sectors: Manufacturing (11.7%), Trade (5.9%), Transport (5.7%), Agriculture (5.2%) and Construction (3.2%). Foreign direct investments (FDI) in Georgia amounted to 1,758 million USD in 2014.

The GINI index of Georgia is relatively high (0.40 in 2014) compared to the other former Soviet Republics. The Unemployment Rate decreased from 15 percent in 2012 to 12.6 percent in 2014. Despite the significant economic growth in the last years, poverty is still widespread, with 21.4% of the total population living below poverty level.

Georgia is an energy import dependent country. The import ranges from 62% to 73% depending on the specific year. Azerbaijan and Russia are the main import countries. Imported natural gas and oil products account for 41% and 25% of the country's energy supply, respectively. Hydro is the third largest source, accounting for 16% of total energy supply. Fuel wood along with hydropower is a large indigenous energy source. Renewable energy development is one of the main priorities of the Georgian energy sector. There is a significant potential for several kinds of renewable energy - hydro, wind, solar, geothermal, and biomass.

1.2 National GHG Inventory

Georgia has conducted fourth national inventory of anthropogenic emissions by sources and removal by sinks of GHG for the First Biennial Update Report to UNFCCC over a period of 2010-2013. The Inventory includes a database of six direct and four indirect gases. The inventory was prepared in accordance with the Intergovernmental Panel on Climate Change (IPCC) Methodology and for the compilation of the inventory, UNFCCC NAI Inventory Software v 1.3.2 (Excel based) was used. The inventory covers six sectors: Energy, Industrial Processes, Solvents and other Product Use, Agriculture, Land use, Land-Use Change and Forestry (LULUCF) and Waste.

In Georgia, the first GHG inventory was performed based on the 1980-1996 data, as part of the preparation of the First National Communication (FNC, 1997-1999). The Second National Communication (SNC, 2006-2009) comprised the period of 1998-2006. The 2007-2011 GHG inventory was performed as part of the Third National Communication (TNC, 2012-2015). The 2010-2013 GHG inventory was prepared for the First Biennial Update Report to UNFCCC during 2015-2016 period. The results of 2010-2011 were recalculated for the various sectors.

Most of the activity data were available from the National Statistics Office of Georgia (GEOSTAT), Ministry of Environment and Natural Resources Protection of Georgia (MoENRP), Ministry of Energy, Ministry of Labor, Health and Social Affairs of Georgia, and other relevant institutions. Some data were obtained from Georgian Oil and Gas Corporation (GOGC), Electricity Market Operator (ESCO), the Georgian National Energy and Water Supply Regulatory Commission (GNERC), British Petroleum (BP) Georgia, Industries, FAOSTAT, and Solid Waste Management Company of Georgia. For emission factors, IPCC default values were used taking into account expert judgment.

In 2013 greenhouse gas emissions in Georgia totaled 16,679 Gg in CO_2 equivalent (35% of 1990 year's emission), without consideration of the LULUCF sector, and 12,555 Gg CO2eq

when taking this sector into account. Forest land (level-21%) as a sink, Grassland (9%), Fugitive emissions from Natural Gas Transportation and Distribution Sector (7%), Enteric Fermentation (5%), Manufacturing Industries and Construction (Solid Fuel-5%) and Road Transport (Diesel and Gasoline – 5-4%) as emitters are the most key source categories in Georgia.

The Environmental Information and Education Center of the MoENRP was the main implementing organization of the inventory. It hired the experts, including local and international experts to prepare GHGs emission inventory. The staff of the Climate Change Service of the MoENRP conducted trainings on GHGs emission inventory methodologies for the interns of the center. The QA/QC for Georgian GHG inventory were performed for the first time and conducted by the external organization - WEG, which is not directly involved in preparing the NIR.

The final national inventory of greenhouses gases was additionally reviewed by an expert nominated by the UNDP/UNEP Global Support Program for National Communications and Biennial Update Reports (GSP), who confirmed the significant progress in improvement of the quality of the national GHG inventory. For the next inventory it is recommended to use the 2006 guideline and conduct recalculations for the previous years.

1.3 Climate Change Mitigation

Georgia is a non-annex I country to the United Nations Framework Convention on Climate Change. However, in 2010 Georgia acceded to the Copenhagen Accord and declared that "Georgia will take steps to achieve a measurable, reportable and verifiable deviation from the baseline scenario supported and enabled by finance, technology and capacity building." In September, 2015 Georgia has submitted its Intended Nationally Determined Contribution (INDC) to the UNFCCC.

According to the INDC, Georgia plans to unconditionally reduce its GHG emissions by 15% below the Business as Usual scenario (BAU) by 2030 and this 15% can be increased up to 25% if the country has an access to low-cost financial resources and technology. Minister of Environment and Natural Resources Protection of Georgia signed the agreement in April, 2016 in New York, USA. Currently, Georgia works on the follow up of Paris Agreement, to initiate the process that will bring to the ratification of the agreement, which will give the country a possibility to implement mechanisms under the new agreement as well as to develop and submit by 2020 more ambitious NDC than its already submitted INDC.

There are several ongoing mitigation policies, programs and projects in Georgia:

- The United States Agency for International Development (USAID) supports preparation of Low Emission Development Strategy (LEDS) of Georgia, which was launched in May 2013 and will be finalized by June 2017.
- Georgia is actively involved in preparation and implementation of projects for Nationally Appropriate Mitigation Action (NAMA). In the framework of this initiative four NAMAs are implemented or are under preparation.
- The EU-Georgia association agreement explicitly mentions the cooperation of the Ministry of Environment and Natural Resources Protection on the preparation of LEDS, as well as Nationally Appropriate Mitigation Actions (NAMAs), and the measures to promote technology transfer on the basis of technology needs assessment.
- The government of Germany works intensively with Georgia to set up a system for MRV through its Partnership Programme led by the Society for International Collaboration of Germany - GiZ.
- In 2008, the EU launched a Covenant of Mayors (COM) process in which signatory cities pledge to decrease emissions by 20% from their territory by 2020. By April 2016 thirteen Cities of Georgia have signed the initiative.
- There are ongoing negotiations between the Ministry of Environment and Natural Resources Protection of Georgia and UNDP to prepare project identification documents necessary to implement the fourth national communication and second Biennial update report to UNFCCC in the next years.
- From its beginning Georgia has been involved in Clean Development Mechanism (CDM) and has registered seven projects. But, due to the uncertainty of perspectives of CDM globally, Georgia's activities in this direction have weakened.
- From 2015, with the support of EBRD, the Ministry of Energy has started preparation for the first National Energy Efficiency Action Plan of Georgia. The NEEAP will identify significant EE improvement measures and expected energy savings in all sectors. The NEEAP will be submitted in 2016.

Implementation of these programs and plans, among other activities, will contribute to achieving the mitigation targets of Georgia.

1.4 Constraints and Gaps, and Related Financial, Technical and Capacity Needs

Major constraints and gaps are crosscutting – similar for all sectors. The lack of well-defined sectoral strategies and policies, coupled with a weak integration and coordination among different government agencies; the lack of an appropriate legislative and strategic framework and capacity in policy making, The deficiency of expertise, monitoring plans and appropriate equipment; the low level of public awareness and acceptability, coupled with an underestimation of socio-economic gains that can be derived from implementation of the UNFCCC; The immaturity of certain new technologies as well as commerciality and competitiveness issues; Significant challenges in setting up sustainable MRV systems and building the staff capacity required for national communication and BUR reporting; Difficulties in mobilizing, accessing and delivering financial resources; technical constraints on how to collect, collate and store data on climate change finance; Institutional challenges relating to the coordination of climate change finance and etc. are the main gaps and challenges Georgia faces in the field.

1.5 Support Received

Georgia has received significant support in Climate Change field during last 5 years. In 2015, GEF funded a project to prepare Georgia's First Biennial Update Report to the UNFCCC. The project was implemented by UNDP. In 2011, a project on Enabling Activities for the Preparation of Georgia's Third National Communication to the UNFCCC was funded by GEF and Government of Georgia and Implemented by UNDP. In the chapter 6 are presented the projects and support received in last five years for Georgia.

1.6 Domestic Measurement, Reporting and Verification (MRV) System in Georgia

Georgia is in the process of establishing a domestic MRV system for mitigation actions in line with its commitments under the UNFCCC. The MRV system is planned to cover not only domestically supported NAMA, but will also aim, in the future, to accommodate the requirements for MRV of internationally supported NAMAs, as well as of other mitigation activities.

The initial experience with different elements of the MRV for GHG emissions has already been gained through the implementation of Clean Development Mechanism (CDM) projects under the Kyoto Protocol. Significant work has also been done under the preparation of the national GHG inventory, a vital element of the MRV system in every country. However, as of now despite the understanding of the role of MRV and the accumulated experience, an overall domestic MRV system has not been designed and implemented on a national level in Georgia yet. Furthermore, no consideration has been given to MRV of sustainable development (SD) co-benefits or financial support up to now. The chapter 7 provides a brief overview of the experience of Georgia with MRV and the proposed design of domestic MRV system in the country, respective institutional arrangements and the implementation plan. The chapter also provides an analysis of the identified gaps on the road to MRV system establishment and the required support for overcoming them.

2 CHAPTER - National Circumstances

2.1 Natural conditions

2.1.1 Geography and political system

Georgia is a democratic semi-presidential republic with the president as the head of state and Prime Minister as the head of the government. The executive branch of power is made up of the president and the cabinet of Georgia. The cabinet consists of ministers, headed by the prime-minister. Legislative authority is vested in the parliament of Georgia and the judicial power is represented by Supreme, Constitutional, District and Municipal courts.

There are 150 members in the parliament of Georgia, of which 77 are party representatives elected through proportional system, and 73 are majoritarian representatives elected through single-member district plurality system. Members of the parliaments are elected for 4 years term while president is elected for 5 years.

Georgia has strongly articulated pro-western policy discourse directed towards its integration into EU and NATO structures. EU-Georgia relations date back to 1992, following the dissolution of the Soviet Union and Georgia's subsequent declaration of sovereignty. In June 2014 the EU and Georgia signed an Association Agreement which includes membership in the Deep and Comprehensive Free Trade Area (AA/DCFTA). The agreement significantly deepens Georgia's political and economic ties with the EU and facilitates the political association and economic integration.

Geography

Georgia is located in the mountainous south Caucasus region, south-east part of Europe. It borders Russia in the north, Azerbaijan in the east, Armenia and Turkey in the south and the Black Sea in the west. Its total area is 69.7 thousand sq. km. of which 40% is covered by forests. Nearly 2.6 million hectares is agricultural land, including 468 thousands hectares of arable land. The length of coastal zone is 310 km and the land border covers 1,838 km.

Despite its small area, Georgia has a very diverse topography; the northern region is characterized by high mountains, and the central and southern parts, while mountainous, are much lower and covered with alpine fields and forests.

Georgia plays an important role in the Caucasus region because of its geopolitical location – connecting the North, South, East and Western countries. Georgia was a part of a historic silk road which was used by merchants until 15th century. The Silk Road was a part of series of trade and cultural transmission routes that were central to cultural interaction through regions of the Asian continent by connecting the West and East by linking traders, merchants, pilgrims, monks, soldiers, nomads, and urban dwellers from China and India to the Mediterranean Sea during various periods of time, from II BC to XVII AD. Georgia's geographical location made it a significant transit country along these trade routes, as all routes connecting Europe and Frontal Asia, Near East, Middle and Central Asia traverse Georgia. Proximity to the sea enhances Georgia's importance as a transit country. Through the sea ports on the Black Sea, Georgia connects to the wider world.

Georgian has its own language and alphabet, which belongs to the Kartvelian group of Iberian-Caucasian languages and is one of the oldest of the living languages. The fifth century Assyrian manuscript "A book of peoples and countries," notes that of the 73 known nations, only 14 had a written language. Among these Georgians are mentioned.

2.1.2 Climate conditions and climate change

Located at the crossroads of Western Asia and Eastern Europe, Georgia's climate is extremely diverse. There are two main climate zones, subtropical and continental. The region's weather patterns are influenced both by dry Caspian air masses from the east and humid Black Sea air masses from the west. At the same time, The Greater Caucasus range moderates local climate by serving as a barrier against cold air flowing from the north. As a result, Western Georgia has a humid subtropical, maritime climate, while eastern Georgia has a range of climate varying from moderately humid to an arid dry subtropical semi desert type.

Western Georgia has heavy rainfall throughout the year, totaling 1,000 to 2,500 millimeters and reaching a maximum in autumn and winter. Black Sea regions receive the most rain, and humidity decreases to the north and east. Winters and summers in these regions are mild; the average temperature is 5°C in winter and 22°C in summer.

In the eastern Georgia, precipitation decreases with distance from the sea. The southeastern regions are the driest areas, and winter is the driest season; the rainfall maximum occurs at the end of spring. The highest daily average lowland temperatures occur in July about 25°C, while average January temperatures over most of the region range from 0 to 3°C.

Climate change

Negative consequences of climate change are already visible in Georgia. The main indicators of the process are increasing temperatures, shrinking glaciers, sea level rise, reduction and redistribution of river flows, decreasing snowfall and an upward shift of the snowline. More extreme weather events like flooding, landslides, forest fires and coastal erosion are also becoming more frequent. All these processes cause significant economic loss and human casualties.

Studies on climate change[1] in Georgia predict the increase of a temperature by 3.5 degrees in mean annual temperature by the end of the century. It is also predicted that precipitation in western regions will decrease by 6% and in eastern regions - by 14%.

[1] Georgia's Third National Communication to the UNFCCC - http://unfccc.int/resource/docs/natc/geonc3.pdf

Based on the data provided by the National Environmental Agency (NEA), changes in annual average, maximum and minimum temperature and annual level of precipitation for 1990 and 2015 years are significant (table-2.1).

Table 2.1 – AVERAGE ANNUAL, MAXIMUM AND MINIMUM TEMPERATURE AND ANNUAL LEVEL OF PRECIPITATION BY MAIN STATIONS OF GEORGIA FOR 1990 AND 2015 YEARS (NEA)

Stations	1990						2015					
	Average Temp. (C^0)	Max. Temp. (C^0)		Min. Temp. (C^0)		Precipitation (mm)	Average Temp. (C^0)	Max. Temp. (C^0)		Min. Temp. (C^0)		Precipitation (mm)
Akhaltsikhe	8.9	35.2	2-Jun	-15.5	28-Jan	450.6	10.5	38.6	31-Jul	-13.6	20-Dec	480.2
Ambrolauri	11	36.2	2-Jun	-10.0	28-Jan	1003.9	12.8	40.0	1-Aug	-7.4	20-Dec	848.6
Bolnisi	12.8	34.1	8-Jul	-10.0	7-Jan	469	13.6	37.5	16-Aug	-6.2	10-Jan	519.6
Gori	10.9	33	10-Jul	-9.5	30-Dec	454.8	12.4	36.8	1-Aug	-10.6	10-Jan	587.3
Mta-sabueti	6.8	26.5	20-Jun	-10.6	-	1202.6	7.7	32.0	1-Aug	-12.8	10-Jan	1231.3
Pasanauri	8.2	31.1	2-Jun	-15.5	10-Jan	842.5	9.2	34.0	16-Aug	-13.9	11-Jan	1009.5
Poti	14.2	35.4	1-Jun	-3.0	17-Mar	2074	15.8	34.5	20-May	-2.8	20-Dec	2252.0
Qobuleti	13.8	36.8	9-Jun	-3.0	17-Mar	2187	-	36.5	21-May	-5.2	10-Jan	2583.8
Qutaisi	14.2	36.7	13-Sep	-2.4	17-Mar	1445.8	16.1	42.2	31-Jul	-2.0	9-Jan	1085.1
Tbilisi	13.5	36.5	8-Jul	-4.8	7-Jan	398.9	14.4	38.5	5-Aug	-7.2	10-Jan	588.5
Telavi	12.4	32.8	10-Jul	-11.7	7-Jan	733.1	13.2	38.2	16-Aug	-8.5	10-Jan	837.4
Zugdidi	13.7	37.1	1-Jun	-5.2	17-Mar	1670.9	15.2	36.6	10-Aug	-4.9	9-Jan	1631.7

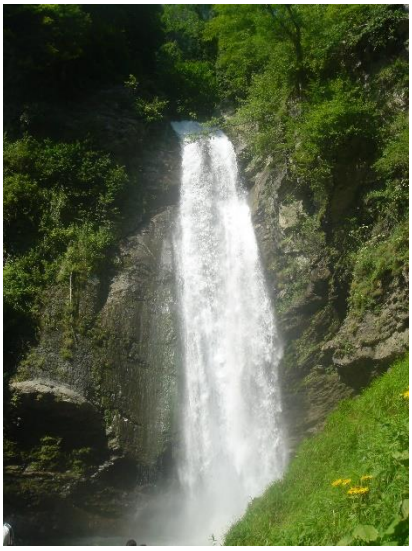
Georgia's coastal zone is considered to be the most vulnerable to climate change as it is affected by a variety of geophysical processes exacerbated by the change including tectonic movements, rising sea levels, tidal waves, floods, underwater currents, and river sedimentation.

Recent droughts have already begun to show the potential damage that climate change could cause to the region. More frequent extreme events such as droughts and floods could end up being more damaging than the long-term change in temperature and precipitation averages.

Heavy rains, a more frequent consequence of climate change, have also occurred and have been accompanied by hail and high winds. These extreme and intense weather events have left many areas of the country in an emergency situation, with felled trees, broken communications, damaged roads, inhibited water supplies, damaged roofs and buildings, flooded farmlands, and destroyed crops.

The potential for climate change to damage agriculture is especially problematic, as a large portion of the rural population depends on it for their livelihood and damage to the sector would undermine the progress made in rural poverty reduction.

2.1.3 Water resources



Georgia is rich in fresh water resources. This is due to the mountainous territory of the country and abundant levels of precipitation. Annual precipitation in Georgia is 1,338 mm and the mean annual precipitation volume is 93.3 cubic km. Amongst former Soviet Union states, Georgia most fresh water resources per capita and is only by Norway, Switzerland and Austria on the European continent.

There are over 26 thousands water streams in Georgia, 99.5% of which are short rivers with a length less than 25 km. 860 lakes have a total surface area of 175 km^2 and a total volume of 400 million cubic meters. 43 reservoirs serve as hydroelectric stations and sources of irrigation. More than 80% of electric energy in Georgia is generated by hydroelectric stations.

There are 734 glaciers which total 511 km^2 and accumulate 30 billion cubic meters of ice. Measurements reveal that 94% of the glaciers have retreated, 4% exhibited no overall change and 2% have advanced. The mean retreat rate equals 8m/year, and maximum retreat rates approach 38m/year. Continued glacier retreat could lead to considerable changes in their runoff, with implications for water resources. In near past, Georgia had 2,560 km^2 of wetlands; today this has been reduced to 627 km^2.

The territory of Georgia is quite diverse in its structural and geological development, which gives rise to a diversity of mineral wealth. The intensity of the geological processes as well as the area and scale of their development processes has determined the size and often quality of deposits. The natural supply of fresh ground water is about 18,000 million cubic meters annually. 90% of this drinking water is based on ground water does not need any special treatment beyond chlorination.

2.1.4 Natural resources

Georgia is among one of the world's richest countries in terms of natural resources and mineral waters in particular. The country has almost all types of mineral waters and over 2 thousand mineral and thermal springs which are successfully used in treatment and rehabilitation of patients with different illnesses. Three major companies, Borjomi, Nabeglavi, and Sairmeare, bottle this mineral water for domestic and international consumption. These waters have linked to the treatment of several digestive diseases and diabetes and are effectively used as antioxidants during food poisoning.

The country features more than 100 climatic and balneological resorts, many of which are use deposits of therapeutic muds.

There are considerable deposits of manganese, silver-lead and zinc ores, barite, coal, and marble on the southern slopes of the Greater Caucasus Mountains and in some areas, copper, zinc, arsenic, mercury, talc, marl, limestone, iron, gold, granite, and marble are also found.

Forest

Forests occupy 40% of the country's territory (3005 thousand hectares) and have an exceptional importance at national, regional and global levels. Georgian forests not only conserve its biological diversity, but ensure continuous delivery of vital direct or indirect benefits and resources to the population.

97% (2915.8 hectares) of Georgian forests are situated on mountain slopes. Average wood stock volume per hectare is 176 m^3, and the average age of Georgian forests is approximately 100-120 years. Broad-leaved trees compromise 80% of the forest, out of which up to 50% are beach.

Georgian forests are severely degraded, due to an unprecedented period of deforestation beginnings in the late 1990s. Unsustainable forestry practices are affecting the diversity, quality and productivity of the forests. These practices began in response to an almost complete termination of timber import from Russia. An additional sharp reduction in fuel importation led to further illegal logging. Degraded forests have drastically decreased protective functions (protection of soils, storage of waters, regulation of waters, sanitary-hygienic functions, etc.) and self-recovery ability. Landslides and avalanches are becoming

more frequent. Deforestation exerts a negative influence on forests' total ability to absorb carbon.

2.1.5 Environment

According to the Constitution, Georgia is commitment to the protection of the fundamental human right to live in healthy environment and to enjoy the natural and cultural surroundings, to receive complete and objective information about their work place and living environment, and to promote the rational and sustainable use of natural resources.

Air quality

Monitoring of air quality in Georgia is only conducted in the five cities of Tbilisi, Kutaisi, Zestaphoni, Batumi, and Rustavi. On average, pollutant concentrations in these cities are 2.5 times higher than the upper limit of acceptable levels. 17% of all illnesses and 19% of all deaths in Georgia are caused by environmental pollution. Road transport is considered to be the main air pollutant in Georgia. This is due to the old cars and bad fuel quality. In order to decrease emission levels, various measures should be implemented including but not limited to the establishment and gradual decrease of an age limit for cars, traffic optimization, the development of electric transport, the introduction of fuel quality control mechanisms, the use of natural gas, etc.

Drinking Water

Regular monitoring of drinking water quality commenced in Georgia in 2008-2009. Programs aimed at the improvement of drinking water supply systems are underway in many regions in Georgia and will lead to significant improvements in the quality of drinking water supplies.

Land and soil

Protection of land and soil is essential for Georgia as land resources are limited. Only 15% of the total area (69,700 km^2) can be cultivated and 70% have a natural-economic use (forests, bushes, meadows and pastures). Georgia suffers from degradation or non-sustainable use of natural resources. Deforestation, desertification and land degradation (overgrazing, soil pollution, and erosion) pose significant challenges. Land desertification results in the progressive loss of plant cover in dry steppes and semi-deserts and around 4% of the country territory (3,000 km^2) is vulnerable to desertification.

Natural disasters

Georgia is situated in one of the most seismically active regions in the Alpine-Himalayan collision belt. Strong earthquakes, with magnitudes up to 7 and macro-seismic intensity of 9 (MSK scale), have occurred in the region. An analysis of the historical and instrumental seismology of this region shows that it is still of moderate seismicity.

Natural disasters take place on quite a large scale and high frequency in Georgia due to the complex geological and geographical conditions. The frequency of natural disasters has increased in the recent past and this increase is considered to be a consequence of the effects of global climate change as well as human activities, such as deforestation, overgrazing of pastures, etc.

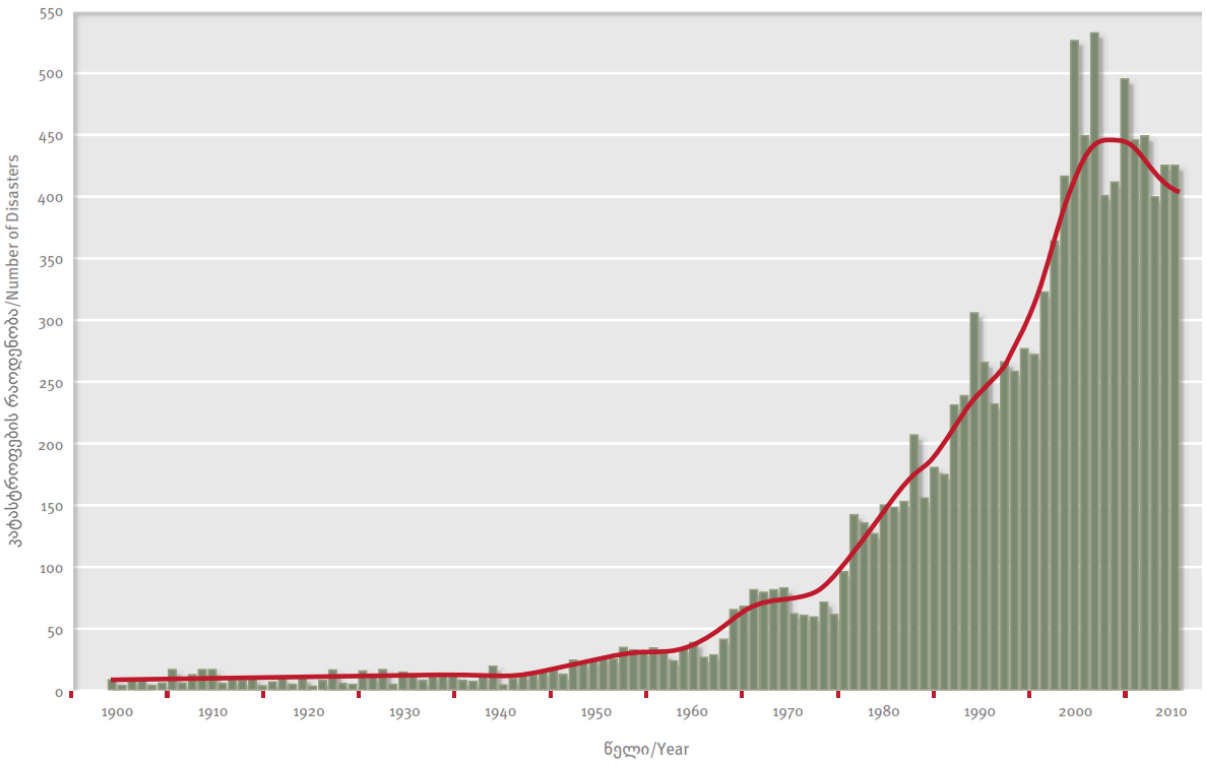


Figure 2.1 – NUMBER OF DISASTERS DURING 1900-2010 YEARS (SOURCE: CENN, ATLAS OF NATURAL HAZARDS AND RISKS OF GEORGIA)

A clear illustration of the increasing impact of climate change on Georgia were the severe wind and hailstorms observed in the Eastern regions in the summer of 2012. The medium-sized hazard resulted in a disproportionate socio-economic disaster: 75,000 people were affected and GEL 202 million in economic output was lost.

The concept of risk reduction as primarily a development issue is rather new for national and local authorities in Georgia. There is a low awareness of the potential consequences of the lack of investment and proper planning for risk reduction on the economic and human development of the country. A dedicated legislative and policy framework for disaster risk

reduction is still lacking. Institutional arrangements and multi-stakeholder coordination mechanisms are not fully functional and efficient. Technical, human and financial capacities exist but are not well coordinated, prioritized and systematized across the relevant sectors, governance levels and institutions. Climate risk reduction and climate change adaptation efforts require better alignment at institutional, policy and program implementation levels, as climate and disaster-related risks can no longer be addressed separately.[2]

Chemicals

Two major groups of chemicals especially hazardous to the environment and human health, persistent organic pollutants and ozone depleting substances are subject to special regulation in Georgia. These substances are not produced in Georgia but their import and export is being controlled.

Legislation

The Law on Environmental Protection was adopted in 1996. This law requires developing and implementing a 5-year National Environmental Action Programmes (NEAP). The NEAP 2 for 2012-2016 years, sets long-term goals, short-term targets and provides respective activities for eleven themes: disasters (covers natural and man-made disasters, industrial accidents), climate change, waste and chemical substances, nuclear and radiation safety, water resources, ambient air, Black Sea, biodiversity and protected areas, land resources, forestry, mineral resources.

According to the Georgian legislation, the National Report on the State of the Environment (SoE) shall be developed once every three years for the purpose of public information. The 2007-2009 National Report was approved in December 2011. It is a document which compiles and analyzes all the existing information on current environmental conditions. The document describes the main directions of environmental policy of the country, presents information on the qualitative state of the environment, presents information on the outcomes of the environmental activities carried out within the frames of international relations, and gives the analysis of environmental impact of different economic sectors. The SoE covering 2010 to 2013 is currently under preparation.

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[2] http://police.ge/files/pdf/sagangebos_statistika/kanonebi/DRR%20Capacity%20Assessment%20Repot%20Georgia%202014.pdf

2.2 Social and economic overview

2.2.1. Population

According to the National Statistics Office of Georgia, the 2015 population was 3,730 thousand people. A more detailed information about urban, rural and gender distribution can be seen on the table below. Population data excludes the occupied territories of the Abkhazian Autonomous Republic and the Tskhinvali region.

Table 2.2 – DEMOGRAPHY (Source: GEOSTAT)

DEMOGRAPHY	2015 (thsd.)	%
Population of Georgia	3,730	100%
Population in urban area	2,140	57%
Population in rural area	1,589	43%
Males	1,779	48%
Females	1,951	52%
Working population	2,409	65%

The demographics in Georgia, like some other former Soviet republics, changed significantly since independence, with the proportion of ethnic Georgians increased by 10 percentage points from 73.7&% and 83.7% between 1989 and 2002. Emigration has been another cause of demographic change, and in 2007 Georgia was named among states with the highest percentage of emigration countries in the world. The 2002 population census in Georgia revealed a net migration loss of 1.1 million persons, or 20% of the population, since the early 90s. The decline in Georgia's population is caused by the emigration in search of employment and a sharp fall of birth rates.

According to the 2014 population census Georgians are the predominant ethnic group, representing 87% of the population, there are significant minorities of Azeris, Armenians, Russians, Ossetians and Abkhazians[3] amongst other smaller groups. A detailed list is given below in Table 2.3.

[3] The census has not covered Georgian region of Abkhazia, which is currently occupied and controlled by Russian army.

Table 2.3 - ETHNIC GROUPS IN GEORGIAN POPULATION (Source: GEOSTAT[4])

POPULATION BY ETHNICITY	2014 (thsd.)	%
Georgians	3,225	86.9%
Azeris	233	6.3%
Armenians	168	4.5%
Russians	26	0.7%
Ossetians	14	0.4%
Yezidis	12	0.3%
Ukrainians	6	0.2%
Kists	6	0.2%
Greeks	6	0.2%
Assyrians	2	0.1%
Other	14	0.4%
Total	3,712	100%

The average life expectancy is 69 years for men and 73 years for women. Population by gender and age can be seen on the figure below:

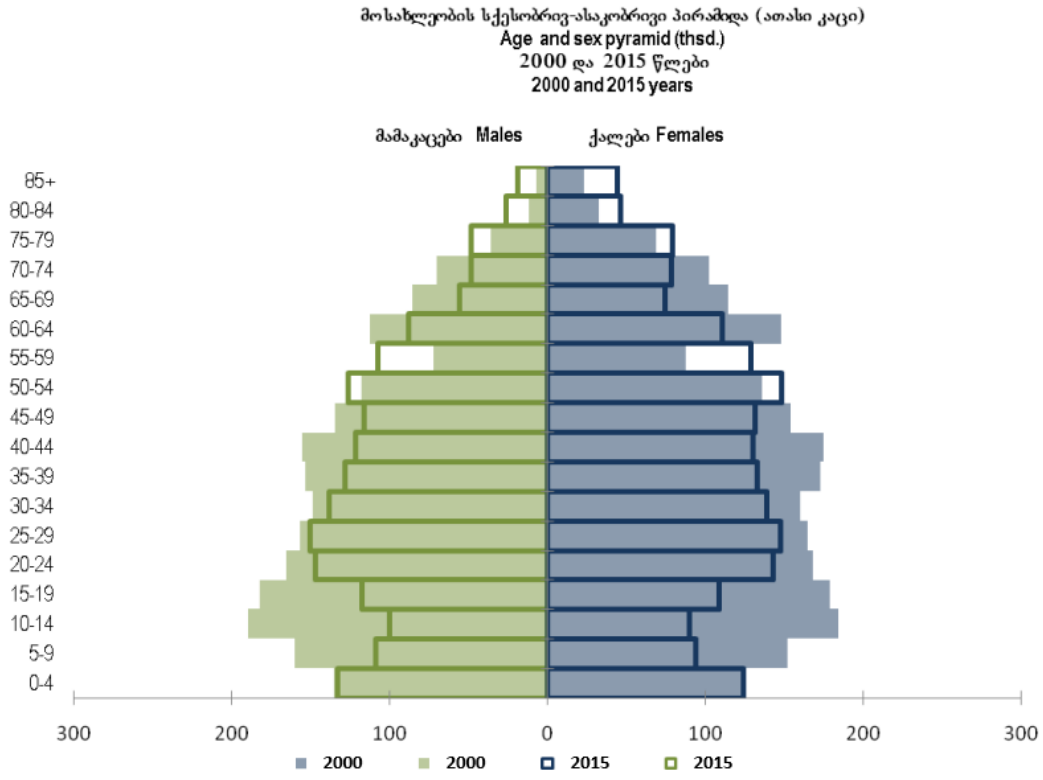


Figure 2.2 – AGE AND SEX PYRAMID (Source: GEOSTAT)

[4] www.census.ge

2.2.2. Economy

Georgia is a lower middle income country with nominal GDP per capita of 3,676 USD in 2014. In 2014 Georgia signed an Association Agreement with EU which includes Deep and Comprehensive Free Trade Area. This is expected to enhance Georgia's trade prospects and boost economic growth by enhancing the country's export potential, especially to developed markets. The process will be facilitated through improvements in quality standards and by bringing Georgia's legislation closer to that of the European Union (EU).

Georgia made significant progress in strengthening its investment environment. Georgia is the top improver since 2005 both in Eastern Europe and Central Asia and globally in the Doing Business index. More detailed information about other indicators and rankings can be seen on the table below.

Table: 2.4 - Georgia in international Ratings

INDICATOR	RANK	OUT OF	SOURCE
Ease of Doing Business 2015	15	189 countries	World Bank
Doing Business 2014	47	146 countries	Forbes
Economic Freedom of the World 2014	16	152 countries	Fraser Institute
Index of Economic Freedom 2015	22	178 countries	Heritage Foundation
The Enabling Trade Index 2014	36	138 countries	The Global Economic Forum
Bertelsmann Transformation Index BTI 2014	48	129 countries	Bertelsmann foundation in Germany
Corruption Perception Index 2014	50	175 countries	Transparency International
The Global Competitiveness Index 2014-2015	69	144 countries	The World Economic Forum
Global Innovation Index 2014	74	143 countries	Cornell University, INSEAD, and the World Intellectual Property Organization (WIPO)
Human Development Index 2013	79	187 countries	Human Development Report Office

Georgia's main economic activities include cultivation of agricultural products (grapes, citruses, other fruits, and hazelnuts), mining of manganese, steel and ferric alloy production, production of chemicals, copper, and gold. Georgia is also a producer of alcoholic and nonalcoholic beverages, metals, machinery small-scale industries etc. The country imports nearly all its needed supplies of natural gas and oil products. Construction of the Baku-T'bilisi-Ceyhan oil pipeline, the South Caucasus gas pipeline, and the Kars-Akhalkalaki Railroad are part of a strategy to capitalize on Georgia's strategic location between Europe and Asia and develop its transit role. The expansion of the South Caucasus pipeline, as a part of the Shah Deniz II Southern Gas Corridor project, will result in a $2 billion foreign investment in Georgia. Gas from Shah Deniz II is expected to begin flowing in 2019.

The nominal Gross Domestic Product (GDP) in 2014 was worth 29,151 mln. GEL (16,508 mln. USD). This value represents 0.03 percent of the world economy. GDP in Georgia averaged 7 billion USD from 1990 until 2014, reaching an all-time high of 16.5 billion USD in 2014 and a record low of 2.51 billion USD in 1994.

During the period of 2010-2014 an average annual GDP growth rate was about 5.6% and in absolute terms real GDP grew from 12,835 to 15,834 mil. GEL (in 2003 prices). For the period 2010-2013 the largest contributions to the real GDP growth, with compound annual growth rates, have the following sectors: Manufacturing (11.7%), Trade (5.9%), Transport (5.7%), Agriculture (5.2%) and Construction (3.2%).

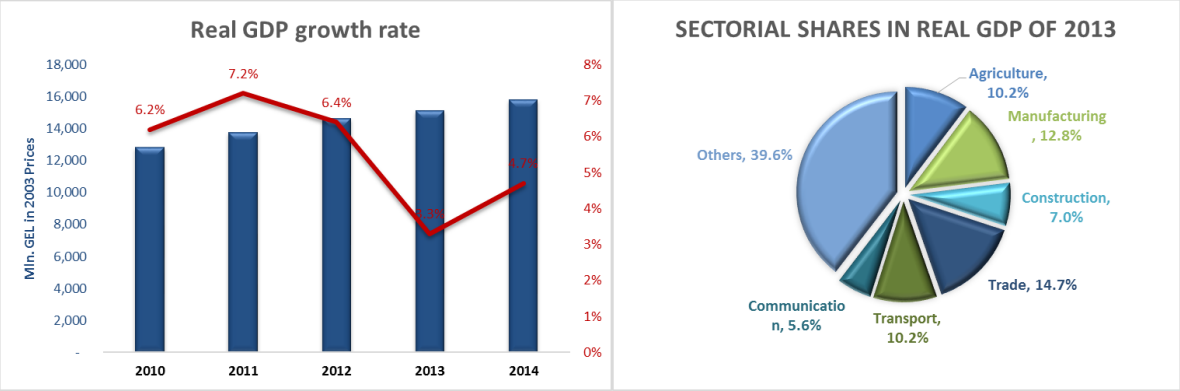


Figure 2.3 – REAL GDP GROWTH RATE AND SECTORIAL SHARES IN REAL GDP, 2013 (Source: GEOSTAT)

Foreign direct investments (FDI) in Georgia amounted to 1,758 million USD in 2014. The largest share of FDI was for transport and communication, reaching 434 million USD. The building sector and manufacturing sectors came second and third, with 317 and 205 million USD respectively.

In 2014 the external trade amounted to 11,457 million USD, 5 percent higher than in 2013. The exports equaled 2,861 million USD (2 percent lower than in 2013), while the imports stood at 8,596 million USD (7 percent higher). The negative trade balance was 5,735 million USD in 2014 and its share in external trade turnover constituted 50 percent.

Table 2.5 – FOREIGN DIRECT INVESTMENT AND TRADE BALANCE OF GEORGIA (Source: GEOSTAT)

(Mln. USD)	2010	2011	2012	2013	2014
FDI	814	1,117	912	942	1,758
Export	1,677	2,189	2,375	2,908	2,861
Import	5,257	7,065	8,049	8,026	8,596
Balance	-3580	-4876	-5674	-5118	-5735

The GINI[5] index of Georgia is relatively high compared to the other former Soviet Republics. A maximum value of 0.43 was recorded in 2010, and receded by an insignificant 0.01 over the following years to rest at 0.40 in 2014. Rural poverty is deeper and more severe than urban poverty.

Unemployment

In Georgia, the unemployment rate, reported by the National Statistics Office, measures the number of people actively looking for a job as a percentage of the labor force. According to the table 2.6, the Unemployment Rate decreased from 15 percent in 2012 to 12.6 percent in 2014. It averaged 15 Percent from 2005 until 2014, reaching an all-time high of 16.9 Percent in 2009 and a record low of 12.6 Percent in 2014.

Table 2.6: UNEMPLOYMENT RATE IN GEORGIA FOR 2005-2014 YEARS

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Active population (labor force), thds persons	2024	2022	1965	1918	1992	1945	1959	2029	2004	1991
Employed, thds persons	1,745	1,747	1,704	1,602	1,656	1,628	1,664	1,724	1,712	1745
Unemployed, thds persons	279	275	261	316	336	317	295	305	292	246
Unemployment rate, percentage	13.8	13.6	13.3	16.5	16.9	16.3	15.1	15.0	14.6	12.6

Poverty

Despite the significant economic growth in the last years, poverty is still widespread, with 21.4% of the total population living below poverty level. The extreme poor – those who are below the lower (or food) poverty line – account for 8.4%. Rural areas continue to record high rates of poverty: 29.7% are poor and 12.4% are extremely poor in comparison the 18.3% poor and 6.7% extremely poor in urban areas.

The poverty line is the minimum level of income deemed adequate in a particular country. Determining the poverty line is usually done by finding the total cost of all the essential resources that an average human adult consumes in one year. While there is no exact definition for Georgia's poverty line, it is assumed that citizens are below the poverty level if their income is less than the minimum wage (the lowest wage upon which a worker and his family can survive).

[5] Gini index measures the degree of inequality in the distribution of family income in a country

Table 2.7: POPULATION UNDER POVERTY LINE (REGISTERED POVERTY)

	2007	2008	2009	2010	2011	2012	2013	2014
Beneficiaries of subsistence allowance	279.5	368.4	436.3	430.6	411.1	436.0	437.2	521
Share of population under poverty line (%)	6.4	8.4	9.9	9.7	9.2	9.7	9.7	11.6

A person whose household income per consumption unit is less than 60 percent of the median income is considered living at a risk of poverty. In 2013 the share of population under 60 percent of the median consumption was 21.4%, and under 40 percent of median consumption - 8.4%, i.e. officially 21.4% of the population in Georgia is considered as poor, and 8.4% as extremely poor.

Table 2.8: POVERTY IN GEORGIA

	2007	2008	2009	2010	2011	2012	2013
Share of population under 60 percent of the median consumption (%)	21.3	22.1	21.0	22.7	23.0	22.4	21.4
Share of population under 40 percent of the median consumption (%)	9.2	9.5	8.8	10.0	10.4	9.3	8.4

According to the World Bank Development Indicators, the poverty headcount ratio at $1.25 a day (PPP) in Georgia was 16.1 percent in 2011 and 14.1 percent in 2012.

In June 2014 the Georgian Government adopted a socio-economic development strategy entitled "GEORGIA 2020," which outlines the country's social and economic development priorities over the period of 2014-2020 and strives to achieve the following results by 2020:

Table 2.9: TARGET ECONOMIC INDICATORS IN THE SOCIO-ECONOMIC DEVELOPMENT STRATEGY "GEORGIA 2020"

Indicator	Current rate	Forecast rate
GDP per capita (Nominal, GEL)	5 811.70	13 000.00
GDP per capita (Constant prices, GEL)	5 811.70	9 200.00
GINI coefficient	0.41	0.35
Inflation (%)	2.40	3.00
Unemployment (%)	15.00	<12.00
Taxes (% of GDP)	24.00	25.00
Exports (% of GDP)	45.00	65.00
Current account (% of GDP)	>10.00	6.00
Public debt to GDP ratio (%)	34.00	<40.00

The strategy is based on three main principles: (i) ensuring fast and efficient economic growth driven by development of production; (ii) implementing economic policies which facilitate inclusive economic growth. It envisages universal involvement in the economic development process (including Diaspora, migrants, ethnic minorities and other groups), prosperity for each member of society through economic growth, social equality and

improvement of the living standards; and (iii) the rational use of natural resources to ensure environmental safety and sustainability.

"Georgia 2020" describes in detail several main problems which include: the private sector's low level of competitiveness and insufficiently developed human capital and limited access to financial resources, which stand in the way of achieving long-term, sustainable and inclusive rates of economic growth. To solve these problems and achieve comprehensive economic growth, the strategy prioritizes several avenues of action: improving the country's investment and business environment; supporting innovation and technological development; facilitating the growth of exports; developing infrastructure and ensuring the country's transit potential is fully realized; ensuring the country's workforce meets labor market requirements; tightening the social security net; creating an accessible and high-quality healthcare system; and mobilizing investments and increasing financial intermediation.

Innovation and creativity is a necessary precondition for the sustainable growth and development. Accordingly, Georgia established the Innovation and Technology Agency on February 19, 2014. The Agency contributes to private and public sector knowledge, innovation and commercialization of research results and promotes innovative entrepreneurship. The Agency is actively involved in technology parks, innovation centers, innovation labs, accelerators and incubators for business creation and development. Several of the main objectives of the Innovation and technology Agency are improving high speed Internet access and e-commerce, decreasing distance to work, computerizing traffic patterns, and developing other similar electronic services.

2.2.3. Energy

Overview

Georgia's energy sector is one of the biggest contributors in total GHG emissions of the country. In 2014 total domestic energy supply was 4.48 million ton oil equivalent (Mtoe) from which 1.37 Mtoe was domestic energy production (31% of the country's total domestic energy supply). Energy consumption increased by 38% during 2010-2014[6]. The main sources of energy are natural gas, oil products, hydro, firewood and coal.

[6] Total final energy consumption in 2010 was about 2920 ktoe (TNC) and in 2014 was 4023 (GEOSTAT).

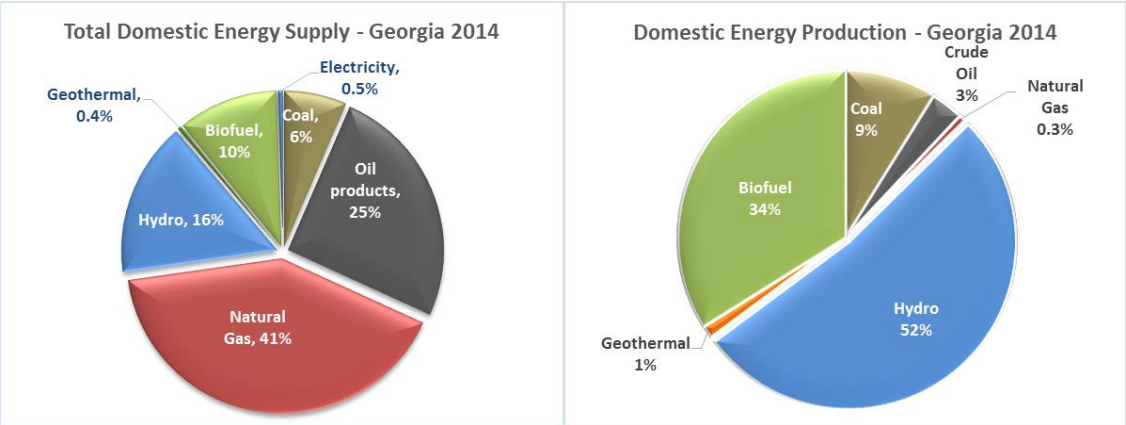


Figure 2.4– SHARES IN TOTAL DOMESTIC ENERGY SUPPLY AND INTERNAL ENERGY PRODUCTION OF GEORGIA, 2013 (source: GEOSTAT)

Georgia is an energy import dependent country. The import ranges from 62% to 73% depending on the specific year. Azerbaijan and Russia are the main import countries. Imported natural gas and oil products account for 41% and 25% of the country's energy supply, respectively. Hydro is the third largest source, accounting for 16% of total energy supply. Fuel wood along with hydropower is a large indigenous energy source and a strong factor for reducing country's energy dependence. Currently fuel wood accounts about 34% in total domestic energy supply.

Residential sector is the biggest consumer of energy (41%) followed by the transport (27%) and industry sectors (18%). The residential sector consumes mainly natural gas and biofuel (for heating and cooking), and electricity.

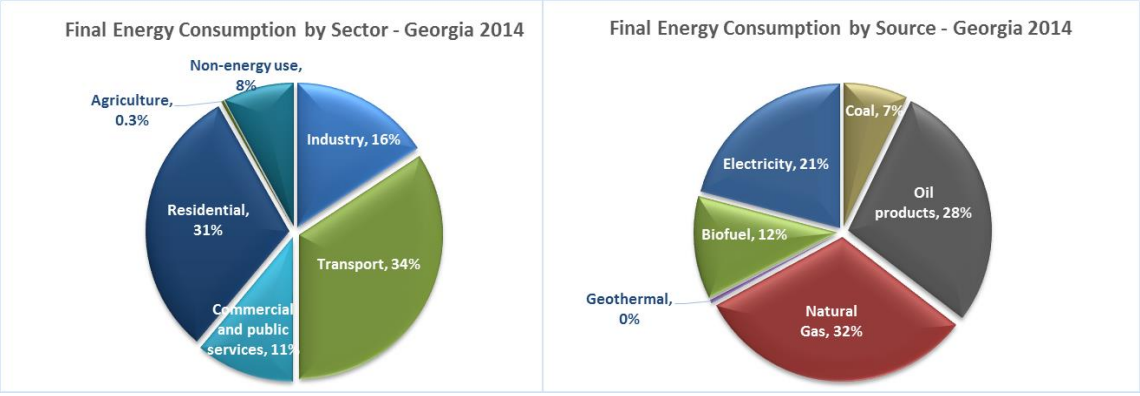


Figure 2.5 - FINAL ENERGY CONSUMPTION BY SECTOR AND BY SOURCE, GEORGIA 2014 (source: GEOSTAT)

Energy policy

The Ministry of Energy is the main entity governing the energy sector and The Georgian National Energy and Water Supply Regulatory Commission (GNERC) is the main

regulatory body, established in 1996. The ministry is responsible for developing energy policy and strategy documents. In 2014 Ministry of Energy updated and drafted energy policy document which outlines main energy policy directions:

- Diversifying energy supply and optimizing local energy resources
- Utilizing Georgia's renewable energy resources
- Gradual approximation and harmonization of Georgia's legislative and regulatory framework with the EU's Energy acquis
- Improving the energy market and energy trading mechanism
- Strengthening Georgia's importance as a transit route in the region
- Establishing Georgia as a regional platform for clean energy generation and trade
- Developing and implementing an integrated approach to energy efficiency
- Taking into account components of environmental protection when implementing energy projects
- Improving service quality and protection of consumer interests

Energy sources

Fossil fuel

Natural Gas

Georgia started gas extraction in the late 1970s. Initially, associated gas was extracted from the Samgori-Patardzeuli field. Free gas extraction started in 1983 when Rustavi gas field was discovered. Associate and free gas extraction has been carried out on Ninotsminda field. Currently gas production in Georgia is insignificant, and during the last five years annual gas production has averaged 16,5 million cubic meters vs consumption of 2 billion cubic meters.

According to studies [WEG] there are four widely spread four formations which could be potential source of shale gas, and more tight gas could be extracted from coal deposits; however, these potential resources are at the early stage of consideration.

Oil

Oil production started in the twentieth century and the annual production currently exceeds 40 thousand tons.[7] The territory is divided into license blocks, and production

[7] Source: Georgian Oil and Gas Corporation (GOGC)

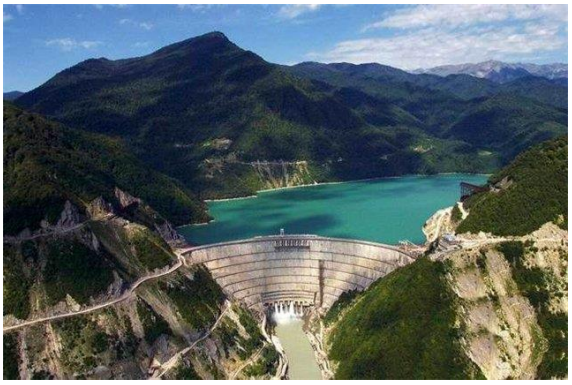
companies are selected through international tenders. All companies have concluded production sharing agreements with the government. Although these companies have already carried out significant exploration works within their licensed territories (Anadarko - Black Sea shelf, CanArgo - Tbilisi adjacent area, Frontera - Kakheti region) new fields have not yet been discovered, despite the promising geological examinations. Georgian Oil and Gas Corporation (GOGC) as a national oil company cooperates with them, monitors their activities and administers the state's share of oil.

Coal

Two types of coal, black and lignite (brown), are acknowledged fuel and energy resources. Out of 9 coal deposits, only 3 of them are commercially important (Tkibuli-Shaori, Akhaltsikhe and Tkvarcheli). Rapid development of the coal deposits in Georgia began after World War II, but coal mining is difficult because of the depth of the coal seams. Annual production of coal currently exceeds 300 thousand tons, but is characterized with low calorific value. By the beginning of 2013, the country's proved coal reserves are 331.1 MT of black coal. Brown coal reserves at Akhaltsikhe coal field sum up to 75.7 MT. In total, there are about 407 million tones.

Renewable Energy Sources

Renewable energy development is one of the main priorities of the Georgian energy sector**.** There is a significant potential for several kinds of renewable energy - hydro, wind, solar, geothermal, and biomass. The share of renewable energy in Georgia's energy balance,[8] including big hydro power plants (HPP), is approximately 27 percent.



Hydro energy

Hydro energy is the most developed source of energy in Georgia. The electricity system relies mainly on hydropower (78% in 2014). Almost half of the country's power generation (4.3 TWh out of 8.3 TWh in 2013) is produced by two power plants – Enguri and Vardnili.

[8] Energy Balance 2014, Georgia (GEOSTAT)

Wind energy

It's estimated that wind energy can generate 4 billion kilowatt-hours annually. The country is divided into four zones: a high speed zone, a partly high speed and low speed zone, a low speed mountain range effective exploitation zone and a low speed mountain range limited exploitation zone [source]. After several years of exploration of wind energy potential, in 2015 the construction of the first wind power plant 20 MW installed capacity will start near the city Gori.[9]

Solar energy

Georgia's geographical location also assures high sun radiation. There are 250 to 280 sunny days annually. An average of 1550 kWh of solar energy is annually irradiated on a surface of one m^2 in Georgia. This is equivalent to about 190 kWh of electricity or 1200 kWh of thermal energy (hot water) annually, based on current efficiencies of photovoltaic or water heating panels. There is no reliable data on the current state of solar energy utilization. However, there is an upward trend in the annual number of installations conducted over the last few years.

Biomass energy

Biomass consumption is increasing globally as a source of heat and electricity, and is likewise playing a major role in Georgia's energy supply. The recent studies indicate[10] that fuel wood is the second biggest indigenous energy source as 57% of households (97% in rural areas) use the firewood for water, space heating and cooking. This is mainly traditional biomass but recent studies also indicate, that there is a considerable amount of residue from wood and agricultural crops worth being used for energy.

Geothermal energy

According to modern hydro-geological studies, the Georgian geothermal water reserves reach 250 mil. m^3 per year. More than 80% of the geothermal deposits are in the west. There are more than 250 natural and artificial springs where the average temperature ranges from 30 to 110 C0. The total emission is 160, 000 m^3 per 24 hours.

Energy Transformation in Georgia

The energy transformation subsector is part of an energy generation segment where one kind of energy is transformed into another. In Georgia, the main segments of the transformation subsector are electricity generation. In 2013, 405 ktoe gas was consumed to produce 154 ktoe of electricity.

[9] Georgian Energy Development Fund (GEDF)

[10] Renewable Energy potential of Georgia and Policies for its Utilization - WEG 2008

2.2.4. Industry

Heavy manufacturing industry in Georgia is one of the most important sectors in terms of value added to exports and employment. In the 1980s, industrial output accounted for 65% of GDP, and Georgia contributed 0.2% of global industrial production with only 0.1% of the world population. After independence, however, nearly a third of factories ceased production. Political stabilization in 1995 led to the development of new industrial contacts has led to the relative stabilization of main industrial indicators and positive growth of GDP. Between 2004 and 2010, real GDP from industry grew faster than total real GDP. Since 2010 the share of real GDP has seen only insignificant growth.

Table 2.10: GROWTH RATE OF INDUSTRY AND ITS SHARE IN GDP, GEORGIA

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Growth rate of real GDP, percent	5.9	9.6	9.4	12.3	2.3	-3.8	6.2	7.2	6.2	3.2
Growth rate of real GDP by industry, percent	11.6	14.1	22.3	11.5	-1.5	-8.5	20.2	13.9	13.6	6.6
Share of real GDP by Industry, percent	9.2	9.6	10.7	10.6	10.2	9.7	11.0	11.7	12.5	12.9

The manufacturing industry exceeds most other sectors. It provides 10% of GDP, 16% of formal employment and around 30% of exports. Only the "trade" (mostly small retail shops) sector is larger. If one looks at the sub-sectors, "metal and metal products" contributes 2.5% of GDP and "chemical and non-metal mineral products" (mostly fertilizers and cement) is worth 2.3%. This makes both of these subsectors roughly the same size as the entire telecommunications sector (3% of GDP) or banking (2.8%) and makes both sub-sectors more valuable than the entire restaurant and catering sector (1.9%) or the hotel sector (0.6%). Another manufacturing sector, that of "transport and manufacturing equipment" (0.9% of GDP) is somewhat smaller but roughly the same size as manufacturing of alcoholic beverages, including wine (also 0.9%).[11]

A few sub-sectors of manufacturing are particularly; manganese, steel, fertilizer, cement, trains, airplane parts, electrical wire and other metal products stand out.

The industrial sector is one of the main producers of GHG emission. In 2011 GHG emissions from industry constituted about 28% of country GHG emissions, including non-energy emissions (15%) and energy related emissions (13%). The main source of GHG emissions is the production of cement, chemicals, steel and iron, and ferroalloys.

[11] Assessment of the Heavy Industry Sector for Rustavi Steel (2013)

Ferroalloys production

Manganeze alloys is Georgia's largest export goods. Mining and processing of ferroalloy makes up around 85% of the GEL 500 million in value added in basic metal production.

The Zestaponi ferroalloy plan is the largest plant in the Caucasus, and it produces mainly silicomanganese. The installed production capacity of Zestafoni ferroalloy plant is 185,000 tons per year.[12]

In 2011 GHG emissions from ferroalloy production constituted 2.6% of total country emissions. According to the "Metal Expert: World Manganese Markets," silicomanganese consumption is expected to increase by about 50% from 2013 to 2022 or with annual growth rate about 4.4%. Very likely the Zestaphoni plant will increase production, which will increase GHG emissions.

Iron and steel production

Steel processing contributes about 0.4% of GDP. The sector is dominated by Rustavi based steel producers, which mainly consists of the large Rustavi Metallurgical Plant and Geo Steel. According to local experts the sector employs around 3000 workers.

A large metallurgical plant located in Rustavi began steel production in 1950. The plant produced coke, sinter, pig iron, steel, rolled items, and hot-rolled and cold-drawn steel pipes. In the 1990s production of steel and iron significantly reduced and in 2000, it stopped completely. The plant recommenced steel production in 2007, but only based on scrap steel. Scrap iron is now worth 3% of exports, slightly lower than processed steel bars.

GHG emissions from this sub-sector may significantly increase in future, as the long term plan of Rustavi plant envisages the construction of one new annually 350,000 ton steel production line and rehabilitation of the Sinter Plant and Blast Furnace complex to produce annually 750,000 tons of pig iron.

Fertilizer production

Fertilizer is Georgia's second largest export good. The supplier of the product is Azot LLC which is the major producer of fertilizers in the South Caucasus. The company is situated in Rustavi and is a fully owned subsidiary of Agrochim S.A. The company hires more than 2000 workers.

[12] The Importance of the Heavy Manufacturing Sector and the Need for an Industrial Policy in Georgia

Rustavi fertilizer plant Azoti produces ammonia and nitric acid (as basic chemicals to produce nitrogenous fertilizers: ammonium nitrate and ammonium sulfate). Carbon Dioxide (CO_2) is emitted during ammonia production and Nitrous Oxide (N_2O) during nitric acid production. Share of GHG emissions from ammonia production in national GHG emissions constitutes 2% and share of nitric acid production 4%. Growing global demand on fertilizers very likely will increase Azoti plant production and related GHG emissions.

Cement production

Another large contributor to GDP, with about GEL 250 million of added value, is non-metal construction materials. In 2013 cement production reach 1.6 million tons. The two biggest cement plants are Kaspi Cement and Rustavi Cement, both of which is owned 75% by Heidelberg Cement. There are also several small and medium cement plants using clinker produced by Heidelberg Cement. In 2011, only non-energy GHG emissions from cement production constituted about 6% of total country emissions.

2.2.5. Transport

Georgia is the transportation hub for the South Caucasus region (Georgia, Armenia, and Azerbaijan) and Central Asia (Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, and Turkmenistan) providing the routs to Russia, Turkey and Europe via the Black Sea. The shortest route from Europe to China and Asia — 400 km of highways and 600 km of air routes — passes through Georgia. Georgia's oil and gas pipelines, Black Sea ports, developed railway system, and airports with direct air services to 17 locations are also playing an increasingly important role in linking East and West.

Georgia's transport system comprises five modes—road, rail, sea, air, and pipelines. All provinces, cities, towns, and neighboring countries are connected either directly or indirectly by at least one of these modes.

Since 2005, Georgia has revised regulations and legislation on many aspects of transport-related infrastructure and services to facilitate the rapid development of its transport sector. Increased economic activity, following these reforms, has led to more intensive use of the sector, particularly for international links, and the sector's contribution to the GDP has been growing on average about 14% annually during 2005-2007 (GDP growth rate in the same period about 11%). In 2008-2009, the growth was negative, largely due to the

conflict with Russia and the global financial downturn. Growth resumed in 2010, but at the lower average annual growth rates of 8% in the transport sector.

Road Transportation

According to the ADB, the vehicle ownership in Georgia increased from 56 vehicles per 1,000 people in 2000 to 139 vehicles per 1,000 in 2011, an average annual growth rate of 9%. Since 2005, registration has been a one-time short process for all new vehicles—there is no annual registration, and re-registration is needed only if the ownership changes. Insurance and roadworthiness testing are not mandatory. As a result, an accurate estimate of the vehicle fleet is not available, although the official register shows a fleet of 744,433 vehicles in 2011. Most of these are used vehicles imported from Europe and United States, of which only 1% are less than 3 years old, while 90% are more than 10 years old. An estimated 40,000 registered vehicles are used as taxis.[13]

Air pollution is largely caused by car emissions, but the existing transport policy is silent about the growing impact of the transport sector on the environment. As mentioned above, most cars in Georgia are used cars imported from Europe (government imposes lower fees on older vehicles). Furthermore the lack of fuel quality control leads to further degradation of vehicle condition and standards. More than a half of total motor fuel consumption consists of cheaper, relatively low-quality petroleum products from Azerbaijan. Because car owners have access to cheaper, low grade petroleum, some have disabled the catalytic converters in newer vehicles imported from Europe in order to run on lower-quality fuels. Vehicle emission standards are now enforced only for vehicles operated by international transport service providers, which are a small fraction of Georgia's entire vehicle fleet.

The recent Social and Economic Development Strategy, Georgia 2020, is only concerned with the development of roads and transport infrastructure but does not address the issues of urban transport optimization and greening. The Ministry of Economy and Sustainable Development has a transport department but no environmental objectives are reflected in transport policies and a regulatory framework is not being enforced.

All modes of international transport (i.e. road, rail, air, and pipelines) indicate growth in demand, ranging from 5%–15% (Source) a year. However, improvements in overall national mobility are not as visible as in international sections. Rural bus services, passenger rail, and secondary and local roads do not meet the demand or expectations of

[13] Georgia Transport Sector Assessment, Strategy, and Road Map – ADB (2014)

the economy. Lack of transport options is considered as a contributor to the national unemployment rate

The European Bank for Reconstruction and Development, European Union, JICA, MCC, and World Bank are assisting road network development in Georgia. MCC and the World Bank have financed secondary road improvements, in addition they are providing technical assistance for institutional strengthening and private sector development in areas such as project management, traffic safety, manpower training, curriculum development, and road maintenance procurement.

Railways

Of the 1,326 km rail network, 293 km is double track and 1,251 km is electrified in Georgia. About 80% of the network is in mountainous terrain, and segments of the main line traverse narrow gorges, where any expansion will be costly and slow. Most of the network is designed for an axle load of 23 tons with speeds of 100 km per hour for passenger trains and 80 km per hour for freight trains. Freight capacity is estimated to increase to 45 million tons per year by 2016.

The Baku-Tbilisi-Kars Railway is a new corridor that will connect Azerbaijan, Georgian and Turkish railways. The project implementation began in 2007 and construction began in 2008 and it foresees the rehabilitation and reconstruction of 178 km-long railway between Marabda and Akhalkalaki and construction of a new railway from Akhalkalaki to the Turkish border. Its total length will be 826 kilometers and it will be able to transport 1 million passengers and 6.5 million tons of freight at the first stage. This capacity will then reach 3 million passengers and over 15 million tons of freight. The railway is planned to be commissioned in 2016.

Maritime Transport - Black sea ports

There are four main ports operating in Georgia – Poti, Batumu, Supsa and Kulevi. The Poti Sea Port is the largest port in Georgia and handles liquid and dry bulk, ferries, and containers. It spans 30 hectares and consists of 15 berths extending over 2.9 km. The port currently serves as the European gateway for international trade in Georgia, Armenia and Azerbaijan, and is ideally located to become a future hub for Central Asia trade. APM Terminals Poti will operate Poti Sea Port in a joint venture with RAKIA. The company plans investments in upgrading and expanding the port facilities to meet APM Terminals' world-class performance levels in productivity and safety.

The Port of Batumi is owned and operated by Batumi Industrial Holdings, a subsidiary of KazTransOil of Kazakhstan, under a 49- year agreement signed with the government in 2008. The port has five separate berths for oil, containers, rail ferry, dry cargo, and passengers, and a conventional buoy mooring for larger vessels with a depth of

13.6 meters. The total area of the port is 13.6 hectares, of which only 3.6 hectares have been developed. Therefore, the port has the space for further expansion, although the immediate need is the improvement of equipment and berths.

The Port of Supsa is an offshore oil terminal, owned and operated by British Petroleum (BP). Opened in 1999, Supsa is the terminus of the 833 km Baku–Tbilisi–Supsa pipeline.

The port of Kulevi, constructed in 2000, is an oil exporting terminal owned and operated by a consortium comprising the State Oil Company of Azerbaijan Republic-SOCAR (51%), Middle East Petroleum (34%), and various Georgian investors (15%). The port has two berths which can accommodate 100,000-ton and 40,000-ton vessels. Its total capacity is 10 million tons of oil per year, transported from Azerbaijan by rail, and the terminal can accommodate up to 168 railway tank cars.

Aviation

In 2013, Georgia became the 40th member of the European Organization for the Safety of Air Navigation. United Airports of Georgia, a state-owned enterprise in operation since April 2011, owns all airports in Georgia. There are 4 airports in Georgia – Tbilisi, Batumi, Kutaisi and Mestia airports. Operations of two international airports are outsourced.

Tbilisi's new international terminal with its 3,000-meter runway, opened in February of 2007, is hailed as one of the world's most comfortable and efficient terminals. Four national and 14 foreign airlines serve Georgia, including Austrian Airlines, British Airways, Lufthansa, Air Baltic, and Turkish Airlines.

The airport in Tbilisi can handle up to 2.8 million passengers and 160,000 tons of freight per year. The airport in Batumi can handle 600,000 passengers a year; Batumi also serves as an international gateway to border towns in Turkey. Kutaisi, which was a regional airport, was upgraded to international standards and opened for traffic in September 2012, handling nearly 13,000 passengers that year. Queen Tamar Airport in Mestia is served by about five flights a week from Tbilisi. A new airport is being constructed in Zugdidi, and the airport in Poti, which was closed in the 1990s, will also be developed.

Since the improvements were completed at Tbilisi and Batumi, annual passenger traffic has almost doubled to more than 1.3 million in 2012. Of these, Tbilisi handled about 1.2 million passengers, Batumi about 170,000, Kutaisi 13,000, and Mestia 3,000.

Future plans in this field include implementation of the obligations under "Common Aviation Area Agreement between the European Union and its Member States and Georgia;" harmonizing Georgian legislation with EU legislation and supporting Civil

Aviation Agency in this process, as well as attracting low cost air companies to the Georgian aviation market and enhancing aviation competition. [14]

Transit pipelines through Georgia

Georgia has a significant transit potential of supplying natural gas and oil from Azerbaijan and the whole Caspian region to the international markets.

The main gas transit pipelines are the South Caucasus Gas Pipeline system (SCP) and North-South Main Gas Pipeline (NSMGP). Through SCP, gas from the Shah Deniz gas field is transported to Erzurum (Turkey) via Georgia. The pipeline has been operational since late 2006 and the length of the SCP is 691 with 249 km in Georgia. A major expected development is expansion of SCP, which has made minor modifications and aims to increase its throughput up to 24bcm annually from current 6-7bcm. The NSMGP was built in the 1970s and it delivers gas from Russia to Armenia over Caucasus through Georgia. The length of the NSMGP is 221 km and its annual capacity is about 12 bcm. Within the framework of the Millennium Challenge Georgia Fund, the pipeline was thoroughly rehabilitated in 2006-2009.

Baku-Tbilisi-Ceyhan (BTC) and the Western Route Export Pipeline (WREP) transports oil through the territory of Georgia. The BTC connects the offshore oil fields in the Caspian to the Turkish coast and further European markets. Throughput capacity – one million barrels per day from March 2006 to March 2009. Since March 2009 it has been expanded to 1.2 million barrels per day by using drag reducing agents.[15] The Baku Tbilisi Ceyhan oil pipeline is the second longest pipeline in the world. The total length of the pipeline is 1,768 km with 249 km in Georgia. The pipeline has eight pumping stations, two of which are located in Georgia. Oil transportation through the BTC pipeline started in 2005.

WREP, also known as the Baku-Supsa Pipeline, is the first investment of International Oil Consortium in Georgia, which has been in operation since 1999.[16] The Western Route Export Pipeline (WREP) transports crude oil from offshore oil fields in the Caspian Sea to the Black Sea, from where the crude is further shipped via tankers through the Bosporus to European markets. The Supsa terminal with the capacity of 120, 000 tons was

[14] Transport Policy Department of Ministry of Economy and Sustainable Development of Georgia

[15] BP Georgia

[16] Georgian Oil and Gas Corporation

constructed as part of the (WREP) pipeline construction project. The length of this pipeline is 829 km. During the first nine months of 2014, the Sangachal terminal exported about 24 million barrels of oil through the Western Route Export Pipeline.

2.2.6. Agriculture

Georgia has rich agricultural traditions. About 43% of country's territory is considered as agricultural. Diverse agro-ecological and climate zones allow the country to produce most types of agricultural products, including sub-tropical goods such as wine, tea, fruit, citruses, hazelnuts, vegetables, grapes, grains, oilseeds, and animal fodder.

Cattle breeding is also well-developed in Georgia. When the country was a part of the Soviet Union, state and collective farms accounted for 40% of the total number of cattle, but from 1992, the cattle population sharply declined. Currently, there are no specialized large-scale farms. Domestic late maturing breeds are characterized by low weight, low milk yield and high fat milk.

Georgian agriculture is currently characterized with low productivity. During 2004-2012 the real agricultural output declined by 8.6% while country's real GDP grew by 60.3%. The share of agriculture in GDP fell from 16.8% in 2004 to 9.6% in real terms in 2012. In the table below some macroeconomic parameters are presented.

Table 2.11 - SOME MACROECONOMIC PARAMETERS RELATED TO AGRICULTURE SECTOR

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
GDP by agriculture, in billion GEL	1.312	1.470	1.298	1.340	1.281	1.194	1.136	1.227	1.199	1.335
GDP, in billion GEL	7.811	8.560	9.363	10.518	10.762	10.356	11.003	11.792	12.521	12.920
Growth rate of GDP by agriculture, in percent	-7.9	12.0	-11.7	3.3	-4.4	-6.8	-4.8	8.0	-2.3	11.3
Share of agriculture in GDP, in percent	16.8	17.2	13.9	12.7	11.9	11.5	10.3	10.4	9.6	10.3

The agriculture sector grew by 11.3% between 2011 and 2012 levels in real terms. By the end of 2014, the cattle population increased by 15.2% compared to 2012 year. In 2014, sawn area of annual crops increased by 24% compared to 2012 level. Consumption of nitrogenous fertilizers also increased by 30% in 2013 compared to 2012. The state budget

for agriculture has increased by over 350% since 2010: it accounted for 3.8 per cent of the overall state budget in 2014, up from 1.3 per cent in 2010.

Various factors contribute to the overall condition of agricultural sector. There are some external factors, like loss of major export markets, limited access to credit and dilapidated rural infrastructure, but most importantly, agricultural sector is tied to climate change. The agricultural sector is the most climate-sensitive of all economic sectors. Frequent floods and droughts, water and power outages are causing serious problems which need to be addressed immediately as the majority of the rural population depends either directly or indirectly on agriculture for their livelihoods. Climate impacts could undermine progress that has been made in poverty reduction and adversely impact food security and economic growth in vulnerable rural areas. In the future, the development of the agricultural sector is expected to be accompanied by an increase in GHG emissions.

2.2.7. Waste

Economic development of Georgia and transition to the market economy leads to increased waste generation. Since waste treatment facilities have not been built consistent with this development, waste disposal problems have arisen.

Currently there is no acceptable state inventory system for wastes in Georgia. Therefore, data on amounts of waste generated annually, waste types, disposal and utilization are practically absent. Different agencies possess some fragmented data but this data is not systematized or digitalized and is not publicly available. Comprehensive waste inventories have not been yet conducted, nor has a state register cataloging waste, their disposal sites, and technologies for mitigating waste been established.

At present there are no facilities for separating, processing and recycling plastics, paper and glass from municipal waste and no practice among population of waste separation.

Taking into account anticipated higher waste generation rates, it is crucially important for Georgia to develop a modern recycling system, including household waste separation, and to reduce the amount of waste being disposed at dump sites.

The Soviet period established an extensive network of sewerage systems and wastewater treatment plants. Centralized sewerage systems exist in 45 towns and settlements of Georgia with a total length of approximately 4,000 km. Almost half (47.6%) of the population was connected to the centralized sewage systems.

Nowadays, the conditions of the sewerage systems are very poor. The lack of maintenance has led to severe deterioration. About 1,500 km of the sewerage network needs renovation. Over two decades ago wastewater treatment facilities were operating in 29 towns (4 of them regional) with a total capacity of about 1.6 million m3 per day. Traditional biological treatment plants existed in 26 towns with a total projected capacity of about 1.43 million m3 per day. Treatment plants with mechanical treatment existed in only 7 residential areas with a total capacity of about 168 thousand m^3 per day.

All municipal wastewater treatment plants came into operation even before 1990. However, due to absence of minimal maintenance work they are either non-operational or in a very poor condition. The few of them are still operating (Tbilisi-Rustavi, Kutaisi, Batumi, Khashuri, Gori); however, they provide only mechanical treatment. There is no plant to provide secondary or biological treatment.

Municipal sewage can be considered as the largest source of water pollution in Georgia (about 80% of the overall wastewater volume is discharged into surface water bodies). Polluted surface and ground water is considered to be a major cause of infectious and parasitic diseases which badly affect public health and the environment.

On January 15, 2015 a new waste management code entered into force. The main goal of the code is to change the Georgian waste management sector on the basis of EU environmental requirements. The new code separates the competences of the waste management entities. The Ministry of the Environment oversees creating and implementing waste management state policy, national strategy and actin plan, promoting measurements for waste separation and recycling. Non-hazardous waste landfill management is the prerogative of the ministry of Regional Development. The municipal waste management is the local authority's competency.

A new Waste Management Code also includes increasing fines for littering. The law regulates household, municipal, constructing and other types of waste transportation and storage. According to the law, penalties for littering start from 50 GEL, while the maximum fine extends up to 5, 000 GEL.

2.2.8. Forestry

Forests play an important role in natural resource management in Georgia since they possess economic value and soil and water protection function as well as support rivers

systems, therefore contributing to hydropower sustainability. Additionally, forests provide energy resources, such as firewood which is so widely used for heating.

Forests cover almost 40% of the land area and is state owned. The Forest Fund includes territories covered with forests as well as territories not covered with forests but designated for forestry needs. The total area of the Forest Fund is estimated to be about three million hectares, out of which 2.7 million hectares are covered with forests. Georgian forests are divided into highland and plain forests. Highland forests comprise 97.7% of the total area under forestry. Average timber stock is 160 cubic meters per hectare. It is estimated that the total annual increase in timber stocks is 1.8 cubic meters per hectare, accounting to 4.6-4.8 million cubic meters in total.

The intensive deforestation since the late 1990's has led to severe degradation of Georgian forests. Unsustainable use of forestry damages the biodiversity, quality and productivity of the forests. Almost complete termination of timber import from Russia played the crucial role in deforestation in Georgia. Moreover, a sharp reduction of firewood import has been compensated with illegal logging by the local population. Due to severe degradation, the protective functions of forests have decreased (protection of soils, storage of waters, regulation of waters, sanitary-hygienic functions, etc) as well their ability to self-recovery. Landslides and avalanches are also becoming more frequent.

The role of the forests in the capture of carbon dioxide is considerable. In Georgia, forests capture approximately 1.66 million tons of carbon annually, while the amount of carbon losses as a result of timber stock production, use of fire wood etc. is about 0.23 million tons. Thus, there is a net capture of 1.37 million tons of carbon, which is equivalent to 5.02 million tons of carbon dioxide.

Forest fires pose serious threats to forests of Georgia. A particularly large area, approximately 1300 hectares, was destroyed in 2008 by such fires. The main reason of these fires was aerial bombing by the Russian air force (total 1,080 ha of forest area).

Bringing the forest fires under control was impossible due to on-going hostilities. In 2009, areas damaged by forest fires did not exceed 70 ha.

Protected areas are an essential part of the global response to climate change. They play an important role in climate change mitigation and adaptation by reducing GHG emissions and helping society cope with impacts of climate change by maintaining essential services on which people depend. Protected areas also can prevent the release of the carbon already accumulated in vegetation and soil.

In recent years Georgia has increased its efforts in the field of conservation. Approximately 40,000 hectares of state forests were allocated to the Agency of Protected Areas. Protection of forest biodiversity and its preservation are stated under the National Biodiversity Strategy and Action Plan of Georgia (2005) that implies sustainable management of forest resources (sustainable forestry).

Pressures from climate change or other factors can undermine carbon dioxide sequestration. To address these pressures, forest management should be modified in a way that it will increase its role of natural sinks. These activities include active restoration and support of natural regeneration. Reforestation and effective protection of forest ecosystems will provide high biomass and carbon storage.

2.3 Sustainable development strategy (low emission development strategy)

The collapse of the centrally planned economy has drastically reduced GHG emissions of Georgia. In 2011 the country's emissions constituted 16 million tons of CO2eq, approximately 33% of the emissions in 1990. The Georgia's GHG emissions by main sectors in several years between 1990 and 2011 are presented in the table below.

Table 2.12. GEORGIA'S GHG EMISSIONS IN 1990-2011

Sector	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011
Energy	36,592	4,790	5,925	5,786	7,234	7,553	7,138	6,667	6,536	7,783
Industrial processes	5,383	522	1,003	1,585	1,855	2,517	2,351	2,199	2,351	2,850
Agriculture	3,983	2,461	2,802	3,460	3,115	2,651	2,552	2,605	2,451	2,445
Waste	2,017	1,029	1,043	1,055	1,073	1,083	1,086	1,097	1,114	1,191
Total	**47,975**	**8,802**	**10,773**	**11,886**	**13,277**	**13,804**	**13,127**	**12,568**	**12,452**	**14,269**

The anticipated economic growth in Georgia will be accompanied by an increase of the country's GHG emissions. The goal of Georgia is to provide economic development in

accordance with low emission scenario – the climate-resilient sustainable economic growth.

LEDS is a national strategy plan addressing the countries circumstances in order to support economic growth and reduce GHG emissions in the long-term.

In December 2012 the "Memorandum of Understanding regarding cooperation on Low Emissions Development between the Government of USA and the Government of Georgia" was signed. In 2013 preparation of LEDS was launched, supported by the US EC-LEDS program. The objective of the US EC-LEDS program is to support efforts of developing countries' to pursue long-term, transformative development and accelerate sustainable, climate-resilient economic growth while slowing the growth of greenhouse gas emissions.

By the Decree of the Government of Georgia a high level inter-ministerial Coordinating Committee and a LEDS experts working group have been established under the leadership of the MENRP.

Main tasks of LEDS are the following: develop baseline scenario for GHG emissions; review existing projections and models and gather data for GHG emission scenarios; choose analytical tools for development of GHG emissions scenarios; determine base year and timeframe for the analysis; develop mitigation scenarios for GHG emissions; identify concrete mitigation actions and policies to ensure the greenhouse gas (GHG) emission reduction necessary to reach the goals and follow these pathways; identify potential GHG abatement options in the key sectors.

2.4 Institutional arrangement for development of Biennial Updated Reports of Georgia

2.4.1 General information

The Ministry of Environment and Natural Resources Protection (MENRP) has been assigned responsibility to implement the UNFCCC and the Kyoto Protocol in collaboration with line ministries and agencies. The Climate Change Service, the structural unit of MENRP, has the mandate to (1) develop and participate in implementation of the national policies and strategies for climate change; (2) develop, organize and coordinate Climate Change National Mitigation Plan; (3) organize the preparation of the Low Emissions Development Strategy; (4) organize and coordinate the development of national adaptation plan for vulnerable ecosystems and economic sectors, monitor current climate change adaptation projects; (5) analyze the decisions of the Conference of Parties to the

Convention; (6) participate in the meetings of COP and subsidiary bodies of the Convention; (7) coordinate preparation of the National Communications of Georgia to the UNFCCC; (8) continuously conduct research and technology needs assessment in order to promote new available technologies for adaptation and mitigation actions.

MENRP, in cooperation with line ministries and agencies, has completed and submitted to the UNFCCC Secretariat the Initial National Communication (November, 1997), the Second National Communication (December, 2010) and the Third National Communication (February 2016). The MENRP is assigned to continue developing the Biennial Updated Reports and National Communications to the UNFCCC in the future.

In 2014 the Government of Georgia and UNDP signed the agreement on implementation of the Biennial Update Report project.

2.4.2 Organizational structure for development of BUR

The MoENRP performs a leadership and coordination role for the development of BUR, acting in coordination with other stakeholders such as the Ministry of Economy and Sustainable Development, Ministry of Energy, Ministry of Agriculture, Ministry of Regional Development and Infrastructure, Ministry of Internal Affairs and National Statistics Office of Georgia. They are key entities in the elaboration of the National GHG Inventories as they are responsible for providing the respective sectorial activity data. BUR project team of GHG inventory experts, experts in the field of energy, industry, transport, agriculture, waste and LULUCF, estimate GHG emissions according to the IPCC guidelines and under the guidance and coordination of the MoENRP.

UNDP Georgia acts as GEF Implementing Agency for the project and assists the country for the entire project length to implement the activities set forth and to monitor and supervise the project on behalf of the GEF. The project has a governance structure, aligned with UNDP's new rules for Results Based Management.

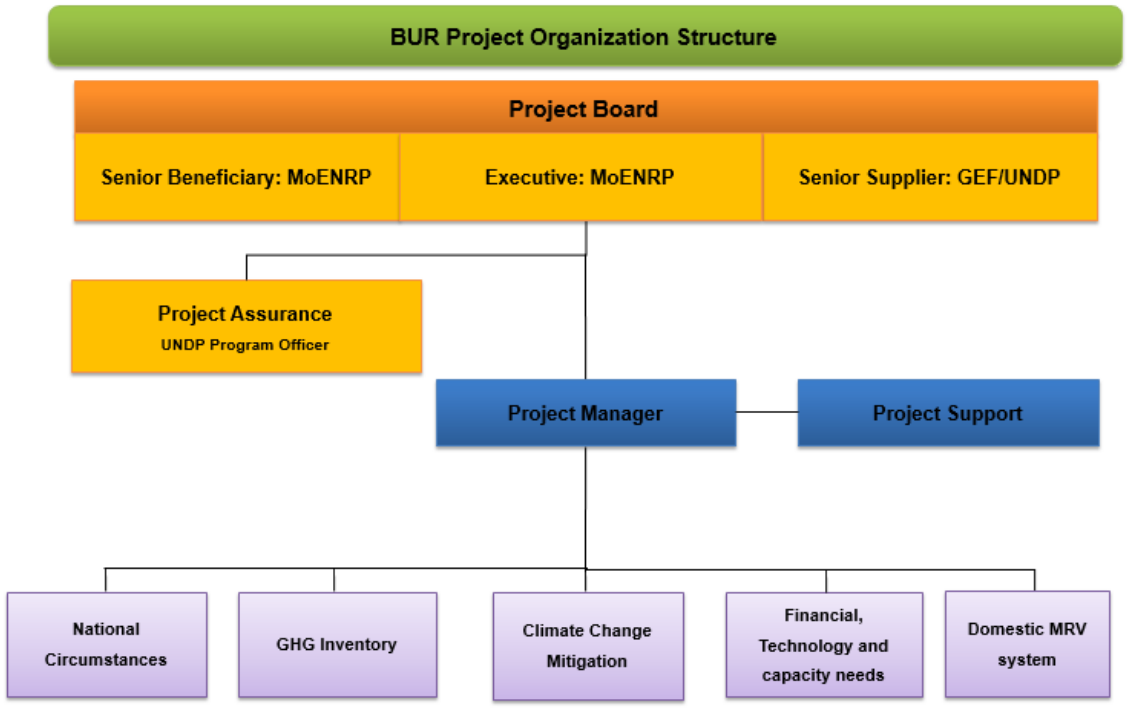


Figure 2.6 - PROJECT GOVERNANCE ARRANGEMENTS

The Project Executive Group is the executive decision making body for the project, providing guidance to the Project Manager, and approving project revisions. It is responsible for reviewing and updating the project risk log, issue log, lessons learnt log and the project monitoring and communication plan. The Project Executive Group consists of three members:

- The Senior Beneficiary is the representative of the MoENRP.
- The Executive (Implementing Partner) convene the Project Executive Group. This position is held by the representative of the MoENRP;
- A position of Senior Supplier is held by the UNDP DRR, or a designated UNDP Development Advisor.

The Project Manager is selected through a competitive process and is placed at UNDP national office. He is tasked with the day-to-day management of project activities, as well as the financial and administrative reporting. The Project Manager is responsible for project implementation and is guided by Annual and Quarterly Work Plans and follows the RBM standards.

UNDP designates a Program Advisor to provide independent project oversight and monitoring functions, to ensure that project activities are managed and milestones accomplished. UNDP will provide financial and administrative support to the project including procurement, contracting, payments, and travel arrangements. UNDP provides procurement and contracting services in accordance with relevant UNDP rules and regulations.

3 CHAPTER - National GHG Inventory

3.1 Overview

Georgia has conducted fourth national inventories of anthropogenic emissions by sources and removal by sinks of GHG for the First Biennial Update Report to UNFCCC over a period of 2010-2013. The Inventory includes a database of six direct gases: CO2, CH4, N2O, HFCs, PFCs and SF6, and four indirect gases: CO, NOx, NMVOC and SO2. The inventory was prepared in accordance with the Intergovernmental Panel on Climate Change (IPCC) Methodology that is comprised of the following key guidelines:

- Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories;
- IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (2000);
- IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry (2003);
- 2006 IPCC Guidelines for National Greenhouse Gas Inventory was used;

For the compilation of the inventory, UNFCCC NAI Inventory Software v 1.3.2 (Excel based) was used. According to the Common Reporting Format (CRF) of the IPCC Methodology, inventories cover six sectors, as follows: Energy, Industrial Processes, Solvents and other Product Use, Agriculture, Land use, Land-Use Change and Forestry (LULUCF) and Waste.

Up to 2010, the main reporting mechanism for Non-Annex 1 countries of the Convention was National Communication. A decision taken by the 16th Conference of the Parties held in Cancun (2010), requires all countries, starting 2014, to present a biennial independent and complete report (BUR) about the trends of GHG emission and the planned mitigation activities for climate change.

In Georgia, the first GHG inventory was performed based on the 1980-1996 data, as part of the preparation of the First National Communication (FNC, 1997-1999). The Second National Communication (SNC, 2006-2009) comprised the period of 1998-2006. The 2007-2011 GHG inventory was performed as part of the Third National Communication (TNC, 2012-2015). The 2010-2013 GHG inventory was prepared for the First Biennial Update Report to UNFCCC during 2015-2016 period. The results of 2010-2011 were recalculated for the various sectors.

Most of the activity data were available from the National Statistics Office of Georgia (GEOSTAT), Ministry of Environment and Natural Resources Protection of Georgia (MoENRP), Ministry of Enegy, Ministry of Labour, Health and Social Affairs of Georgia, and

other relevant institutions. Some data were obtained from Georgian Oil and Gas Corporation (GOGC), Electrcity Market Operator (ESCO), the Georgian National Energy and Water Supply Regulatory Commission (GNERC), British Petroleum (BP) Georgia, Industries, FAOSTAT, and Solid Waste Management Company of Georgia. For emission factors, IPCC default values were used taking into account expert judgment.

3.2 Institutional Framework of the Inventory

The Ministry of Environment and Natural Resources Protection of Georgia (MoENRP) is the key governmental body responsible for the development of climate change policies. It is also responsible for the greenhouse gas inventory in Georgia, but due to a lack of human and financial resources, the inventory cannot be performed without external assistance.

This inventory was conducted within the framework of the First Biennial Update Repot to the UNFCCC, which the country prepares with the financial assistance provided by the Global Environment Facility (GEF). The inventory, at this stage, is conducted with support of UNDP Georgia, which acts as the GEF Implementing Agency for the project, assisting the country for the entire project length to implement the activities set forth, and monitoring and supervising the project on behalf of the GEF.

The Environmental Information and Education Center of the MoENRP was the main implementing organ of the inventory project. It hired the experts, including local and international experts to prepare GHGs emission inventory.

The staff of the Climate Change Service of the MoENRP conducted trainings on GHGs emission inventory methodologies for the interns of the center.

Under the grant agreement between UNDP and the think tank World Experience for Georgia (WEG), the latter provided quality assurance and quality control for the GHGs emission inventory process.

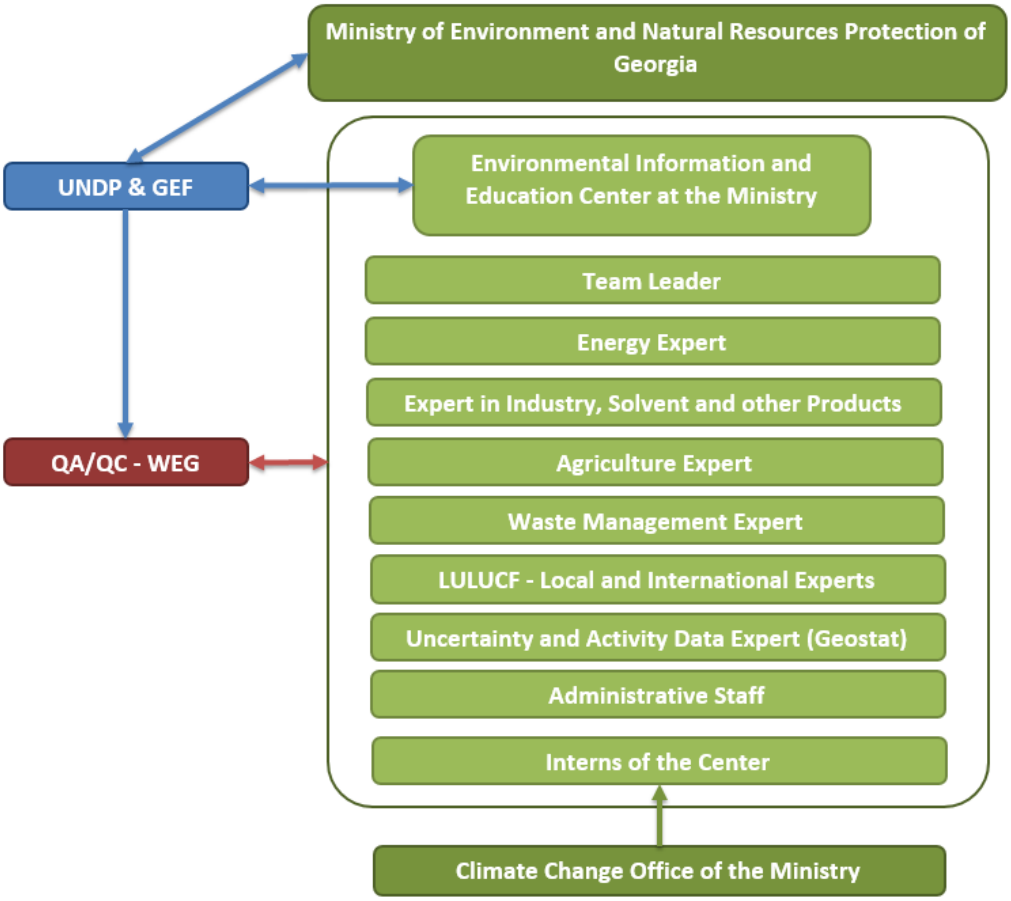


Figure 3.1 - INSTITUTIONAL FRAMEWORK OF THE GHGS INVENTORY IN GEORGIA

3.3 Description of key categories

In the country's national inventory, certain source categories are particularly significant in terms of their contribution to the overall uncertainty of the inventory. The assessment of key source-categories of greenhouse gases emission was conducted in accordance with IPCC GPG guidelines. Key source-categories analyzed using level and trend assessment.

As the structure and management principles of Georgia's economy in 1990 were categorically different compared to now, using 1990 as a base year would identify those source-categories that underwent the most structural and essential changes, following the breakup of the Soviet Union, and would not be informative for assessing current trends and processes of emissions. The current inventory was conducted for the 2010-2013 period. Hence, 2010 has been used as a base year for trend assessment. The identified key source-categories with/without LULUCF sector are presented in annex 8.1.

Forest land (level-21%) as a sink, Grassland (9%), Fugitive emissions from Natural Gas Transportation and Distribution Sector (7%), Enteric Fermentation (5%), Manufacturing

Industries and Construction (Solid Fuel-5%) and Road Transport (Diesel and Gasoline – 5-4%) as emitters are the most key source categories in Georgia.

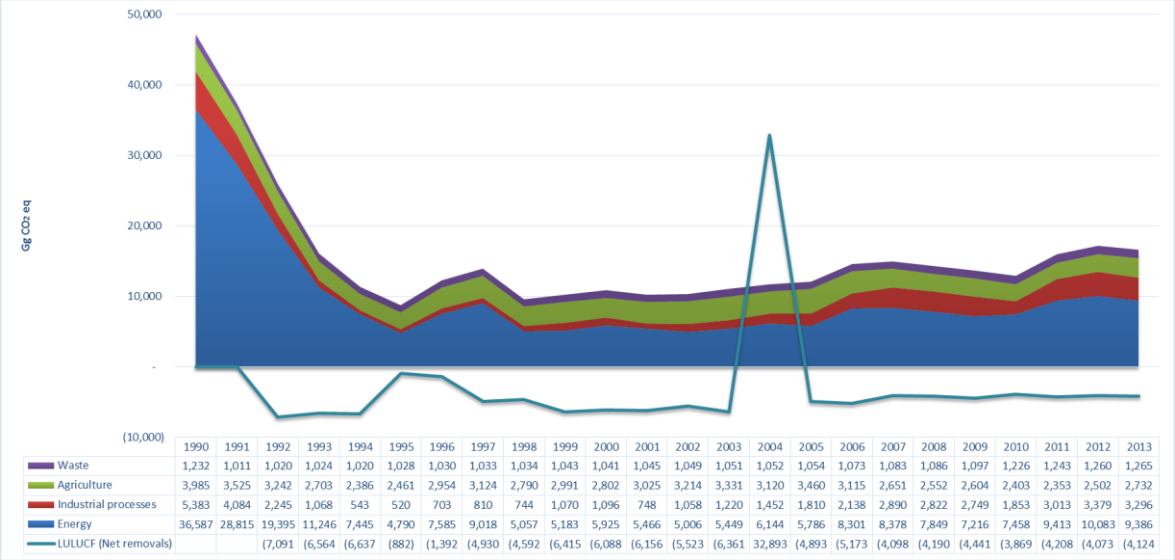
3.4 GHG emission by sectors and gases in 1990-2013

Emission and removal trends by sectors over 1990-2013 are provided in the Figure 3.2, which comprises all sectors, including the LULUCF sector. As can be seen from the Figure, energy is the dominant sector, and it accounts for more than half of total emissions in that period. Following the breakup of the Soviet Union, the contribution of the agricultural sector in total emissions grew gradually, and it ranks second in 1992-2006. From 2007, industrial processes increased and now rank second. In 2013 the contribution of the energy and industry sectors in total emissions were 56% and 20% respectively, while the share of agriculture and waste sectors were 16% and 8% respectively.

LULUCF sector had a net sink of greenhouse gases during 1992-2013, except 2004, in which net source of emissions were observed. This sharp change is mainly attributed to the cropland category, in particular orchards in perennial plants. Changes in land cadastre data in 2004 caused these, as they specified the boundaries of perennial orchards, and areas covered with perennial crops were almost halved. It can be said, with high probability, that these areas were not reduced in a single year, a process steadily underway in prior years as well. As a result, it needs to be analyzed and respectively adjusted in the future. Overall, the sink capacity of the LULUCF sector fluctuates between (-882) Gg CO2 eq and (-7,091) Gg CO2 eq, showing a stable trend.

Without consideration of the LULUCF Sector, 2013 greenhouse gas emissions in Georgia totaled 16,679 Gg in CO_2 equivalent, and 12,555 Gg CO_2eq when taking this sector into account.

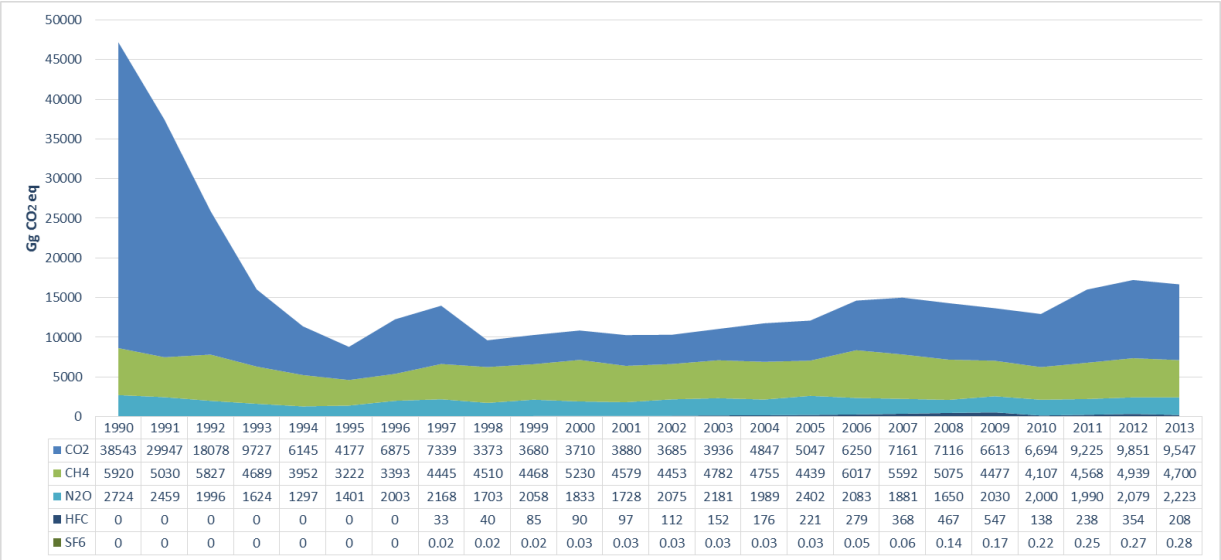
Figure 3.2 - **GHG EMISSION TRENDS IN GEORGIA BY SECTORS IN 1990-2013 (Gg CO_2-eq.)**



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Waste	1,232	1,011	1,020	1,024	1,020	1,028	1,030	1,033	1,034	1,043	1,041	1,045	1,049	1,051	1,052	1,054	1,073	1,083	1,086	1,097	1,226	1,243	1,260	1,265
Agriculture	3,985	3,525	3,242	2,703	2,386	2,461	2,954	3,124	2,790	2,991	2,802	3,025	3,214	3,331	3,120	3,460	3,115	2,651	2,552	2,604	2,403	2,353	2,502	2,732
Industrial processes	5,383	4,084	2,245	1,068	543	520	703	810	744	1,070	1,096	748	1,058	1,220	1,452	1,810	2,138	2,890	2,822	2,749	1,853	3,013	3,379	3,296
Energy	36,587	28,815	19,395	11,246	7,445	4,790	7,585	9,018	5,057	5,183	5,925	5,466	5,006	5,449	6,144	5,786	8,301	8,378	7,849	7,216	7,458	9,413	10,083	9,386
LULUCF (Net removals)			(7,091	(6,564	(6,637	(882)	(1,392	(4,930	(4,592	(6,415	(6,088	(6,156	(5,523	(6,361	32,893	(4,893	(5,173	(4,098	(4,190	(4,441	(3,869	(4,208	(4,073	(4,124

Greenhouse gases (CO_2, CH_4, N_2O, HFC and SF_6) emission trends for 1990-2013, without consideration of the LULUCF sector, are provided in the Figure 3.3 CO2 was the highest contributor in 1990 with 81.7%, followed by methane with 12.5% and nitrous oxide, with 5.8%, ranking third. Along with the disintegration of the economy, emissions decreased and for a considerable period (1998-2003) methane was the leading gas in Georgia's greenhouse gas. From 2004, with economic advancement, CO2 emissions have been rising. Furthermore, hydrofluorocarbons emissions have risen considerably over the past years, which is related to the rise in the number of refrigerators and conditioners that are charged with hydrofluorocarbons. By 2013, CO2 accounts for 57.2%, methane – 28.2%, nitrous oxide – 13.3%, while hydrofluorocarbons – 1.2%. The contribution of sulphur hexafluoride (SF6) emissions is very low.

Figure 3.3 - **GHG EMISSION TRENDS IN GEORGIA IN 1990-2013 (Gg CO_2-eq.)**



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
CO2	38543	29947	18078	9727	6145	4177	6875	7339	3373	3680	3710	3880	3685	3936	4847	5047	6250	7161	7116	6613	6,694	9,225	9,851	9,547
CH4	5920	5030	5827	4689	3952	3222	3393	4445	4510	4468	5230	4579	4453	4782	4755	4439	6017	5592	5075	4477	4,107	4,568	4,939	4,700
N2O	2724	2459	1996	1624	1297	1401	2003	2168	1703	2058	1833	1728	2075	2181	1989	2402	2083	1881	1650	2030	2,000	1,990	2,079	2,223
HFC	0	0	0	0	0	0	0	33	40	85	90	97	112	152	176	221	279	368	467	547	138	238	354	208
SF6	0	0	0	0	0	0	0	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.05	0.06	0.14	0.17	0.22	0.25	0.27	0.28

3.5 The Energy Sector

3.5.1 Sector overview

Domestic energy supply in Georgia is mainly based on imported natural gas and oil products, as well as domestic hydro resources and fuel-wood, all of which are used for electricity production, heat production and mechanical energy in the transport sector. Electricity production is predominantly based on hydro power plants (more than 70%), thermal (Gas) power plants and import from neighboring countries in winter months. Residential sector, transport and industry are the key energy consumer sectors in Georgia.

In 2013, greenhouse gas emissions from the energy sector amounted 9,386 thousand tonnes of CO_2 equivalent, which is about 56% of Georgia's total GHG emission (excluding LULUCF). It is considerably lower compared to the contribution of this sector in 1990 (78%). Compared to 1990, the total GHG emissions of the sector decreased four times, while they increased by 58% relative to 2000. A significant fall in GHG emissions in the 1990s is due to the breakup of the Soviet Union and fundamental changes in the economy of the country. However, the national economy started increasing after 2000 and the average annual growth of real GDP amounted to 8.4% before 2008. During 2008-2009, economic growth of Georgia has slowed down due to the Russian-Georgian war. Again, from 2010, the real GDP of the country started increasing by 5.8% on average until 2014[17].

In 2010, hydro generation reached its maximum, while the generation from thermal power plants was the lowest in the past decade. In 2011 emissions from the energy sector increased mainly due to the increased thermal power generation and improvement of the economic situation. Table 3.1 shows the CO_2 equivalent of emissions in the energy sector by sub-sector categories.

Table 3.1 - GREENHOUSE GAS EMISSIONS FROM THE ENERGY SECTOR (Gg, CO_2 eq)

Source-Category	1990	1995	2000	2005	2010	2011	2012	2013
1A Fuel combustion	**33,929**	**3,881**	**3,546**	**4,589**	**5,916**	**7,395**	**7,892**	**7,466**
1A1 Energy industries (electricity and heat production)	12,182	1,093	976	784	542	1,220	1,319	951
1A2 Manufacturing industries and construction	10,531	523	415	608	891	1,630	2,004	1,933
1A3 Transport	3,827	1,552	1,120	1,219	2,574	2,537	2,655	3,096

[17] GEOSTAT – Real Growth of GDP - http://geostat.ge/?action=page&p_id=118&lang=geo

1A4 Other sectors (commercial/ residential/ agriculture/ fishing/ forestry)	7,112	701	1,035	1,978	1,669	1,923	1,914	1,474
1A5 Other (not elsewhere specified)	277	12	0	0	241	86	0	12
1B Fugitive emissions	**2,658**	**909**	**2,381**	**1,196**	**1,542**	**2,018**	**2,191**	**1,920**
1B1. Solid fuels	268	12	2	-	75	99	118	113
1B2. Oil and natural gas	2,390	897	2,379	1,196	1,467	1,919	2,072	1,806
Total from energy sector	**36,587**	**4,791**	**5,927**	**5,786**	**7,458**	**9,413**	**10,083**	**9,386**

As can be seen from the Table, a large share of emissions from the energy sector is due to fuel combustion (80% in 2013) and the remaining 20% is caused by fugitive emissions. Among emission source-categories, the highest growth relative to 2000 was in fugitive emissions from the transformation of solid fuel (2 Gg in 2000, 113 Gg in 2013), which is due to the intensification of coal mining works in recent years. During 2000-2013, GHGs emissions from the industry and transport sectors increased about 4.7 and 2.8 times respectively. In the transport sector, GHG emissions increased due to the growing auto-park and a majoity share of second-hand cars in the park. In Georgia, the number of motor vehicles in 2002-2013 period increased from 319,600 to 906,700[18]. From 2006, the development of energy transit pipelines (South Caucasus Gas Pipeline, Baku-Tbilisi-Erzurum oil Pipeline) though Georgia required additional gas for the pipeline operation. Figure-3.4 shows emission trends in 2000-2013 from the energy sector by various source-categories.

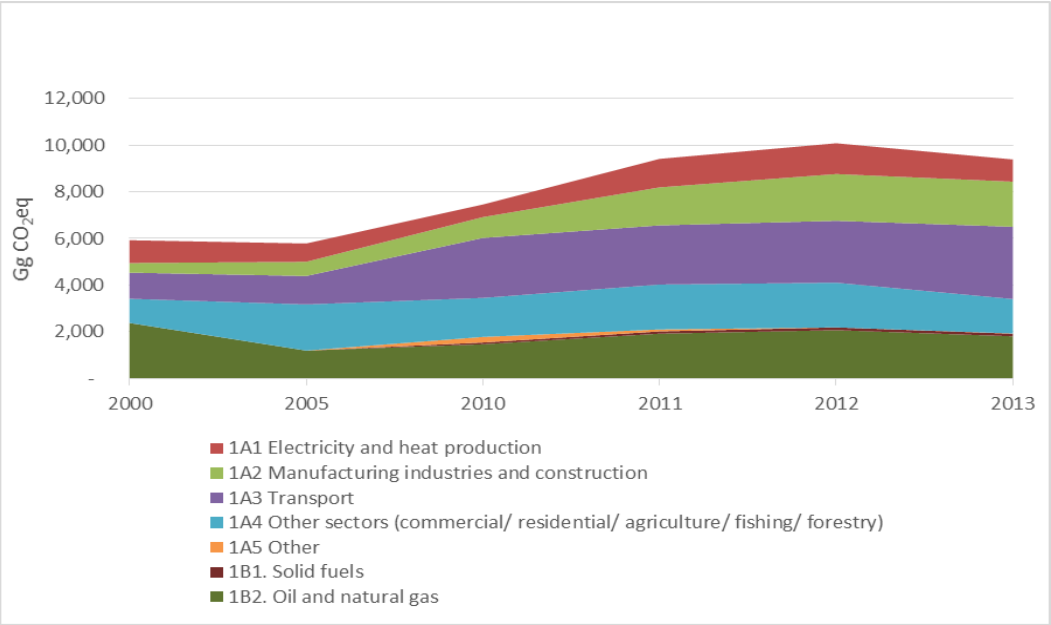


Figure 3.4 - TREND OF GREENHOUSE GAS EMISSIONS FROM THE ENERGY SECTOR 2000-2013 (GG CO2 EQ.)

[18] GEOSTAT – Annual Report 2014 http://geostat.ge/cms/site_images/_files/yearbook/Yearbook_2014.pdf

In 2013 the largest shares, in total, in GHG emission had the following source categories: transport – 33%, manufacturing industries and construction – 21%, gas transmission and distribution subsector – 19% and energy industry (electricity production) – 10%. Figure-3.5 shows the change of the contribution of greenhouse gas emissions in the energy sector in 2000-2013.

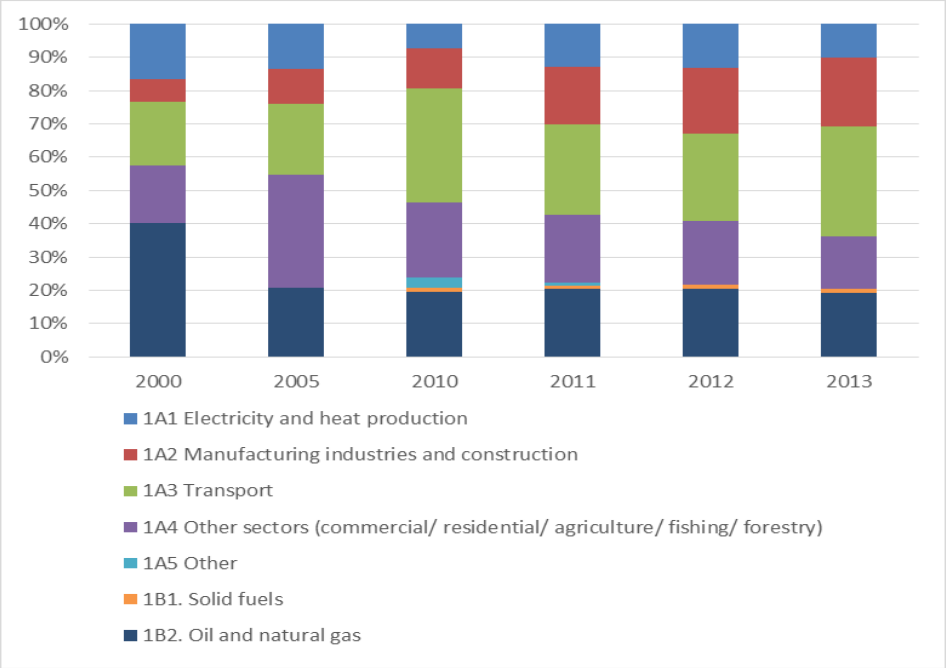


Figure 3.5 - CHANGE IN THE SHARE OF EMISSIONS FROM SOURCE-CATEGORIES IN THE ENERGY SECTOR, 2000-2013

Emissions from the electric energy production and transport sectors are characterized by unsteady trends. Fluctuation in the energy industry is due to the changes in consumption of natural gas for power generation, which, in turn, is dependent on the share of hydro power generation. As for the transport sector, changes in shares are mainly due to the switching fuels for cars from gasoline to compressed natural gas (CNG), an increasing number of vehicles in the country, and the development of energy transit pipelines though Georgia.

3.5.2 Energy industries

Georgia is a country rich with hydro resources and the largest share of power generation comes from hydropower plants. For 2014, the country has 64 HPPs and 4 TPPs with installed capacities of 2,791 MW and 680 MW respectively. The consumption of gas by thermal power plants is the main cause of emissions from the electric energy production source-category.

Table 3.2 - GHGS EMISSIONS FROM THE ELECTRIC ENERGY AND HEAT PRODUCTION SOURCE-CATEGORY (Gg)

Gas	1990	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013
CO_2	**12,165**	**975**	**783**	**1,349**	**924**	**795**	**749**	**541**	**1,219**	**1,318**	**950**
CH_4	0.22	0.02	0.02	0.03	0.02	0.02	0.02	0.01	0.02	0.02	0.02
$CO_{2eq.}$	**4.62**	**0.39**	**0.39**	**0.55**	**0.38**	**0.33**	**0.38**	**0.21**	**0.42**	**0.42**	**0.36**
N_2O	0.040	0.003	0.003	0.002	0.002	0.003	0.002	0.002	0.002	0.002	0.002
$CO_{2eq.}$	**12.4**	**0.62**	**0.82**	**0.92**	**0.65**	**0.57**	**0.82**	**0.62**	**0.74**	**0.74**	**0.53**
Total in $CO_{2eq.}$	**12,182**	**976**	**784**	**1,350**	**925**	**796**	**750**	**542**	**1,220**	**1,319**	**951**

3.5.3 Manufacturing Industries and Construction

Manufacturing industries and the construction sub-sector, comprise emissions caused by the burning of fuel from various industries, such as cast iron and steel production, ferroalloys, chemicals, paper, food products, drinks and tobacco production, etc., as well as emissions from construction materials production.

Manganeze alloys is Georgia's largest export goods. The main Ferroalloys producer in Georgia, Zestaponi ferroalloy plant, is the largest ferroalloy plant in Caucasus and produces mainly silicomanganese. A large metallurgical plant located in Rustavi began steel production in 1950. The plant produced coke, sinter, pig iron, steel, rolled items, and hot-rolled and cold-drawn steel pipes. In 1990-ies, the production of steel and iron significantly reduced, and in 2000 stopped completely. In 2007, the plant recommenced steel production, but only based on scrap steel.

The Rustavi fertilizer plant "Azoti", produces ammonia and nitric acid (as basic chemicals to produce nitrogenous fertilizers: ammonium nitrate and ammonium sulfate).

In 2013, cement production reached 1.6 million tonnes. The two largest cement plants are Kaspi Cement and Rustavi Cement. There are also several small and medium size cement plants using clinker produced by Heidelberg Cement.

During 2010-2013, primarily coal products and natural gas were used with small amounts of oil products (gasoline, diesel oil and residual fuel oil) in this sector. Below, in Table 3.3, GHGs emissions from the manufacturing industries and construction are provided. GHGs emissions increased about 2.17 times from 2010 to 2013 from the source category.

TABLE 3.3 - GHGS EMISSIONS FROM THE MANUFACTURING INDUSTRIES AND CONSTRUCTION SOURCE–CATEGORY (Gg)

Gas	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013
CO_2	**10,481**	**519**	**413**	**607**	**546**	**719**	**653**	**587**	**887**	**1,622**	**1,994**	**1,923**
CH_4	0.72	0.04	0.03	0.04	0.05	0.06	0.05	0.04	0.08	0.15	0.18	0.17
$CO_{2eq.}$	**15.12**	**0.84**	**0.58**	**0.93**	**0.96**	**1.31**	**1.12**	**0.92**	**1.76**	**3.19**	**3.75**	**3.63**
N_2O	0.11	0.01	0	0	0	0	0	0	0.01	0.02	0.02	0.02
$CO_{2eq.}$	**34.1**	**3.1**	**0.77**	**0**	**0.4**	**0.47**	**0.53**	**0.6**	**2.64**	**5.23**	**6.44**	**6.49**
Total in CO_2eq.	**10,531**	**523**	**415**	**608**	**547**	**721**	**655**	**589**	**891**	**1,630**	**2,004**	**1,933**

3.5.4 Transport

Georgia is the transportation hub for the South Caucasus region and Central Asia, providing routs to Russia, Turkey and (over the Black Sea) to Europe. Georgia's oil and gas pipelines, Black Sea ports, developed railway system, and airports with direct air services to 17 locations are also playing an increasingly important role in linking East and West.

The transport sector in Georgia, like in the majority of the world's countries, is one of the most significant emitters of greenhouse gases.

Under the transport sector, Georgia's GHGs Inventory reviews road transport, rail transport, civil aviation, domestic navigation and pipelines.

The trends of greenhouse gases from the transport sector are provided in Table 3.4. As can be seen from the table, like other source-categories of fuel combustion, carbon dioxide is a dominant greenhouse gas in this case as well (99.2% of emissions).

Table 3.4- GHGS EMISSIONS FROM THE TRANSPORT SOURCE-CATEGORY (GG)

Gas	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013
CO_2	**3,793**	**1,537**	**1,112**	**1,212**	**1,747**	**2,022**	**2,168**	**2,423**	**2,558**	**2,521**	**2,639**	**3,071**
CH_4	0.59	0.28	0.26	0.29	0.37	0.19	0.47	0.5	0.46	0.45	0.47	0.86
$CO_{2eq.}$	**12.39**	**5.88**	**5.5**	**6.18**	**7.78**	**3.99**	**9.82**	**10.56**	**9.66**	**9.45**	**9.87**	**18.06**
N_2O	0.07	0.03	0.01	0	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02
$CO_{2eq.}$	**21.7**	**9.3**	**3.07**	**0.94**	**4.45**	**5.1**	**5.52**	**6.32**	**6.20**	**6.20**	**6.20**	**6.20**
Total in $CO_{2eq.}$	**3,827**	**1,552**	**1,120**	**1,219**	**1,759**	**2,031**	**2,183**	**2,440**	**2,574**	**2,537**	**2,655**	**3,096**

3.5.5 Other sectors

Emissions in this source-category comprise of emissions from the following subsectors: Commercial and Public Services, Residential, Agriculture, Fishing and Forestry.

Greenhouse gases emissions from this source category are provided in Table 3.5**.** The shares of methane (8% in 2013) and nitrous oxide (2% in 2013) are high, compared to other source categories; this is due to firewood consumption in the residential sector.

Table 3.5 - GREENHOUSE GASES EMISSIONS FROM THE COMMERCIAL/RESIDENTIAL/AGRICULTURE/ FISHING/FORESTRY SOURCE-CATEGORIES (GG)

Gas	1990	1995	2000	2005	2010	2011	2012	2013
CO_2	**7,077**	**696**	**677**	**1,413**	**1,549**	**1,822**	**1,686**	**1,326**
CH_4	0.49	0.05	14.20	22.30	4.78	3.93	9.09	5.85
$CO_{2eq.}$	**10**	**1**	**298**	**468**	**100**	**83**	**191**	**123**
N_2O	0.08	0.01	0.19	0.31	0.06	0.06	0.12	0.08
$CO_{2eq.}$	**25**	**3**	**59**	**97**	**20**	**19**	**37**	**25**
Total in $CO_{2eq.}$	**7,112**	**701**	**1,035**	**1,978**	**1,669**	**1,923**	**1,914**	**1,474**

The residential sector is a dominant subsector (80.4% in 2013), while GHGs emissions from commercial and agricultural sub-sectors amounted to 17.4% and 2.2% respectively.

3.5.6 Non-CO2 Emissions from Fuel Combustion

Non-CO2 emissions, such as CO, NOx, NMVOC, were calculated using the Tier 1 approach from fuel combustion. Table 3.6 provides estimates of non-CO2 emissions from fuel combustion for 2010-2013.

Table 3.6 - NON-CO_2 EMISSIONS FROM FUEL COMBUSTION FOR 2010-2013 PERIOD

Non-CO_2 From Fuel Combustion (Tier 1) Gg	2010	2011	2012	2013
CO	242	228	305	254
Nox	32	37	39	41
NMVOCs	40	39	47	41

3.5.7 Fugitive emissions

Fugitive emissions comprise methane (CH_4) emissions from mining and processing of coal, and methane emissions from the activity related to oil and natural gas.

The methane emission trend from the fugitive emissions subsector are provided in Table 3.7.

Table 3.7 - METHANE FUGITIVE EMISSIONS (GG)

Source	1990	1995	2000	2005	2010	2011	2012	2013
1B1. Solid fuel transformation	12.78	0.57	NO	NO	3.58	4.72	5.64	5.4
1B2. Oil and natural gas	113.8	42.73	113.3	56.96	69.83	91.35	98.68	86.01
Total fugitive emissions CH_4	126.6	43.3	113.3	56.96	73.41	96.07	104.3	91.41
Total fugitive emissions in CO_{2eq}.	2,658	909	2,379	1,196	1,542	2,017	2,191	1,920

As can be seen from the Table, the dominant subsector is the oil and natural gas sector, where high emissions are caused by high losses of natural gas in the process of transportation and distribution. Over the years, emissions from the mining and processing of coal increased as well, which is due to the intensification of mining of this fuel in Georgia.

3.6 Industrial Processes

The Industrial Processes (IP) sector includes GHG emissions from the categories of mineral products, chemical industry, metal production, drinks and food production, and consumption of halocarbons and SF6. GHGs produced or discharged during the industrial processes as raw materials are chemically of physically transformed compounds, including: CO2, CH4, N2O, SF6 and HFCs. Emissions from the industrial processes are given in the Table 3.8 over 2010-2013 period.

Table-3.8 EMISSIONS FROM THE INDUSTRIAL PROCESSES IN GEORGIA IN 2010-2013 (GG CO2 EQ.)

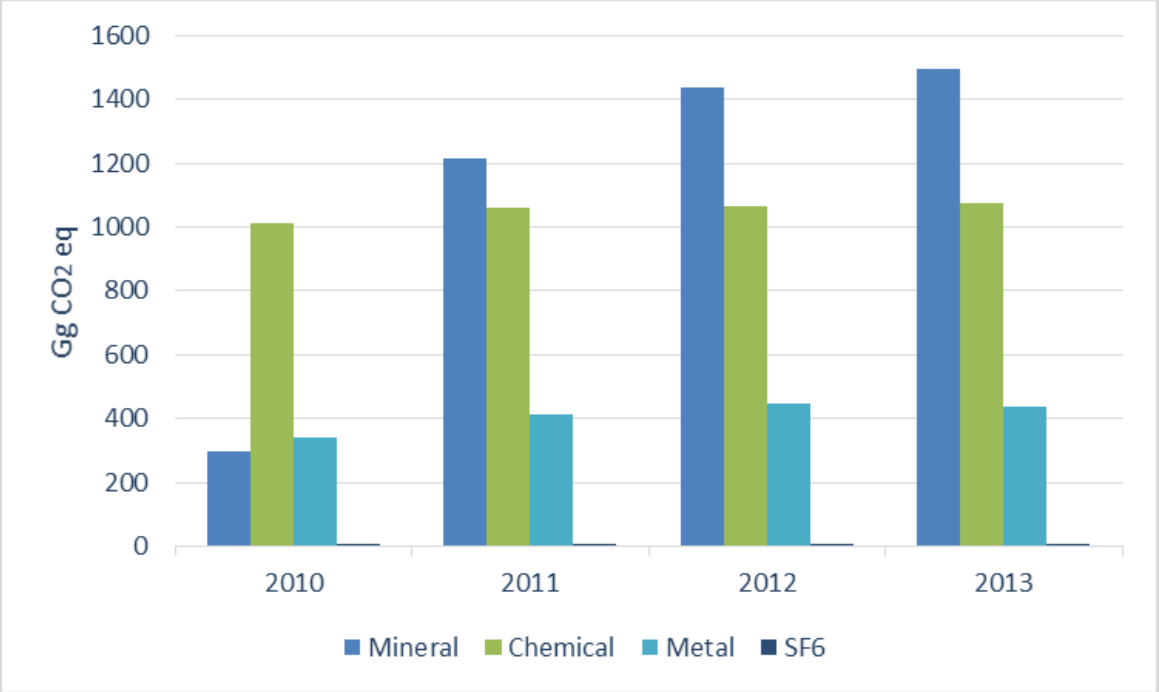
Source-Category	2010	2011	2012	2013
2A Mineral Industry	**294.7**	**1215.3**	**1436.7**	**1497.0**
2A1 Cement Production	254.6	489.2	601.5	599.9
2A1 Lime Production	35.4	720.7	830.5	890.9
2A3 Limestone and Dolomite Use	0.4	1.2	1.9	2.6
2A7 Glass Production	4.2	4.2	2.8	3.5
2B Chemical Industry	**1010.1**	**1060.5**	**1065.1**	**1075.1**
2B1 Ammonia Production	214.3	242.3	254.6	250.7
2B2 Nitric Acid Production	795.8	818.2	810.5	824.4
2C Metal Production	**339.5**	**411.3**	**445.0**	**435.9**

2C1 Iron and Steel Production	3.3	10.7	14.3	17.8
2C2 Ferroalloys Production	336.3	400.5	430.8	418.1
2F Consumption of Halocarbons and Sulphur Hexafluoride	**0.2**	**0.3**	**0.3**	**0.3**
2F6 SF6 Emissions from Appliances	0.2	0.3	0.3	0.3
Total from IP sector	**1644.5**	**2687.3**	**2947.1**	**3008.2**
2F1 Refrigeration and Air Conditioning Equipment	**137.5**	**238.2**	**354.4**	**208.0**

In 2013 the emissions from the IP sector were estimated at 3008.2 Gg CO2 eq. comparing to the emission level in 2010 at the end of the calculation period the GHG emissions were increased by 82% approximately. The significant upward of the emission trend during the 4 years mainly is attributable to increase in production in mineral industry, particularly Lime and Cement manufacture.

The key emission source-categories in the IP sector can be considered Lime production (accounts for 29.6 % of total IP emissions), Nitric Acid Production (27.4 %), Cement Production (19.9 %), and Ferroalloys Production (13.9 %).

Figure 3.6 - EMISSIONS FROM THE INDUSTRIAL PROCESSES IN GEORGIA IN 2010-2013 (GG CO2 EQ.)



The emission increase by 82 per cent from 2010 to 2013 mostly would be attributed to an economy recovery after the war in Georgia. Particularly, the emissions from the Mineral production have skyrocket-ted from 2010. The CO2 level has reached 1496 Gg approximately four times higher than it was at the beginning of the period. Cement and Lime production are main contributors for this picture. Accordingly the both source-categories are key categories in terms of level and trend assessment.

The Metal Production sub-category was another key supplier of the trend. The highest emissions in the sub-category were 458 Gg of CO2 in 2012. The trend was an upwarding between 2010 and 2012, since the ferroalloys production has increased by 24 per cent from 2010.

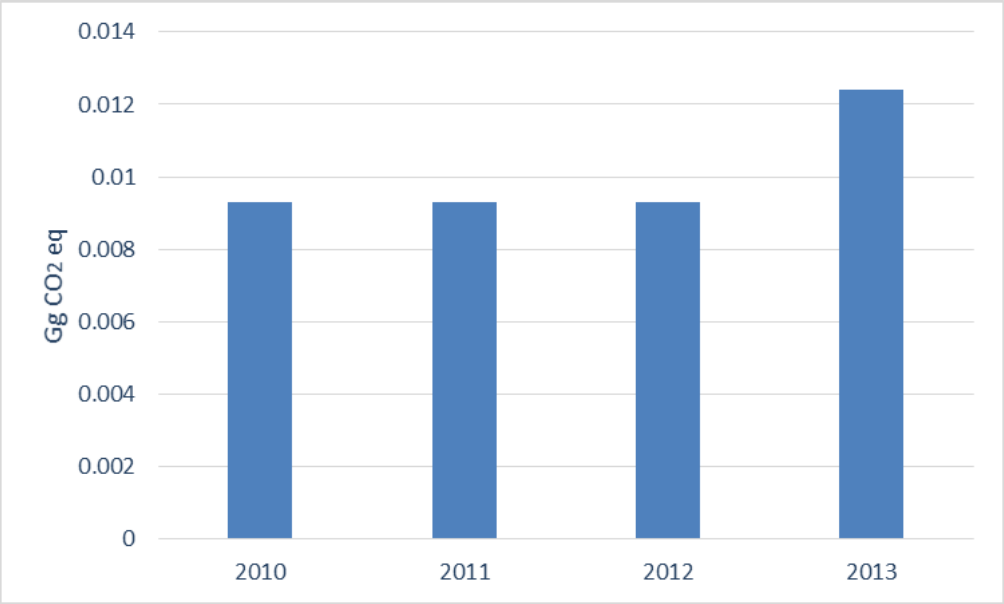
In Chemical Industry the emissions have increased between 2010 and 2013 by approximately by 6 per cent. The largest upturn were recorded in 2011 from 1081 Gg to 1155 Gg of CO2 eq. Afterwards, the emissions have slightly declined by 0.5 per cent due to the reduction of producing of nitric acid. At the end of the period the emissions have increased again by 1 per cent comparing the value calculated for the year of 2012.

The Potential HFC and SF6¬ emissions were also estimated for the four years period under the Consumption of Halocarbons and Sulphur Hexafluoride sub-sector. The estimation covers following HFC compounds: HFC-134a, HFC-125, HFC-143a, and HFC-32. The emissions of SF6 have calculated from the data of electrical appliances, particularly voltage breakers containing the compound. Finally, the inventory chapter also provides data of non-direct GHG emissions from the Industrial Processes.

3.7 Solvents and Other Products Use

The Solvent and Other Products Use (SOPU) sector includes GHG emissions from the anesthesia in the medical field. GHG emitted during the anesthesia process is nitrous oxide (N2O). The total emissions from subsector "Solvent and other product use" are given in Figure 3.7

FIGURE-3.7 TOTAL EMISSIONS OF N_2O FROM SUBSECTOR "SOLVENT AND OTHER PRODUCT USE" IN CO2 EQ (GG)



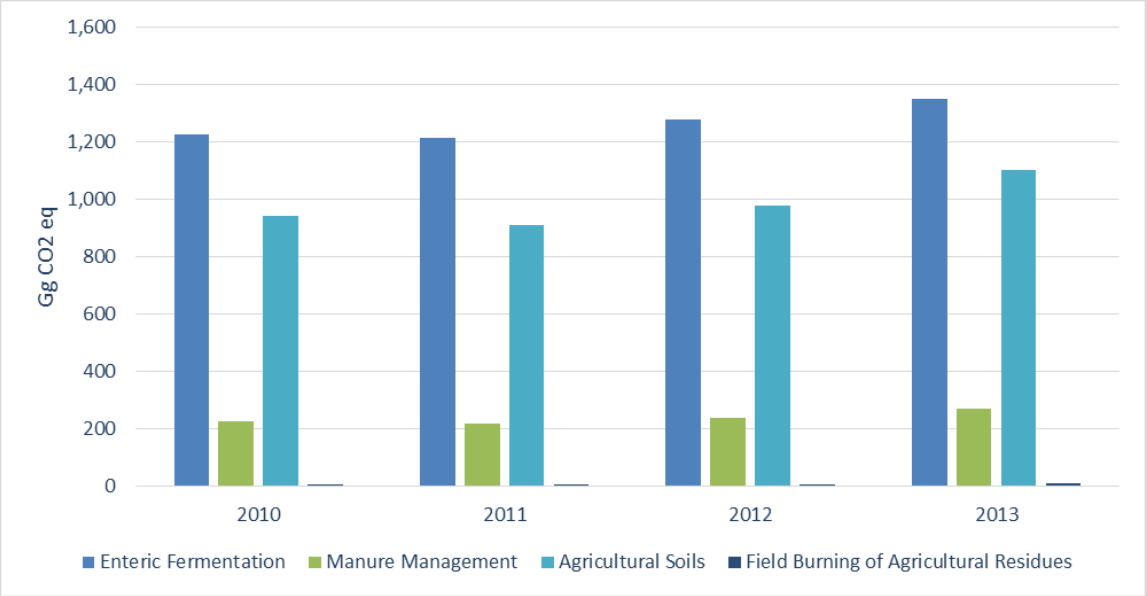
Average annual emissions of N_2O used for anesthesia in medicine during the discussed period, amounted to 0.00003 Gg/year approximately.

3.8 Agriculture

3.8.1 Sector overview

Georgia's agriculture sector, as source of GHG emissions, comprises of four subcategories: Enteric Fermentation, Manure Management, Agricultural Soils, and Field Burning of Agricultural Residues. In 2013 agriculture sector accounted 2,732 Gg CO2 eq. which is about 16% of national GHG emissions (excluding LULUCF).

Figure-3.8 GHG EMISSIONS FROM AGRICULTURE SECTOR OVER 2010-2013 IN GG CO_2 EQ.



Methane and nitrous oxide emissions from the agricultural sector are summarized in Tables 3.9-3.10 These clearly show that methane (CH_4) emissions from enteric fermentation are the largest source of methane within this sector, while agriculture soils are the largest source of nitrous oxide (N_2O).

Table 3.9: METHANE EMISSIONS FROM THE AGRICULTURE SECTOR (GG)

Gas/Source	2010	2011	2012	2013
Enteric Fermentation	58.42	57.79	60.88	64.33
Manure Management	4.75	4.53	4.99	5.63
Field Burning of Agricultural Residues	0.17	0.29	0.27	0.35
Total CH_4 in Gg	**63.33**	**62.61**	**66.14**	**70.31**

Table 3.10: NITROUS OXIDE EMISSIONS FROM THE AGRICULTURE SECTOR (GG)

Gas/Source	2010	2011	2012	2013
Manure Management	0.41	0.40	0.43	0.49
Agricultural Soils	3.04	2.94	3.15	3.55
Direct Soil Emissions	1.82	1.78	1.9	2.14
Synthetic Fertilizers	0.31	0.26	0.30	0.39
Animal Waste Applied to Soils	0.38	0.36	0.40	0.44
Crop Residue Decomposition	0.06	0.11	0.11	0.13
Pasture Range and Paddock	1.07	1.04	1.10	1.18
Indirect Emissions	1.22	1.16	1.25	1.41
Atmospheric Deposition	0.24	0.23	0.24	0.27
Nitrogen Leaching & Run Off	0.99	0.94	1.01	1.14
Field Burning of Agricultural Residues	0.01	0.01	0.01	0.01
Total N_2O in Gg	**3.46**	**3.35**	**3.59**	**4.05**

3.8.2 Enteric Fermentation

The emissions source category “enteric fermentation” consists of the sub-sources: cattle, buffalos, sheep, goats and swine. Emissions by cattle is a key-source category, contributing about 90% of the total emissions from enteric fermentation. During 2010-2013, GHG emissions varied mainly as a result of livestock population variations.

The prevailing native breeds of cattle in Georgia are Georgian Mountain (Highlander) and Red Mingrelian. The Georgian Mountain and Red Mingrelian are late maturing and are

endowed with small weight, low productivity and high fattiness of milk. Since the 30-ies of the 20th century, several high-productive early maturing breeds have been imported. In 2013 GHG emissions from the enteric fermentation source-category amounted 49% in total emissions from agriculture sector of Georgia.

3.8.3 Manure Management

During the handling or storage of livestock manure, both CH_4 and N_2O are emitted. The magnitude of emissions depends upon the quantity of manure handled, the manure properties, and the type of manure management system. Typically, poorly aerated manure management systems generate large quantities of CH_4 but smaller amounts of N_2O, while well-aerated systems generate little CH_4 but more N_2O. In 2013 GHG emissions from the manure management source-category amounted about 10% in total emissions from agriculture sector of Georgia.

3.8.4 Agricultural soils

Nitrous oxide emissions from agricultural soils consists of direct and indirect sources. Direct source emissions result from nitrogen that has entered the soil from synthetic fertilizer, nitrogen from animal manure, nitrogen from crop residue decomposition, and nitrogen deposited by grazing animals on fields (pasture range and paddock). Emissions from indirect sources are emitted off site through volatilization and leaching of synthetic fertilizer and manure nitrogen. In 2013 GHG emissions from the agricultural soils amounted about 40% in total emissions from agriculture sector of Georgia.

3.8.5 Field burning of agriculture residues

Crop residue burning is a net source of CH_4 and N_2O. CH_4 and N_2O emissions from field burning of agriculture residues are not key sources for Georgia. In 2010-2013, the share of methane emissions from this source in the sectoral emissions were within 0.15–0.27%, and the share of Nitrous oxide emissions within 0.07–0.12%.

3.9 Land Use, Land Use Change and Forestry (LULUCF)

3.9.1 Sector overview

In Georgia, almost in every land use category – forestland, cropland, grassland, wetland, settlement, and other land, there was no change in the area according to the most updated data, concerning 2010-2013.

Table 3.11 DISTRIBUTION OF THE TERRITORY OF GEORGIA BY LAND USE CATEGORIES

(Data of FAOSTAT, the National Statistics Office of Georgia[19] and the Ministry of Environment and Natural Resources Protection[20]), Thousand ha

Land Categories	Land Use Subcategories	Year			
		2010	2011	2012	2013
Forest Land	Forests where economic activities take place.	2521.8	2521.8	2521.8	2521.8
	Protected forested areas	300.6	300.6	300.6	300.6
	Total	2822.4	2822.4	2822.4	2822.4
Cropland	Annual croplands	125	125	125	125
	Perennial cropland	415	402	400	451
	Total	540	527	525	576
Grassland	Pasture	1804.2	1804.2	1804.2	1804.2
	Hayland	135.8	135.8	135.8	135.8
	Total	1940	1940	1940	1940
Wetlands	Territorial waters (Black Sea) area	679	679	679	679
	Wetlands	215.1	215.1	215.1	215.1
	Total	894.1	894.1	894.1	894.1
Settlements		88.4	88.4	88.4	88.4
1. Other land (including the area of Forest Fund[21])		1343.5	1343.5	1356.5	1307.5
Total area of Georgia		**7628.4**	7628.4	7628.4	7628.4
Country's land area		**6949.4**	6949.4	6949.4	6949.4

The other land category covers unused lands such as rocks, canyons, sandy grounds, eroded and landslide affected lands, glaciers, areas occupied by cemeteries, as well as the

[19] http://www.fao.org/statistics/en/

[20] http://moe.gov.ge/index.php?lang_id=GEO&sec_id=43

[21] Forest Fund area that is included in the other land category comprises areas which are not forested and have not been included in any of the other land use categories.

areas of the Forest Fund. The Table above shows that forest land represents the prime proportion (40 %) of the country's land area.

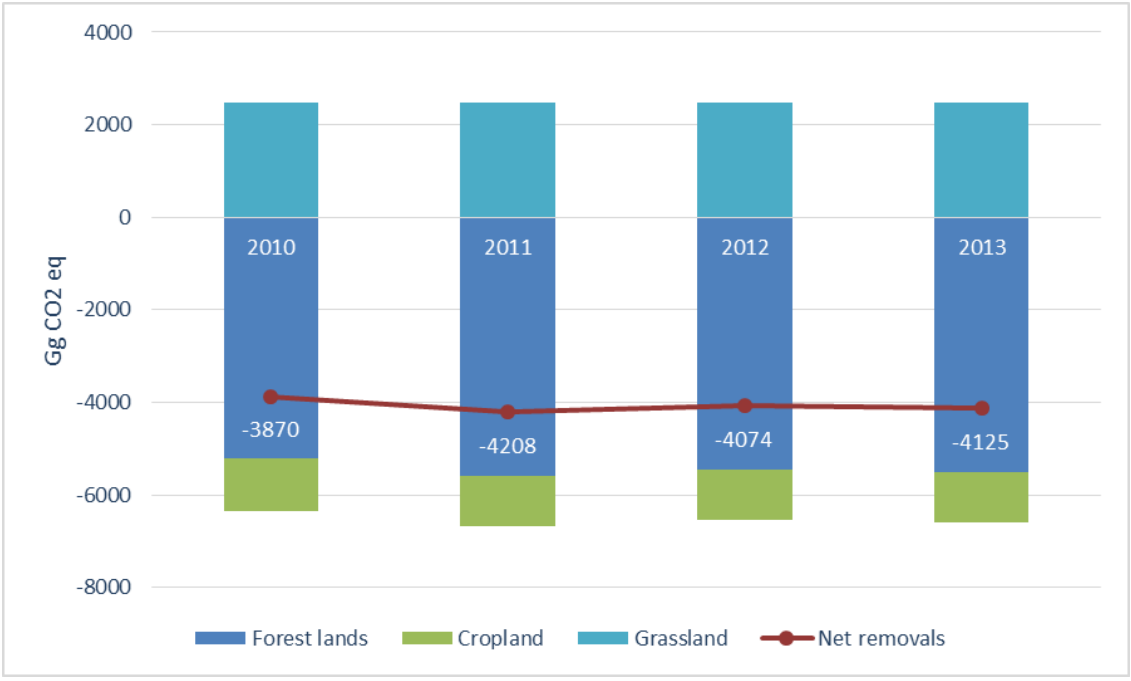
GHG emission/removal inventory in LULUCF was conducted for the following land categories only: forest land, cropland, and grassland. In this sector, calculations were carried out using default values of emission factors (Tier I approach), which approximately comply with Georgia's climate conditions.

Table 3.12 CARBON STOCK CHANGES (CSCS) AND CO_2 EMISSIONS/REMOVALS IN LAND USE, LAND-USE CHANGE AND FORESTRY SECTOR IN 2010-2013

Year	Forest Land		Cropland				Grassland (Hayfields and Pastures)		Net Emission/Removals	
			Annual Croplands		Perennial Woody Crops					
	Carbon stock net change Thousand tC	Gg CO_2	Carbon stock net change Thousand tC	Gg CO_2	Carbon stock net change Thousand tC	Gg CO_2	Carbon stock net change Thousand tC	Gg CO_2	Carbon stock net change Thousand tC	Gg CO_2
2010	1,420	(5,207)	46	(170)	263	(963)	(674)	2,470	1 055	-3,870
2011	1,527	(5,597)	32	(118)	263	(963)	(674)	2,470	1148	-4,208
2012	1,491	(5,467)	31	(114)	263	(963)	(674)	2,470	1 111	-4,074
2013	1,501	(5,502)	35	(129)	263	(963)	(674)	2,470	1 125	-4,125

The calculations show, the dynamics of carbon accumulation is almost equal from year to year, and fluctuates between 1148- 1055 thousand tons of carbon.

Figure-3.9 CO2 EMISSION/REMOVAL IN LULUCF SECTOR (2010-2013)



3.9.2 Forest land

Forest land area remained stable and this is the result of the absence of clear cuts in Georgia, which could lead to the land-use conversion from forest land to other land use categories, and of the conversion to forest land.

Greenhouse gas emissions/removals in the forest land category were estimated only for forested areas where economic activity is allowed. Carbon stock changes were not assessed in areas where none of such activities officially took place, as well as in areas that are not under the control of the official government. These activities are necessary in order to distinguish how high or low the biomass decrease rate is in comparison with forest regeneration and increment volume, and if the forest represents a sink or source of GHG.

Since the East and West Georgian forests, as well as the climatic conditions, are significantly different from each other, the forested area (2 822.4 thousand ha) was divided into the eastern dry and western humid climate of forests and forest types (coniferous and deciduous) to increase the calculation accuracy. In addition, separate calculations were made for forest areas in Adjara. The data on reserves of species dominating in the forests of both regions were used to calculate the results.

Based on Forestry Department data for 2010-2013, several forest fire incidents took place in Georgia, which caused a loss of biomass.

3.9.3 Cropland

The cropland category includes all agricultural lands (including areas covered by perennial crops), as well as all rested lands on which all works are temporarily suspended. Perennial crops include orchards, vineyards and plantations of different types. The cropland category also includes lands on which annual crops are grown, for further use as pastures.

The amount of carbon, accumulated on croplands, depends on the species grown on them, the management practices, and climate conditions. Annual crops (cereals, vegetables) are harvested each year; consequently, carbon is not accumulated in above ground biomass in the long term. In case of perennial crops (orchards, vineyards etc.), carbon is accumulated on an annual basis, which enables the development of carbon stock in the long run.

In Georgia, cropland is a sink of GHG. Although it is characterized by decreasing rate. The removal from the source-category was decreased from 1133 Gg CO2 to 1092 Gg CO2 during 2010-2013 period.

3.9.4 Grassland

Grasslands act as carbon emitter in each evaluated year, which is caused by the degradation of pasture lands, especially in eastern Georgia. This land use category becomes a carbon emitter due to intensive irregular exploitation of pastures. Hence, the scale of carbon taken up by soils is scarce.

The calculations were conducted using the equation for the cropland category. The calculations demonstrated that the condition of haylands is stable and emissions do not take place, while the grasslands act as a source of emission. For example, out of the total area of grasslands in Georgia (1 940 thousand ha), the pastures of East Georgia are spread on 1 214 thousand ha, while the pastures of West Georgia- on 726 thousand ha.

3.9.5 Wetlands

The wetland category includes the lands, which are saturated or covered with water throughout the year. These areas are not part of forest land, crop lands, grasslands - haylands or settlements categories. According to the Guidelines, this category is divided into "wetland remaining wetland category" and "the land converted to wetland". Calculations for wetlands are done to define emissions as a result of developing peat and drying wetlands. In this subsector due to a lack of data, calculations were not carried out.

3.9.6 Settlements

The settlements category includes all areas used by the population, transport infrastructure, and small size settlements. For this category, the inventory was conducted for the crops available in settlements (along the roads, in the yards).

Since the data necessary to calculate the inventory were not found in Georgia, calculations were not carried out. Missing data: on the areas covered by timber plants (ha) in all settlements (cities, villages and settlements), by years, as well as on the volume of annual accretion of carbon in given crops (toneC/year), and average age of timber plants in composition of cover (year).

3.9.7 Other land

The category of other land includes all areas which are lacking vegetation and do not fall within the other land use categories: rocks, glaciers etc. According to the methodology, calculations are not done for this category, since it is considered that these are typical unmanaged areas. As for the lands converted into other land category (forest lands, wetlands and so on), a lack of the necessary activity data, resulted in not being able to conduct carbon stock change estimation.

3.10 Waste

3.10.1 Sector overview

The treatment of waste has become a serious environmental concern and Municipal Solid Waste (MSW) management continues to be an important environmental challenge for Georgia. Currently, there is no acceptable state inventory system for waste in Georgia. Very limited data is scattered among different agencies. Comprehensive waste inventories have not yet been conducted, nor was a state register established, which should include waste catalogue, inventories of wastes and their disposal sites, as well as databases on wastes and technologies of their utilization and rendering harmless.

The problem is particularly serious in cities. Given the potential for higher waste generation rates, it is important that Georgia develops modern recycling systems, including household waste separation, to reduce the amount of waste being disposed off at dump sites. At present, there are no facilities for separating, processing and recycling plastics, paper and glass from municipal waste.

Untreated municipal wastewater is a major cause of surface water pollution in Georgia. The centralized sewage system exists in 45 towns in Georgia. The systems are, however, in poor condition. Construction projects for a biological wastewater treatment facility for Batumi and the coastal settlements from Batumi to the Turkish border, as well as for the city of Poti have already been developed.

In 2013 GHG emissions from waste sector constituted about 1,265 Gg CO2 eq. (8% of total national emissions). Solid waste disposal sides (5.2%) and domestic waste water handling (1.4%) are the key source-categories.

Table 3.13: GHG EMISSIONS FROM WASTE SECTOR (GG)

Gas/Source	2010	2011	2012	2013
CH_4 / Solid Waste Disposal Sides	41.1	41.6	41.7	41.9
CH_4 / Industrial Waste Water Handling	1.4	1.6	2.2	2.1
CH_4 / Domestic Waste Water Handling	11.0	11.1	11.1	11.2
N_2O / Domestic Waste Water Handling	0.33	0.33	0.34	0.34
CO_2eq Emissions from Waste Sector	1,226	1,243	1,260	1,265

3.10.2 Solid Waste Disposal Sites (SWDS)

There are more than 60 landfills in Georgia. In 14 unmanaged landfills, the waste layer is very shallow and actually methane is not generated. In 12 cities with population more then 50,000, habitant landfills are managed. There is very scarce information about the composition of solid waste disposed in landfills of Georgia.

In order to calculate methane emissions from landfills of Georgia, the First order decay (FOD) method is used. The FOD method assumes that the degradable organic component/degradable organic carbon (DOC) in waste, decays slowly throughout a few decades, during which CH4 and CO2 are formed.

3.10.3 Wastewater Handling

The water used in households and industry contains a vast amount of toxins which gravely deteriorate the natural environment, flora and fauna, and the quality of life of population. Phreatic water resources are polluted, which has consequences for agricultural products, and the population as well.

To handle wastewater from municipal sewage and from industrial facilities mainly anaerobic methods were used. Common practice is wastewater treatment in an anaerobic open lagoons system without methane recovery from either wastewater or sludge treatment. The methane emissions from aerobic systems are negligible. Wastewater treatment systems generate N2O through the nitrification and denitrification of sewage nitrogen. Main source of nitrogen from human sewage is protein. FAO Statistics Division provides per person protein consumption data for Georgia.

3.11 Uncertainty Assessment

The uncertainty analysis is one of the main activities of the inventory process. Uncertainty information is not intended to dispute the validity of the inventory estimates, but to help prioritize efforts to improve the accuracy of inventories and guide decisions on the methodological choice.

The uncertainty analysis in the inventory is based on the Tier 1 approach and covers all source-categories and all direct greenhouse gases, where 2013 was taken for the uncertainty assessment, and 2010 as base year. The uncertainty estimation for the activity

data and emission factors was based on typical values of the IPCC and on experts' judgment. A detailed description is given in the national inventory report of Georgia.

The results revealed that the level of emissions' uncertainty is within 25.14% (excluding LULUCF sector - 9.89%), and the uncertainty trend - 43.71% (excluding LULUCF sector - 13.13%). The highest uncertainty assessments have fugitive emissions from coal, oil and gas extraction and indirect emissions from agriculture, as well as methane and nitrous oxide emissions from biomass combustion. Uncertainty is also fairly high in case of nitrous oxide emissions from Commercial and Public Services, Residential, Agriculture, Fishing and Forestry.

3.12 Quality Assurance and Quality Control

To ensure a high quality GHG inventories, the team preparing the Georgian GHG NIR guaranteed the transparency, completeness, consistency, comparability and accuracy of the information used by establishing a separate system for Quality Assurance and Quality Control (QA/QC).

The QC is carried out through a system of routine technical activities that monitor and maintain the quality of the inventory, while it is being prepared. The QC activities are carried out by sector teams during the preparation of the sectorial GHG NIRs and also by the QA/QC expert/coordinator during the compilation and preparation of the GHG NIR of Georgia.

The QA is a system of planned review procedures implemented by staff members who are not directly involved in preparing the NIR or in compiling the NGHGI. Independent third parties are responsible for reviewing the sectorial and national inventories.

The QA/QC for Georgian GHG inventory were performed for the first time and conducted by the external organization - WEG, which is not directly involved in preparing the NIR.

The final national inventory of greenhouses gases was additionally reviewed by an expert nominated by the UNDP/UNEP Global Support Program for National Communications and Biennial Update Reports (GSP), who confirmed the significant progress in improvement of the quality of the national GHG inventory.

For the next inventory it is recommended to use the 2006 guideline and conduct recalculations for the previous years. To move to the new guidelines trainings will be needed for the inventory team.

4 CHAPTER - Climate Change Mitigation

4.1 State Policies and Programs on Climate Change Mitigation

Georgia is a non-annex I country to the United Nations Framework Convention on Climate Change. However, in 2010 Georgia acceded to the Copenhagen Accord and declared that "Georgia will take steps to achieve a measurable, reportable and verifiable deviation from the baseline scenario (below "Business as Usual" levels) supported and enabled by finance, technology and capacity building." In sight of ongoing international negotiations and expectations of the quantified mitigation obligation it pledged after the 2015 Paris Conference, Georgia has submitted its Intended Nationally Determined Contribution (INDC) to the UNFCCC.

According to the INDC, Georgia plans to unconditionally reduce its GHG emissions by 15% below the Business as Usual scenario (BAU) by 2030. This number will mean a 34% reduction in emission intensity per unit of GDP from 2013 to 2030. Conditional to a global agreement addressing the importance of technical cooperation, access to low-cost financial resources and technology transfer, this 15% can be increased up to 25%. At 25%, Georgia's reduction in greenhouse gas (GHG) emission intensity per unit of GDP from 2013 to 2030 would be approximately 43%. The 25% reduction would also ensure that by 2030 GHG emissions in Georgia will stay 40% below the 1990 levels.

To prepare for its INDC, Georgia was supported by the US Government's USAID "Enhancing Capacity for Low Emission Development Strategy" Program, the European Union, and the Government of Germany. Georgia's INDC is largely based on the results achieved during the Low Emission Development Strategy (LEDS) preparation process.

Next step after COP 21 in Paris, was to sign the Paris agreement. Minister of Environment and Natural Resources Protection of Georgia signed the agreement in April, 2016 in New York, USA. Currently, Georgia works on the follow up of Paris Agreement, to initiate the process that will bring to the ratification of the agreement, which will give the country a possibility to implement mechanisms under the new agreement as well as to develop and submit by 2020 more ambitious NDC than its already submitted INDC.

There are several ongoing mitigation policies, programs and projects in Georgia:

- On December 2012, United States Agency for International Development (USAID) and the Ministry of Environment and Natural Resources Protection of Georgia signed a memorandum of understanding to support the preparation of Georgia's LEDS, a national level, country-led, and country-specific strategic plan to: (a) provide an integrated comprehensive pathway for long-term, sustainable

development; (b) take into account each country's development objectives and unique circumstances; (c) promote transformational development; (d) help each country meet international climate change commitments; and (e) help each country access financing from both public and private sources. Preparation of LEDS was launched in May 2013 and will be finalized by June 2017.

- In recent years, Nationally Appropriate Mitigation Action (NAMA) has become a key element of negotiation on mitigation in the UNFCCC process. Georgia is actively involved in preparation and implementation of projects for NAMAs. In the framework of this initiative the following NAMAs are implemented or are under preparation: Adaptive Sustainable Forest Management in Borjomi-Bakuriani Forest District; efficient use of biomass for equitable, climate-proof and sustainable rural development; energy efficient refurbishment in the Georgian public building sector; and vertically integrated Nationally Appropriate Mitigation Action (V-NAMA) with focus on the urban transport sector.
- On 27 of June, 2014 the EU-Georgia association agreement was signed and entered into force from September the same year. The agreement explicitly mentions the cooperation of the Ministry of Environment and Natural Resources Protection on the preparation of LEDS, as well as Nationally Appropriate Mitigation Actions (NAMAs), and the measures to promote technology transfer on the basis of technology needs assessment.
- GIZ global program Vertical Integration of Climate Policies (V-CLIM) is the follow-up of the global project "V-NAMAs – Involving Sub-national Actors into National Mitigation Strategies through Vertically Integrated NAMAs." The overall objective of the project is to strengthen the capacity of climate policy-makers and institutions at national and subnational level in order to leverage subnational mitigation potential. In Georgia, the project will support MoENRP in analysing and formulating specific vertically integrated climate measures. It will further support Georgia's participation in international dialogue and knowledge exchange. The specific activity package for Georgia will be elaborated at a later stage, together with the representatives of the partner countries. The programme is expected to start in summer 2016, but the exact launching date is still unclear.
- The government of Germany works intensively with Georgia to set up a system for MRV through its Partnership Programme led by the Society for International Collaboration of Germany - GiZ.
- In 2008, the EU launched a Covenant of Mayors (COM) process in which signatory cities pledge to decrease emissions by 20% from their territory by 2020. The cities

must develop Sustainable Energy Action Plans (SEAP), monitor their implementations, and report reduced emissions. By April 2016 thirteen Cities of Georgia (see chapter 6) have signed the initiative and are in different stages of the process. Eight cities have already submitted SEAPs and five of those SEAPs are accepted. Several donors, including EU and USAID are providing the cities with support to draft SEAPs and implement mitigation measures identified in these action plans.

- There are ongoing negotiations between the Ministry of Environment and Natural Resources Protection of Georgia and UNDP to prepare project identification documents necessary to implement the fourth national communication and second Biennial update report to UNFCCC in the next years.
- From its beginning Georgia has been involved in Clean Development Mechanism (CDM) and has registered seven projects, although one of them was not implemented. Total expected reduction from these projects constitutes 1,899,868 tons of CO_2 eq. Nowadays, due to the uncertainty of perspectives of CDM globally, Georgia's activities in this direction have weakened.
- From 2015, with the support of EBRD, the Ministry of Energy has started preparation for the first National Energy Efficiency Action Plan of Georgia. The NEEAP will identify significant EE improvement measures and expected energy savings in all sectors, taking into account the country's potential and national EE targets and aiming to achieve high EE performance from the economy. The NEEAP will be submitted in 2016.

Implementation of these programs and plans, among other activities, will contribute to achieving the mitigation targets of Georgia. Envisioned mitigation actions are given below.

The analysis of mitigation measures presented in the First Biennial Update Report (FBUR) is derived from the projects implemented, ongoing and planned by public entities, Georgian NGOs and local municipalities.

4.2 Mitigation Measures and Potential by Sectors

The disintegration of Soviet Union and subsequent collapse of a centrally planned economy in early 90s caused significant reduction in national greenhouse gases (GHG) emissions (lowest value 8,799 Gg CO_2eq in 1995). According to the Inventory of GHG, the emissions from Georgia in 2013 amounted to 16,679 Gg CO_2eq (see Inventory chapter) which is about 35% of 1990 emissions level (47,187 Gg CO_2eq). GHG emissions from

Georgia constituted about 0.03% of global emissions. Economic growth unavoidably will be accompanied by an increase in GHG emissions. Therefore, Georgia will undertake efforts to substantially limit this increase by boosting investments in low carbon technologies throughout the country.

4.2.1 Energy

The greenhouse gases inventory, prepared using data from 2010-2013 for First Biennial Update Report of Georgia to the UNFCCC, demonstrated that the leading sector in greenhouse gases emissions is the energy sector (including transport sector) with a 56% share of the total. Excluding transport sub-sector, emissions from energy sector constitute about 38% in national GHG emissions. The MARKAL[22]-Georgia model's Business As Usual (BAU) scenario prepared for the National Energy Efficiency Action Plan of Georgia predicted the energy balance for 2030 (see annex 2) and a CO_2 emission inventory (reference approach) has been conducted. For 2030, CO_2 emissions will constitute about 10 million tonnes (118% growth compared to 2013) from energy sector only (excluding transport sub-sector).

Presented below are implemented, ongoing and planned mitigation actions in energy sector of Georgia.

First National Energy Efficiency Action Plan (NEEAP)

The project started in 2015 and is funded by the European Bank for Reconstruction and Development (EBRD). The goal of the project is to assist the Ministry of Energy with the preparation, drafting, adoption and publishing of the country's first NEEAP. The NEEAP will identify significant EE improvement measures and expected energy savings in all sectors, taking into account the country's potential and national EE targets, and aiming for high EE economic performance. The project was funded by EBRD. Various Analytical Centers, individual experts and NGOs are assisting the Ministry of Energy and the Ministry of Economy in preparation and drafting of the First National Energy Efficiency Action Plan (NEEAP). Based on the NEEAP, the main energy efficient measures in energy sector are presented in the below table.

[22]MARKAL (MARKet ALlocation) integrated energy system model

Table 4.1. MITIGATION MEASURES IN ENERGY UNDER NEEAP

N	Mitigation Measure	Coverage	Funding				Annual GHG emissions reduction in tonnes CO_2eq	
			Local funding	IFIs/Banks	Donor funding	Total	2020	2030
1	Efficient lighting systems in residential and commercial buildings	Nationwide	58 mln EUR	-	-	58 mln EUR	78,761	73,698
2	Improvement of energy efficiency in existing houses	Nationwide	37 mln EUR	100 mln EUR	9 mln EUR	146 mln EUR	15,036	65,537
3	Improvement of energy efficiency in existing apartment buildings	Nationwide-cities	18 mln EUR	44 mln EUR	9.5 mln EUR	71.5 mln EUR	15,405	73,395
4	Improvement of the energy efficiency in existing commercial buildings	Nationwide	0.5 mln EUR	6.5 mln EUR	0.6 mln EUR	7.6 mln EUR	2,719	7,553
5	Development of national energy efficiency information system for publicly owned buildings and street-lighting	Nationwide	1.5 mln EUR	-	0.5 mln EUR	2 mln EUR	NC	NC
6	Pilot project for low energy public sector buildings	Nationwide	0.012 mln EUR	-	0.035 mln EUR	0.047 mln EUR	22	22
7	Efficient lighting systems in public buildings	Nationwide	0.52 mln EUR	-	0.115 mln EUR	0.635 mln EUR	1,431	1,431
8	Improvement of energy efficiency in schools	Nationwide	2.3 mln EUR	24 mln EUR	0.5 mln EUR	26.7 mln EUR	5,783	23,959
9	Improvement of the energy efficiency in central government-owned public buildings	Nationwide	0.2 mln EUR	-	0.5 mln EUR	0.7 mln EUR	NC	NC
10	Improvement of energy efficiency in kindergartens	Nationwide - CoM cities	1.3 mln EUR	13.3 mln EUR	0.164 mln EUR	14.8 mln EUR	4,290	20,439
11	Improvement of the energy efficiency of additional non-central government-owned public buildings	Nationwide - CoM cities	1 mln EUR	-	0.4 mln EUR	1.4 mln EUR	NC	NC
12	Green Procurement on Energy Efficiency	Nationwide	1 mln EUR	-	0.3 mln EUR	1.3 mln EUR	NC	NC
13	Improvement of efficiency in street-lighting/outdoor lighting	Nationwide	1.8 mln EUR	82 mln EUR	0.26 mln EUR	84 mln EUR	46,570	58,212
14	Reduction of losses in hydropower production	Nationwide	0.8 mln EUR	101.4 mln EUR	1 mln EUR	103 mln EUR	222,897	441,465
15	Natural gas savings through replacement of old Thermal Power Plants (TPP) with efficient Combined Cycle Gas Turbine (CCGT) technology	Nationwide	400 mln EUR	-	-	400 mln EUR	589,462	647,739
16	Reduction of losses in electricity transmission networks and grid integration of new generation	Nationwide	500 mln EUR	-	-	500 mln EUR	NC	NC
17	Regulations on the "Rules of calculation of normative electricity losses"	Nationwide	91 mln EUR	-	-	91 mln EUR	84,020	167,927
18	Reduction of losses in gas pipelines	Nationwide	5.5 mln EUR	-	-	5.5 mln EUR	289,283	750,904
19	Efficient wood-burning stoves	Nationwide	0.05 mln EUR	-	7.5 mln EUR	7.6 mln EUR	284,472	726,983
20	Solar hot water heating	Nationwide	0.8 mln EUR	-	16.4 mln EUR	17.2 mln EUR	43,747	126,023
	Total					**1567.3 mln EUR**	**1683.9**	**3185.3**

The plan, if implemented, will reduced GHG emissions each year through the above measures, will constitute 1,683.9 Gg CO_2eq by 2010 and 3,185.3 Gg CO_2eq by 2030. The required cost will be €1,567,332,000.

Market Assessment of the Residential Sector in Georgia

The aim of the project funded by EBRD is to review the current policy, legal and regulatory environment for residential energy efficiency, to assess the legal, regulatory, technical and financial aspects of the implementation of energy performance standards in buildings, and to improve housing policy and apartment building legislation, thereby facilitating the energy efficiency improvements in residential sector. The project has two phases.

Phase I of this project, which was completed in April 2016, comprises a detailed analysis of the building sector in Georgia, including policy, legislative and institutional set-up, and technical and economic considerations. The assessment of existing gaps in energy performance in the residential sector is based on a review of sector statistics and an overview of the housing policy, the legal regime for homeowner associations, management and maintenance, obligations in multi-story apartment buildings, the relevant institutions and their capacity.

In phase II, the phase I recommendations on amendments to buildings and housing codes or related legislation shall be drafted together with the Ministry of Economy in order to address sector deficiencies.

Hydropower Investment Promotion Project (HIPP).

The three-year 2010-2012 Hydropower Investment Promotion Project (HIPP) was implemented by Deloitte Consulting Overseas. The project was financed by USAID (about 10 mil. USD)[23] and intended to assist the Government of Georgia (GOG) to meet its goals for energy security by promoting and initiating private sector development of 400 MW of new, climate friendly run-of-river hydropower stations, thereby displacing natural gas imports. The project was successful, directly enabling the GOG to secure investment commitments for 543 MW of new capacity. Georgian Electricity Market Model (GEMM) 2015 and Electricity Trading Mechanism (ETM) were developed by USAID HIPP in 2011. GEMM 2015 has created an enabling environment for development of Georgian hydro resources and at the same time protected domestic tariff costumers. It has enhanced the regulatory support framework. GEMM 2015 and the ETM are in line with EU competitive market principles, and will be harmonized with the Turkish power market. The progress

[23] USAID Hydropower Investment Promotion Project (HIPP) final report, August 1, 2013

has been achieved through a comprehensive approach including promotional services, studies, workshops, and technical assistance provided to a variety of stakeholders in the energy sector. Program success was also to be measured by the amount of private investment leveraged by United States Government (USG) funding.

Hydro Power and Energy Planning Project (HPEP).

As a follow-up to the HIPP project, USAID allocated additional 2.9 mil. USD for the one year project: **Hydro Power and Energy Planning Project (HPEP). The HPEP project conti**nued supporting market-based initiatives to stimulate investments in the hydro power sector. The main Goals were as follows:

- Accomplish the tasks outlined in the GEMM 2015;
- Finance the new run-of-river HPP projects through nonrecourse (project-based) loans,
- Facilitate cross-border, competitive clean energy trading; and
- Leverage funds from the public and private sector for hydropower development.

The project was successful, directly enabling the GOG to secure project financing for Clean\Energy Invests 185 MW of new capacity and enabling USAID to deliver $250 million of clean energy investment.

Governing for Growth (G4G) in Georgia

In 2015 USAID launched a new five-year project entitled Governing for Growth (G4G) in Georgia. The project budget is $19.3 mil. and is designed to promote the Public-Private Dialogue (PPD) necessary to garner support for economic development policies. G4G is implemented through five main components, one of which is improving the governance of energy trading, including cross-border electricity trading.

Promotion of Biomass Production and Utilization in Georgia.

The project began in 2013 and is supported by Global Environment Facility (GEF) and United Nations Development Programme (UNDP). The Ministry of Environment and Natural Resources Protection of Georgia and the Tbilisi Municipality are the two main implementing entities. The objective of the project is to promote sustainable production and use of upgraded biomass fuels for municipal heating service sector, thereby reducing

dependence on fossil fuels and avoiding GHG emissions. To do this, a comprehensive strategy proposes to promote the supply and demand of biomass through demonstrative and replicable activities, such as the launch of a pilot plant producing upgraded fuels from biomass waste and the establishment of a two-component Investment Grant Mechanism to fund biomass-related projects. The project budget is 5.38 mil. USD hopes to reduce direct emissions by 47,800 tons of CO_2eq over 20 years. Using GEF bottom-up methodology, the project calculates it can reduce indirect emissions by 143,400 tons of CO_2eq in this period (replication factor=3). The GEF bottom-up approach implies that the products methods and investments can be replicated. Using GEF top-down methodology for the same period, the project estimates it can reduce indirect emissions by 546,000 tons of CO_2eq.

Planned project activities from now until mid-2017 include: awarding final portions of investment grants to producers and consumers of biomass fuels; completing the procurement process needed to production and use biomass fuels; supporting producers and consumers in technical, business and energy efficiency matters; developing the national bioenergy strategy and action plan and quality standards of biofuels and equipment; establishing a bioenergy association; forming a proposal to improve the access of biomass projects to finance (such as establishing a dedicated funding window), and popularizing biomass fuel through various public awareness activities.

Climate Change Strategy of Adjara.[24]

The research financed by UNDP was completed in 2013. A report has been prepared by a large group of experts from various organizations.

Using the BAU scenario, the report found that Georgia's final energy consumption by 2030 will be up 116% from 2011, increasing GHG emissions by 151%. Considering the GHG mitigation plan in the Adjara Climate Change Strategy (which includes increasing energy efficiency and promoting renewable energy sources in the residential sector, municipal and touristic buildings, and outdoor lighting), the savings over the BAU scenario will be 537.8 GWh in energy consumption and 121 thousands of tons of CO_2 eq. in emissions.

Technology Needs Assessment (TNA)[25]

This research was supported by Global Environment Fund (GEF) was completed in 2012. The technology Needs Assessment (TNA) report was prepared by the Ministry of

[24]Climate Change Strategy of Adjara - http://www.ge.undp.org/content/dam/georgia/docs/publications/UNDP_GE_EE_Adjara_CC_2013_eng.pdf

[25]http://weg.ge/wp-content/uploads/2012/11/technology-needs-assessment-and-technology-action-plans-for-climate-change-mitigation.pdf

Environment Protection of Georgia with technical support provided by UNEP (United Nations Environment program) Risoe Center.

Under the project, a needs assessment for climate change mitigation technologies has been conducted for Georgia. The project identified priority sectors and preferred technologies which complied with both development priorities and greenhouse gas emission reduction potential. Market scope and barriers for the selected technologies were also analyzed, and Relevant Technology Action Plans as well as Pilot Project proposals were developed.

Introduction of clean energy in Georgia through the solar power generation system

The aim of the project is to assist Georgia in producing clean energy. The project is funded by Japan International Cooperation Agency. According to the signed agreement between the Governments of Japan and Georgia (June 16, 2010) 480,000,000 Japanese yen (USD 4,174,000) has been allocated with the purpose of producing clean energy in Georgia. The above project envisages the installation of solar photovoltaic systems in Ilia State University (35 KW) and Tbilisi Airport (315 KW). It started in November 2015 and will last until the end of July 2016. Expected Emission reduction will total 0.6 kt CO_2 equivalent annually. Also Japan will establish a well-equipped laboratory for both researchers and students working in this area as well as general public educational tours. These measures will increase field knowledge and promote clean energy implementation in Georgia.

Kartli Wind Farm

LLC Qartli Wind Farm, subsidiary of JSC Georgian Energy Development Fund and Georgian Oil and Gas Corporation, with the financial support of EBRD, is constructing the first wind power plant in Georgia (Kartli Wind Farm) in Shida, Kartli region, with installed capacity of 20.7 MW and annually generated electricity of 88GWH.

In 2015 Georgian Energy Development Fund began active cooperation with the European Bank of Reconstruction and Development on the issue of project financing. In compliance with requirements of EBRD, 30% of total value of the project should be financed by the receiving organization and the remaining 70% by an EBRD loan.

A Loan Agreement was signed between the EBRD and the LLC Qartli Wind Farm. According to this agreement, the bank issued 24 mil. USD for project financing. The project is estimated to be complete by September 2016.

Energocredits for renewable energy and energy efficiency projects.

Energocredit is a dedicated programme of the European Bank for Reconstruction and Development aimed at supporting sustainable energy development projects. EBRD provides 35 mil USD to Georgian financial institutions to lend to businesses and individuals implementing energy efficiency measures and renewable energy projects. Additionally, high quality technical consulting is provided by international and local experts, funded by the Austrian Federal Ministry of Finance. With these funds, the programme aims to enhance energy efficiency awareness and to transfer skills to local financial institutions in sustainable energy lending. Due to a grant funded by the European Union Neighborhood Investment Facility and the EBRD Shareholder's Special Fund, successful projects and environmentally friendly investments will benefit from a 10 or 15% cash return of the loan amount. During 2008-2016 total amount of loans disbursed has been amounted 51.7 million USD and corresponding GHG Emission reduction constitutes 137,000 t CO2eq (annually) or 2,050,000 t CO2eq (lifetime).

4.2.2 Transport

Transport is an important sector for energy consumption and therefore one of the key sources of GHG emissions in Georgia. In 2013, transport accounted for 26% of all energy consumption and 18% of national GHG emissions in Georgia. The vast majority of fuel used in the transport sector is either oil products (diesel and gasoline) or natural gas – all of which are imported. Based on the Business as Usual (BAU) scenario of the MARKAL-Georgia model prepared for the EC LEDS project, CO_2 emissions from transport sub-sector have been estimated to increase by 110% in 2030 (6.5 mil. tonnes CO_2) from 2013 (3.1 mil. tonnes CO_2).

According to transport statistics in 2013, road travel represented the biggest share of domestic passenger transport at 77.6 %, followed by subway at 21.7%, rail at 3%, and aviation at 0.1%. There was a threefold increase in vehicle registration from 320 thousand in 2003 to 910 thousand in 2013. The number of vehicles increased with the growing economy and individual income. The transport sector is a large source of GHG emissions and will stay that for a long time.

Under the national energy efficiency action plan (NEEAP) the following energy efficiency and mitigation actions are considered for the transport sector (see below the table).

Table 4.2 – MITIGATION MEASURES IN TRANSPORT

N	Mitigation Measure	Coverage	Funding				Annual GHG emissions reduction in tonnes CO2eq	
			Local funding	IFIs/Banks	Donor funding	Total	2020	2030
1	Railway improvement - Modernization of Georgian Railways (2011-2019)	Nationwide	147 mln EUR			147 mln EUR	11,864	46,209
2	Railway improvement - Tbilisi Railway Bypass Project (2019-2030)	Nationwide	-	-	-	-	2,966	23,105
3	Railway improvement - Baku-Tbilisi-Kars Railway (2008-2018)	Nationwide	242 mln EUR	-	-	242 mln EUR	8,898	23,105
4	Roads - Improved road infrastructure between cities (2014-2020)	Nationwide	127 mln EUR	-	0.05 mln EUR	127 mln EUR	NC	NC
5	Urban mobility - Improved road infrastructure and traffic management within cities (2016-2020)	Tbilisi, Kutaisi, Batumi, Rustavi, Zugdidi, Gori	25 mln EUR	-	0.65 mln EUR	25.6 mln EUR	26,895	40,713
6	Urban mobility - Improvement of buses/ minivan transport systems (2015-2025)	Tbilisi, Kutaisi, Batumi, Rustavi, Zugdidi, Gori	8 mln EUR	-	0.37 mln EUR	8.5 mln EUR	135,820	277,743
7	Urban mobility - Expansion of the metro system in Tbilisi (2016-2020)	Tbilisi	-	312 mln EUR	-	312 mln EUR	581	581
8	Urban mobility - Encouraging modal shifts from cars to public transport/ walking/ bicycling (2016-2022)	Tbilisi, Batumi, Kutaisi, Zugdidi, Gori	3.7 mln EUR	-	0.4 mln EUR	4.1 mln EUR	30,450	61,958
9	Urban mobility - Tram system development & bus rapid transit (2016-2030)	Kutaisi, Tbilisi	-	-	0.25 mln EUR	0.25 mln EUR	5,288	15,913
10	Vehicle improvement - Renewal of the public transport fleet (2016-2025)	Tbilisi, Kutaisi, Batumi, Rustavi, Zugdidi	69.2 mln EUR	-	2.8 mln EUR	72.1 mln EUR	3,406	4,288
11	Vehicle improvement - Technical inspection of vehicles (2017-2030)	Nationwide	17.5 mln EUR	-	1 mln EUR	18.5 mln EUR	87,575	188,024
12	Vehicle improvement - Fuel switching amongst taxi services (2015-2026)	Batumi	35 mln EUR	-	-	35 mln EUR	2,117	7,056
13	Public awareness - Information campaign for transport (2016-2030)	Nationwide	0.83 mln EUR	-	0.35 mln EUR	1.2 mln EUR	83,452	154,263

There are also additional mitigation actions in transport sector of Georgia which are implemented, ongoing and planned:

Creation of Traffic Management Centre

- Tbilisi: Currently out of 214 traffic lights, only 128 are connected to the monitoring and management system. The long term target is to cover all traffic lights. Implement green wave systems to reduce crossroad waiting time and improve traffic flow.

- Maintain current rehabilitated central roads and rehabilitate new/secondary and internal roads.
- Install new traffic lights to organize traffic and ensure safety.

Improving road infrastructure will optimize traffic patterns and decrease fuel consumption and therefore GHG emissions.

Improvement of Public Transport Service

- Electronic Display Boards on 450 Bus Stops: Electronic display boards will be installed at 450 bus stops. Commuters will be informed about the arrival time of concrete modes and routes of public transport, increasing the convenience of public transportation.
- New Comfortable Minibuses: in 2011 new Ford Transit minibuses (with a Euro 4 engine) have been introduced in the capital city. The minibus service have been improved considerably.
- Electric Display Boards in Minibuses: The minibus vehicles will be provided with electric boards displaying the routes. The boards will be visible round the clock.

Construction of Adjara bypass road

The bypass road will ultimately reduce external and internal transit transport traffic city-wide and reduce travel time and distance, indirectly reducing CO2 emissions.

A 30 km city bypass road will connect the Sarpi-Choloki section. The first stages of the work will construct the 15,4 km Choloki-Ochkhamuri and Chakvi-Makhinjauri sections and is currently underway.

Tbilisi Sustainable Urban transport strategy

The updated Tbilisi SUT Strategy, which defines policy directions and prioritizes interventions along a multimodal and integrated approach, will be implemented between 2015 and 2030 in three phases: immediate (2015-2017), medium (2018-2021) and long-term (2022-2030).

The Tbilisi SUT Strategy, developed by the Government of Georgia and Tbilisi City Hall, is resolved around 3 main areas: (i) ensure a healthy living environment (with focus on sustainable urban transport), (ii) enhance Tbilisi as the regional economic center, and (iii) develop Tbilisi as cultural, touristic and youth hub. This vision is consistent with recommendations summarized in ADB's Sustainable Transport Initiative Operation Plan.

The urban transport strategy was endorsed by Tbilisi Municipality Government, Protocol #5, on February 3, 2016.

Construction of Tbilisi-Rustavi Highway

The Tbilisi-Rustavi highway project will widen the existing road from 2-6 lanes to 6 lanes. The width of each lane will be 3.5m. The construction of urban road is envisaged in a populated area, where the road run atop the embankment Mtkvari River (from 5.00 to 7.00). In its turn, construction of the road includes designing of recreational zones, in particular: a greening zone, bicycle lanes, pedestrian lanes and recreational areas.

Implementation of the works will result in: saving travel time, increasing safety on the road, alleviating traffic congestion, alleviating motor transport environmental damage, improving public transportation conduction, and indirectly reducing CO2 emissions.

Tbilisi Household Survey 2016

The city of Tbilisi owns a Multimodal Transport Demand Model with socio-economic data and mobility patterns based on the 2010 Household Survey. There is a program to update both the Household Survey and the model by the end of 2016. The results will check the zoning of the Household Survey and Transport Demand model for relevance, and determine if zoning changes are needed. The multimodal transport model is a key forecasting tool for any infrastructure project and will access the performance of the Public Transport Policy.

National Urban Assessment

The Asian Development Bank (ADB) launched its Urban Operational Plan (UOP) 2012–2020 at the Asian Urban Forum in November 2011. Under the UOP, ADB is supporting developing member countries (DMCs) in developing their urban economies, improving environmental sustainability, and making pro-poor investments. To maximize development impact, the ADB plans to expand its operations beyond traditional urban investments (ADB 2011). The ADB Manual on National Urban Assessments (NUA) provides an integrated framework for conducting rapid urban sustainability assessments at both national and urban region levels by developing strategic policy options and targeting investments in the urban sector.

ADB Country Partnership Strategy 2014-2018

The CPS is based on ADB's Midterm Review of Strategy 2020 and will fully align with the government's Socio-economic Development Strategy of Georgia. It seeks to foster inclusive economic growth, enhancing regional connectivity, and ensuring environmentally sustainable growth. Its priority sectors (transport, water supply and sanitation, energy, public sector management, and finance) are within ADB's core areas of operations. Common drivers of change in Georgia and the CPS include private sector development, governance and capacity development, and knowledge solutions. More specifically it focuses on road improvements to promote trade and regional connectivity; upgrading and developing energy infrastructure, including assistance for renewable energy initiatives, power transmission, and hydropower generation.

The Urban Cable Car Master Plan

Georgian local authorities do not have the resources and powers needed to renovate or improve public transport. The Georgian Government, through the Land Transport Agency (LTA), seeks to review its transport policy in order to use existing infrastructure and refurbish, improve and develop new transport systems. The current study (started in November 2015) focuses on urban cable cars with the objective to define a long term development strategy for cable car systems in Georgian towns and cities, prioritize needs and develop an investment program. The output of this study – the Urban Cable Car Master Plan – should provide the Georgian government with all the necessary information to develop a public investment strategy in the medium term. The study will end in 2016.

The ISTBAR Project

The objective of this project is to promote sustainable transport in the City of Batumi and Region of Adjara during 2015-2019. This objective will be met through implementation of four (4) components: i) the development of integrated sustainable urban transport plans for the City of Batumi and the Region of Adjara; ii) the development specific feasibility studies and functional plans for low carbon transport in Batumi; iii) the investment in sustainable urban transport measures in Batumi based on the feasibility studies; and iv) the development of sustainable transport plans for other corridors of Batumi and other municipalities in Adjara. The project will be implemented over a 4-year period and is expected to generate direct GHG emission reductions of 877 tonnes CO2 respectively through sustainable urban transport measures undertaken in Batumi City. Indirect emission reductions for the 10 year period after the project are estimated to be 562,631 tonnes CO2.

Greening the Freight Transport and Logistics Sector in Georgia

This World Bank financed a study aimed at assisting the Government of Georgia create the basis for green growth in the freight transport and logistics sector. The study will (i) assess the current market dynamics of freight transport and logistics sectors (ii) identify the barriers related to transport and logistics to the country's export and developmental potential and (iii) identify opportunities for green freight transport and logistics in Georgia through investment and policy reform.

The project includes the following tasks:

- Collecting cargo volume and traffic data.
- Carrying out road transport operator and freight forwarder surveys and assessments.
- Carrying out exporter and importer surveys and assessments.
- Compiling ongoing and planned policy reforms and investment programs.
- Proposing greening investments.

4.2.3 Industrial Processes

The main sources of non-energy related GHG emissions from the Industrial processes sector are: Cement production, Lime production, Chemical industry (Ammonia and Nitric acid production), Iron and steel production, and Ferroalloy production. Therefore, the following mitigation measures are prioritized:[26]

Cement production

The capacity of existing cement plants of Georgia constitutes about 1.8 million tons per annum. Leading cement manufacturer Heidelberg Cement plans the construction of a new cement plant with annual output 2 million tonnes. Georgian "Lider Cement" and French "LAFARGE" intend to build advanced cement plant with rated annual capacity is 250,000 tonnes equipped with modern technologies. The expected by 2030 cement production will reach 4 million tonnes.

Growth in Gross Domestic Product can be a driving factor to cement demand. Increased industrialization caused by economic growth has a tendency to drive corresponding increases in cement consumption. This relationship is well known and has been widely

[26] Based on LEDS

used in the past to both assess the relative economic growth between nations and to forecast likely cement consumption rates as a given nation's GDP increases.

Baseline scenario - Cement production by 2030 is estimated based on the 2003-2014 years' data, assuming that average annual growth is kept during the next years. Estimated values are given in table 4.3 Taking into account envisioned cement production capacity by 2030, an average annual growth rate in table 4.3 is credible.

Table 4.3: ESTIMATED CEMENT PRODUCTION IN 2015-2030 YEARS IN THOUSAND TONNES

2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1,899	2,018	2,138	2,257	2,377	2,497	2,616	2,736	2,856	2,975	3,095	3,095	3,334	3,454	3,574	3,693

Carbon dioxide is emitted as a by-product of clinker production, an intermediate product in cement manufacturing, in which calcium carbonate ($CaCO_3$) is calcinated and converted to lime (CaO), the primary component of cement. To estimate the GHG emissions from cement production IPCC 1996 default emission factor 0.4985 tCO_2 /t cement shall be used.

Table 4.4: ESTIMATED GHG EMISSIONS IN 2015-2030 YEARS IN GG CO_2

2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
946	1,006	1,066	1,125	1,185	1,245	1,304	1,364	1,424	1,483	1,543	1,543	1,662	1,722	1,781	1,841

Mitigation scenario. Under consideration it is the reduction of limestone share in clinker and reduction of clinker share in cement production by replacing it with thermal power plant fly ash. In this case of beginning from 2021, 3% of fly ash will be added before the clinker combustion kiln, thus replacing the share of limestone to raw material; and an additional 2% will be added to the clinker before the cement mill, GHG emissions will decreased by 6.8% compared to the baseline. In table 4.5 it is estimated the GHG emission reduction for the period 2021-2030. Implementation of this mitigation measure depends on expert's final conclusion – how this measure will be reflected on cement quality.

Table 4.5: GHG EMISSION REDUCTION IN GG CO_2

Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
GHG emission reduction	89	91	96	100	108	112	118	127	132	137

Ammonia production

Baseline scenario. Ammonia production by 2030 is estimated based on the 2003-2014 years data, considering that average annual growth is kept during next years. Estimated values are given in table 4.6.

Table 4.6 PROJECTED AMMONIA PRODUCTION

Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Averaged annual growth rate
1000 tonnes	281.4	290.1	298.8	307.6	316.3	325.0	333.7	342.5	351.2	359.9	2.77%

Rated capacity of Rustavi "Azoti" fertilizer plant constitutes 400,000 tons of ammonia per year. Real production will depend on Ammonia market perspectives. According to the 2013 study "Ammonia Global Market to 2020: Food Security Concerns Driving Demand for Ammonia-Based Fertilizers," global demand for ammonia increased from 96,437,749 tons in 2000 to 120,779,623 tons in 2011, and is expected to grow at a Compound Annual Growth Rate (CAGR) of 3.2% to reach 160,093,693 tons in 2020.[27] Therefore, an average annual growth rates given in table 2.3.4 can be considered as credible. Plant owners suggested that ammonia production in subsequent years will mainly depend on the demand for fertilizers and nitric acid. To estimate GHG Emissions from ammonia production, the default emission factor from the 1996 IPCC is applied. EF=1.5 tCO_2/tNH_3. CO_2 emissions for 2003-2030 are given in table 4.7

Table 4.7.: ESTIMATED CO_2 EMISSIONS FROM AMMONIA PRODUCTION

Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Gg CO2	409.0	422.1	435.2	448.3	461.4	474.4	487.5	500.6	513.7	526.8

Mitigation scenario. Carbon capture and storage (CCS) can be a key long-term cost-effective option for reducing CO_2 emissions from industrial applications, and the only way ammonia production facility will be able to achieve deep reductions. The CCS in the high-purity sources sector (case of Azoti plant) presents early opportunities for CO_2 storage demonstration, as only compression, transport and storage are needed for CCS. If these opportunities can be linked to storage through enhanced oil recovery, overall costs of CCS

[27] http://www.researchandmarkets.com/research/wjtzjq/ammonia_global

could be lower than USD 10/t CO_2 or even negative. The possibility of Georgia's capture into the existing oil well in Kakheti is considered. However, extensive research is needed before this measure can be recommended for implementation.

Nitric acid production

Nitrous Oxide (N_2O) is a gaseous by-product produced in the manufacture of nitric acid. The waste from nitric acid production is typically released into the atmosphere. As N_2O does not have any economic value or toxicity at emission levels typical of nitric acid manufacture, its emissions are not regulated in Georgia.

Baseline scenario. Nitric acid production by 2030 is estimated based on the 2003-2014 years' data, considering that production average annual growth is kept during next years. Estimated values are given in table 4.8

Table 4.8 PROJECTED NITRIC ACID ANNUAL PRODUCTION

Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Averaged annual growth rate
1000 tonnes	525.3	541.9	559.1	576.8	595.0	613.9	633.3	653.3	674.0	695.3	3.165%

Operating pressure in Rustavi plant is medium. For the medium pressure combustion plants IPCC 2006 recommends default value 7 kgN_2O/tone nitric acid ±20%. N_2O emission factor from IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories is used.

Table 4.9: PROJECTED N2O EMISSIONS FROM NITRIC ACID PRODUCTION

Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Gg CO2 eq	1,221.3	1,265.2	1,309.2	1,353.1	1,397.0	1,440.9	1,484.8	1,528.7	1,572.7	1,616.6

Mitigation scenario. For mitigation the secondary N_2O abatement catalyst technology can be used, which involves the installation of a secondary catalyst in the burner basket. According to the plant owners information, this option is considered, but installation of the secondary N_2O abatement catalyst technology is envisioned no earlier than in 2015 year. Destruction efficiency of catalyst equals to 80%.

Table 4.10: GHG EMISSION REDUCTION IN $GgCO_2eq$

	2026	2027	2028	2029	2030
Baseline	1,414	1,455	1,497	1,539	1,580
Mitigation	277	285	293	301	309
Reduction	1,136	1,170	1,204	1,238	1,271

Under the national energy efficiency action plan (NEEAP) the following energy-related mitigation measures are considered in the industry sector (see below the Table 4.11).

Table 4.11 – MEASURES IN INDUSTRY

N	Mitigation Measure	Coverage	Funding			Annual GHG emissions reduction in tonnes CO2eq	
			Private companies	Donor funding	Total	2020	2030
1	Conversion of wet-cement process to dry cement process	Tbilisi, Rustavi	75 mln EUR	0.036 mln EUR	75 mln.EUR	76,336	854,033
2	Energy saving activities at metal manufacturers	Rustavi and other industrial centres	23.7 mln EUR	0.2 mln EUR	24 mln EUR	18,706	129,038
3	Improved boilers and steam/ hot water distribution systems	Nationwide	28 mln EUR	0.5 mln EUR	28.5 mln EUR	14,632	81,524
4	Attention to motors, fans, pumps, compressors	Nationwide	36.7 mln EUR	0.5 mln EUR	37.2 mln EUR	16,129	89,865
5	Energy efficient refrigeration systems	Nationwide	3.5 mln EUR	0.5 mln EUR	4 mln EU	1,531	8,531
6	LED lighting	Nationwide	23.3 mln EUR	0.09 mln EUR	23.4 mln EUR	6,923	38,014

4.2.4 Agriculture

Share of agriculture sector in national GHG emissions of Georgia constituted about 16% in the year 2013. The agriculture sector suffered from severe lack of skills and knowledge with regards to mitigating the climate change. No significant progress has been achieved in mitigating GHG emissions from this sector. Only a few hundred domestic bio-digesters have been installed in the villages of Georgia, insignificantly reducing GHG emissions.

Agriculture has the potential to benefit from **synergies between climate change adaptation and mitigation** within the right enabling conditions**.** According to the Food and Agriculture Organization (FAO) Climate Smart Agriculture is defined as agriculture that sustainably increases productivity, resilience (adaptation), reduces/removes GHGs (mitigation), and enhances the achievement of national food security and development goals. Agriculture systems can "provide both mitigation and adaptation benefits if they are designed and managed appropriately." Examples of multiple benefits are erosion reduction and soil carbon increase have resulted from afforestation of degraded lands.

Georgia's agriculture sector is highly vulnerable to the impact of climate change, which is leading to serious production losses and threats to food security. Increasing dryness is threatening to devastate the already semi-arid regions in Eastern Georgia. Funded by the International Fund for Agricultural Development (IFAD) Project "Enhancing Resilience of Agricultural Sector in Georgia" aims to address these challenges by supporting the inclusive growth of climate-smart agricultural value chains. It will mainstream a climate-smart approach throughout its activities, driven by the needs of small-scale farmers.

Currently the project "Sustainable Management of Pastures in Georgia to Demonstrate Climate Change Mitigation and Adaptation Benefits and Dividends for Local Communities" is under implementation and will be ended in 2017. The project is funded by the European Union and co-funded by the UNDP.

The overall goal of the project is the improvement of Carbon Stock in Pastures of Georgia. The project intends to rehabilitate over 4,000 ha of degraded pastures and 300 ha of migratory route by introducing and implementing sustainable pasture management practices among farmers and sheep-breeders.

As a result of the project pastures will be managed in a better way, which means that the quality of pastures will improve, and will result in better carbon stock on the territory. The project has already done baseline carbon stock inventory based on IPCC Tier 2 methodology by actual field work and laboratory measurement of carbon stock in above-ground biomass, below-ground biomass and soil. By the end of the project carbon stock inventory will be carried out again in order to determine any possible changes or trends.

At present following results are achieved:

- A map consolidating information on vegetation types and their spread in the Vashlovani Protected Areas was created. The map was prepared based on GIS analysis and field trotting;
- A new accurate map was created based on hard copies of the soviet maps that specify the exact locations of farms and pastures;
- A comprehensive assessment to study livelihoods of Tushetian shepherds and to examine their socio-economic attitudes, dependency on pastures, and opportunities for livelihood improvement was launched;
- In Vashlovani Protected Area four sites with different vegetation types were fenced to draw out long-term pasture monitoring system and create appropriate methodology for botanical surveys.
- Preparation of Sustainable Pasture Management Plan for Vashlovani Protected Areas kicked off;
- Local livelihood assessment which identifies the needs of the Tush shepherds was conducted.
- Carbon inventory of pasturelands, general soil fertility assessment and water balance modeling was carried out;
- Two automatic meteorological stations were purchased for Vashlovani Protected Areas
- Works to introduce natural flow based water supply system launched

Under the LEDS strategy the following baseline scenario is considered in the agriculture sector.

Baseline scenario

GHG emissions from agriculture sector for 2014-2030 years are estimated in the same way as for 2010-2013 years applying IPCC Methodologies (see inventory chapter). Livestock population and distribution by categories in 2015-2030 years is projected based on suggestions of the Ministry of Agriculture of Georgia: by 2030 cattle population will reach 1.3 million, with 15% being highly productive dairy cattle and the rest being mixed breeds. For comparison, livestock population constituted 1,206,000 in 2013. The population of sheep and goats will be 1,000,000. The swine population is 900,000, from which 700,000 are mixed breeds and 200,000 are highly productive breeds (mainly European Landrace), and number of poultry will be 30,000,000. Large scale development/introduction of commercial dairy farming as well as commercial pig (swine) farming is assumed beginning since 2021 year. Sown area will be 600,000 hectares and N fertilizer consumption 250kg per hectares. It is supposed that 90% of manure from dairy cattle will be treated in anaerobic lagoons. In table 4.12 projected GHG emissions from agriculture sector and sub-sectors for 2015-2030 years are presented.

Table 4.12: GHG EMISSIONS (in Gg CO_2 eq) FROM AGRICULTURE FOR 2014, AND 2021-2030 YEARS UNDER BASELINE SCENARIO

Source	**2014**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
CH4 Enteric fermentation	1,345	1,481	1,521	1,529	1,539	1,553	1,571	1,594	1,621	1,654	**1,694**
CH4 Manure management	149	228	304	387	494	626	760	920	1,106	1,296	1,333
CH4 Field burning of agricultural residues	6	17	19	20	22	23	25	27	28	30	31
CH4 total (GG CO2 eq.)	**1,500**	**1,726**	**1,844**	**1,936**	**2,055**	**2,202**	**2,356**	**2,540**	**2,755**	**2,980**	**3,059**
N2O Manure management	144	149	150	151	152	152	153	154	155	156	156
N2O Direct emissions from agricultural soils	291	476	502	529	555	581	608	634	661	687	719
N2O Indirect emissions from agricultural soils	426	551	569	587	605	623	640	658	676	694	712
N2O Pasture range and paddock	348	379	384	389	393	398	402	407	411	416	420
N2O Field burning of agricultural residues	3	9	10	10	11	12	13	14	15	15	16
N2O total (GG CO2 eq.)	**1,212**	**1,565**	**1,615**	**1,666**	**1,716**	**1,766**	**1,817**	**1,867**	**1,918**	**1968**	**2024**
Total	**2,712**	**3,291**	**3,459**	**3,602**	**3,771**	**3,969**	**4,173**	**4,407**	**4,673**	**4948**	**5083**

Mitigation scenario

Mitigation measures are planned for the following sub-categories: methane emissions from manure management and direct and indirect nitrous oxide emissions from agricultural soils. Even though the share of methane emission from enteric fermentation in the agricultural sector of GHG emissions is high, 49.6% in 2014 and 42.4% in 2030, and mitigating methane emissions can therefore play an important part in achieving overall reductions in GHG emissions from agriculture, no mitigation measures are considered for this sub-sector. In this stage comprehensive research to find proven and reliable CH_4 mitigation technologies which would be practically feasible and economically viable while still improving ruminant production is needed before these technologies can be recommended to livestock producers.

Methane emission reductions from manure management. Manure can be an alternative energy source for livestock farmers. In anaerobic conditions, i.e. in the absence of oxygen, manure will be partially converted to energy in the form of biogas. One of the most common practices to store manure is the use of storage structures such as a covered lagoon. Covered lagoons involve placing an impermeable floating cover, e.g. a plastic cover, over the surface of the lagoon to capture methane. In a covered lagoon digester, anaerobic digestion of organic matter occurs. Here is considered, that all lagoons will be covered and a digester will be used. Methane emissions will be reduced by 903 GgCO2eq (from 1,333 GgCO2eq to 430 GgCO2eq).

Direct and indirect nitrous oxide emissions from agricultural soils. Taking into account, that by 2030 N fertilizer consumption will reach 250kg per hectares, the share of Nitrous oxide emissions from soils in GHG emissions from agriculture will increase from 26.4% in 2014 to 35.8% in 2030. Applied into the soils, nitrogenous fertilizers and manure (N fertilizers and N manure), is not always used efficiently by crops. Improving this efficiency can reduce emissions of N_2O generated by soil microbes largely from surplus Nitrogen. Practices that improve N fertilizer use efficiency include: (a) adjusting application rates based on precise estimation of crop needs (e.g. precision farming); (b) avoiding time delays between N fertilizer application and plant N uptake (improved timing); (c) using slow-release fertilizer forms or nitrification inhibitors (which slow the microbial processes leading to N_2O formation); (d) placing the N fertilizer more precisely into the soil to make it more accessible to crops roots; avoiding excess N applications, or

eliminating N fertilizer applications where possible; etc. Based on a literature survey, it is considered that by applying all above mentioned measures to N fertilizer and N manure, N fertilizer consumption by 2030 year will be reduced by at least 80 kg/ha (from 250 kg/ha to 170 kg/ha). In table 4.13 GHG emissions from agriculture sector for mitigation scenario are presented.

Table 4.13: GHG EMISSIONS (in Gg CO_2 eq) FROM AGRICULTURE SECTOR FOR MITIGATION SCENARIO

Source	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
CH4 Enteric fermentation	1,481	1,521	1,529	1,539	1,553	1,571	1,594	1,621	1,654	1,694
CH4 Manure management	182	200	220	243	271	301	336	376	418	430
CH4 Field burning of agricultural residues	17	19	20	22	23	25	27	28	30	31
CH4 total	**1,680**	**1,740**	**1,769**	**1,804**	**1,848**	**1,897**	**1,956**	**2,026**	**2,102**	**2,156**
N2O Manure management	149	150	151	152	152	153	154	155	156	156
N2O Direct emissions from agricultural soils	438	459	480	502	523	544	565	586	607	628
N2O Indirect emissions from agricultural soils	521	535	548	562	575	589	603	616	630	643
N2O Pasture range and paddock	379	384	389	393	398	402	407	411	416	420
N2O Field burning of agricultural residues	9	10	10	11	12	13	14	15	15	16
N2O total	**1,497**	**1,538**	**1,579**	**1,620**	**1,660**	**1,701**	**1,742**	**1,783**	**1,824**	**1,864**
Total	**3,177**	**3,278**	**3,347**	**3,424**	**3,509**	**3,598**	**3,698**	**3,808**	**3,926**	**4,021**

Table 4.14: GHG EMISSION REDUCTION (in Gg CO_2 eq) FROM AGRICULTURE SECTOR IN 2021-2030 YEARS

Source	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
CH4 Manure management	46	104	168	251	354	459	584	730	878	903
N2O Direct emissions from agricultural soils	37	43	48	53	59	64	70	75	80	91
N2O Indirect emissions from agricultural soils	30	34	39	43	47	51	56	60	64	69
Total	**113**	**181**	**255**	**348**	**460**	**575**	**709**	**864**	**1,022**	**1,062**

4.2.5 Waste

Though some efforts in this direction are made, no tangible results are achieved in mitigation of GHG emissions from the waste sector despite the fact that Georgia recognizes that efficient waste disposal can lead to enhanced environmental benefits and energy conversion.

- Four-year (2014-2017) project "Waste Management Technologies in Regions" supported by the USAID is under implementation. The main objective of the project is to support the competent central and targeted local government authorities, local businesses and communities in target regions, and municipalities in the design of an integrated waste management system. The project will assist the Government of Georgia in designing an adequate waste management system in the targeted regions of Adjara and Kakheti and implement pilot interventions in selected municipalities to support a cleaner and healthier environment, minimize adverse impacts from waste on human health and natural resources, and reduce GHG emissions from landfills.
- Solid waste management company of Georgia makes efforts to estimate methane generation potential of main landfills of Georgia aimed to extract methane and flare and/or generate electricity.
- EBRD has supported implementation of the "Kvemo Kartli Solid Waste Management Project." One of the project's objectives was to estimate potential reductions in GHG emissions arising from utilization of biogas from existing and planned landfill sites in the targeted region and to estimate methane budgets for both the existing and new landfills, together with CO2 emissions from any fuels displaced by the methane following the EBRD GHG Assessment Methodology.
- The KFW project "Rehabilitation of the Municipal Infrastructure of Batumi" is divided into three phases. Two phases already are implemented: the wastewater treatment plant with mechanical-biological treatment is constructed and under operation in Adlia (close to Batumi). The third phase envisages using the extracted methane for electricity generation.

Under the LEDS the following baseline scenario is considered in waste sector.

Baseline and Mitigation Scenarios

Methane emissions for baseline scenarios are estimated using the methodology described in the inventory chapter. Baseline emissions are presented in table-2.5.1 below.

Mitigation scenario assumes that since 2021, when Georgia will start implementation of its Nationally Determined Contribution, some portion of degradable waste (paper) in four big cities is recycled (70% of paper by 2030). Also it is assumed that starting from 2021, some portion of food and wood (yard waste) are composted (in 2030, 30% of food and wood). The composition of the waste and related parameters have been adjusted to drive the measure and to take into account the impact of envisioned recycling and composting activities on the composition of the waste sent to SWDS. By 2030 Methane emissions due to recycling and composting decreased compared to the baseline by 3.3 GgCH4. The amount of deposited waste also is reduced by 101,000 tonnes. Accordingly waste disposal related expenses of municipalities are reduced. It is assumed that 70% of methane (about 24.7 Gg CH4) is extracted from big landfills in 2030. In total, during 2020-2030 years 190.6 GgCH4 landfill gas (equivalent to 280 million m3 of Natural gas) is extracted. In table 4.15. and on the right figure the baseline emissions, mitigation scenario emissions and deviation from baseline are given.

Table 4.2.15.: METHANE EMISSIONS (in Gg CO_2 eq) RELATED TO BASELINE AND MITIGATION SCENARIOS AND DEVIATION FROM BASELINE

Year	Scenario		Emission reduction due to		Deviation from baseline
	Baseline	Mitigation	Waste recycling and composting	Methane extraction	
2021	42.6	32.9	0.02	9.8	9.8
2022	42.7	33.3	0.1	9.3	9.4
2023	42.8	28.1	0.3	14.4	14.7
2024	42.8	19.0	0.6	23.2	23.8
2025	42.9	19.0	0.8	23.0	23.9
2026	42.9	18.9	1.2	22.8	24.0
2027	43.0	18.9	1.5	22.6	24.1
2028	43.0	18.7	2.1	22.2	24.3
2029	43.0	18.6	2.5	21.9	24.4
2030	43.1	18.4	3.3	21.4	24.7

4.2.6 Land Use, Land Use Change and Forestry (LULUCF)

The INDC submitted to UNFCCC in 2015 by Georgia covered all sectors including LULUCF. The Georgian Government prioritizes three options for climate change mitigation activities in forestry sector:

a) Establish Sustainable Forest Management (SFM) practices;
b) Conduct afforestation/reforestation and assist natural regeneration;
c) Expand the protected area.

According to INDC the following unconditional commitments were taken, to be fulfilled by 2030 in forestry:

- Strongly support CO2 reduction in one pilot area, the Borjomi-Bakuriani Forest district (currently the only forest district where carbon emissions have been quantified) by at least 70% between 2020 and 2030, by strengthening law enforcement and introducing SFM practices. It is estimated that this measure will lead to an overall emission reduction of at least 1 million tons of CO2 over a period of 10 years in this district covering 45,000 hectares;
- Implement afforestation/reforestation activities on already identified 1,500 ha of degraded lands by 2030;
- Assist natural regeneration of forests through different silvicultural methods on 7,500 ha by 2030 in order to restore natural forest cover.

Commitments dependent on international financial and technical support include:

- In case of external financial and technical support, the country commits itself to afforest/reforest up to a total of 35,000 hectares, as well as supporting relevant activities to assist natural regeneration in identified areas needing afforestation / reforestation until 2030;
- If Georgia receives substantial financial and technical support for the development of forest inventories and remote sensing as well as the development of internationally recognized practices for Sustainable Forest Management - SFM and carbon monitoring for the identified forest districts (covering up to 250,000 ha of forest lands) – the country commits itself to support the sustainable management of forests. This will lead to an overall carbon sequestration up to an estimated 6 million tons of CO2 on these lands over a period 2020-2030. These forest lands

include the forest district of Akhmeta (covering up to 70,000 ha) where the first set of locality/site-specific criteria and indicators (C&I) for SFM will be selected/tested and implemented. The objective is to gain relevant expertise for further development of the C&I for SFM in the rest of identified forest lands to achieve the nation-wide development of SFM practices, thereby support the carbon sequestration;

- With financial support from international sources to set up an adequate infrastructure and assure effective planning for the management of additional protected areas during 2020-2030, the country commits itself to expand the protected area from 0.52 million ha to 1.3 million ha (about 20% of Georgia's territory) comprising at least 1 million ha of forests.

Another instrument for fighting with GHG emission in Georgia is the **Nationally Appropriate Mitigation Actions (NAMAs)**. In LULUCF Sector up to now, there is one project under implementation under NAMA framework: "Adaptive Sustainable Forest Management in Borjomi-Bakuriani Forest District."

Based on world practice there are several potential mitigation measures in LULUCF sector, which might be appropriate for Georgia. Deforestation, soil and nutrient management, forest degradation and biomass burning (forest fires and agricultural burning) represent main challenges in LULUCF sector. Taking into account high forest coverage of Georgia, reforestation and sustainable forest management are the key factors in reducing net GHG emission in Georgia.

Wetlands also hold a significant GHG absorption potential. Peat lands store a large amount of carbon and act as small net sinks. Drainage of peat lands for agriculture and forestry results in a rapid increase in decomposition rates, leading to increased emissions of CO_2, and N_2O, and vulnerability to further GHG emissions through fire. Proper wetland management is another mitigation factor, to be considered for Georgia. In Georgia total area of wetland is estimated as 225 000 ha, with over 60 000 ha drained during the past century. Preservation and proper management of existing wetlands is another important measure to be undertaken.

Grassland and pastures of Georgia is the third largest category of land use, according to international statistics (FAO) area by 2012 estimated as 1.94 mln ha – 27.9 % of total land area of Georgia. According to the current GHG inventory, grasslands-pastures are emitters of GHG, which is caused by pasture degradation, especially in Eastern Georgia. As a result of intensive grazing and excessive exploitation, carbon accumulation in the soil is very small, which turns this sub-sector into a carbon emitter. Ongoing desertification process in South-East Georgia is another important factor, negatively affecting the emission process.

Sustainable pasture management in Georgia, limiting grazing and should be another key direction in GHG emission reduction.

Based on the above-described brief overview of available data on technologies, production and development plans from key emitters in the LULUCF sector, several major directions can be outlined to which the mitigation measures should be addressed.

Identified mitigation measures in general:

1. Reforestation measures, sustainable management and preservation of Forests, Forest deceases and Parasites;
2. Forest fires' prevention and prompt response;
3. Assessment of available wetland resources, their management and preservation;
4. Support for Protected Areas in Georgia to preserve natural landscape;
5. Activities to prevent soil erosion, caused by natural (desertification) or human (i.e. intensive grazing) factors, recreation of windbreaks;
6. Management of mines, mine deposits and restoration of soil cover;
7. Development of Green Zones in Large Cities.

In the forestry sector, there are three categories of mitigation options:

1. Sustainable forest management (increased carbon sequestration in existing woodlands)
2. Afforestation & re-afforestation (carbon storage)
3. Driver & causes of deforestation and degradation (reduction of emissions from the forestry sector)

Respectively there are three priority options for climate change mitigation actions in forestry sector: (a) establish Sustainable Forest Management (SFM) practices; (b) conduct afforestation/ reforestation and assist natural regeneration; and (c) expand the protected area.

In terms of implemented or ongoing project activities, the major projects are outlined below and grouped by main categories:

Forests

From 2008-2010, the WWF Caucasus Program Office, with the support of German Government, implemented the project: **"Rehabilitation of forest landscapes to reduce climate change caused impacts in Southern Georgia."** Rehabilitation measures of

forests in the watersheds and mountains in Lagodekhi (Chiauri forest) and Kharagauli (former "kolkhoz" forests) were out.

The project **"Sustainable Development and Responsible Attitude to Environment,"** financed by the Government of Finland, had been implemented by United Nations Development Program (UNDP) since 2010 and aimed at the restoration of forest burnt by forest fires in armed conflict between Russia-Georgia in 2008. Up to 950 hectares area was damaged due to the 2008 forest fire in Borjomi Gorge; 250 hectares were completely destroyed. In all, more than 120 oak, pine and fir trees were planted on 80 hectares within the project. The works on 60 hectares were conducted by the support of the Ministry of Environment and Natural Resources Protection of Georgia, LEPL National Forestry Agency, the Government of Finland and the United Nations Development Program and on 20 hectares with the help of the Austrian government. An experimental nursery school was opened, which serves to educate young foresters and supplies forest restoration activities with seedlings.

WWF-Caucasus Program Office has implemented (financially supported by Austrian Development Agency) a project "**European Neighbourhood and Partnership Instrument East Countries Forest Law Enforcement and Governance II Program"** (FLEG II Program). The nearby village Bodzauri (Khulo Municipality, Adjara Autonomous Republic). In total, about 120 ha of forests were restored by protection (fencing) and promoting natural regeneration in 2015. No planting was conducted.

The **"Adaptive Sustainable Forest Management in Borjomi-Bakuriani Forest District"** part of NAMA Georgia was launched in 2014. The project aims to decrease the GHG emissions through the sustainable management of forest land: analysis of the baseline CO2 and non-CO2 emissions and removals by sink associated to forest land use and land use change, forest vegetation types, carbon pools and activities in the Borjomi-Bakuriani pilot region. The restoration of forests: 45.000 hectares of forest will be restored to substantially enhance carbon sequestration and storage.

In 2009-2011 KFW has supported a regional project entitled **"Restoration of Forest Landscapes in the Southern Caucasus"** with total budget of 1.3 million. The project aims to mitigate the impacts of climate change through forest protection, management and restoration in Southern Caucasus.

Degraded landscape

From 2008-2011, GIZ has implemented a project **"Climate-tolerant rehabilitation of degraded landscapes in Georgia"** funded by BMUB, with the objective of rehabilitating degraded arid and semi-arid steppe landscapes in the context of climate change. The project focused on the rehabilitation of windbreaks through reforestation activities in the Dedoplistskaro region. The project restores degraded landscapes, taking into account future climatic changes. This includes introducing drought-resistant permanent crops, reforestation and planting to provide erosion protection. It supports communities and districts in the pilot regions in developing and implementing appropriate policies and identifying sustainable land-use strategies. Reforestation models in pilot regions in Kakheti were developed and implemented: a model of about 38 kilometers of degraded plantings were rehabilitated to provide protection against wind; over 100 hectares of mixed forest consisting of native, climate-adapted tree species were planted on degraded pasture land. Field studies were carried out to estimate the potential of the planting for CO2 storage: CO2 reduction by 2040 is likely to be 162 tonnes per hectare through biomass and 99 tons per hectare in the soil.

Protected Areas

Establishment and further sustainable management of Georgia Protected Areas were founded through the several projects funded by WWF.

1998-2006 **Borjomi-Kharaguali National Park,** Created Georgia's first national park in Borjomi-Kharagauli region. Budget 2.6 million EUR.

2003-2011 **Kharagauli Communal Forestry Project**, supports modern forestry management near the National Park. Budget 1.2 million EUR

2008-2011 **Javakheti National Park**, Establishes National Park, preserves wetlands, and includes a program for socio-economic development of involved communities. Budget 2.25 million EUR.

2011- Ongoing **Support Programme for Protected Areas**, project aims at Improvement of the Protected Areas in Kazbegi, Kintrishi, Algeti and Pshav-Khevsureti. Total budget 8.25 million EUR.

Strategy/Policy

The regional project targeting the development of strategy in soil erosion control was launched in 2013 entitled **"Integrated erosion control in the South Caucasus."** The goal is to develop strategies for integrating erosion control into national regulations on sustainable land use, including biodiversity climate change strategies for improved agriculture and pasture management. The project received 6.69 million EUR in funding and will be accomplished in 2017. The main implementing agency from Georgia is the Ministry of Environment Protection and Natural Resources of Georgia.

In 2012 a project entitled "**Sustainable Forest Governance in Georgia: Strengthening Local and National Capacity and Developing Structured Dialogue Phase I**" (budget 582 000 EUR) was implemented, ad in 2015 it was continued by the second phase "**Sustainable Forest Governance in Georgia Phase II**" (budget 1 million EUR). The project is managed by CENN. The goal is to contribute to the successful implementation of the forest reform in Georgia. The objectives are: (1) developing National Forest Policy implementation tools and mainstreaming forestry priorities in relevant sectors' policy documents; (2) modernizing Forest Management Practices based on the best international expertise; (3) supporting forest management decentralization.

Another large scale regional project run by CENN (2011-2017) and funded by GIZ (BMZ) and ADA for a total of 20.6 million EUR is **"Sustainable use of biodiversity in the South Caucasus."** Within the project framework are several pilot projects which collaborate with local NGOs including:

- improved management of the forests of Georgia according to international standards for sustainable forest management;
- a National Forest Monitoring Systems (NFMS) which uses remote sensing data to provide reliable information on the status and development of the forests;
- Up-to-date information about the extent and boundaries of the forests based on quantitative remote sensing data and qualitative data deriving from observer assessment;
- creation of a detailed electronic database of crop varieties and farm animal breeds;
- the planting of (wild) fruit trees and berry bushes in windbreak stripes (Eastern Georgia);
- the creation of a woody islands usable area to increase the bio-diversity.

Greening in Big Cities (SEAP)

Covenant of Mayors Sustainable Energy Action Plans - SEAPs were prepared and signed by eight Self Governing Cities of Georgia between 2011 and 2015. SEAPS consider the green zones of cities as sectors of GHG emissions mitigation. According to these plans, in total about 11500/t CO2 GHG removal by increment by 2020 (2014 baseline) can be achieved. However, this would require about an investment of 3.6 mil. USD. Below in table 4.16. are some mitigation measures in LULUCF sector planned under SEAPs.

Table 4.16. MITIGATION MEASURES IN LULUCF SECTOR PLANNED UNDER SEAPS

City – SEAP	Budget Needed $ 3 600 000	Planned Action by 2020	GHG removal increment by 2020 (2014 baseline)
Batumi 2014	NA	Adding 1Ha Greening area per year (6 Ha by 2020)	680 t CO2
Zugdidi 2015	$ 105 947 $ 542 431	Planting additional 1 Ha in Botanic Garden Planting 4Ha greening	315 t CO2
Tbilisi 2011, 2015	748 000 $ 1 603 800 $	Planting Tbilisi Sea dendrological garden 80 Ha Sustainable management of city green cover 180 Ha	6312.5 t CO2
Telavi 2015	$ 309 150	Planting 2Ha per year (Total 10 Ha by 2020)	265 t CO2
Kutaisi 2014	$ 30 000 $ 38 440 $ 92 431	Planting 1Ha greening in 2014 Planting 1Ha on sidewalks in 2014 Planting add 5Ha in Botanic garden	652 t CO2
Gori 2015	$ 77 652	Planting 4000 trees in the City central Park	168 t CO2
Rustavi 2012	NA	Plantation of trees and bushes in parks, gardens, green spots. Overall 1200 plants (trees and bushes)	1500 t CO2
Akhaltsikhe 2015	$ 50 400 $ 24 645	Planting new 5Ha Rehabilitation 1 Ha green Zones (440 plants)	135 t CO2

This concludes the review of mitigation measures by sectors.

4.3 Low Emission Development Strategy (LEDS)

On December 2012, the United States Agency for International Development (USAID) and the Ministry of Environment and Natural Resources Protection of Georgia signed a memorandum of understanding to support the preparation of Georgia's Low Emission Development Strategy (LEDS). Areas for cooperation include activities that increase and encourage the use of clean and energy efficient resources; support the development of a national GHG inventory system; improve the policy environment in low emission economic growth; expand economy-wide and technical modeling efforts; and improve governance of Georgia's natural resources.

LEDS is a national level, country-led, and country-specific strategic plan to promote economic growth and reduce long-term GHG emissions trajectories. Designed and implemented appropriately, LEDS will: (a) provide an integrated comprehensive pathway for long-term, sustainable development; (b) take into account a country's development objectives and unique circumstances; (c) promote transformational development; (d) help a country meet international climate change commitments; and (e) help country access financing from both public and private sources.

Preparation of LEDS was launched in May of 2013. The process is supported by the United States Government's initiative Enhancing Capacity for Low Emission Development Strategies (EC-LEDS). The objective of the EC-LEDS is to support developing countries' efforts to pursue long-term, transformative development and accelerate sustainable economic growth while slowing the growth of GHG emissions.

By Decree of the Government of Georgia high level inter-ministerial "LEDS Coordinating Committee", consisting of high level representatives of key Ministries (Deputy Ministers of Economy and Sustainable Development, Energy, Finance, Agriculture, Regional Development and Infrastructure etc.); and a LEDS expert working groups for all GHG emitting key sectors have been established. Responsibilities are allocated to relevant Ministries. Now baseline emissions are estimated and mitigation measures are identified and prioritized. Preparation of LEDS will be completed by mid-2017.

Further, in 2013 USAID launched its "EC-LEDS Clean Energy Program." The program will support Georgia's efforts to increase climate change mitigation through energy efficiency and clean energy. The broader goal is to enable more responsible management and the development of Georgia's natural endowments. The objectives of the program are to (i) support Georgian municipalities in institutionalizing and implementing climate change mitigation measures (see chapter 6), (ii) promote and facilitate private-sector investments in energy efficiency and green buildings and (iii) build the capacity of the Government of Georgia (GOG) to develop and implement a national Low Emissions Development Strategy in support of the USG EC-LEDS initiative. EC-LEDS Clean Energy Program is expected to reduce GHG emissions in Georgia by at least 236,000 tons of CO2 equivalent, facilitate up to $14 million in private sector investments in clean energy, and save up to 315 GWh of energy.

4.4 Activities Carried Out Under the Clean Development Mechanism (CDM) Of the Kyoto Protocol

From the three mechanisms defined by the Kyoto Protocol, Georgia, as a Non-annex I party to the UNFCCC can participate only in Clean Development Mechanism (CDM). The goal of Clean Development Mechanism is to assist Non-annex 1 parties in achieving sustainable development and contributing to striving towards final goal of the Convention, as well as to help Annex 1 parties to meet a part of their emission reduction targets under the Kyoto Protocol. In the framework of CDM Non-annex 1 parties will benefit from the project measures, and the reduction of emissions will be certified.

On January 20, 2005, the Government of Georgia and the Ministry of Environment and Natural Resources Protection of Georgia signed Decree No.2, which appointed Georgia as CDM DNA. As the scope of CDM Projects involves practically all key economic sectors, the Government of Georgia decided to create an entity comprised of representatives from key Ministries for its administration. This entity was officially formed on September 28, 2005 by Decree No. 172 and entitled the CDM National Council of Georgia. The main task of the CDM National Council is to determine whether proposed projects contributes to sustainable development of the country using criteria established for all CDM projects. The CDM National Council will then recommend that the DNA issue a letter of approval for successful projects on behalf of the Government of Georgia.

The dominant source of CO_2 emissions is fuel consumption for power generation. Renewable energy (hydro, wind, etc.) utilization for power generation is one of the most efficient ways to reduce CO_2 emissions. There are 6 registered CDM projects in Georgia (see annex 8.3). Total expected reduction constitutes 1,899,868 tons of CO_2 eq.

4.5 Nationally Appropriate Mitigation Actions (NAMAs)

Recently, the Nationally Appropriate Mitigation Actions (NAMA) have become key negotiating elements on mitigation in the UNFCCC process. NAMA is primarily conceived of as a way for developing countries to make progress in reducing their domestic GHG emissions with financial and technological support from the international community.

Georgia joined the Copenhagen accord and declared that it will "establish nationally appropriate mitigation actions in the context of sustainable development, supported and

enabled by technology and capacity-building, in a measurable, reportable and verifiable manner."

Currently the following NAMAs are implemented or under preparation

Adaptive Sustainable Forest Management in Borjomi-Bakuriani Forest District is supported financially by the Austrian Government/Kommunalkredit Public Consulting GmbH. This NAMA initiative has used the existing capacities of the Georgian forest sector and upgraded these with means of capacity building, best practice examples, on-site training and participatory pilot activities to generate a relevant climate change adaptation and mitigation impact in the Borjomi-Bakuriani pilot region as basis for up-scaling and policy development at national level. It generated new applied knowledge by developing site-specific forest management practices which shall increase both the climate change resilience and the carbon storage potential of the forest ecosystem. The NAMA analyzed the baseline CO_2 and non-CO_2 emissions and removals by sinks associated to forest land use and land use change, forest vegetation types, carbon pools and activities in the Borjomi-Bakuriani pilot region. Climate change mitigation activities are derived from proposed good practice guidelines on sustainable management of forests. The restored 45,000 hectares of forest in Borjomi-Bakuriani pilot district will substantially enhance carbon sequestration and storage. As a showcase for good practice in sustainable forest management, the pilot activities in Borjomi-Bakuriani district will contribute to the implementation of the recently approved national forest vision.

It is estimated that by strengthening law enforcement and introducing sustainable forest management measures (SFM), overall emissions can be reduced by at least 1 million tons of CO_2 in this district covering 45,000 hectares between 2020 and 2030.

Efficient use of biomass for equitable, climate-proof and sustainable rural development. The objective of the NAMA is to foster climate resilient, low-carbon, sustainable rural development and poverty reduction in an inclusive way through building capacities and enhancing cooperation between stakeholders, promoting the use and up-scaling of Solar Water Heaters (SWH), Fuel Efficient Wood Stoves (FEWS), Energy Efficient Insulation (EEI) Measures in rural households, and encouraging sustainable forest management. Two planned measures within the pilot project include the installation of SWH and FEWS and implementation of EEI measures in 11,500 households. These

measures will be supported by a financial mechanism and sustainable forest management in 6 rural areas of Georgia.

About 400,000 households in rural areas of Georgia are using on average about 9 m^3firewood per household for heating and cooking and generating hot water. In total, firewood consumption is about 3.6 million m^3. Georgian forests are considered as unsustainably managed, thus this practice causes serious forest degradation. About 57% of used biomass or about 2,000,000 m_3 is non-renewable. This leads to about 2,300 $GgCO_2$emissions annually. Through the NAMA, about 36,000 tons of CO_2 shall be mitigated per year. During the project lifetime about 360,000 tCO2, with a potential for up to 188,000 tons of CO_2 annual emissions (during the project lifetime 1,880,000 tCO2 in total) through up scaling. As co-benefits, rural households using sustainable energy will have improved livelihoods in terms increased comfort and reduced labor burden, forests shall be protected from degradation due to reduced fuel wood consumption, 135 local jobs will be created, and national energy dependency will be reduced.

Energy efficient refurbishment in the Georgian public building sector. The NAMA is aimed at the long term transformation the energy sector by first focusing creating the necessary regulatory structures to support the nationwide adoption of deep energy efficient refurbishment and rehabilitation of the existing infrastructure. By piloting the renovation of key public buildings and central government facilities in large cities and testing their energy performance through Energy Service Companies, the NAMA seeks to build the local capabilities and experience necessary to continue both the deep energy efficient renovations of entire buildings.

The project offers a programmatic approach to perform low carbon renovations of existing buildings. The second phase will extend the process to the residential sector once the majority of barriers are removed and the country has more experience in full building refurbishment, rehabilitation and maintenance. In this approach, all stakeholders are equally involved, including formal establishments like households associations and condominiums who currently have limited activity and influence. This inclusive approach allows different stakeholders to understand private benefits as well as the benefits achieved through national and international processes.

The full renovation of 50 000-60 000 square meters of public buildings including the installation of EE/renewable measures is planned. The focus is mainly on heating systems

and building facades. An estimated 18 million EUR is needed for the project implementation, and since the energy savings will not be enough for full commercial loans at the rates available in Georgia, the implementation process should be supported by partial grants and concessional loans.

Vertically integrated Nationally Appropriate Mitigation Action (V-NAMA) with the focus on urban transport sector. The project started in 2015, and is funded by the German Ministry of Environment, Buildings, and Nuclear Safety (BMUB). The initial goal of the project was to support INDC preparation in Georgia. The first mission in March 2015 developed an overview of urban transport sector issues and recommended developing a V-NAMA focused on urban transport with the following three components:

- A Policy and Regulation Component to create a national framework for Sustainable Urban Mobility;
- An Investment Component to establish the necessary financial mechanisms to mobilize and blend local, national, and international (climate) funding for priority urban mobility investments;
- An Empowerment Component that fosters a horizontal learning plan TASK FORCE and a vertical dialogue plan TASK FORCE for a systematic and continuous dialogue between national and local government.

VICLIM is the follow-up of the global project "V-NAMAs – Involving Sub-national Actors into National Mitigation Strategies through Vertically Integrated NAMAs." The overall objective of the project is to strengthen the capacity of climate policy-makers and institutions on national and subnational level in order to leverage subnational mitigation potential. The project will support MoENRP in analysing and formulating specific vertically integrated climate measures. It will further support Georgia's participation in knowledge exchange and dialogue at international level. The specific activity package for Georgia will be elaborated at a later stage together with the representatives of the partner countries. The programme is expected to start in summer 2016, but exact launching date is still unclear.

4.6 Activities Implemented Under the Covenant of Mayors (CoM)

By April 2016 thirteen Georgia Cities have joined the European Union initiative entitled Covenant of Mayors (CoM) and committed to reduce GHG emissions within their territories by increasing energy efficiency and the use of renewable energy sources. These cities are requested to prepare and submit for acceptance to the CoM Secretariat their Sustainable Energy Action Plans (SEAP). Eight cities already submitted SEAPs, and five

SEAPs have been accepted. The list of the CoM signatory cities of Georgia, their targets and status of SEAPs are presented in Table 4.17.

Table 4.17: CoM SIGNATORY CITIES OF GEORGIA, THEIR TARGETS AND STATUS OF SEAPS

Signatories	Population	Adhesion	SEAP Status	CO_2 reduction target
Akhaltsikhe, GE	19,200	31 Oct 2014	Submitted	21%
Batumi, GE	170,000	15 Jul 2011	Accepted	22%
Bolnisi, GE	76,600	16 Mar 2015		
Gori, GE	50,400	13 Jul 2012	Accepted	27%
Kazbegi , GE	4,900	27 Feb 2015		
Kutaisi, GE	196,600	15 Jul 2011	Accepted	23%
Mtskheta, GE	7,800	11 May 2015		
Rustavi, GE	120,800	2 May 2011	Accepted	24%
Tbilisi, GE	1,100,000	30 Mar 2010	Accepted	25%
Telavi, GE	70,900	30 Jan 2015	Submitted	20%
Telavi City Hall, GE	21,800	24 Mar 2014		
Tianeti, GE	12,900	13 Jan 2015		
Zugdidi, GE	76,600	1 Aug 2013	Accepted	24%

The EC-LEDS Clean Energy Program (see chapter 3), through Component 1 among other activities will support the municipalities of Georgia to enable their participation in the EU initiative Covenant of Mayors (CoM). Partial grants will be provided for identification and implementation of demonstration projects in the CoM signatory municipalities. Grants will cover up to 20% (not to exceed $50,000 per project) of total project implementation costs. Now 5 projects are under implementation. The overall objective of these projects is to contribute to the fulfillment of commitments undertaken under CoM and implementation of measures defined in the SEAPs (see also table 4.18. below).

Table 4.18. – ONGOING CoM PROJECTS

Title of the project	Description	Nature	Coverage (gases/ sectors)	Objectives of the action	Annual GHG emission reduction tons CO_2eq.
LED Street Lighting Demonstration Project in Batumi	The project aims improvement of urban transport infrastructure and introduction of demonstrative model of energy efficient outdoor lighting system	Energy efficiency improvement	CO2/ energy sector	GHG emission reduction due to reduction in consumed electricity partly generated by thermal power plants	3,060
LED Street Lighting Demonstration Project in Public Park	The project aims expansion of green areas in the city and introduction of demonstrative model of energy efficient decorative outdoor lighting system	Energy efficiency improvement, afforestation	CO2/ energy sector, Forestry	GHG emission reduction due to reduction in consumed electricity partly generated by thermal power plants; and CO2 sequestration by planted trees.	238
Low Emission Development for Sport - Kutaisi Torpedo vs.	The project aims introduction of solar thermal water heating system, solar lighting system,	Energy efficiency	CO_2/	GHG emission reduction due to reduction in consumed electricity	238

CO_2 Emissions	building envelope and replacement of incandescent light bulbs with energy saving ones.	improvement	energy sector	partly generated by thermal power plants	
Bright City	Project will introduce outdoor lighting in about 20 streets of Zugdidi city.				696
Energy Efficiency Measures for Tbilisi Elders Boarding House	The project aims installation of heating and hot water supply system working on natural gas, introduction of solar thermal system, Energy Efficiency upgrade of the building envelope, separate building cold spaces from warmer occupied areas, and replacement of incandescent light bulbs with energy saving ones.				404

Other mitigation actions under CoM are presented in sectorial chapters as well.

5 CHAPTER - Constraints and Gaps, and Related Financial, Technical and Capacity Needs

Major constraints and gaps are crosscutting – similar for all sectors. Expert consultations for climate change mitigation in Georgia have identified the following:

- The lack of well-defined sectoral strategies and policies, coupled with a weak integration and coordination among different government agencies at inter-ministerial and inter-institutional levels;
- The lack of an appropriate legislative and strategic framework;
- The lack of capacity in policy making. Unclear distinction between causes of environmental deterioration, processes accentuating this deterioration, and impacts resulting from the deterioration. This often leads to partial, symptomatic, and short-termed solutions instead of measures comprehensively tackling the original problem;
- The lack of expertise, monitoring plans and appropriate equipment;
- The lack of data including
    - standardized data collection systems which makes information difficult to use and exchange;
    - The chaotic, dispersed, inaccurate, and outdated state of databases, often rendering information unreliable;

- The long time frames and uncertainty associated with the effects of climate change, resulting in a low level of priority being accorded to the issue;
- The lack of public awareness and acceptability, coupled with an underestimation of socio-economic gains that can be derived from implementation of the UNFCCC;
- The immaturity of certain new technologies as well as commerciality and competitiveness issues;
- Significant challenges in setting up sustainable MRV systems and building the staff capacity required for national communication and BUR reporting.

Financial constraints and gaps:

- Difficulties in mobilizing, accessing and delivering financial resources (e.g. understanding the different reporting requirements by donors such as in project proposals and financial reporting; fragmentation of and lack of harmonization of donor landscape);
- Difficulties in collecting information on financial resources available to implement activities that have multiple uses or climate change co-benefits;
- Technical constraints on how to collect, collate and store data on climate change finance;
- Institutional challenges relating to the coordination of climate change finance.

Sector Specific Gaps and Needs

Listed below are sector specific gaps and barriers for climate change mitigation.

Energy Sector

An important barrier for investment in renewable energy development and energy efficiency in Georgia is the lack of a long-term strategy and the predictability of the market as well as necessary legislative framework to promote Energy Efficiency and Renewable Energy apart from hydropower. Key challenges in energy efficiency investment are mostly related to finance and awareness of potential energy savings from implementing measures

at policymaking as well as consumer level. Subsidized gas and electricity tariffs create additional difficulty for enabling the market forces to guide the EE and RE decisions.

Financial Gaps

Enhancing Capacity for Low Emission Development Strategies (EC-LEDS) – EC-LEDS Clean Energy Program provides Partial Grants (USD 213,910) for implementation of 5 demonstration projects in CoM signatory cities. Kutaisi City Hall (USD 171,278) and Zugdidi Municipality City Hall (USD 205,290) also participate in financing of these projects. The sources of financing of remaining USD 1,985,054 are not identified.

National Energy Efficiency Action Plan (NEEAP) - The draft of the First NEEAP identifies significant energy efficient improvement measures and expected energy savings as well as expected sources of financing (central budget, other sources), but the real financial sources for implementation of the measures are not committed yet.

Clean Development Mechanism (CDM) – The amount of money required to implement 6 CDM projects in Georgia creates difficulties. All the registered projects have gotten CERs (Certified Emission Reductions), but the CER market is in deep crisis.

The first gender-sensitive Nationally Appropriate Mitigation Action (NAMA) – A typical problem amongst rural population remains a lack of financial resources. Monitoring results show that the use of solar water heater reduced fuel costs by 43%, saving on average each household more than 150 EUR per year. A solar collector costs up to 375 EUR, therefore the payback time is 2-3 years. However, without access to subsidies or cheap loans, low-income families do not have access to required funds to invest in a solar collector.

Sustainable Energy Action Plans (SEAP) – The main gap remains the shortage of financial resources. Several donors, including EU and USAID are providing the cities with support in implementation of mitigation measures, but the significant part of money should be found locally. Most of the budget resources are used for infrastructure repairs and social projects, which hampers the development of long-term energy policies.

Technical, Technology and Capacity Gaps

Enhancing Capacity for Low Emission Development Strategies (EC-LEDS) – Since 5 demonstration projects contain significant number of different EE equipment and

materials, there is a need for assistance in selection, purchasing of the appropriate assortment and their installation.

Promotion of Biomass Production and Utilization in Georgia – The significant gap is limited local technical capacity as well as competition from subsidized natural gas. Low awareness of advanced biomass energy technologies and related benefits is one of the barriers. Awareness raising and appropriate training will be needed as well as technical advice for potential developers of **advanced biomass technology.**

Climate Change Strategy of Adjara – Due to limited local technical capacity certain technical assistance would be helpful in the course of strategy's implementation.

Nationally Appropriate Mitigation Actions (NAMAs) – Taking into account lack of financial resources in population, it would be essential to provide technical assistance in **selecting of affordable equipment and trainings for its installation.**

Sustainable Energy Action Plans (SEAP) – In the course of implementation Action Plans CoM signatory cities need technical aid to obtain modern energy-efficient and renewable technologies, as well as to install them. Due to large amount of work to be done in CoM signatory cities, the lack of duly trained specialists becomes important impediment. Local know-how is needed to select appropriate technologies adaptable to local conditions and to install them. This also requires knowledge of modern energy-efficient and renewable technologies on the international market.

Building and industrial EE measures (NEEAP): The biggest long-term barrier to introducing mandatory energy auditing across Georgian industry is the lack of local skills and expertise in industrial and building energy auditing. The lack of legal requirements for minimum energy performance or mandatory energy audits does not encourage action in this direction.

Hydropower Investment Promotion Project (HIPP) – One of the key barriers in implementation of project goals is insufficient legal and regulatory framework as it dissuades strategic investors in power sector. One more gap is lack of appropriate tools to operate a competitive electricity market.

Technology Needs Assessment (TNA/NAMAs) – The priority technologies identified and selected by TNA are being addressed by NAMAs. Practical introduction of advanced technologies is difficult due to low demand and weak market activity as well as lack of adequate skills and knowledge both on supply and consumption sides. The first gender-sensitive Nationally Appropriate Mitigation Action (NAMA) has revealed lack of capacity of the technical staff of national and local partner NGOs.

Energocredit for renewable energy and energy efficiency projects - Lack of knowledge about modern energy-efficient and renewable technologies on the international market does not enable businesses and individuals to benefit from banking credit under this project. This gap is being partly addressed by the project itself.

Transport Sector

Due to the significant gap in knowledge of transport planning (Transit Networks, Bus Networks, Traffic Management and missing links, Non-motorized Transport, Smart Technologies, Metro, Urban Cable Car, Railways), most technical assistances and consulting services were performed and lead by a team of reputable international consultants.

Tbilisi Sustainable Urban Transport Strategy – The Strategy identifies short, medium and long term actions which will significantly act on energy efficient improvement measures and expected energy savings, sources of financing (central budget, other sources), but real financial mechanisms for implementation of actions are not developed yet.

From the draft of NEEAP, key barriers and drivers of investment in energy efficient transport technologies include:

- Inadequate infrastructure for expansion of freight transport;
- Lack of knowledge about the vehicle fleet and lack of regulations to ensure vehicles are less polluting;
- Lack of walking/cycling friendly infrastructure in most major urban areas – in particular the capital;
- A culture increasingly geared towards personal cars resulting in significant traffic and pollution problems in the capital and elsewhere.

Industry Sector

Based on the draft of NEEAP, there are several key barriers to investment in the industry energy efficiency, including:

Technology & Equipment: Historically, there has been little or no investment in energy-saving equipment and there is still a great deal of Soviet style equipment in use that:

- Is old technology, built with robustness rather than efficiency in mind;

- Was built at a time when energy costs were subsidized and efficiency was not a prime consideration;
- Was oversized even for outputs in the 1960's – 80's; oversized equipment is inherently inefficient compared with correctly sized units. With continued reduction in demand, this oversize issue has become more acute.

Mentality and Energy Management capacity: There is limited awareness of modern energy management practices and EE technologies in industrial enterprises of Georgia. Understanding of energy consumption processes and potential for improvements is also limited to basics. This is true for primary and secondary energy consumption such as steam, hot water, or compressed air.

Energy audits and energy consultancy: There is very little independent energy-efficiency expertize that Georgian industry can draw on, including generic/cross-sector technologies and sector-specific technologies. Energy auditors are being trained and energy audits are conducted by various donor projects; however, this is not yet a mainstream practice.

Subsidized energy costs: Although unit costs have been rising substantially in recent years and are now approx. 50 – 70 EUR/MWh (electricity) and 20 to 25 EUR/MWh (natural gas), they are still only around 50% (electricity) to 70% (natural gas) of the unit costs for EU industry.

High cost for investment in EE technologies: There is no local production of EE equipment: boilers, furnaces, motors, etc. As such, Georgian industry has to pay international prices for any EE equipment plus transport and any import levies, yet the return on investment is worse, because unit energy costs are lower than international prices.

Agriculture Sector

There are significant opportunities for GHG mitigation in agriculture, but for the potential to be realized numerous barriers need to be overcome. The following institutional, human resources, technical and financial constraints, gaps and needs have been identified as affecting the county's capacity to deal with the mitigation of GHG emissions in the agricultural sector:

- Sectoral development plans and strategies generally do not consider the issue of climate change and therefore do not define measures to reduce emissions; few studies

have been carried out on such issues. In estimating GHG emissions reductions, the main constraint is that the institutions currently creating and implementing sectoral policies do not have sufficient experience or adequate capacity to integrate climate change issues and develop measures to reduce GHG emissions. Capacities must be strengthened to develop models for estimating GHG emissions. The formulation and prioritization of policies, programmes and measures related to GHG emissions must be improved and capabilities to produce cost estimates for GHG emissions reduction measures must be built;

- The lack of relevant data for GHG emissions projections in the agricultural sector prevents the quantification of the impacts of GHG emissions reduction measures. In accordance with defined roles and responsibilities, efforts need to be made to continue improving capacities within the relevant institutions through intensified capacity development programmes;
- Upfront investment costs, including costs of investment in equipment, machinery, materials and labor;
- Institutional barriers, such as insecure land tenure, policy uncertainty, imperfect markets, limited access to technical extension services, or lack of institutions to support collective action. Constraints on the quality of extension or rural credit services themselves may also limit the potential for adoption by farmers.
- There is insufficient capacity in institutions that play an important role in the preparation of GHG inventories, both at the level of collecting and providing data; and at the level of coordination and policy making.

The establishment of a legal basis for the implementation of measures to reduce GHG emissions in the agricultural sector is vital. A sectoral strategy for agriculture incorporating climate change considerations in an integrated manner would provide guidance for decision makers and create an enabling environment for the introduction and implementation of new low-carbon and sustainable practices in the sector.

Waste Sector

Currently there is no acceptable state inventory system for solid wastes in Georgia. Therefore, data on amounts of wastes generated annually, waste types, disposal and utilization are practically absent. The very limited data available is scattered between different agencies. This data are not digitized and accessible to different users. Comprehensive waste inventories have not been yet conducted, nor the state register has been established which should include waste catalogue, inventories of wastes and their disposal sites, as well as databases on wastes and technologies of their utilization and rendering harmless. There is very scare information about the composition of solid waste disposed in landfills of Georgia. There is no separation and recycling of waste in practice. Therefore biodegradable part of the waste is not separated. Landfills in general are not modern or large enough to allow effective containment of emitted gases in amounts that would justify the project's cost.

Gaps and barriers associated with institutional, social, legal and financial aspects include:

1. Lack of integrated sustainable waste management concepts,
2. Lack of demonstration activities concerning solid waste management technologies and services,
3. Lack of institutional capacity (trained personnel, insufficient funds, policy constraints),
4. Lack of public awareness on the need of waste segregation at the household level, essential, for a successful waste management, and
5. Insufficient access to waste management knowledge.

Despite its critical nature and the wide variety of economic opportunities (for instance, energy generation from landfill gas), the waste management infrastructure has remained relatively stagnant. The investment gap is largely attributed to high barriers to entry such as significant start-up costs associated with relevant facilities and regulatory instability. These factors, combined with worldwide declines in bank lending, have left potential investors at a loss for how to mobilise their impending involvement.

LULUCF Sector

Identified mitigation measures in LULUCF sector require substantial technical, administrative and financial resources. LULUCF sector was only recently added to National Communication and INDC, still only partly with main accent on Forestry. Other sub-sectors of Wetlands and Urban areas were not considered at all.

The critical improvement needed in LULUCF sector is the creation of a complete national land-use GeoDatabase. The lack of data is one of the key gaps in LULUCF sector, causing uncertainty over GHG inventory to be high. The last nation-wide forest inventory was conducted in early 1990s. According to the expert assessment, in the 600,000 ha declared as timber production forests, timber and fuel-wood extraction has significantly exceeded the annual allowable cut over the last two decades. In 2014, the forest resources assessment of the pilot area - Borjomi-Bakuriani Forest District shows the reduction in forest biomass by almost 20% over the past 15 years.

This concerns not only data on current status of land cover but also the ongoing changes to have realistic assessment of GHG emission/sink values from the sector and also to have realistic future projections. Methodologies on data acquisition and selection for LULUCF sector analysis are defined in the Good Practice Guidance for Land Use, Land-Use Change and Forestry publication. Estimation of Land Areas (according to IPCC GPG: 2.4.4 Tools for Data Collection, 2.4.4.1 REMOTE SENSING (RS) TECHNIQUES, IPCC GPG) can be done using different approaches, and for Georgia, the best solution would the application of remote sensing data.

Other barriers pertain to state policy development in sub-sectors of LULUCF field:

Proper assessment of wetland resources and State Policy of wetland management in Georgia Assessment of soil erosion levels and its mapping and policy for sustainable pasture management (as the main artificial source of soil degradation) are needed.

Coordination of efforts between the stakeholders. The activities to LEDS, INDC and NAMA in the forestry sector should be coordinated to create a "total architecture" of strategy, activities and international commitment. Priorities should be defined based on traceable and transparent objective criteria.

Accountability. The results achieved through the different projects and activities are not assessed or available. There are very few monitoring reports, making it difficult to estimate effectiveness.

Measurability and verifiability of the reduction effect (Measurement, Reporting, Verification, MRV) is an important precondition for international support. However, the skilled technicians required for MRV creates high transaction costs, making effective MRV dependent on both technical and financial resources.

Insufficient information prohibits accurate assessment of financial gaps, but some numbers can still be derived, based on available projects:

SEAP – about 3.6 mil. USD is needed for Greening of Cities under SEAPs, but it is not specified if city municipalities have the required amount in their budgets.

Upper Svaneti Adaptation Strategy to the Climate Change – The financial gap of Planting of Soil Protection Forests on Eroded Slopes (23.3 Ha in total) and Establishment of Forest Nurseries in Upper Svaneti Financial gap is 46,161 USD.

Climate Change Strategy of Adjara – The required budget for the project prosed to rehabilitate areas damaged from land erosion in Kobuleti Municipality is 1.211 mil USD. From the total amount of project cost, 500,000 USD of labour will be contracted out to the Chinese company CINOHYDRO, but it is unclear if this is cofounding or just technical detail of the project.

Establishment of monitoring system aiming at the prevention of climate change impact on spreading wreck-diseases in Adjara forests: 220, 000 USD is needed.

Rehabilitation of degraded sub-alpine forests:

- The budget for the rehabitation of 111 ha of sub-alpine forest for a 10 years period is 133,400 USD (44,000 cofounding from Forestry Agency of Adjara): financial gap 89, 400 USD;
- The budget for planting 20 ha of pine forest for 10 years is 223, 500 USD (75,000 USD cofounding from Forestry Agency of Adjara): financial gap 148, 500 USD.

6 CHAPTER - Support Received

Georgia has received significant support in Climate Change field during last 5 years. Listed below are various donor projects that have provided different forms of support.

Georgia's First Biennial Update Report to the UNFCCC

The goal of the project is to assist the country in the preparation and submission of its First Biennial Update Report to the Conference of the Parties to the UNFCCC for the fulfilment of its obligations to the Convention under decision 1/CP.16 (paragraph 60) and decision 2/CP.17 (paragraph 41) and it's Annex III. The main outcomes of the project are: updated national circumstances and institutional arrangements relevant to the preparation of the national communications; prepared GHG inventory for 2012-2013 and conducted recalculations for 2010-2011; described mitigation actions and their effects; identified constraints and gaps; assessed related financial, technology and capacity building needs; and made recommendations to address the needs; supported the establishment of domestic Measurement, Reporting and Verification arrangements. The project is funded by GEF (352,000 USD) and Government of Georgia (64,000 USD) and implemented by UNDP. The project duration is 2015-2016.

Enabling Activities for the Preparation of Georgia's Third National Communication to the UNFCCC

The Third National Communication of Georgia (TNC) updated and strengthened information provided in the Second National Communication regarding national circumstances, greenhouse gas inventories, climate change mitigation, vulnerability to climate change and steps taken to adapt to climate change, and information on public awareness, education, training, systematic research and observation. The project has increased the capacity to produce subsequent NCs that meet CoP guidelines and improve climate change policies in Georgia. The project was funded by GEF and Government of Georgia and Implemented by UNDP. The total budget of the project was 580,000 USD. It started in 2011 and ended in 2015.

Below in the table are presented the projects and support received in last five years[28].

[28] National and Regional Donor activity in climate change, water and energy, biodiversity and GHG emissions reduction in Georgia (at 1 January 2016)

Table 6.1 – SUPPORT RECEIVED FOR GEORGIA

Project	Donor and Implementing agency	Duration and Budget	Scope of the project
Institutionalization of Climate Change Adaptation and Mitigation in Georgian Regions	Donor: USAID Implementing Agent: National Association of Local Authorities of Georgia (NALAG)	Duration: April 2012March 2016 Budget: USD 1,2 mln.	The Goal of the Program is the fostering of climate change adaptation measures in regions of Georgia through institutionalization of climate change adaptation and mitigation at the local and national levels by building capacities of local authorities.
Enhancing Capacity–Low Emission Development Strategy (EC_LEDS)	Donor: USAID Implementing Agent: WINROCK	Duration: Sept 2013 – Sept 2017 Budget: 6mio USD	This activity aims to incorporate holistic approaches to economic development on a less than "business-as-usual" emission pathway. Sectors for reducing the rate of emission growth will be targeted, as outlined in a country low emission development strategy.
Promotion of Biomass Production and Utilization in Georgia	Donor: GEF/UNDP Implementing Agent: Ministry of Environment and Natural Resources Protection of Georgia	Duration: 2013 – 2016 Budget: 5,380,000 USD	The project activities are proposed in Samegrelo-Zemo Svaneti region and Tbilisi. According to the project the 70 % of the total grant will co-finance: a) The substitution of existing boilers with the new dual fired (gas and biomass) ones; b) The private sector producing briquettes and pellets from biomass. 30 % of the total grant plus technical assistance.
Clima East Policy Project – Support to Climate Change Mitigation and adaptation in the Eastern Neighbourhood countries and Russia	Donor: EU Implementing Agent: Consortium led by HTSPE Ltd (including: Ricardo energy & Environment, Ecorys, Milieu Ltd, IIASA)	Duration: 2012-2016 Budget: €8,2 Million	The Clima East Policy Project is intended to provide support to the ENP East countries so that they are more equipped for greenhouse gas emission reductions and better prepared to deal with climate change impacts. It also aims to facilitate dialogue in this area among the EU and the seven PCs.
FLEG II – Forest Law Enforcement Governance	Donor: EU Implementing Agent: World Bank, EU, IUCN, WWF, Austrian Development Corporation	Duration: 2012-2016 Budget: EUR 9 mln.	Protection of forests – important as carbon sinks. The program supports governments, civil society, and the private sector in participating countries in the development of sound and sustainable forest management practices, including reducing the incidence of illegal forestry activities.
Feasibility Study Of The LRT Project	Donor: French Development	Duration: 2011-2012	Main Objectives: - Develop a multimodal

In Tbilisi, Georgia	Agency Implementing Agent: SYSTRA	Budget: EUR 0.9 mln.	transportation model; - Propose a long term light rail transport network; - Perform the preliminary design of the 1st LRT line.
Tbilisi Household Survey 2010	Donor: French Development Agency Implementing agent: The French company SYSTRA, the Georgian company Spectrum	Duration: 2010-2011 Budget: EUR 0.2 mln.	The objective of the Transportation Household Survey was to obtain the statistical data on the population's current mobility and current determinants of trip behavior as well as to gain general information to understand the future needs and challenges the further transportation development in Tbilisi Metropolitan Area.
Trainings for Tbilisi city hall transport department employees in using PTV VISUM and ViSSIM software	Donor: SYSTRA	Duration: 10 days, in 2013	The objectives of trainings were: create and update transport monitoring tool (multimodal transport model) to be able to test transport strategies and projects.
Tbilisi Rail Bypass Project in Georgia: Master plan for Major Development Site in Tbilisi	Donor: EU Implementing Agent: SYSTRA	Duration: Dec 2010-Nov 2011 Budget: EUR 1.5 mln	Study for the urban development of railway territory (90 hectares) in the centre of Tbilisi. The creation of Tbilisi railway bypass will release the current territory in the centre of town (set of tracks, depot, workshops, etc.) which will leave a total area of 90 hectares to be developed, including the creation of a new urban boulevard. There are numerous issues including soil depollution, the generation of an urban project to reconnect the area with the town, the definition of a programme that meets Tbilisi's current needs (offices, facilities) whilst leaving opportunities for architectural statements. This is a high profile project, Tbilisi's most ambitious urban project for the coming twenty years.
Adjara Solid Waste Management Project	Donor: EBRD, Swedish International Development Agency	Duration: 2010-2018 Budget: EUR 7 mln.	The project intended to improve solid waste management services in Adjara Autonomous Republic through building a new sanitary landfill and closing of existing landfills in Batumi and Kobuleti.
A municipal waste composition study in two regions of Georgia within the framework of "Waste Management Technologies in Regions"	Donor: USAID Implementing agent: International City/County Management Association (ICMA) together with CENN	The project was launched on March 18, 2014.	Organic materials, plastic, paper and diapers are the most common waste on landfills in Georgia, according to a composition study conducted by the Waste Management Technologies in Regions Program in Kakheti region and the Autonomous Republic of Adjara.

7 CHAPTER - Domestic Measurement, Reporting and Verification (MRV) System in Georgia

7.1 Introduction

Georgia is in the process of establishing a domestic measurement, reporting and verification (MRV) system for mitigation actions in line with its commitments under the United Nations Framework Convention on Climate Change (UNFCCC). The MRV system is planned to cover not only domestically supported Nationally Appropriate Mitigation Actions (NAMA)[29], but will also aim, in the future, to accommodate the requirements for MRV of internationally supported NAMAs, as well as of other mitigation activities.

The initial experience with different elements of the MRV for GHG emissions has already been gained through the implementation of Clean Development Mechanism (CDM) projects[30] under the Kyoto Protocol. Significant work has also been done under the preparation of the national GHG inventory (see Chapter 3), a vital element of the MRV system in every country[31]. Finally, MRV systems have been designed for several internationally supported and one domestically supported NAMA. However, as of now despite the understanding of the role of MRV and the accumulated experience, an overall domestic MRV system has not been designed and implemented on a national level in Georgia yet. Furthermore, no consideration has been given to MRV of sustainable development (SD) co-benefits or financial support up to now.

This chapter provides a brief overview of the experience of Georgia with MRV and the proposed design of domestic MRV system in the country, respective institutional arrangements and the implementation plan. The chapter also provides an analysis of the identified gaps on the road to MRV system establishment and the required support for overcoming them.

7.2 Experience with MRV in Georgia

The earliest experience that Georgia had with MRV on a project basis was through the implementation of GHG emission reduction projects under the CDM. The list of the registered CDM projects hosted in Georgia is provided in Table 7.1 below.

[29] http://www4.unfccc.int/sites/nama/SitePages/Country.aspx?CountryId=66

[30] http://cdm.unfccc.int/Projects/projsearch.html

[31] Third National Communication of Georgia to the UNFCCC (draft version).

Table 7.1: REGISTERED CDM PROJECTS IN GEORGIA

Registration Number	Project Title	CERs Issued (Yes/No)
762	Landfill Gas Capture and Power Generation Project in Tbilisi	No
2404	Leak Reduction in Above Ground Gas Distribution Equipment in the KazTransgaz-Tbilisi Gas Distribution System- Tbilisi, Georgia	Yes
6213	Leak Reduction in Above Ground Gas Distribution Equipment in 'Socar Georgia Gas' gas distribution system, Georgia	No
7756	Georgia: Refurbishment of Enguri Hydro Power Plant	Yes
7983	Adjaristsqali Hydro Project	No
9079	Gudauri Small Hydropower Project	Yes
8491	Dariali Hydroelectric Power Project	No

Source: UNFCCC

Out of the above seven projects, Certified Emission Reduction (CERs) were issued only for three projects, two in the area of renewable energy (HPP) and one related to reduction of leakage in the natural gas transmission network. These projects provide good learning experience for conducting GHG MRV on a project basis in the energy sector which is envisioned to be a major target for future mitigation actions. Although, the existing CDM projects provide examples of the type of data to be gathered, as well as guidance on measurement, reporting and verification, they still do not provide systematic experience for MRV on a larger scale, such as sector or sub-sector level.

In the past few years, Georgia also acquired experience in designing MRV for NAMAs. There are two internationally supported NAMAs that have been designed with the assistance of German and Austrian consultants and are included in the NAMA registry as NAMAs seeking support for implementation. The list of these registered NAMAs is provided in Table 7.2.

Table 7.2: NAMAs FROM GEORGIA IN THE NAMA REGISTRY AS OF 29 MARCH 2016

NAMA Title	Developed by
Adaptive Sustainable Forest Management in Borjomi-Bakuriani Forest District[32]	Österreichische Bundesforste AG Consulting BFW - Austrian Research and Training Centre for Forests, Natural Hazards and Landscape
Efficient use of biomass for equitable, climate proof and sustainable rural development[33]	GIZ
Energy Efficient Refurbishment in the Georgian Public Building Sector[34]	Ecofys/Remissia

Source: UNFCCC

Both NAMAs developed proposals for their GHG MRV systems which are sector-based and can serve as a foundation for standards of the forestry components of the domestic MRV System in Georgia. However, as none of these NAMAs has been implemented yet, there is no practical experience with sectoral MRV.

Georgia has also designed with the support of Österreichische Bundesforste AG Consulting a domestically supported NAMA for the development of energy crop plantations. The NAMA is implemented by the National Forestry Agency of Georgia with funds from the state budget of Georgia. This NAMA is the first domestically supported NAMA for which the domestic MRV system described below is expected to be applied.

Finally, Georgia possesses certain experience with GHG MRV outside the scope of the CDM and NAMAs through the Covenant of Mayors[35], an EU initiative under which thirteen self-governing cities and municipalities in Georgia have committed to voluntary GHG reductions. Under this initiative, participating municipalities have estimated their GHG emissions baseline, developed sustainable energy action plans, as well as MRV methodologies to capture the effects of the proposed mitigation actions.

When discussing the experience of Georgia with MRV and its readiness to develop a domestic system, it is important to note that Georgia is in the advantageous position to have an operational statistical data collection system under National Statistics Office of

[32]http://www4.unfccc.int/sites/nama/_layouts/un/fccc/nama/NamaSeekingSupportForImplementation.aspx?ID=52&viewOnly=1

[33]http://www4.unfccc.int/sites/nama/_layouts/un/fccc/nama/NamaSeekingSupportForImplementation.aspx?ID=154&viewOnly=1

[34]http://www4.unfccc.int/sites/nama/_layouts/un/fccc/nama/NamaSeekingSupportForImplementation.aspx?ID=158&viewOnly=1

[35] http://www.covenantofmayors.eu/index_en.html

Georgia (GeoStat)[36]. This system has already been utilized in the preparation of the national GHG inventory (for details, please refer to Chapter 3). The system will also be used as a basis for the implementation of the domestic MRV system in the country, not only for GHG emissions, but also for sustainable development and financial support. However, certain additional arrangements need to be made in the process of operationalization of the MRV system, as described in the ensuing sections.

In summary, it can be clearly stated that despite the existing experience with some elements of MRV in Georgia for the major sectors of the economy and related to GHG emissions, no attempts have been made up to now to design a domestic MRV system that follows common rules, guidelines and standards and covers GHG emissions, sustainable development (SD) co-benefits and financial support. To overcome this, the Government of Georgia has initiated a process for establishing a comprehensive domestic MRV system as described in the next section.

7.3 Design of the Domestic MRV System in Georgia

The Georgian domestic MRV system is designed in a holistic manner and in line with the existing UNFCCC Guidelines, covering not only GHG emissions, but also SD co-benefits of the implemented mitigation actions and MRV for the financial flows. The system reflects the current vision of the Georgian Government on MRV design and implementation and is expected to be approved in the near future after final intra-agency consultations.

The MRV system utilizes as much as possible the existing systems and processes for data collection, reporting, and verification, including quality control and quality assurance procedures. (Please also refer to the QA/QC procedures in the GHG Inventory chapter for details.) This allows the system to be set up in a cost-efficient manner and utilizing already existing infrastructure.

At the current stage, the methodological part of the MRV system is developed to follow the MRV approaches already proposed under CDM projects and programmatic activities, or already designed NAMAs. In the future, the MRV approach for individual mitigation activities is expected to evolve and be simplified, allowing the necessary information for emission reductions form individual activities to be collected from the already existing information in the GHG inventory and statistical data.

[36] http://www.geostat.ge/index.php?action=0&lang=eng

The MRV for SD co-benefits will use an already existing tool for evaluating sustainable development impacts of NAMAs, the UNDP NAMA SD Evaluation Tool[37]. The tool captures various sustainable development indicators and has already been applied to a number of NAMAs designed within the UNDP MDG Carbon[38]. The tool can subsequently be localized for Georgia based on the experience with its implementation in the country.

The NAMA SD Tool captures the impact of every NAMA on the seventeen sustainable development goals[39].

Goal 1. End poverty in all its forms everywhere

Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture

Goal 3. Ensure healthy lives and promote well-being for all at all ages

Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Goal 5. Achieve gender equality and empower all women and girls

Goal 6. Ensure availability and sustainable management of water and sanitation for all

Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all

Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Goal 10. Reduce inequality within and among countries

Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable

Goal 12. Ensure sustainable consumption and production patterns

Goal 13. Take urgent action to combat climate change and its impacts

Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development

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[37] http://www.undp.org/content/undp/en/home/librarypage/environment-energy/mdg-carbon/NAMA-sustainable-development-evaluation-tool.html

[38] http://www.undp.org/content/undp/en/home/ourwork/environmentandenergy/projects_and_initiatives/mdg-carbon.html

[39] https://sustainabledevelopment.un.org/?menu=1300

Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development

In the NAMA SD Tool, the impacts of each NAMA intervention are divided in five separate domains, namely environmental, social, growth and development, economic and institutional. For each domain, a set of quantifiable indicators is provided, e.g. air pollution and biodiversity are included under the environmental domain and access to sustainable technology and energy security are included under growth and development. A parameter is selected for each indicator, and baseline and target values are set. After the NAMA implementation, monitoring is conducted to capture how the particular intervention has deviated from the baseline value and whether it has reached the established target. The SD Tool provides great degree of flexibility, for which reason it was selected to be included as part of the MRV system in Georgia.

Finally, the MRV for financial streams is planned to be developed in the period 2016 - 2017 in cooperation between the Ministry of Environment and Natural Resources Protection and Ministry of Finance of Georgia. For ease of tracking, relevant government entities supporting NAMAs and other mitigation activities shall identify and clearly label climate change mitigation related flows in their budgets. Support from donors related to climate change will also be tracked and recorded by the Ministry of Finance of Georgia.

7.3.1 Institutional Arrangements to Facilitate the MRV System

The MRV system is planned to cover **not only domestically supported Nationally Appropriate Mitigation Actions (NAMA), but will also aim, in the future, to accommodate the requirements for MRV of internationally supported NAMAs, as well as of other mitigation activities**. The operation of the domestic MRV system is supervised by the **Low Emission Development Strategy's Coordination Committee (LEDSCC)**. The work of the LEDSCC will be supported by the **Technical Group on MRV (TG-MRV)** which will provide guidance on the various technical aspects of the MRV system. Both MRV bodies will work with the implementation entities, relevant

government agencies and other stakeholders to ensure the smooth implementation and operation of the MRV System in Georgia. The details of the MRV system are provided below.

The **LEDSCC** is an inter-agency body established as part of the design of the Low Emission Development Strategy of Georgia. It consists of high-level representatives of various government agencies involved in low emission development, such as the Ministry of Environment and Natural Resources Protection (MENRP), Ministry of Agriculture, Ministry of Economy and Sustainable Development, Ministry of Finance and others. Although the LEDSCC currently is not explicitly charged with supervision of the MRV system, amendments will be made in its charter to cover the work related to MRV.

The new MRV-related functions LEDSCC will include provision of advisory on the work of the MRV, adoption of operational rules, such as the rules and procedures of the Technical Group on MRV (TG-MRV, see below for details) and other relevant activities.

The other body that is to be established under the Georgian domestic MRV system by the end of 2016 is the **TG-MRV.** The TG-MRV will consist of three permanent members who will form a Secretariat. The members will be selected through and open recruitment process and become staff of the Environmental Information and Education Center (EIEC) under the MENRP. The members of the Secretariat shall meet at least the following requirements.

1) Experience with industry, energy or forestry sectors, as well as other sectors that might be prioritized for mitigation activities in Georgia.

2) Understanding of climate change issues and climate change mitigation in particular.

Prior experience with MRV is preferable, but not required as all the Secretariat members will receive training on MRV system development and operation. The details of the proposed training are described in detail under the Gaps and Required Support section of this chapter.

TG-MRV will also keep a roster of industry experts. The experts will be recommended by the relevant government agencies and possess proven experience in the respective industry. The experts should also have understanding of the underlying processes leading to GHG emissions in the particular sector. Similar to the TG-MRV Secretariat members, the experts will receive training on MRV as part of the operationalization of the MRV System.

TG-MRV will be in charge of developing standards[40] and templates for the MRV system, establishment of baselines for various mitigation activities and sector types and design of measurement, reporting and verification guidelines, which will be subsequently approved by the LEDSCC. The TG-MRV will also review the applications for accreditation of verifiers before their formal accreditation by the LEDSCC.

TG-MRV is expected to start its work on sector-specific standards by developing the MRV methodology for the domestically supported NAMA for energy crop plantations that is implemented by the National Forestry Agency of Georgia with funds from the state budget of Georgia. In consultation with international donors, the TG-MRV will also initiate the work on streamlining the MRV of the two internationally supported NAMAs already included in the NAMA registry.

In the future, when new NAMAs are initiated, the implementing entities can seek guidance and work with the TG-MRV on the development of standards for the specific new mitigation activities. The overall structure of the MRV system is presented in Figure 7.1.

[40] The term "standards" is used to describe the various methodologies, tools and guidelines for measurement of GHG emission, as well as the reporting and verification of the measurement results. It should not be confused with "technical standards".

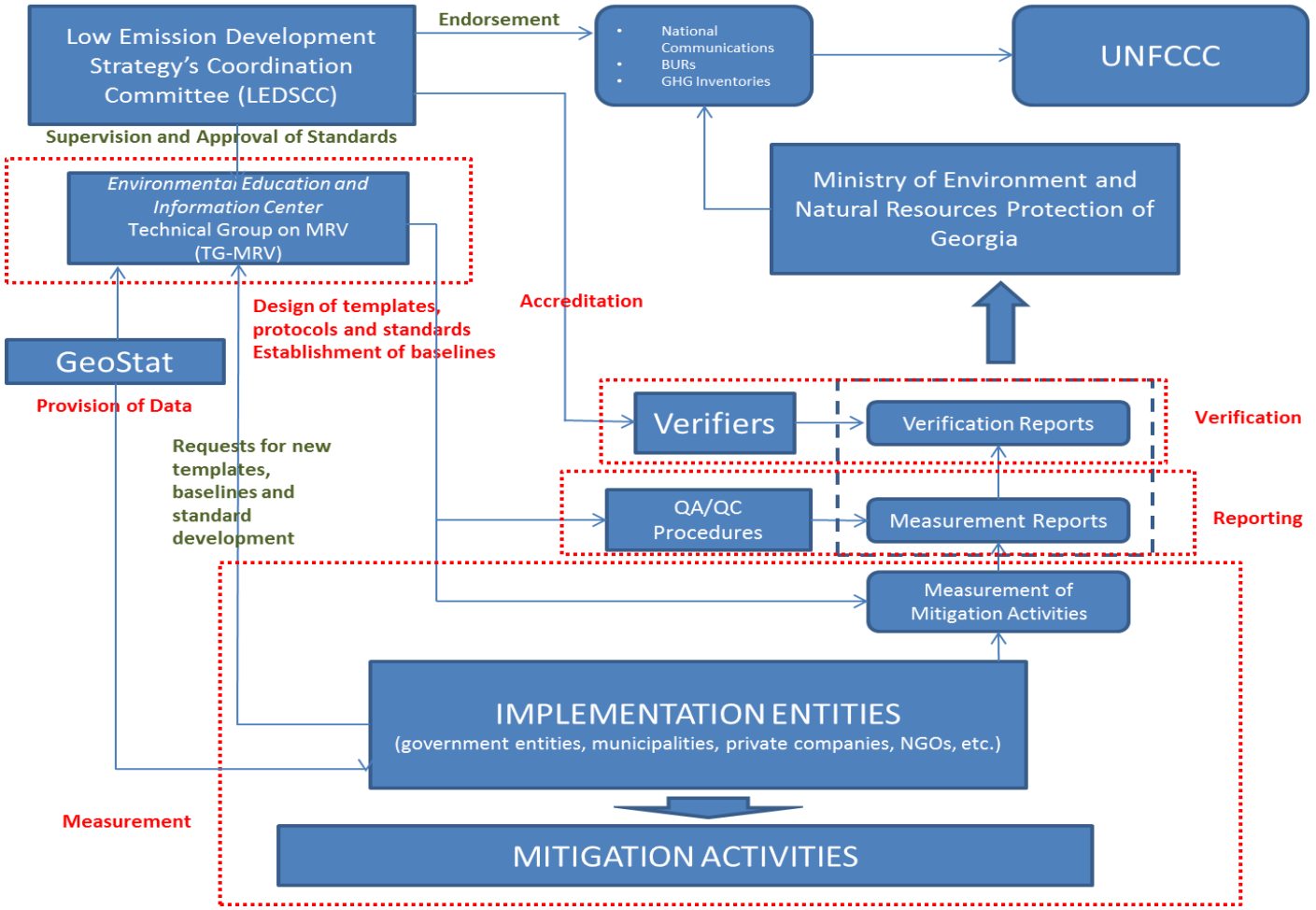

Figure 7.1: PROPOSED STRUCTURE OF THE DOMESTIC MRV IN GEORGIA

7.3.2 Measurement

The measurement of the impact of NAMAs and other mitigation activities implemented in Georgia is conducted by each implementing entity. The implementing entities can be government institutions, municipalities, NGOs, private entities or any other organizations and institutions that implement NAMAs or the mitigation activity.

The measurement is aimed to be executed in a simplified manner following approved templates, guidance and standards. In case specific standards do not exist, the implementing entity may request the TG-MRV to provide guidance and/or develop the new templates and standards.

A set of default values will be developed for each of the sectors where mitigation activities are implemented in order to simplify the measurement on the side of the implementing entities, while still maintaining conservativeness, transparency and accountability. The default values will be determined based on data by GeoStat and other official sources. For example, for the energy sector, as long as grid emission factor values, a default values for energy loss in the transmission and distribution system are established, measurement can be simplified only to the measurement of electricity generation (e.g. for renewable energy generation activities) or electricity consumption (e.g. for energy efficiency activities).

7.3.3 Reporting

For the ease of implementation of the reporting process, sector-specific templates for reporting will be designed. The templates will allow standardization of reporting requirements and procedures and will allow to easily process the data reported as a result of all mitigation activities.

It is noteworthy that the reporting templates will contain a section to describe the application of the QA/QC procedures, in order to further improve the overall quality of reporting. The QA/QC approach and the uncertainty assessment of the inventory that is provided in the respective chapter of this BUR report will be also referred to during the operationalization of the MRV system. The QA/QC procedures should be designed and implemented by each implementing entity, while following guidance from the TG-MRV and the existing Georgian national requirements.

Reporting will be conducted at predetermined intervals and will be streamlined with the already existing reporting processes, such as statistical reporting. However, the data collection system of GeoStat does not specifically operate for the purpose of execution of MRV. Similar issues were identified in the preparation of the National GHG Inventory, as described in the respective chapter.

In order to overcome this, at the stage of design of new NAMAs or other mitigation activities, consultations will be conducted with GeoStat to confirm the availability of required data and the need for any changes in order to request different or more detailed data than the available ones. GeoStat possess a system to accommodate such requests and update its data collection system and statistical reporting forms at annual intervals. Training on MRV will be provided to GeoStat in the process of MRV operationalization to facilitate this process.

7.3.4 Verification

All measurement reports shall be subject to verification. For transparent operation of the MRV system, the verification process is designed as a **third-party independent process** under the verification guidelines to be approved by the LEDSCC.

The verification guidelines will reflect the national circumstances in Georgia, including the specific conditions in the various sectors of the economy, as well as the existing national requirements and procedures. The domestic MRV system will prioritize national verifiers and will actively work towards building sufficient local capacity. The verifiers can be individuals and/or companies employing individuals that meet at least the following requirements:

1. A minimum of three years of experience in energy audit, ISO audit or CDM validation and verification.

2. Valid certification for ISO 14064-3.

3. Proven knowledge of Georgian energy, forestry and other relevant sectors.

A list of national experts who can serve as verifiers is provided in Table 7.3 below.

Table 7.3: LOCAL EXPERTS

Name	Institution	Certificate/Experience
Giorgi Mukhigushvili	WEG[41]	Certified reviewer of greenhouse gas inventories of Parties included in Annex I to the UNFCCC
Kakha Mdivani	MENRP	UNFCCC Certificate GHG Inventory in the Industry Sector
Anna Sikharulidze	REMISSIA[42]	UNFCCC Certificate GHG Inventory in the Energy Sector
Marina Shvangiradze	REMISSIA	UNFCCC Certificate GHG Inventory in the Forestry Sector
Medea Inashvili	ClimaEast[43]	UNFCCC Certificate GHG Inventory in the Waste Sector
Murman Margvelashvili	WEG	Energy Audit
Manana Dadiani	EEC[44]	IPMVP Certificate
Tengiz Ivanidze	EEC	IPMVP Certificate
Konstantine Barjadze	EEC	Energy Audit

At the initial stage, the process for accreditation of verifiers will involve only a submission of a set of documents, confirming that the applicants fulfill the eligibility requirements listed above. Upon screening of the provided documents by the Environmental Information and Education

[41] http://weg.ge/en
[42] http://remissia.ge/index.php/en/
[43] http://www.climaeast.eu/
[44] http://www.eecgeo.org/index.htm

Center, accreditation will be granted by the LEDSCC. With the operationalization of the MRV, and if deemed needed and practical, local accreditation standards may be further designed.

All measurement reports and their verification reports will be submitted to the MENRP. The MENRP will use the provided information to assess the impact of the ongoing mitigation activities and will report the results to the UNFCCC as part of the subsequent BURs, national communications and other reporting documents.

7.4 MRV Implementation Plan

The establishment of an MRV system is a complex process, consuming time and resources. In addition to the establishment of a working organizational structure, it is necessary that the MRV system is also legally supported through Government decrees on the work of the MRV. This will provide the legal basis for the relevant institutions to demand from the implementing entities to conduct measurement and reporting and subject the outcome of their work to verification. Furthermore, the legal basis of the MRV will allow the domestic MRV system to become permanent and independent of political changes. The process of establishing the domestic MRV system in Georgia is presented below in Figure 7.2 and detailed below.

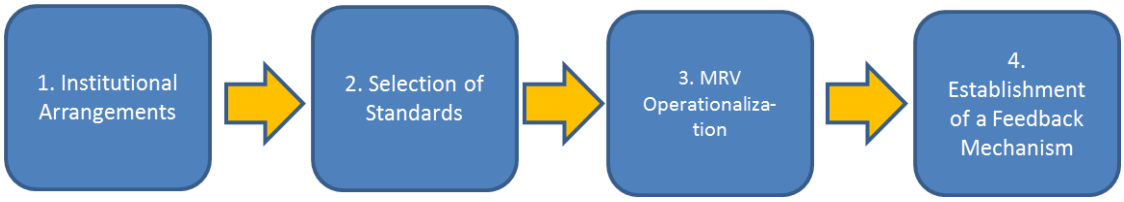

Figure 7.2: ESTABLISHMENT OF THE MRV SYSTEM

7.4.1 Institutional Arrangements

The first step in the establishment of the MRV system involves finalization of the institutional arrangements and their validation through a series of stakeholders' consultations. The MENRP shall initiate consultations with other relevant government entities and get their endorsement for the proposed system. Following that, the finalized institutional arrangements will be included in a special legal document on MRV, such as a Cabinet Decree. This decree will describe the purpose of the MRV system, the responsibilities of the different entities participating in it, such as the LEDSCC and the EIEC and will provide tentative timelines for operationalization of the MRV System.

At this step, the staffing of the TG-MRV will also take place, including the development of the TOR for the Secretariat members and roster of experts, their selection and the preparation of the operational guidelines of the TG-MRV.

The finalization of this step is expected to be completed by the end of 2016.

7.4.2 Development of Standards

Once the TG-MRV is established, the groups will start developing the detailed MRV standards and rules for the NAMAs that have been endorsed by the Georgian Government. This includes the design of the relevant templates for measurement and reporting, establishment of baselines and accreditation of verifiers.

This process is expected to be completed by the end of June 2017.

7.4.3 Operationalization

Once the standards are selected and MRV rules are fully developed, it is crucial to operationalize the MRV system by the TG-MRV. This will include the creation of a domestic registry of mitigation activities, covering the description of each activity and the parameters to be monitored. Furthermore, the measurement and data collection responsibilities, as well as reporting and verification processes will be established. The operationalization process will include also the application of the QA/QC procedures to ensure data quality.

The first NAMA under which the MRV system will be operationalized is the domestically-supported NAMA for the development of energy plant plantations. The TG-MRV will establish the baseline for the NAMA, develop an MRV methodology, including the identification of the required data and data sources, design reporting templates and make other relevant arrangements.

The operationalization of the MRV system is expected to be completed by the end of 2017.

7.4.4 Establishment of a Feedback Mechanism

Once the MRV system is operational, sufficient data on the effect of the various mitigation actions will be collected, including data on GHG emission reductions, effect on sustainable development and financial flows. These data need to be analyzed in order to understand the impacts of the various mitigation activities and provide feedback to the national climate change and development policy of Georgia. Such a mechanism will also allow creating a more efficient model of policy making on the path to low carbon development.

The feedback mechanism is expected to be put in place by July 2018.

7.5 Gaps Analysis and Required Support

Analysis of the current situation in Georgia showed that there are certain gaps in several areas that might prevent the timely and successful implementation of the MRV system in the country.

7.5.1 Capacity

Despite the experience of Georgia with GHG MRV under the CDM and NAMAs, there is a very small number of MRV experts on the ground. Therefore, it is necessary to provide training and constant support for increasing the local capacity for MRV in different economic sectors through the training and education of the staff of the TG-MRV and local verifiers. Furthermore, overall

dissemination of information on the role of MRV and its importance in the combat against climate change and sustainable development should be conducted.

External support is required for overcoming this gap, including through training by international experts, development of training courses, and preparation of printed materials and publications targeted at experts and wider audience.

Currently, it has been considered as an option to require donor support for the establishment of the MRV System as per the required timeline above. At the initial stage, the project will provide training to verifiers, the staff of the TG-MRV and the experts in the TG-MRV roster. A parallel component of the project will work with GeoStat to streamline their activities and adjust them to the requirements of the MRV. Finally, the project will provide legal guidance in the process of establishment of the legal structure of the MRV System and designing its rules and modalities. The project will be completed with the operationalization of the MRV system based on a pilot domestically supported NAMA.

7.5.2 Legal Gap

There is currently no law or decree that defines MRV and its operation in Georgia. It is crucial that such a legal document is developed as soon as possible for the operationalization of the MRV. Although starting with a law may be difficult due to the time required for adopting such a document, the issuance of a Cabinet of Ministers' Decree on MRV is expected to be the first step in defining the MRV legally.

Georgia may require advice from Annex I countries on the exact legal structure of such a document, based on the experience of countries like the EU member states.

7.5.3 Financial Gap

The current budget of the government has not allocated any funds for the establishment and operationalization of the MRV in Georgia. At the initial stages, existing structures, institutions and processes will be applied for the MRV. However, with the establishment of new institutions for designing MRV standards, additional financial support might be required until the full operationalization of the domestic MRV system.

8 Annexes

8.1 Annex – Key source-categories

Table 8.1 - KEY SOURCE-CATEGORIES OF GEORGIA'S GHG INVENTORY ACCORDING TO 2013 - LEVEL AND TREND ASSESSMENT APPROACHES (EXCLUDING LULUCF)

Ref	IPCC Source Categories	GHG	2013 Emissions (Gg CO2 eq)	Level Assessment (%)	Trend Assessment 2010-2013 (%)	Reason to Select as Key-category
1B2	Fugitive Emissions from Natural Gas Transmission and Distribution	**CH4**	1,805	10.6%	1.4%	Level, Trend
4A	Enteric Fermentation	**CH4**	1,351	7.9%	4.1%	Level, Trend
1A2	Manufacturing Industries and Construction - Solid Fuel	**CO2**	1,322	7.7%	10.8%	Level, Trend
1A3b	Road Transport - Diesel	**CO2**	1,223	7.2%	2.6%	Level, Trend
1A3b	Road Transport - Gasoline	**CO2**	1,148	6.7%	9.0%	Level, Trend
1A4b	Residential - Gas	**CO2**	999	5.9%	0.1%	Level, Trend
1A1	Gas for Electricity and Heat Production	**CO2**	950	5.6%	8.5%	Level, Trend
2A2	Lime Production	**CO2**	891	5.2%	15.2%	Level, Trend
6A	Solid Waste Disposal Sides	**CH4**	880	5.2%	4.1%	Level, Trend
2B2	Nitric Acid Production	**N2O**	824	4.8%	3.6%	Level, Trend
4D1	Direct Soil Emissions	**N2O**	663	3.9%	1.1%	Level, Trend
2A1	Cement Production	**CO2**	600	3.5%	4.9%	Level, Trend
1A3b	Road Transport - Gas	**CO2**	490	2.9%	8.5%	Level, Trend
4D3	Indirect Emissions	**N2O**	437	2.6%	0.9%	Level, Trend
2C2	Ferroalloys Production	**CO2**	431	2.5%	0.3%	Level, Trend
1A2	Manufacturing Industries and Construction - gas	**CO2**	389	2.3%	0.1%	Level, Trend
4D2	Pasture Range and Paddock	**N2O**	366	2.1%	1.1%	Level, Trend
2B1	Ammonia Production	**CO2**	251	1.5%	0.4%	Level, Trend
1A4a	Commercial and Public Services - gas	**CO2**	249	1.5%	0.3%	Level, Trend
6B2	Domestic Waste Water handling	**CH4**	235	1.4%	1.1%	Level, Trend
1A2	Manufacturing Industries and Construction - Liquid Fuel	**CO2**	212	1.2%	3.4%	Level, Trend

2F	Consumption of Halocarbons and Sulfur Hexafluoride (Refrigeration and Air Conditioning Equipments)	**HFC**	208	1.2%	0.6%	Level, Trend
1A3c	Other Transportation	**CO2**	202	1.2%	1.0%	Level, Trend
4B	Manure Management	**N2O**	152	0.9%	0.2%	Level, Trend
1A4b	Residential - Liquid Fuels	**CO2**	41	0.2%	5.6%	Trend
1A4c	Agriculture, Fishing and Forestry - liquid fuels	**CO2**	28	0.2%	1.8%	Trend
1A5	Other (Not Elsewhere Specified)	**CO2**	12	0.1%	5.4%	Trend
1A4c	Agriculture, Fishing and Forestry - Gas	**CO2**	3	0.0%	1.9%	Trend

Table 8.2 - KEY SOURCE-CATEGORIES OF GEORGIA'S GHG INVENTORY ACCORDING TO 2013 LEVEL AND TREND ASSESSMENT APPROACHES (INCLUDING LULUCF)

Ref	IPCC Source Categories	GHG	2013 Emissions (Gg CO2 eq)	Level Assessment (%)	Trend Assessment 2010-2013 (%)	Reason to select as Key-category
5A	Forest Land	**CO2**	5502.00	21%	10%	Level, Trend
5C	Grassland	**CO2**	2470.00	9%	7%	Level, Trend
1B2	Fugitive Emissions from Natural Gas Transmission and Distribution	**CH4**	1804.7	7%	1%	Level, Trend
4A	Enteric Fermentation	**CH4**	1350.9	5%	2%	Level, Trend
1A2	Manufacturing Industries and Construction - Solid Fuel	**CO2**	1322.2	5%	10%	Level, Trend
1A3b	Road Transport - Diesel	**CO2**	1223.2	5%	1%	Level
1A3b	Road Transport - Gasoline	**CO2**	1148.0	4%	6%	Level, Trend
1A4b	Residential - Gas	**CO2**	999.2	4%	1%	Level, Trend
5B	Perennial Crops	**CO2**	963.00	4%	3%	Level, Trend
1A1	Gas for Electricity and Heat Production	**CO2**	950.3	4%	8%	Level, Trend
2A2	Lime Production	**CO2**	890.93	3%	13%	Level, Trend
6A	Solid Waste Disposal Sides	**CH4**	879.9	3%	2%	Level, Trend
2B2	Nitric Acid Production	**N2O**	824.41	3%	2%	Level, Trend
4D1	Direct Soil Emissions	**N2O**	663.0	3%	0%	Level

2A1	Cement Production	**CO2**	599.95	2%	5%	Level, Trend
1A3b	Road Transport - Gas	**CO2**	490.4	2%	7%	Level, Trend
4D3	Indirect Emissions	**N2O**	437.1	2%	0%	Level
2C2	Ferroalloys Production	**CO2**	430.71	2%	0%	Level
1A2	Manufacturing Industries and Construction - Gas	**CO2**	388.6	1%	0%	Level
4D2	Pasture Range and Puddock	**N2O**	366.0	1%	0%	Level
2B1	Ammonia Production	**CO2**	250.68	1%	0%	Level
1A4a	Commercial and Public Services - Gas	**CO2**	249.0	1%	0%	Level
6B2	Domestic Waste Water Handling	**CH4**	235.2	1%	1%	Level, Trend
1A2	Manufacturing Industries and Construction - Liquid Fuel	**CO2**	212.3	1%	3%	Level, Trend
2F	Consumption of Halocarbons and Sulfur Hexafluoride (Refrigeration and Air Conditioning Equipments)	**HFC**	208.03	1%	1%	Level, Trend
1A4b	Residential - Liquid Fuels	**CO_2**	40.5	0%	4%	Trend
1A5	Other (Not Elsewhere Specified)	**CO_2**	12	0%	4%	Trend
1A4c	Agriculture, Fishing and Forestry - Gas	**CO_2**	3.3	0%	2%	Trend

8.2 Annex – GHG emissions by sectors and subsectors in 2013 (Gg)

Table 8.3 GHG EMISSIONS BY SECTORS AND SUBSECTORS IN 2013 (Gg)

Greenhouse Gas Sources and Sink Categories	**CO2 emissions (Gg)**	**CO2 removals (Gg)**	**CH4 (Gg)**	**N2O (Gg)**	**NOx (Gg)**	**CO (Gg)**	**NMVOCs (Gg)**	**SOx (Gg)**
Total national emissions and removals for 2013	**12,017**	**6,595**	**224**	**7**	**46**	**260**	**95**	**2**
1. Energy	**7,283**	**NA**	**98**	**0.12**	**41**	**254**	**41**	**2**
A. Fuel Combustion (sectoral approach)	7,283		7	0.123	41	254	41	2
1. Energy Industries	950		0.02	0.002	3	0.3	0.09	0.001
2. Manufacturing Industries and Construction	1,923		0.17	0.021	6	2	0.3	1
3. Transport	3,071		0.9	0.021	29	155	29	1
4. Other sectors	1,326		6	0.079	4	97	12	0.03
5. Other	12		NE	NE	NE	NE	NE	0.001

B. Fugitive Emissions From Fuels	NA		91		NE	NE	NE	NE
1. Solid Fuels			5		NE	NE	NE	NE
2. Oil and Natural Gas			86		NE	NE	NE	NE
2. Industrial Processes	**2,264**	**NA**	**NA**	**3**	**5**	**2**	**1**	**1**
A. Mineral Products	1,497				NE	0.004	0.15	0.49
B. Chemical Industry	331		NA	3	4.73	1.74	1.04	0.01
C. Metal Production	436		NA	NE	0.01	0.0003	0.01	0.01
D. Other Production	NA		NA	NA	NA	NA	0.02	NA
E. Production of Halocarbons and Sulphur Hexafluoride								
F. Consumption of Halocarbons and Sulphur Hexafluoride								
G. Other	NO		NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	**NA**			**0.00004**			**53.63**	
4. Agriculture			**70.31**	**4.05**	**0.15**	**4**	**NO**	**NA**
A. Enteric Fermentation			64.33					
B. Manure Management			5.63	0.49			NE	
C. Rice Cultivation			NO				NO	
D. Agricultural Soils			NE	3.55			NE	
E. Prescribed Burning of Savannahs			NO	NO	NO	NO	NO	
F. Field Burning of Agricultural Residues			0.35	0.01	0.15	4	NE	
G. Other			NO	NO	NO	NO	NO	
5. Land-use Change and Forestry	**2,470**	**6,595**	**0.014**	**0.0002**	**0.001**	**0.210**	**NA**	**NA**
A. Changes in Forest and Other Woody Biomass Stocks	NE	6,465						
B. Forest and Grassland conversion	NE	NE	0.014	0.0002	0.001	0.21		
C. Abandonment of Managed Lands		NE						
D. CO2 Emissions and Removals from Soil	2,470	129						
E. Other	NO	NO	NO	NO	NO	NO		
6. Waste			**55.20**	**0.34**	**NE**	**NE**	**NE**	**NE**
A. Solid Waste Disposal on Land			41.90		NE		NE	
B. Waste-water Handling			13.30	0.34	NE	NE	NE	
C. Waste Incineration					NE	NE	NE	NE
D. Other			NO	NO	NO	NO	NO	NO
7. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items								
International Bunkers	**267**		NE	NE	NE	NE	NE	NE
Aviation	267		NE	NE	NE	NE	NE	NE
Marine	NE		NE	NE	NE	NE	NE	NE
CO2 Emissions from Biomass	**2,049**							

8.3 Annex – Clean Development Mechanism (CDM) projects

Title of the project	Description	Nature	Coverage (gases/ sectors)	Objectives of the action	Quantitative Goal/ Progress indicator	Methodology /Assumption	Steps taken and envisaged,	Results achieved
Georgia: Refurbishment of Enguri Hydro Power Plant	The project increased the overall output from the Enguri HPP, thereby allowing to produce more electricity without the need to construct an additional power plant.		CO_2/energy sector	Reduction of GHG emissions that would have otherwise taken place due to generation of electricity in grid connected carbon intensive power plants	Annual GHG emission reduction equals to 581,715 tonnes CO_2eq. and 5,817,151 tonnes CO2eq over a ten year crediting period	CDM methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"	The rehabilitation works for 3 power units were completed in 2013.	Capacity of each unit reached 270MW, and the plant load factor reached 55%. By now 420,103 CERs are issued
Leak Reduction in Above Ground Gas Distribution Equipment in the KazTransgaz-Tbilisi Gas Distribution System- Tbilisi, Georgia	The project aims to reduce leaks at above-ground infrastructure in the Tbilisi gas distribution system specifically gas leaks at gate stations and pressure regulator stations, valves and fittings, and connection points with industries and residential buildings.	In addition to reducing gas losses (and thus financial losses), this project will help improve the company's standing in terms of corporate sustainability and environmental management	CH_4/ Energy sector	As a result of natural gas leaks reduction, methane (main component of NG) emissions are reduced.	Estimated annual emission reduction equals to 339,197 tone of CO_2eq.	CDM methodology AM0023 "Leak reduction from natural gas pipeline compressor or gate stations"	The project utilized advanced leak detection equipment to identify leaks and employed advanced leak repair materials to completely seal the leak and retain the repair indefinitely	781,502 CERs are issues
Leak Reduction in Above Ground Gas Distribution Equipment in 'Socar Georgia Gas' gas distribution system, Georgia					Estimated annual emission reduction equals to 166,496 tone of CO2eq.			Emission reduction is monitored

Title of the project	Description	Nature	Coverage (gases/ sectors)	Objectives of the action	Quantitative Goal/ Progress indicator	Methodology /Assumption	Steps taken and envisaged,	Results achieved
Gudauri Small Hydropower Project	The proposed project activity involves the installation of a new 9.2 MW grid connected hydro power plant	The project supports sustainable development of region, covering the increasing demand for electricity at the ski arena and tourist resort and contributing to social well being	CO_2/ energy sector	The CDM project activity would result in reduction of GHG emissions that would have otherwise taken place due to generation of electricity in grid connected carbon intensive power plant.	The project aims to reduce 22,891 tCO2 per year	CDM methodologies AMS- I.D "Grid connected renewable electricity generation"; and ACM0002	Stage I consisting of 8 MW generating 50.6 GWh/yr unit was commissioned in February 2014.	33,030 CERs are requested during first crediting periodtCO2e
Adjaristskali Hydro Project	The purpose of the project is to build a greenfield run-of-river hydro power project with a total installed capacity of 334.8 MW	The Project contributes to the social and economic development by providing temporary and permanent jobs; improving infrastructure, like roads and services; and contributing income at a municipal and national level	CO_2/ energy sector	The project will provide clean renewable energy to the national grid and displace electricity based on thermal generation from natural gas and coal.	The project aims to reduce 391,956 tCO2 per year and 2,743,692 during 7 years (crediting period)	CDM methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"	Adjaristsqali Hydro power plant is under construction	Adjaristskali Hydro power plant will be commissioned in 2017.
Dariali Hydroelectric Power Project	The purpose of the project is to build a greenfield run-of-river hydro power project with a total installed capacity of 108 MW	The Project will contribute to sustainable develop-ment by reducing the country's dependence on fossil fuel imports and thereby enhances the level of energy security; Increases employment opportunities in the area where it is located. The Project therefore contributes to poverty alleviation	CO_2/ energy sector	The project will generate low emissions electricity for the Georgia national grid, thereby displacing electricity that is relatively carbon intensive.	The project aims to reduce 259,229 tCO_2 per year and 2,592,291during 10 years (crediting period)	CDM methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"	Dariali Hydro power plant is under construction	Dariali Hydro power plant will be commissioned in 2017.

8.4 Annex – Energy Balance of Georgia 2030

Fuel	Gasoline (TJ)	Jet Kerosene (TJ)	Other Kerosene (TJ)	Diesel Oil (TJ)	Residual Fuel oil (TJ)	LPG (TJ)	Bitumen (TJ)	Lubricants (TJ)	Other Oil (TJ)	Antracite (TJ)	Lignite (TJ)	Other bituminous coal (TJ)	Coke Oven Coke (TJ)	Firewood (TJ)	Natural gas (TJ)
Unit-TJ															
Production														20,444	377
Import	32,257	10,969	7	35,466	92	765	6,061	1,056	401	174	21,675	6,931	6,997		147,346
Export															
International aviation bunker		(10,862)													
International marine bunker															
Stock changes					(30.53)				(401)						
Total primary energy	**32,257**	**108**	**7**	**35,466**	**61**	**765**	**6,061**	**1,056**	**-**	**174**	**21,675**	**6,931**	**6,997**	**20,444**	**147,723**
Transformation	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**(10,234)**	**-**	**-**	**-**	**(30,002)**
Electricity generation (GAS TPP)															(22,616)
Electricity generation (Coal TPP)											(10,234)				
Electricity generation (HPP)															
Distribution losses															(7,386)
Transportation losses															
Total final energy	**32,257**	**108**	**7**	**35,466**	**61**	**765**	**6,061**	**1,056**	**-**	**174**	**11,442**	**6,931**	**6,997**	**20,444**	**117,721**
Industry					30.53					174	11,411	6,931	6,997	27	14,991
Transport, among them	32,205	108	-	35,163	-	-	-	-	-	-	-	-	-	-	25,387
Road transport	32,205			35,163											25,387
Rail transport															
Domestic aviation		108													
Domestic Navigation															
Pipelines															
Residential			7			746					31			18,443	54,015
Commercial and Public Services					30.53	19								1,972	14,761
Agriculture / fishing / forestry	52			303										1	297
Other (unspecified)															
Non-energy use							6,061	1,056							8,270