Sustainable Energy Action Plan of Telavi City

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GLOSSARY OF TERMS

Global Warming Potential (GWP) – dimensionless quantity characterizing for the particular GHG efficiency in terms of greenhouse effect production. Carbon dioxide GWP has been taken as a conventional unit of the quantity. Its value varies widely for other GHGs equaling to e.g. methane – 21, nitrous oxide – 310. GWP is applied to convert various GHGs to CO_2 equivalent. For example, 1 ton of methane reduction corresponds to 21 tons of CO_2 emission reduction (21 t CO_2eq.). Similarly, 1 ton of N_2O reduction equals to 310 CO_2 reduction in terms of efficiency (310 t CO_2eq.).

Pilot Project – the first test project within the framework of the program aiming at appraisal and perfection of selected methodology and technology along with preliminary results analysis and efficiency estimation of the project. Pilot project outcomes determine follow-up ways and means of the project implementation.

Conservative Assessment – the lowest/ most modest results oriented assessment.

GHG – Greenhouse gas. Natural (or artificial) gas being a part of the atmosphere having the ability to contain the earth's heat radiation. There are naturally occurring gases – known as direct GHGs – water vapor (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), and ozone (O_3), and indirect GHGs e.g. sulfur dioxide (SO_2) and ammonia (NH_3). These gases, while interacting with water vapor and other elements, form various particles (aerosols) of sulfur and nitrogen salts that also play a significant role in the greenhouse effect.

Tier 1 – selected source from the category of the simplest approach applied for the GHG gas emissions calculation in which typical values of countries with similar geographic and climatic conditions are considered as emission rates/factors.

Tier 2 – includes more detailed emissions applying emission coefficients set/measured within the particular country. It increases reliability and accuracy of outcomes. Results obtained through mathematical or physical modeling are being used as well for emission calculation at higher – the third level, along with locally measured emission coefficients.

ACRONYMS

BAU	Business As Usual
C	Carbon
CDM	Clean Development Mechanism
CH_4	Methane
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2 eq.	Carbon dioxide equivalent (CO_2 eq)
CoM	Covenant of Mayors
EBRD	European Bank for Reconstruction and Development
EC -LEDS	Enhancing capacity for low emission development strategies
EU	European Union
EU –COM	European Union Covenant of Mayors
GDP	Gross Domestic Product
GEF	Global Environment Facility
GEL	Georgian Lari (currency unit)
Gg	Gigagram (10^9g= 10^3t)
GIZ	(Die Deutsche Gesellschaft für Internationale Zusammenarbeit)German Society for International Cooperation
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
JRC	Joint Research Centre of the EU
KW	Kilowatt (10^3 watts)
LED	Light Emitting DIod
LEPL	Legal Entity of Public Low
LLC	Limited Liability Company
Muni- EIPMP	Municipal emissions inventory, projection and mitigation measures planning
MW	Megawatt (10^6 watts)
N_2O	Nitrous Oxide
NCV	Net Calorific Value
NG	Natural Gas
NH_3	Ammonia
NO	Nitrogen Oxide
NO_2	Nitrogen Dioxide
NO_X	Nitrogen Oxides
QA/QC	Quality Assurance/Quality Control
RDF	Regional Development Fund
UNFCCC	United Nations Framework Convention on Climate Change
USAID	US Agency for International Development
VOC	Volatile Organic Compound

1. INTRODUCTION

The city of Telavi is administrative center of the Kakheti Region, located at the north-eastern foothills of the Gombori Range, in the north-western part of the Alazani Valley, at the elevation of 550-800 m a.s.l and in 158 km from Tbilisi. Telavi was proclaimed as a city in 1801, its area now is 1 280 ha and its population was 21.5 thousand people in 2014[1]. The climate in Telavi is temperate wet, with moderately cold winter and hot summer. Mean annual temperature equals to 12.2 ^{0}C and the annual sum of precipitation makes 747 mm.

Stages of development

The first settlement at the site of contemporary Telavi appeared in the late Bronze Age, developed in the Hellenic Era and in ancient ages a town-like settlement emerged at the same place. In Georgian sources information on Telavi has been found since the XI century, when it became the center of Kakheti-Hereti Region. In the XII century Telavi is mentioned as an important core of trade and workmanship in Georgia, and since the second half of the XVII century – as a hotbed of literacy. In 1758 a philosophy and religion school was founded in Telavi, transformed in 1782 into theological seminary (today it is the Telavi First Public School).

After the joining the Kartli and Kakheti Kingdom to the Russian Empire (1801) Telavi became the center of Telavi Region, and since 1930 the city of Telavi has obtained the status of Telavi District administrative center.

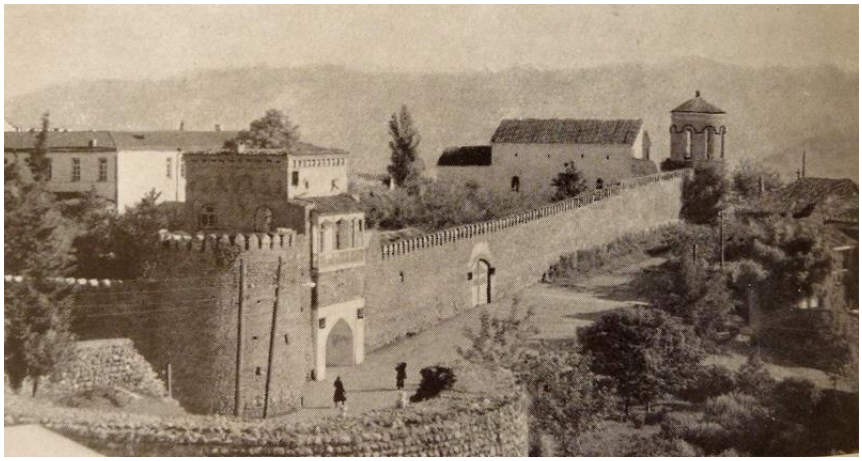


Figure 1. Old Telavi. The fortress of the King.

The formation of modern outline of Telavi has started since the 30-es of the past century. Before the beginning of the reconstruction Telavi was mainly taken by one –or two-story wooden houses. The central part of the city was occupied by small blocks and two markets, surrounded by shops of merchants and craftsmen, as well as taverns. Basic reconstruction works in Telavi has commenced since 1947, when the State Design Institute developed the Telavi planning and reconstruction project. The project designers also have planned the

[1] http://www.geostat.ge

greening of Telavi streets[2].The construction of different infrastructure units has started in Telavi, including the arrangement of borders, squares, planting of trees.

At present Telavi is an important transportation junction, industrial, agricultural and cultural center. The State University is disposed here (former Teachers Training Institute), the Theatre, Historic-Ethnographical Museum and many historical and cultural sights, among them the Lord's Basilica (VI-VII centuries), old wall of Fortress (X-XI centuries), Residence of the Alaverdi Eparchy[3].

Socio-economic situation and culture

Population and employment

According to the information provided by the Telavi City Hall, number of Telavi population as of January 2014 accounted for 21.5 thousand. At this stage Georgia's National Statistics Service has no specific statistical data on Telavi as this city has acquired the self-governing status only since 2014[4].

However, judging from official information about the Telavi Municipality, its number of population for the recent years is more or less stable: if in 2011 the population of Telavi Municipality accounted for 71 thousand, by 2014 this number has changed slightly and became 70 900. At this stage the number of employed and unemployed persons in Telavi is unknown. According to Telavi City Hall, the conduction of special survey on this subject is planned. Although, judging from the official statistics about the Kakheti Region, since 2010 the number of employed persons is growing. In particular, in 2010 the number of employed persons (both hired and self-employed) made 174 000, while in 2014 this number has increased up to 186 200.

At present 9 public schools and 9 kindergartens are functioning in Telavi.

At the same time Telavi gives a shelter to internally displaced persons (IDP) from Abkhazia and South Ossetia. According to the Georgian Ministry of Resettlement and Refugees, and Agency on Social Services, as of September 2014, the number of IDPs from Georgia's occupied territories registered in Telavi equaled to 461 persons and 157 households/families, including 54 pensioners, 13 disabled persons and 1 person who lost the bread-winner. At first a part of refugees from Abkhazia lived in the Telavi "Intourist" Hotel, the Tourist Campus "Turbaza" and at the third floor of Telavi Children's Hospital. In 2004-2005 private investors purchased these buildings and the State has allotted compensation to the dwellers. As a result part of them have settled in Telavi city and another part – in nearby villages. For the refugees living in the

[2]Rcheulishvili L. Telavi, 1963 (in Georgian)
[3] http://en.wikipedia.org/wiki/Telavi

[4]http://www.geostat.ge/?action=page&p_id=472&lang=geo;

"Turbaza" Campus the City Council allocated the 5-storey residential building at the entrance of Telavi City. Presently 59 families totaling 180 persons are living there. In 2008 at the same territory 2-storey residential building has been allotted for the refugees where 26 families are living now. Number of recipients of social assistance in Telavi by groups is given in Table 1.

Table 1. Number of recipients of social assistance by group in Telavi

#	Number of recipients of social assistance by groups in Telavi	
1	Disabled persons	1 749
2	Member of family with lost bread-winner	369
3	Subjects to political repression	11
4	Recipients of state compensation	99
5	Recipients of consumer subsidies	94
	Total	**2 322**

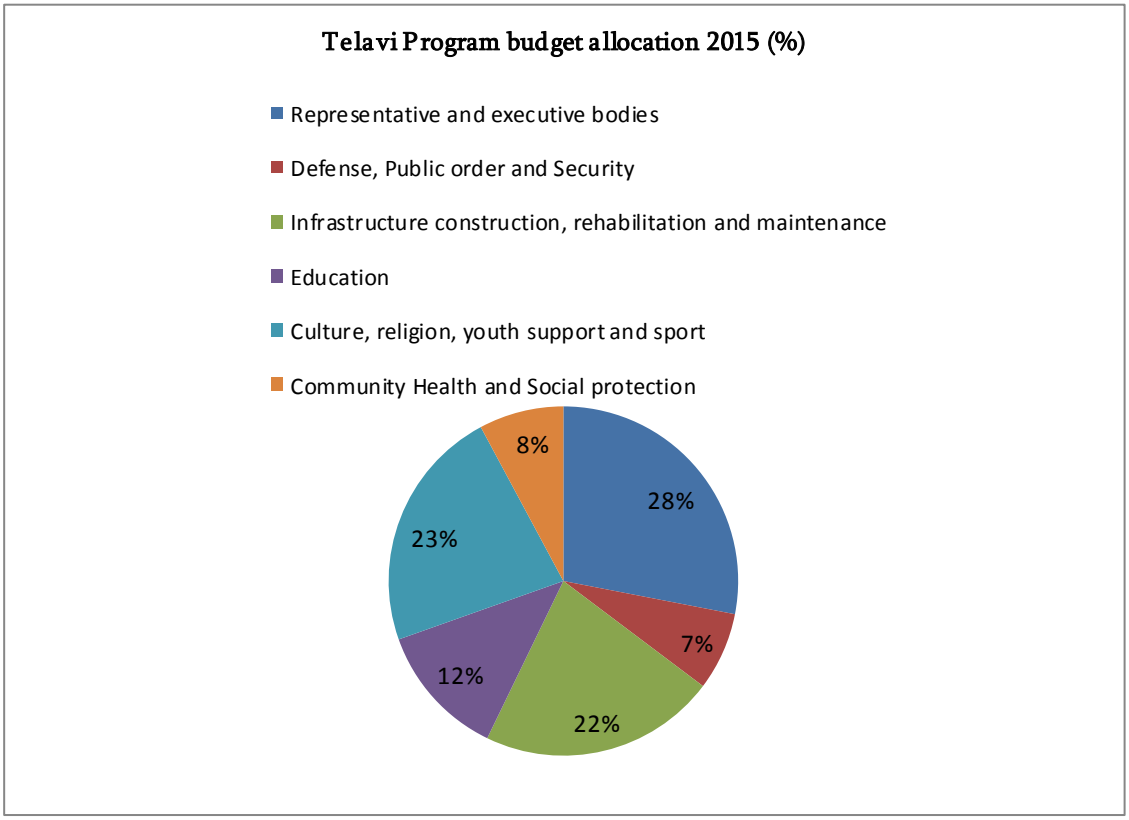
Economy

The Telavi budget in 2015 equaled to 9 408 300 GEL. The total budget distribution by programs is presented in Table 2, from which it is clear that one of priorities in the budget is the development of infrastructure, comprising in 2015 about 22% of total spending (Figure 2).

Table 2. The budget of Telavi in 2015 and its distribution according to programs

#	Title of the program	GEL
1	Financing of representative and executive bodies	2 638 500
2	Defense, public order and security	680 100
3	Infrastructure development, rehabilitation and running	2 060 800
4	Education	1 166 200
5	Culture, religion, youth support and sporting	2 125 600
6	Public healthcare and social security	737 100
	Total	**9 408 300**

Figure 2. Percentage distribution of Telavi budget by programs in 2015



As it has been mentioned above, Telavi has acquired the self-governing city status in 2014 and at this stage the amount of its GDP is not defined. However, in this case as well, judging from the statistics on the Kakheti Region as a whole, since 2010 the Kakheti GDP has increased significantly: in 2010 the GDP of Kakheti Region was 973.3 million GEL while in 2013 it made-up 1 331.5 million GEL.

The GDP determining factors of a self-governing city are trade, transport and communications, hotels and restaurants, financial activities, realty operations, construction, food industry, healthcare and social security, education, agriculture. In case of Telavi the distribution of GDP according to these factors is as follows (Figure 3).

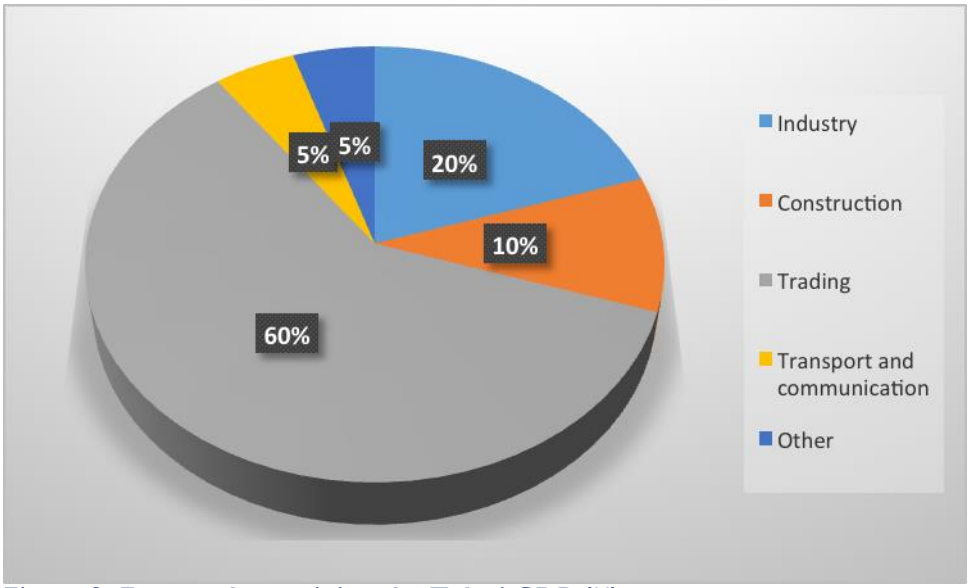


Figure 3. Factors determining the Telavi GDP (%)

Currently in Telavi, as in a self-governing municipal city, a systematic formation of these factors is taking place. According to the Telavi City Hall, approximately in July 2015 all incomes of Telavi via automatized programming regime will be reflected on the city account, making it possible to define precisely the value of GDP.

Wine-making is one of the major branches of Telavi and in general the Kakheti Region economy. In April 2014 the "Kakheti Wine-makers Guild"[5] has been set up aiming the popularization of wine. Up to now 16 wine-making companies are represented in the Guild.

The Guild actively cooperates with the Tourism Information Centre and they jointly coordinate the development and conduction of Wine Tours. Only in Telavi 19 wine-making enterprises are functioning. The Kakheti Wine-makers Guild represents Telavi in wine-making, its development and economic aspects.

The Table 3 below clearly demonstrates the important share of Kakheti in Georgia's overall wine production and Table 4 suggest the leading role of Telavi Municipality in production of major kinds of grapes in Georgia.

Table 3. Production of grapes in Kakheti in Georgia by municipalities, thousand tons

Region/year	2006	2007	2008	2009	2010
Georgia	**162.5**	**227.3**	**175.8**	**150.1**	**120.7**
Imereti	36.3	54.5	43.7	30.3	25
Shida/Inner Kartli	10.9	16	8.1	16.4	8.6
Kakheti	**80.2**	**118.6**	**100**	**82.7**	**64.7**
Other regions	35.1	38.2	24	20.7	22.4
Share of Kakheti, %	**49.4**	**52.2**	**56.9**	**55.1**	**53.6**

Table 4. Production of grapes by regions, thousand tons

[5]http://kwg.ge/ge/photo-gallery/kakhetis-meghvineta-gildia

Municipality	Rkatsiteli	Saperavi	Other kinds	Total area of vineyards
Akhmeta	1 289	308	150	1 747
Gurjaani	5250	1 787	581	7 618
Dedoplistskaro	936.5	491	71	1 498.5
Telavi	3 903	1 682	463	6 048
Lagodekhi	1 643	199	4	1 846
Sagarejo	2 747	952	250	3 949
Signagi	3 486	565	443	4 494
Kvareli	3 787	2 316	279	6 382
Total	**23 041.5**	**8 300**	**2 241**	**33 582.5**

Source: Ministry of Agriculture, 2007

Tourism is also sector with a lot of economic potential for Telavi. The Tourism Information Center[6] is functioning in Telavi, the primary objective of which is comprehensively informing the guests and local tourists on tourist services and tourism production. The Center database contains detailed information on different tourist items (stay and catering objects, museums, galleries, protected areas, wine cellars, etc.). Tourists visiting the Information Center are able to get recommendation on tourist targets and sights within the city and the Region of Telavi, to plan a tour in the specific direction. Currently the Telavi Information Center actively collaborates with the Georgian Tourism National Administration in developing Strategic Plan on Tourism Development in Telavi.
According to Telavi Tourism Information Center, in 2012 the Center was visited by 178 guests (among them 18 Georgians), in 2013 – by 203 persons (among them 10 Georgians) and in 2014-by 148 foreign tourists.

Figure 4. Restored streets of Telavi downtown

Major part of tourists are interested in wine-making, as well as in Tusheti Protected Area. Most portion of tourists come from Germany, the Ukraine, Russia, France, Poland, Israel and the USA.

As for the **transport infrastructure,** against the background of globalization processes going on in the world and due to Georgia's geostrategic location, the development of country's economy is directly linked with the orderly and efficient functioning of the transportation sector. In this respect the city of Telavi plays an important role. Telavi is connected with transportation lines with Georgian capital, using which the freight turnover is performed.

[6]http://gnta.ge/

Correspondingly one of the main priorities of Telavi City Hall is the development of Transport Sector, coordinated functioning of its separate segments, modernization and construction of transport infrastructure according to international standards and harmonization of country's legislation with the international regulations.

Culture

The development of culture in the city of Telavi is managed by City Hall Culture, Education, Monuments Protection, Sports and Youth Service, which conducts its activity according to 2015-2017 Strategic Plan. The main priority of the Service is to identify the Telavi cultural heritage, its preservation, interpretation and usage. More specifically, the Strategic Plan on the preservation of cultural heritage foresees the implementation of program on taking care of cultural heritage monuments being in close contact with the tourism development, as well as the raising of tourists' interest to Telavi and equipment with modern amenities of the infrastructure and its development.

Telavi – Signatory to the CoM and self-governing city

According to the new Code on Self-governance statute, approved by the Parliament of Georgia[7], since 2014 the city of Telavi has acquired the status of self-governing city. The gaining of self-governing city status brings important changes in the form of city governance concerning its rights and responsibilities and mandate. The management of the city gets more freedom from the central government in decision-making process and in planning and developing the city within the limits of its own possibilities. In accordance with Article 2 of Self-governance Code citizens of Georgia have a right to resolve problems of local importance through the bodies of local self-governance on the basis of Georgia's legislation. The unit of self-governance is municipality which has its administrative borders and administrative center, has elected governing bodies and possesses its own property, budget and income. The Municipality is an independent legal entity of public low (LEPL)[8].

Figure 5. Administrative building of Telavi Municipality

[7] https://matsne.gov.ge/ka/document/view/2244429
[8] https://matsne.gov.ge/ka/document/view/2244429

After obtaining the status of self-governing city Telavi became a legatee of the signature to the CoM[9]. Telavi Municipality has signed the CoM as early as in March 2014 and thus has undertaken an obligation to prepare and implement within its administrative borders the SEAP aimed at the reduction of GHG emissions to 2020 at least by 20%[10].

Plans for Telavi development

At the present stage Telavi has no Strategic Development Plan. In this direction the city management team is cooperating with the German partners from the city of Biberach having a 28-year long history of friendship and collaboration. In March 2015 the meeting has been held between the City Hall experts of the cities of Biberach and Telavi on the problems of Telavi strategic plan development and concrete steps were determined for the upcoming activities. According to the Telavi City Hall Service on the cooperation with tourist international funds and non-governmental organizations all staff members of the City Hall are engaged in this process within the limits of their competence and profession. The Strategic Development plans are being prepared for each service and later they will be aggregated into one joint document.

2. THE ENERGY SUSTAINABLE DEVELOPMENT STRATEGY

The SEAP for the city of Telavi includes Transportation, Buildings, Street lightning and Greening sectors. Thus the Plan presumably will serve as a basis for the Strategic Plan of Telavi Development, which yet has to be worked out because Telavi has become the self-governing city not long ago, only in 2014.

The presented version of Telavi SEAP is prepared in 2015 and covers 4 years till 2020. It is to be taken into account that due to the short span remaining till 2020, the possibility remains for Telavi not to be able to achieve the 20% emissions reduction goal and hence the reaching of this objective will be shifted to 2025.

Proceed from this, for main sectors discussed in the SEAP (Buildings, Transport) the emissions reduction strategy has been defined for two periods of time: short-term (2016-2018) and long-term (2019-2025) periods. Measures planned for the short span are concrete and detailed, while the activities projected for the long period are discussed in a more strategic sense and require additional survey, planning and technical and economic grounding. Such approach is in full compliance with the SEAP development Guidelines.

Based upon the 2014 base year GHG emissions inventory and CO_2 emissions projected growth parameters to 2020, in the frame of Telavi SEAP the GHG emissions reduction sectoral strategy has been worked out for all sectors and main directions were defined.

Transportation sector

In the Transport sector a number of strategic directions are discussed. These are:

[9]Telavi Municipality Decree N 03/04/2015
[10] http://www.covenantofmayors.eu/about/signatories_en.html?city_id=4592

- Setting up of municipal public transport and restriction of transit traffic at the territory of the city;
- Working out of parking policy;
- Facilitating walkable and cycling/electric transport travel routes in the city.

In the short-run perspective the city plans to create the municipal transport enterprise, serving the town with well-planned routs and comfortable buses operating on a clean fuel. It's assumed that these buses will create an efficient alternative to the travel on long distances by private vehicles. The arrangement of transfer stations is planned as well to promote the transfer of passengers from intercity lines to inner city routs.

At the same time, in the nearest future the Telavi City Hall plans to develop the parking strategy establishing tariffs for private cars and taxis. The management of parking infrastructure will be under the responsibility of the municipal enterprise, created for the administration of public transport. This will enable to use the parking revenues for improving and subsidizing the public transportation.

In the long-run perspective the strategic vision on the future of Telavi Transport sector is focused on facilitating pedestrian and cycling/electric cycling travel, being the healthier alternative to journeys by taxi or private car. As Telavi is disposed at the slope of the mountain, the cycling is difficult and hence the use of motorized bicycle is considered for local population and application of electric bikes – for tourists.

Buildings sector

The emissions inventory in the Buildings sector has demonstrated that 94% of GHG emissions from the buildings in Telavi come from the residential houses. Thus, to achieve the 20% reduction of emissions it is urgently necessary to work out the programs for the residential sector, supporting the introduction of special energy efficiency and renewable energy measures in this sector. At the same time it should be considered that the energy consumption in Telavi is low as it is, the buildings are not heated utterly and significant part of population is living in the conditions of energy poverty. Accordingly, such programs require solid preparatory activities including the search of donors for outside financing, specification of legislative basis and regulations to enable the Municipality to operate directly with the population. The Telavi City Hall takes into consideration that in the remaining 4 years till 2020 it may be impossible to implement completely all these programs. In this case the reaching of target indices on the reduction of emissions could be postponed till 2025.

However, in the coming 4 years the Telavi City Hall strategy foresees the greatest support to the use of energy saving and renewable energies in municipal buildings to demonstrate their advantages for population and other commercial buildings. In addition to this, the popularization and facilitation of energy saving measures is planned for residential buildings which are relatively more organized and are engaged in the City Hall co-financing programs. To such buildings belong the dwellers cooperatives in the buildings.

At the same time, to achieve the emissions reduction targets it is highly valuable to conduct the energy efficiency and renewable energy introduction measures in private houses as well. The City Hall will elaborate specific programs for this task and will collaborate with state structures, as well as different funds and private organizations. In a long-run prospective the City Hall will care of to provide the city population and construction organizations with building standards based upon the local climate conditions and explain their importance in securing the heat/budget savings.

According to the SEAP strategy for the city of Telavi the following measures will be implemented.

In the municipal buildings:

1. Thermal insulation of roofs in all municipal buildings;
2. Equipment of lighting systems with LED lamps in kindergartens;
3. Application of solar collectors in day nurseries.

In the residential sector in a short-run perspective the City Hall will collaborate with the flat-owners cooperatives for the adoption of following measures:

1. Popularization of the use of LED bulbs;
2. Thermal insulation of common places in residential buildings.

In a long-run perspective the City Hall will work out programs and schemes to collaborate with the owners of private houses in introducing the following activities:

1. Facilitating in private houses such energy efficiency measures as thermal insulation of roofs and decrease in infiltration;
2. Promoting the use of renewable energy sources (solar collectors in residential buildings);
3. Establishing of building standards (in cooperation with the Ministry of Economy and Sustainable Development of Georgia) relevant to Telavi Region's climate conditions and raising awareness of general public and construction organizations on that matter.

In addition, there are another two sectors which are not less important in the process of GHGs reduction. These are the Street lighting and Greening sectors.

Street lighting sector

In the Street lighting sector it is planned to replace all existing in the city streets and squares inefficient bulbs with efficient LED lamps.

Greening sector

The state of 37.4 ha (75%) of the territory of Telavi recreation zones area (50 ha) is unsatisfactory, that is caused by different reasons, including hailstorms in 2012 and 2014, illnesses of plants (drying of pines), etc. Ensuring from this, the implementation of greening

measures is important not only for the increase of CO_2 absorption, but in general for the improvement of living and recreation conditions.

The presented strategy incorporates the planting of greenery in different areas of the city, among them in recreation zones damaged in 2012 by natural hazards (span of activities includes 5 years). In particular 2 ha of territory will be planted annually, resulting in the increase of greenery by 10 ha to 2020. The removal of emissions by that time will yet be low, but in the process of their growth the amount of CO_2 absorbed will gradually increase.

Summary of the SEAP for the city of Telavi

The methodology to work out Sustainable Energy Action Plan for the city of Telavi does not imply the use of a baseline year, which can create obstacles for the process of city development and may hamper the city to fulfill its commitments.

The used methodology in the presented document provides envisaging the development perspective of the country and the selected city as well as inevitable growth of emissions to 2020 resulting from the increased demand on energy carriers. This increase is considered in the BAU scenario, in comparison to which the reduction of emissions is evaluated as a sequel of implementation of different measures and project proposals. The methodology for the development of BAU scenario is discussed in more detail in the Transportation Sector.

The GHG inventory summary results for 2014 and BAU projections for 2020 as well as savings resulted from the implementation of SEAP in Telavi are presented in Table 5 and Table 6.

Table 5. Emissions of GHGs in Telavi in 2014 and 2020 (tCO_2 eq.)

Sector	2014	2020 (BAU)
Transport	10 143	13 794
Buildings	12 190	16 578
Street lighting	173	228
Total	**22 505**	**30 600**

Table 6. GHG emission savings in different sectors according to the Telavi SEAP

Sector	Saving (t CO_2eq)
Transport	1 430
Buildings	4 501
Street lighting	111
Greening	266
Total	**6 308**

As it could be seen from these Tables, according to the Telavi SEAP 6 308 tons of emissions in CO_2eq may be saved in 2020, making 28.0% of 2014 emissions and 20.6% of BAU scenario in 2020. It comes from the Table 9 that the major part of savings (71.4%) comes to Buildings Sector.

Figure 6 shows the distribution of sectoral emissions in 2014 base year and Figures (Figure 7, Figure 8 and Figure 9) demonstrate the growth of emissions from different sectors in accordance with the BAU and SEAP scenarios.

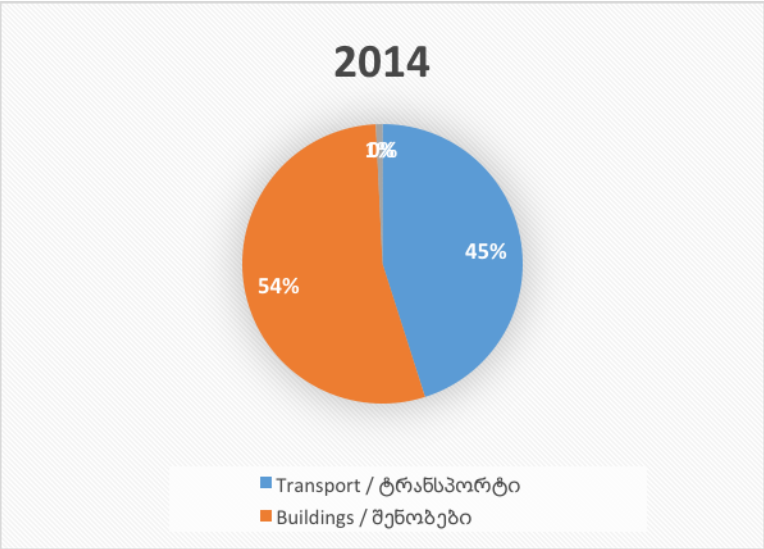


Figure 6. Distribution of sectoral emissions in 2014 in Telavi

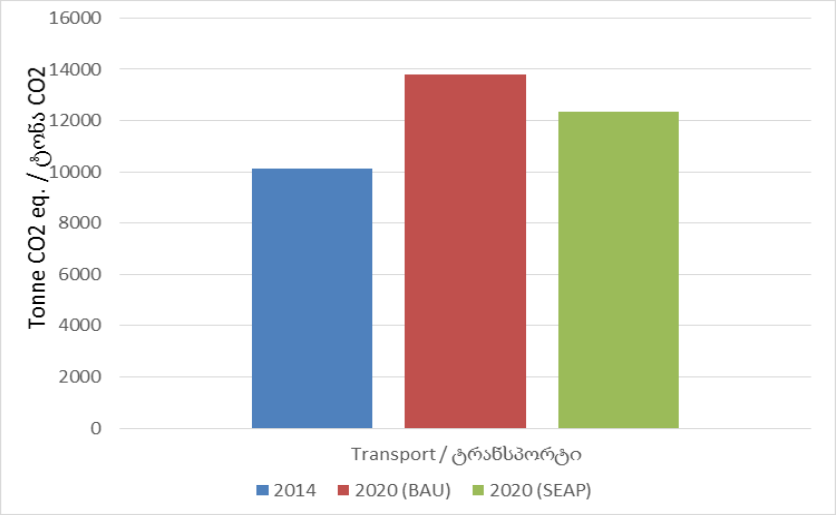


Figure 7. Growth of emissions according to BAU and SEAP scenarios in the Transport sector

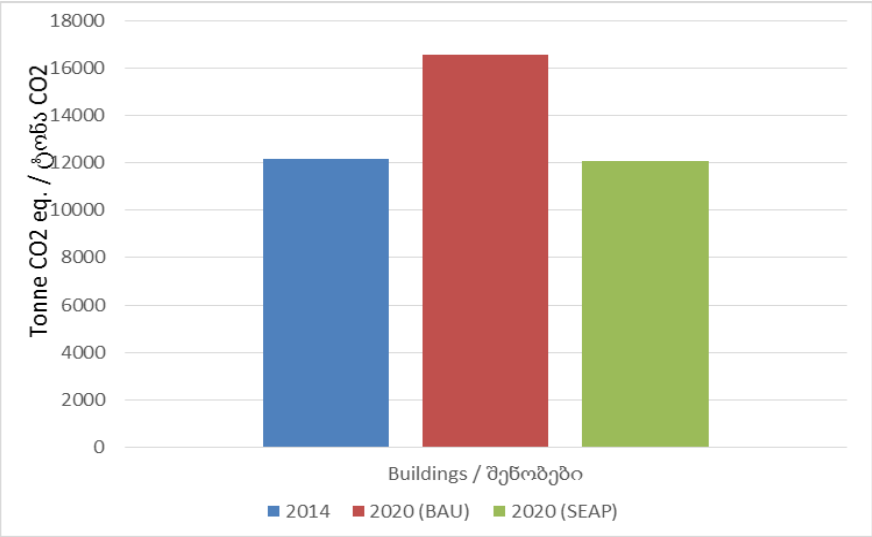


Figure 8. Growth of emissions according to BAU and SEAP scenarios in the Buildings sector

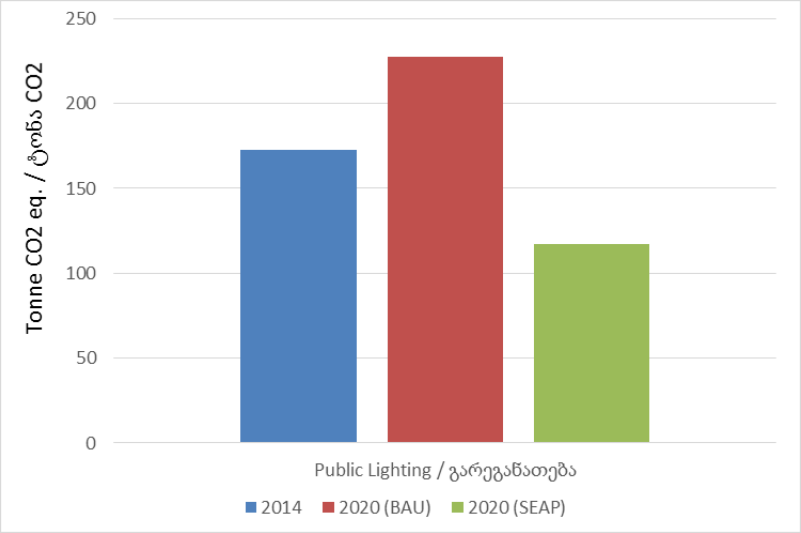


Figure 9. Growth of emissions according to BAU and SEAP scenarios in the Street lighting sector

3. TRANSPORTATION

3.1. Overview of the sector

The city of Telavi is the most densely populated town, important transport junction, industrial, agricultural and cultural center of the Kakheti Region. The accounted number of population in Telavi equals to 21 500. The city is divided into 5 territorial units: 1- Eastern Telavi, 2-Central Telavi, 3-Old Telavi, 4-Alazani-Kavkasioni, 5-Western Telavi.

Total area of the city is 78.4 ha. There are 165 streets and 109 blind lanes, among them 5 streets are of transit destination with total length of 11 km., 3 streets are roads of regional importance with total extent of 7km. Total number of motor bridges at the territory of the city makes 15. A part of Telavi streets requires total rehabilitation and another part – the partial rehabilitation. At present no traffic lights are functioning at the city territory.

The disposition of the city, stipulating its role as a junction of central and main motor roads, and the absence of efficient bypass highway causes the intense traffic through the central part of the city, which is occupied by the major infrastructure facilities. Sufficiently large part of city population is engaged in the motor-car business (trading the second-hand vehicles), seriously increasing the number of cars riding in the city.

The scarcity of public transportation and small number of regular routes, as well as the location of the city at the mountain slope reduce the number of pedestrians and causes the catastrophic growth of the number of vehicles inside the city, manifested by the frequent jamming of the traffic. These factors are causing rising emissions, environmental pollution and excessive noise at the territory of the city. Presently the major part of city population travels by taxis or private cars due to the lack of public vehicles. At the same time the huge tourist potential of the Region and the disposition of the city determine the role of Telavi as a major tourist center, requiring it's unloading from the excess vehicles.

10 petroleum service and 5 gas filling stations are functioning now in Telavi, to which 1 gas station will be added soon.

According to 2014 data, about 18 000 vehicles are riding daily at the territory of the city, including the transit cars. The SEAP discusses only the vehicles registered at the territory of Telavi and moving inside the city. Detailed information on the type of vehicles operating on different fuels as of 2014 is given in Tables below (the data are taken from the statistics of the Ministry of Internal Affairs[11] and the results of population questioning conducted in 2014 in the frames of EC-LEDS project[12]).

Table 7. Permanently owned vehicles in Telavi as of 2014

Type of motor-vehicles, number according to fuel type	Passenger cars (except taxi and municipal transport)	Municipal transport	Buses	Mini-buses	Taxi	Light-duty vehicles (capacity <2t)	Heavy-duty trucks
Operating on gasoline	2 192	18	0	15	34	13	9
Operating on diesel	158	9	0	110	50	281	235
Operating on natural gas	2 426	0	0	36	480	65	49
Total	**4 776**	**27**	**0**	**161**	**564**	**359**	**293**

Source: Ministry of Internal Affairs and EC-LEDS questioning

[11]Georgia's Ministry of Internal Affairs has no information on vehicles registered at the city level and it owns the data on vehicles registered in Telavi Municipality as a whole, so these data were recounted on the basis of EC-LEDs survey results.

[12]EC-LEDS Knowledge, Attitude and Behavior Baseline Survey", USAID's "Enhancing Capacity for Low Emission Development Strategies (EC-LEDS) Clean Energy Program", prepared by Winrock International Georgia, August 2014

In Telavi the public transport is represented by private mini-buses and shuttle mini-buses, operating both on Telavi shuttle lines and on Telavi District lines, which are riding daily at the city of Telavi territory.

For the calculation of fuel consumption by buses and mini-buses registered in the city only those vehicles were considered which are running on internal lines in the city, while the remaining transport operates on the routes outside the city or is obsolete and is out of use. In the city itself there are 2 shuttle lines with 2 mini-buses at each of them. The cost of trip by shuttle mini-bus is 0. 50 GEL. The number of mini-buses operating in Telavi in 2014 is given in Table 8.

Table 8. Public transport operating in Telavi in 2014

Type of motor vehicles	Buses	Mini-buses
Operating on diesel	0	4

The data on fuel consumption and covered distance (run) by different types of motor vehicles, which were used to assess the fuel spending, are presented in Table 9.

Table 9. Features of the transport in Telavi

Types of motor vehicles	Passenger cars (except taxi and municipal transport)	Municipal transport	Buses	Mini-buses	Taxi	Light-duty vehicles (capacity <2t)
Annual run (km/vehicle)	7 900	5 500	43 800	10 950	7 300	3 650
Average fuel consumption per 1 vehicle Gasoline (l/100km)	9.5	10	12	10	12	30
Average fuel consumption per 1 vehicle Diesel (l/100km)	10	10	10	8	10	25
Average consumption of natural gas (m^3/100km)	9		12	10	12	30

Source: Comparison between questioning of fuel service stations and drivers

3.2. Methodology

Same as for other sectors, the baseline year for the transportation sector was chosen to be 2012. GHG emissions are calculated using a formula adapted for the Intergovernmental Panel on Climate Change (IPCC) methodology Tier 1 sectoral approach for the local level, which is based on actual fuel consumption data:

Carbon Dioxide emissions$_j$ (GgCO2) =

☐☐$_i$ {Actual fuel consumption ji (unit) x caloric value of fuel i(MW.h13/per unit)
x carbon emissions factor (TC/MW.h)/1 000 x oxidized carbon portion i} x 44/12,
Where lower index refers to sector and lower index i - type of fuel.

Emissions for other gases with sector approach were calculated via following formula:
GHG emissions (GgGas) =
☐☐i {Actual fuel consumption ji (unit)
x caloric value of fuel(MWh/per unit)
x Gas emissions factor ji(TGas/MWh)/1 000].

The IPCC typical values of carbon emission factors (carbon emission per energy unit) and transfer coefficient (fuel's heat of combustion, i.e. caloricity) have been considered for calculations since 1996.

Table 10. Transfer Coefficients and Carbon Emissions Factors for Different Types of Fuel

Type of Fuel	Unit	Transfer Coefficient (MW/h unit)	Carbon Emission Factor (Ton C/ MWh)
Gasoline	1 000 liters	0.00950	0.247
Diesel	1 000 tons	0.01070	0.267
Liquid Gas	1 000 tons	0.0132	0.227
Natural Gas	1 million m^3	0.00935	0.202
Firewood	1 000 m^3	0.00210	--

The average emissions factor from the electricity grid was applied in 2012, which was 0.136 kg CO_2/kWh. A small portion of carbon in fuel is not oxidized during combustion but most is oxidized later in the atmosphere. It is calculated that non-oxidized carbon is stored indefinitely. Typical values of oxidized carbon recommended by the IPCC and used for 2006-2011 inventory are given in Table 11.

Table 11. Portion of Oxidized Carbon for Different Fuels

Fuel	Portion of Oxidized Carbon
Oil and Oil Products	0.990
Natural Gas	0.995

Different gas emissions factors for the transport sector are given below in Table 12.

[13] Basic energy unit in IPCC methodology is Terajoule, while in the SEAP methodology it is MW/h, that is why MW/h is used in the text

Table 12. Methane and Nitrous Oxide Emission Factors for Transport Sectors (kg/MWh)

GHG	Gasoline	Diesel	Natural Gas
CH_4	0.072	0.018	0.180
N_2O	0.0020	0.0020	0.0004

Global warming potential values (GWP) of these gases for converting methane and nitrous oxide into carbon dioxide equivalent are presented in Table 13.

Table 13. Global Warming Potential of Methane and Nitrous Oxide

Gas	Life Expectancy, Years	100-year GWP
CH_4	12±3	21
N_2O	120	310

A guidance document[14] has been developed by the Joint Research Centre (JRC) for the MGCe Eastern Partnership member cities, according to which these cities are given a choice to determine mandatory reductions of emissions through three alternative approaches:

1. Reduction for full emissions of fixed base year;
2. Per capita emissions reduction for fixed year emissions;
3. Reduction by Business As Usual (BAU) scenario for prospective emissions of 2020.

The Telavi SEAP uses emissions reduction calculations for the BAU scenario. There are two options of scenario construction described by the guidance document:

1. The city can develop its own methodology, which will be evaluated by the JRC later;
2. The city may use national ratios indicated in the guidance document, developed for the Global Atmosphere Research (EDGAR) project CIRCE[15] employing an emissions database. The POLES (Prospective Outlook for the Long-term Energy Systems)[16] method has been used, and considers growth of energy consumption due to population and economic growth. According to the baseline year, the BAU scenario calculates the level of emissions for 2020 assuming that current trends of population,

[14]HOW TO DEVELOP A SUSTAINABLE ENERGY ACTION PLAN (SEAP) IN THE EASTERN PARTNERSHIP AND CENTRAL ASIAN CITIES" — GUIDEBOOK, European Commission Joint Research Centre, Institute for Energy and Transport, Luxembourg: Publications Office of the European Union © European Union, 2013

[15] U.M. Doering, G. Janssens-Maenhout, J.A. van Aardenne, V. Pagliari (2010), CIRCE report D.3.3.1, Climate Change and Impact Research in the Mediterranean Environment: Scenarios of Future Climate Change IES report 62957. - A. Pozzer, P. Zimmermann, U.M. Doering, J. van Aardenne, H. Tost, F. Dentener, G. Janssens- Maenhout, and J. Lelieveld, Effects of business-as-usual anthropogenic emissions on air quality, Atmos. Chem. Phys. Discuss., 12, 8617-8676, 2012, doi:10.5194/acpd-12-8617-2012

[16]Russ, P., Wiesenthal, T., van Regenmorter, D., Ciscar, J. C., 2007. Global Climate Policy Scenarios for 2030 and beyond. Analysis of GHG Emission Reduction Pathway Scenarios with the POLES and GEM-E3 models, JRC Reference report EUR 23032 EN. http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=1510

economy, technologies and human behavior will continue, and that no national measures will be taken towards a reduction of emissions[17].

For the city of Telavi the second approach has been applied, i.e. JRC ratios, according to which the 2014 emissions will grow by 36% to the year of 2020.

Applying this method, an Excel-based software program, muni-EIPMP (municipal emissions' inventory, projection and mitigation measures planning), has been developed by the USAID funded "Enhancing Capacity for Low-Emission Development Strategies Clean Energy Program", which has been used for the creation of Telavi SEAP. Applying this program it is possible to produce the baseline scenario on the basis of JRC ratios as well as using any other national factors. Since at the time of Telavi SEAP the BAU national scenario has not been generated yet, the JRC coefficients were applied.

3.3. Base year (2014) inventory and Baseline Scenario of the GHG emissions (2015-2020)

The structure and the baseline year inventory of 2012 data regarding fuel consumption by the Telavi Transport include the following types of transportation:

- Municipal service vehicles;
- Public transport (buses, mini-buses and taxis);
- Private and commercial transport.

According to the SEAP development methodology, fuel consumption by navigation, air traffic and railway is not considered since travelling by above mentioned facilities is not within the city's territorial limits.

Energy consumption in the Telavi Transport sector has reached about 44.2 thousand MWh in 2014 (Table 14).

Table 14. Final Energy Consumption of Telavi Transport sector (MWh) – 2012

Subsector	Natural Gas	Diesel	Gasoline	Total
Municipal Vehicle Fleet	0	52	91	143
Public Transport	4 904	642	343	5 890
Private & Commercial Transport	17 119	5 705	15 360	38 184
Total	**22 023**	**6 399**	**15 795**	**44 217**

Emissions of GHGs from the Transport sector reached about 10.1 thousand tons of CO_2 equivalent in 2012.

[17]JRC Report, "An approach with a Business-as- Usual scenario projection to 2020 for the Covenant of Mayors from the Eastern Partnership", 2012. http://edgar.jrc.ec.europa.eu/com/JRC-IES_CoM-East_report_BAUprojections2.pdf

Table 15. GHG Emissions from Telavi Transport sector in CO2eq – 2012

Subsector	Natural Gas	Diesel	Gasoline	Total
Municipal Vehicle Fleet	0	14	23	37
Public Transport	1 005	170	85	1 260
Private & Commercial Transport	3 507	1 512	3 827	8 846
Total	4 511	1 682	3 913	10 143

As it has been mentioned above, according to JRC factors, in comparison to baseline year 2014, the GHG emissions to 2020 will increase by 36%. Correspondingly, in line with the BAU scenario, in 2020 emissions of GHGs from the Transport Sector will nearly amount to 13.8 thousand tons in CO_2eq.

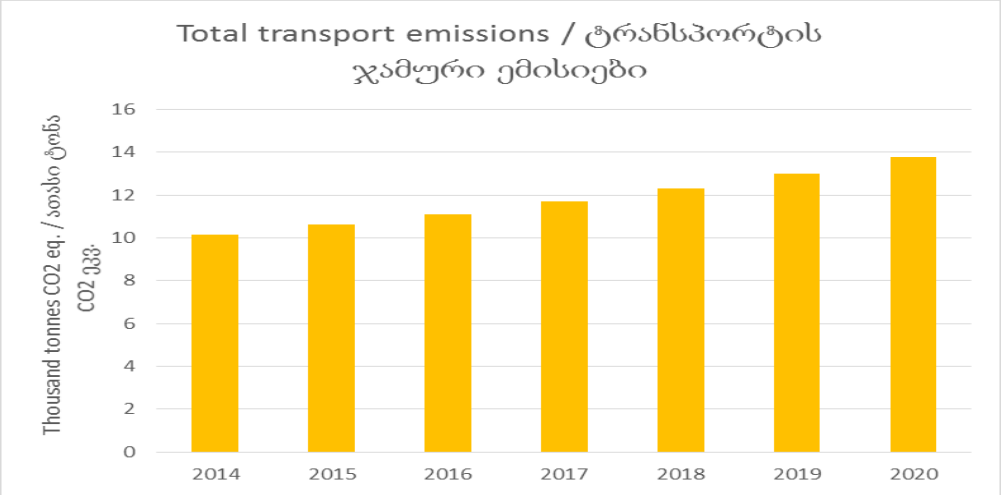


Figure 10. Trend of GHG emissions from Transportation sector according to BAU scenario

3.4. Action Plan for the reduction of emissions from the Telavi Transportation Sector

Compared to other cities of Georgia Telavi is featured by sufficiently high share of private vehicles. According to the EC-LEDS survey, 22% of Telavi residents own a motor-car, while e.g. in Tbilisi this index equals to 25%. Correspondingly, a private car is the most popular mean of transportation. Taxi is also a popular kind of transport, which due to short distances is relatively cheap. This factor creates the overloading of transportation lines and traffic jams, resulting in air pollution. Hence, the strategic view of SEAP in Transport Sector is concentrated on the creation and promotion of alternative to private cars means of transportation, including public/mass transport, walking and the use of motor/electric bikes.

Telavi became a self-governing city in 2014, till that time it was a part of Telavi Municipality and had no right to regulate the public transport on its territory. The public transport was controlled by private sector which itself worked out both the transport lanes and other policies related with transportation. After transforming into self-governing city Telavi has acquired the right to regulate public transportation on its territory and thus this direction gains a first priority in city's SEAP.

After implementing measures envisaged in the Telavi SEAP the emissions of CO_2 from the transport sector will be reduced by 1 430 tons in CO_2eq to 2020. All activities will be carried out by the Property Management, Economic Development, Statistics, Infrastructure, Spatial Arrangement, Architecture and Construction Service at the Telavi City Hall.

Table. 19. Action Plan for the Telavi Transportation Sector

Sectors and spheres of activity	Principal measures in separate sector	Responsible Department, person or company (in case of engaging the third Party)	Dates of beginning and termination	Cost	Anticipated saving of energy (MWh)	Expected reduction of CO_2 emissions (t)
Public transport	**Activity PB1. Creation of municipal public transport network and planning of routes**	Telavi City Hall's Property Management, Economic Development, Statistics Infrastructure, Spatial Arrangement, Architecture and Construction Service	2015-2016	1 380 000 GEL	1 735	391
	Activity PB2. Arranging the transfer station	Telavi City Hall's Property Management, Economic Development, Statistics Infrastructure, Spatial Arrangement, Architecture and Construction Service	2015-2016	600 000 GEL		
Transportation and traffic planning	**Activity UP1. Restoration and development of transport infrastructure** • Restoration and rehabilitation of road cover • Arranging the crossroad • Mounting of road signs	Telavi City Hall's Property Management, Economic Development, Statistics Infrastructure, Spatial Arrangement, Architecture and Construction Service	2015-2106	2 600 000 GEL	601	138
Transportation and traffic planning	**Activity UP2. Arrangement of bypass road**	Telavi City Hall's Property Management, Economic Development, Statistics Infrastructure, Spatial Arrangement, Architecture and Construction Service, Department of Motor Roads at the Ministry of Regional Development and Infrastructure of Georgia	2018-2020	1 912 000 GEL		
Private transport	**ActivityPRT1. Promotion of motor biking and walking**	Telavi City Hall's Property Management, Economic Development, Statistics Infrastructure, Spatial Arrangement, Architecture and Construction Service	2015-2020	---	3 443	783
	Activity PRT2. Setting up of parking system	Telavi City Hall's Property Management, Economic Development, Statistics Infrastructure, Spatial Arrangement, Architecture and Construction Service	2015-2016	56 000 GEL	286	117
Total					**6 065**	**1 430**

3.5. Detailed description of measures

1. **Activity PB1. Creation of municipal public transport network and planning of routes.** The measure implies setting up of municipal enterprise completed with electric or hybrid type buses, adapted for the use of elderly and disabled passengers. At the same time the integrated ticketing system will be introduced and bus stops/stations will be arranged, at which electronic displays will be mounted. The listed and other additional measures will increase the comfort and attractiveness of public transportation.

   The planning of possible routes is given in Table 16.

Table 16. Planning of bus routes

Route direction	Length of the route, km	Number of stops	Average duration of trip, min
Bus station – Mshvidoba St. – Rustaveli Ave. – Ketevan Tsamebuli Ave. – University – Hospital – Erakle II Ave. – Bus station	15	25	40
Bus station – Alazani Ave. – Ketevan Tsamebuli Ave. – Kakutsa Cholokashvili St. – David the Rector St. – Georgian Leonidze St. – Military settlement – Queen Tamar St. – Chavchavadze Ave. – Alazani Ave. – Bus Station	15	25	40
Bus Station – Kavkasioni St. – Agmashenebli St. – Gombori side –street-Chavchavadze Ave. – Queen Tamar St.-Giorgi Leonidze St. – University – Alazani Ave. – Bus Station	15	20	40

The number of necessary buses and approximate cost of purchase are presented in Table 17.

Table 17. Number and cost of buses in Telavi

Number of routes	3
Frequency of buses	Every 20 min
Number of buses on each route	2
Total number of buses	6 basic and 1 in reserve
Presumable cost of 1 bus	120 000 GEL
Assumed total cost of buses purchase	840 000 GEL

The details of arraigning bus stop/stations are shown in Table 18.

Table 18. Arranging bus stop/stations

Number of routes	Total number of stops	Approximate cost of arranging one stop	Assumed total cost of arranging stops, GEL
3	60	9 000	540 000

The municipal enterprise/company of limited liability (LLC) will be established for the management of public transport, at the same time being responsible for carrying out parking

policy. The parking service revenues will enable the enterprise to improve the public transportation functioning.

To calculate the emissions reduction it has been assumed that as a result of taken measures as well as the next one (activity PB2), the traffic of private transport (including taxis) will be reduced by about 5%, while that of public transport will correspondingly increase, resulting in the cutback to 2020 of annual emissions by 391 tons compared to the baseline scenario.

2. Activity PB2. Arrangement of transfer station

Together with the improvement and regulation of public transport system it is important to restrict in the city the traffic on intercity routes coming outside. For this reason a transfer station is to be arranged for removing from intercity routes to local lines inside the city. This measure will significantly unload the traffic in the city. The station could be positioned at the crossroad of Alazani Avenue and the bypass road. At the same place it would be convenient to dispose the bus garage and charging station for electric buses. The assumed budget of this measure is given in Table 18.

Table 19. Budget of the transfer station construction in Telavi

Approximate cost of the construction	500 000 GEL
Minimal area	1500 m^2
Minimal number of stopping places	25
Minimal number of served buses in 1 hour	40
Number of charging devices	3
Total cost of chargers	100 000 GEL
Approximate total cost	600 000 GEL

Emissions reduction resulting from this measure is included in calculations under the activity PB1.

3. Activity UP1. Restoration and development of transport infrastructure, which contains the following measures:

- Restoring and rehabilitating of road cover;
- Arranging the crossroads;
- Installation of road signs.

The restoration and improvement of road cover implies the repair of damaged asphalt cover at the territory of the city. In 2015 the tender is announced on this project having the assumed budget of 396 216 GEL. At the same time the following measures are planned to be taken in the nearest future:

1. Substitution of cobbled roadway with asphalt cover and construction of pavements on the Rustaveli Avenue. The assumed cost of the project equals to 287 500 GEL.
2. Complete rehabilitation of the Tabidze Street, it's covering with the asphalt, arrangement of pavements and torrent – draining system. The assumed cost of the project is 375 500 GEL.

The city development future priority plan includes the surface cover rehabilitation of all main streets in Telavi. Total number of projects makes 98 and their overall assumed financing equals to 31 562 200 GEL, from which 2 500 000 GEL, presumably will be allocated in 2015-2020.

3. Arranging the crossroads. In this direction for the nearest future the project is planned concerning the arrangement of 2 crossings at the most overloaded places in the city: 1. crossing at the crossroad of Ketevan Tsamebuli Street, the Chavchavadze Avenue, Alazani Avenue and Saakadze Avenue and 2. Crossing at the crossroad of Agmashenebli Avenue, Alazani Avenue, Kavkasioni Street and Vardoshvili Street. At these crossroads the two-way traffic may be allowed, significantly unloading the transport movement and decreasing the vehicle run. The tender is announced on this project with the assumed cost of 95 377 GEL.
4. For the mounting of road signs the City Hall has purchased 100 road signs and their installation is going on.

The listed above measures will facilitate the significant relieving of traffic in Telavi, shortening of trip distances and creation of comfortable environment for pedestrians, finally resulting in the lessening of consumed fuel and the reduction of emissions. Apart from this, these measures are aimed at the preparation of further steps and future plans, resulting in the regulation of public transportation and bringing into the parking system.

The implementation of GHG emissions reduction opportunities directly related with the traffic management and the improvement of road infrastructure is a complicated and contradictory process. The curtailing of traffic will result in the lessening of GHG emissions from individual vehicles as they will be able to move more efficiently. However this may not result in the reduction of overall emissions, because the downsizing of traffic makes the use of private cars more attractive that from its part again causes the rising of emissions. Thus, these measures and related with them reduction of emissions may be discussed in the context of wider transportation strategy coupled with other measures discussed in this document.

According to the performed assessment of emissions reduction, it was assumed that as a result of introduction of all listed above measures the distance covered annually by all types of motor-cars could be decreased to 2020 by 1% that will bring the cutback of emissions to 2020 by 138 tons in CO_2 equivalent.

4. Activity UP2. Arrangement of bypass road. This measure implies the rehabilitation of bypass road (Gombori motor-road-Gulgula-Railway side-street) and the restriction of transit freight transportation through the city, resulting in freeing of the central part of the city from the traffic. Details of the rehabilitation of the bypass road are given in Table 20.

Table 20. Details of the rehabilitation of bypass road

Section of the bypass road	Length of the section, m	Assumed cost of 1m² rehabilitation, GEL/m²	Assumed cost of section's rehabilitation, GEL
Gulgula section	1 000	30	240 000
Telavi section from Gulgula to Alazani Ave.	1 200	55	528 000
Kurdghelauri section from Alazani Ave. to	2 200	65	1 144 000

Tbilisi Highway			
Assumed total cost of road rehabilitation			1 912 000

For the implementation of this measure the Telavi City Hall has already asked for assistance Georgia's Motor-Roads Department at the Ministry of Regional Development and Infrastructure but the consent on road rehabilitation is not yet received. The City Hall will continue negotiations with the Department on this issue.

The reduction of emissions under the above-discussed activity is not calculated, as the transit transport was not included in the emissions inventory. However this measure will undoubtedly have an impact both on the amount of emissions and the reduction of local pollutants.

5. Activity PRT1. Promotion of motor biking and walking. Facilitating the motor biking and walking is one of the most effective and, that is important, healthy way of emissions reduction. Although Telavi is disposed on the mountain slope, creating difficulty to cycling. For this reason this plan considers the use of motor bikes and electric bikes as an alternative to cycling. In this context the Telavi City Hall plans promoting the motor bikes by conducting the parking policy, in the frames of which special, free of charge parking will be organized. For tourists the electric bikes hiring stations will be set up.

As to facilitating the walking in the city, at present the rehabilitation of "Telavi Canal" and its surrounding territory in the central part of the city is under way. This activity incorporates the modification of the bottom of the ravine, construction of walkable bridges on the canal and setting up of parking grounds for about 40 cars.

For pedestrians it is also important to arrange crossings and pavements. For a successful implementation of these measures special programs have to be conducted aimed at the behavioral changes among the population. The objective of these programs should be to demonstrate the advantages of walking and cycling in comparison to driving.

To calculate emissions reduction as a result of these measures it was assumed that the walking support activities included will decrease by 1% the necessity of driving private cars or taxis, while motor bikes will substitute about 10% of private cars, that will result in the saving of about 783 tons of emissions.

The cost of the measure is not assessed in this case, because the price of separate parts of activities calculated in other measures. As to the conduction of behavior change programs, the estimation of their costs is to be carried out separately.

6. Activity PRT2. Setting up of parking system

At present the parking policy for Telavi is under development. Its main objective is to relive the city (especially its central districts) from motor vehicles. Parking policy will be implemented by the same enterprise, which will provide the city with the public transport, allowing use of the parking revenues for the improvement of transportation servicing.

For the arrangement of parking grounds it would be necessary to divide the city into zones to determine the parking fees according to them. In the downtown part of the city the parking will be limited on an hourly basis and will be provided with parking meters. Presently the Telavi City Hall has registered 16 sites for arranging the parking of estimated 320 cars. The free of

charge parking for motor-bikes will be organized separately. The details of equipping parking grounds with the parking meters are given in Table 21.

Table 21. Cost of arranging the parking system in Telavi

Number of parking grounds/lots	Average number of cars per 1 lot	Number of parking meters per 1 lot	Total number of parking meters	Assumed of one parking meters, GEL	Assumed total cost of parking meters, GEL
16	20	1	16	3 500	56 000

The assessment of parking policy effectiveness separately, without taking into account other measures is difficult. However, according to the Guidelines on Mitigation in Transport Sector[18], the increase in expenses on vehicle ownership by 10% brings the decrease in the number of owners by about 3%. Based on conservative assumption, that the parking policy will reduce the number of car owners by only 1%, the saving of CO_2 emissions will make about 117 tons in CO_2eqannually.

4. BUILDINGS

4.1. Overview of the sector

One of the most important parts of Telavi SEAP is the buildings sector, which also includes municipal and other commercial buildings (offices, shops, hotels, etc.). One of the significant preconditions for the reduction of GHG emissions is the lowering of energy consumption in these buildings and thus special attention should be given to measure directed towards the planning in them energy efficiency and renewable application measures.

Total fund of Telavi buildings

The city of Telavi is divided into 5 territorial units, each of them having its representative in the City Hall. At the territory of each unit the residential, commercial and municipal buildings are disposed, from which 4 557 are residential houses with the total area of 479 705 m^2. 85.2% of this space belongs to 1-2 story private houses and the rest is located in the multi-apartment buildings. The aggregated data on Telavi residential buildings are given in Table 22.

Table 22. Combined data on the residential buildings in Telavi

#	Quantity of stories	Number	Total area, m^2
1	1and 2-story private	4 441	408 572
2	2- story	17	8 027
3	3 -story	11	6 531
4	4 -story	26	16 920
5	5- story	49	33 871
6	6- story	1	830
7	9- story	12	4 954
	Total	**4 557**	**479 705**

[18]Technologies for Climate Change Mitigation – Transport Sector, UNEP Risoe Center, 2011. http://tech-action.org/

According to the survey conducted in 2014 under the EC-LEDS project among the residents of Telavi, the majority of population (55%) lives in houses built in the period of 1951-1981. The share of new houses in Telavi is sufficiently small. In the Telavi municipality the external walls of houses usually are built of blocks and stones, while tin-plates and slate are used for roofing. Frames of windows are often made of wood, though about a quarter of households have installed the metalplastic windows.

Figure 11. The view of typical Telavi private house

The greatest part of Telavi residential buildings is constructed in 1960-1980-es, while in the central part of the city – in the period of 1954-1955. The roofs, facades and windows of houses in Telavi were damaged by the severe storm in 2011 and after this under the assistance of City Fund all buildings were roofed with tin-plates but without considering the thermal insulation. Not a single entrance is equipped by the door. The apartments constructed in 1960-es were heated by the centralized heating systems. After the collapse of the Soviet Union these systems ceased their functioning and each household has installed its own heating system.

Figure 12. The view of typical 4-story residential building

The majority of dwellers of residential buildings for heating the space are using natural gas costing 0.48 GEL per m^3 that results, according to the survey in the monthly spending of about 60-80 GEL.

In line with the results of EC-LEDS the survey the absolute majority of Telavi Municipality's population gets energy resources (electricity and natural gas) from the centralized energy supply systems.

In the winter period the monthly consumption of natural gas increases 4 times. The analysis of the survey shows that in Telavi municipality about one-third of the dwelling space is usually heated. The main source of heating in Telavi is still the firewood. Only 36% of population is using the natural gas for heating.

According to the majority of Telavi municipality population the duration of heating season usually makes 7 months from October to April. In most cases one or a few rooms are heated separately using stove, fire-place, electric heater or other appliance (96%). Only 2% of residents are heating the space all-day-round. The majority of population are using heater for 12 hours a day.

The majority of households in Telavi use hot water from the individual heaters, applying different heating sources (41%). For this purpose the main source is natural gas and the electricity is the second provider of heat.

The main and sole mean of cooking in the urban districts of Telavi municipality is an oven, usually using natural gas.

The majority of population has a TV set. The share of households owing the washing machine and a fridge is high in Telavi, though 49% of families do not use refrigerator in winter to reduce the expenses.

Other kinds of household appliances are owned by the relatively small portion of population. The number of households owning a computer is sufficiently high in Telavi, however the possession of air conditioner is enough rare and may not be a subject for analysis.

In Telavi the average household uses 10 bulbs, the majority of which are incandescent and only 8% of respondents have managed to transfer on the energy efficient lamps. Every third household uses both traditional and energy efficient bulbs (29%).

The Telavi City Hall owns 56 buildings with the total area of 37 628 m^2, that is listed in Table 23.

Table 23. List of buildings belonging to the municipal property in Telavi

№	Name of realty	Number	Area, m^2
1	Kindergarten	9	9 486
2	Sports school	6	5 482
3	Other buildings	45	22 600
	Total		37 628

Other buildings are of different purpose and include both the dwelling houses and the institutions as well. Part of buildings belonging to the municipal property is under the partial ownership. At the same time in Telavi there are state-owned buildings (e.g. schools, medical institutions) and commercial buildings, all of them listed in Table 24.

Table 24. Incomplete list of central state owned and commercial buildings functioning in Telavi city

№	Name of realty	Number	Area, m^2
1	Public school	9	23 677
2	Medical institution	18	11 520
3	Hotel	17	4 625

Commercial buildings of other type, due to lack of information, are not cited here. The compilation of information on energy consumption proved to be possible only for state-owned

buildings (Schools, University, Court, Patrol Police, Archive, etc.) and hence the emissions inventory was undertaken only for them.

Energy consumption in Telavi

The distribution of electric energy in Telavi is enacted by the "Kakheti Energy Distribution" Company, which is conducting its activity all over the territory of Kakheti Region and its database gives no possibility to pick out the consumption of electricity according to types of buildings at the territory of Telavi city. Therefore the consumption of electric energy by the population in Telavi was assessed based upon the results of energy audit and questioning of population carried out in the frame of EC-LEDS project. As to the electric energy, consumed in the municipal and state buildings, this information was gathered by the Telavi City Hall. According to the obtained results in 2014 in the Telavi residential and non-residential sectors 17 497 MWh of electricity has been consumed, including:

- In residential sector – 16 892 000 KWh;
- In municipal buildings – 219 000 KWh;
- In other buildings – 386 000 KWh.

The provider of natural gas to the population of Telavi is the company "Wissol Petroleum Georgia" the database of which allows to single out the consumption of distributed gas in the residential buildings, while the statistics on energy consumption in municipal and other buildings was provided by the Telavi City Hall.

According to these data, in 2014 in the Telavi residential, municipal, commercial and other buildings 4 693 thousand m^3 of natural gas has been consumed, among them:

- In residential buildings - 4 357 thousand m^3;
- In municipal buildings – 41 thousand m^3;
- In other buildings – 296 thousand m^3.

According to the Telavi Forestry information each household in the city is allotted to get 7 m^3 of firewood annually and the institutions may consume the firewood corresponding to their need. In accordance with the Telavi Forestry statement there is no aggregated database on the consumption of firewood by Telavi residents, hence this figure has been assessed on the basis of EC-LEDS survey, according to which 67% of Telavi households are using the firewood with the annual consumption rate of 6.5.-7 m^3. Consequently, in 2014 in residential buildings of Telavi nearly 27 000 m^3 of firewood has been consumed. In municipal buildings in 2014 301 m^3 of firewood has been used up, and in other state buildings – 63 m^3.

4.2. Methodology

The methodology for calculating CO_2 baseline (2012) emissions and future trends (up to 2020) for the Telavi Buildings sector was the same as in the Transport sector, which includes carbon dioxide emission factors and transfer coefficients as well as methane and nitrous oxide emissions factors resulting from incomplete combustion of fuel. They were taken from IPCC 1996 and are given below (Table 25).

Table 25. Methane and Nitrous Oxide Emission Factors for Buildings (kg/MWh)

#	GHG	Natural Gas	Oil Products	Firewood, hazelnut Shell
1	CH_4	0.018	0.036	1.08
2	N_2O	0.00036	0.002	0.014

Emissions reduction potential after energy saving measures has been calculated by selecting typical for Telavi buildings, carrying out energy audits and evaluating energy efficiency measures, then transposing these results to other buildings. Residential houses, schools, hospitals, kindergartens, hotels, educational institutions, shops, offices, etc. have significant potential for energy conservation. An energy audit must be conducted by trained specialists to understand how to improve building insulation and energy saving measures.

It is impossible to assess the energy-saving potential of a building through simple accounting/fixing of annually consumed energy quantities (e.g. 700,000 kWh/yr.) as this figure doesn't indicate the size of the building. The clear idea on the energy efficiency of the building could be given by the specific consumption of energy or the quantity of energy rated on 1 m^2 of building's area, e.g. 130 KWh/m^2yr. However, there are many other factors, such as type of the building (administrative, hospital, school, etc.), climate conditions, level of building thermal insulation, etc. which are affecting the amount of consumed energy and, correspondingly, the specific energy consumption of the building. Further its value should be compared to the "standard" for the given country "Key Numbers".

Key numbers should reflect standard values of building's specific energy consumption, considering all the above-mentioned factors. The comparison between energy consumption measured and calculated values and the Key Numbers allows to quickly assess the energy efficiency and energy saving potential of the building. The specific energy consumption value also characterizes the energy efficiency of the building same as consumed per one mile fuel defines the energy efficiency of the motor vehicle.

An energy audit of typical buildings in Telavi was conducted using "Key Numbers" of the ENSI software. A Norwegian Consulting Company—ENSI--founded in 1992, developed simple software called "Key Number" for a quick calculation of energy characteristics that can be applied both for projecting rates for new buildings and reconstruction activities and for assessing energy-saving measures for existing buildings. Key figures reflect model values of specific types of energy consumption, taking into account all factors. Comparing measured and calculated values of energy consumption with key numbers permits a rapid assessment of energy efficiency and energy saving potential.

Today the actual exploitation conditions of buildings in Georgia differ substantially from designed/normative conditions. Thus, measured energy consumption may be higher than the one calculated e.g. due to water leakage or improper operation of a heating system; or lower, e.g. due to heating or ventilation system shutoffs. Additionally, along with energy-saving measures, an owner might need to improve the microclimate in the building by installing a forced air ventilation system or improving the existing system. All these will lead to an increase in energy consumption.

Due to the fact that in most cases "measured energy consumption" does not coincide with "estimated energy consumption", for getting the correct value of energy savings the calculated values of energy consumption should be used as a "baseline scenario", which describes the building's energy consumption under the comfort conditions.

In order to assess the energy consumption and relevant emissions three different scenarios ($E_1=E_2=E_3$) could be used: E_1- to get statistical data on energy (power, NG, wood,etc) consumption by building sector from energy providers; E_2- to calculate specific consumption of energy per sq. meter of building based on the results of energy audits and applied the data to other buildings. E_3- to calculate per capita energy consumption based on the results of building audit or surveys and multiply it by city population. Finally, cross comparison of these three scenarios makes it possible to determine the accuracy of calculation for each scenario (E1 = E2 = E3).

According to the **first scenario (**E_1), it is possible to estimate an annual energy consumption on the basis of annual statistical data of consumed natural gas, electricity and firewood obtained from providers. Usually data on consumption are provided in standard units (kWh/yr, m^3, l, etc) and should be converted to kWh in order to compare, sum up or do any other mathematical operations (E1, kWh/yr).

The **second scenario (**E_2**)** needs a detailed energy audit of different types of pre-selected "typical" buildings and an estimation of specific energy expenditures (energy consumption per m^2, kWh/m^2yr) on heating, cooking and electricity use by various appliances. An energy audit carried out using ENSI software would allow us along to the assessment of energy consumption to determine the actual potential of energy-savings, involves a situational analysis and other tools to reduce energy consumption and CO_2 emissions.

To work out the mentioned plan for Telavi, the detailed energy audit was undertaken, covering different by energy consumption buildings. They are:

The Telavi #7 kindergarten; Address: 2A Alazani Ave.

The Telavi #4 Public School building; Address: 19, Erekle the Second Ave.

The private dwelling house; Address: 8 Samachablo st.

Two-story residential building; Address: 75, Rustaveli Ave.

Tree-story residential building; Address: 77, Rustaveli Ave.

Four-story residential building; Address: 79 Rustaveli Ave.

Five-story residential building; Address: 11, Agmashenebli lane

Nine-story residential building; Address: 36, Alazani Ave.

The Student Youth House: Address: 18, Tsabadze st.

The Regional Hospital. Address: 2, Aladashvili st.

Figure 13. Examples of Telavi residential buildings.

After defining the energy specific conusmption, the estimation of annually consumed energy (E2, KWh/yr) on heating, hot water, cooking and electric appliances has been conducted for various types of buildings.

The **third scenario (E_3)** is based on statistical data on the number of people living in the area. Determination of per capita energy consumption (kWh/yr. per capita) allows us to calculate the approximate annual energy consumption of the entire population (E3, kWh/yr) in the area.

4.3. Base year (2014) inventory and GHG emissions baseline scenario (2015-2020)

According to the SEAP development manual the Telavi Buildings Sector structure includes 3 sub-sectors: municipal buildings, residential buildings and other (commercial buildings). The data are based on the energy consumption in the building in 2014. Energy consumption by the Buildings Sector in 2014 is given in Table 26.

Table 26. Final Energy Consumption in Telavi Buildings sector (MWh) - 2014

#	Subsector	Electricity	Natural Gas	Firewood	Total
1	**Municipal Buildings**	219	384	627	**1 230**
2	**Other (commercial) buildings**	386	2 759	132	**3 276**
3	**Residential buildings**	16 892	40 650	56 250	**113 792**
	Total	**17 497**	**43 792**	**57 009**	**118 298**

In 2014 GHG emission from the Buildings sector amounted to 12.2 tons in CO_2eq (Table 31).

The emission factor for electricity is taken equal to 0.104 tCO_2/MWh that is grid coverage value in 2014.

Table 27. GHG Emissions from Telavi Buildings sector (ton CO_2 –eq.) 2014

#	Subsector	Electricity	Natural Gas	Firewood	Total
1	**Municipal Buildings**	23	77	17	**117**
2	**Other (Commercial buildings)**	40	556	4	**599**
3	**Residential buildings**	1 757	8 190	1 527	**11 473**
	Total	**1 820**	**8 823**	**1 547**	**12 190**

According to BAU scenario calculations using JRC factors, to 2020 GHG emissions will grow by 36% and correspondingly will reach 16.6 thousand tons in CO_2 eq.

4.4. GHG emissions reduction Action Plan for Telavi Buildings Sector

The electricity emission factor is taken equal to 0.104 tCO_2/MWh that is grid average value in 2014.

As it could be seen from Table 22, the 89% of GHG emissions from Telavi buildings are released from residential houses. Therefore to achieve the 20% mark in emissions reduction it is of utmost importance to develop in the residential sector programs, facilitating the introduction of energy efficiency and renewable energy adoption measures. At the same time it should be considered that as it is, the energy consumption in Telavi is low, the buildings are not completely heated and large part of population lives in energy poverty. So such programs require carrying out of serious preparatory activities, working with donors in search of external financing, specification of legislative basis and regulations to enable the City Hall to work directly with the population. The Telavi City Hall takes into consideration that in time of the preparation of this plan only 4 years remain till 2020 and hence it is possible that by 2020 all these programs could not be utterly operational. In this case the achievement of emissions reduction targets will be postponed till 2025. Nevertheless in the nearest 4 years the strategy of Telavi City Hall envisages maximal substantiation of energy saving and use of renewable energies in municipal buildings to demonstrate the advantages of this approach to the population and other commercial groups. At the same time the energy saving measures will be popularized and promoted for the residential buildings, that are more organized and the co-financing programs to which the City Hall has already prepared – that is the building cooperatives.

Based upon the discussed above considerations, in accordance with the short-term (2016-2020) SEAP strategy for the city of Telavi the implementation of following measures is planned.

In municipal buildings:

1. Thermal insulation of roofs in City Hall administrative building and kindergartens;
2. Equipment of lighting systems with LED lamps in kindergartens;
3. Application of solar collectors in kindergartens and day nurseries;
4. Development of high efficiency heat generator operating on bio-waste for municipal buildings.

In the residential sector in a short-run perspective the City Hall will collaborate with cooperatives for the adoption of following measures:

1. Popularization of the installation of LED bulbs in flats;
2. Thermal insulation of common places in residential buildings.

In addition to this the City Hall will work out special programs on energy saving and renewable energy application for private houses and providing financial assistance from donors and state agencies.

In the long-run perspective (2019-2025) the City Hall will perform programs for the introduction of following measures in the residential buildings:

1. Energy efficiency measures (thermal insulation of roofs, reduction of infiltration from the windows, replacement of windows);
2. Promotion of the use of renewable energy (solar water-heaters, heaters operating on biofuel).

The Action Plan for the reduction of GHG emissions from buildings is presented in Table 28.

Table 28. Action Plan for reducing GHG emissions from the Buildings sector in Telavi

Sectors and Activities	Key Measures in Activities	Responsible Department, Person or Company (If a third party is involved)	Implementation Period (Start and End Dates)	Expected Energy Saving from each Measure (MWh/yr.)	Expected CO2 Reduction (T/yr.) from each measure	Cost of each Measure (GEL)
Municipal Buildings(MB)						
Activity MB1	Improve Thermal Insulation in Municipal Buildings					
MB 1.1	Thermal insulation of ceiling in the municipal buildings	Economic Policy Agency at the Telavi City Hall	2016	1 904	385	637 500
Activity MB 2	Mounting of efficient lighting systems in municipal buildings					
MB 2.1	Lighting system with LED bulbs in kindergarten	Economic Policy Agency at the Telavi City Hall	2016	63	6.5	3 150
Activity MB 3	Municipal Buildings Renewal					
MB 3.1	Thermal insulation of building's ceiling in Kindergarten	Economic Policy Agency at the Telavi City Hall	2015-2018	328.5	66.6	152 100
Activity MB 4	Application of renewable energy resources in hot water supply					
MB 4.1	Application of solar collectors in kindergarten	Economic Policy Agency at the Telavi City Hall	2015-2020	226.8	45.8	135 900
MB 5.1	Application of high efficiency heat generator operating on bio-waste in municipal buildings	Economic Policy Agency at the Telavi City Hall	2015-2020	961.2	194.4	216 000
Residential buildings (RB)						
Activity RB 1	Install Efficient Lighting Systems					
RB 1.1	Install 1 energy efficient bulb in each flat of 7 residential buildings	Economic Policy Agency at the Telavi City Hall	2015-2017	45.4	4.3	1 890
Activity RB 2	Residential Buildings Renewal					
RB 2.1	Add thermal insulation in shared areas of residential buildings	Economic Policy Agency at the Telavi City Hall	2016	88	18.8	7 245
RB 2.2	Energy efficiency measures (roof thermal insulation, reduction of infiltration) in 2-story typical private houses	Investor and owner	2015-2020	16 886	3 360	2 301 600
RB 2.3	Promoting the use of renewable energy (solar collectors) in 2-story typical private	Investor and owner	2017-2020	210	420	1 300 000

	houses					
Total				20 713	4 501	4 755 385

Measure MB 1.1. Roof thermal insulation in municipal buildings (Telavi Student Youth House)

The thermal insulation of ceiling or the roof in the residential building makes it possible to reduce heat losses by 20-30%.

Based upon the results of energy audit, the introduction of mentioned above thermal insulation measures is planned in a number of municipal buildings, among them in the Telavi Student Youth House.

As a result of implementing this measure the expected annual energy saving from the roof of the Youth House will make 14 184 KWh, equivalent to the reduction of CO_2 emissions from the building by 2.87 t/yr.

The annual saving of natural gas will be equal to 14 184 / (0.9 x 8) = 1 970 m^3/yr. Considering the price on gas this will result in the annual saving of 1 970 x 0.9 = 1 773 GEL.

The amount of investment required for the thermal insulation of the roof equals to 190 x 25 = 4 750 GEL.

The measure foresees to carry out the same measure in all active/functioning municipal buildings except kindergartens, for which the measures are planned separately. Total area of such buildings amounts to about 25 500 m^2. Profitability parameters of measure MB 1.1 are given in Table 29.

Table 29. Profitability parameters of measure MB 1.1.

Measure	Investment Cost GEL	Payback PB	Internal Rate of Return IRR, %	Net Present Value Quotient	CO2 reduction ton/yr.
Thermal insulation of roof 190 m^2	4 750	2.7	37	2.57	2.87
Total in municipal buildings 25 500 m^2	637 500	2.7	37	2.57	385

Measure MB 2.1. Lighting system with LED bulbs in kindergarten

The potential of energy saving has been defined by comparative analysis between incandescent and LED lighting systems.

As a result of implementing this measure in kindergartens the energy saving will make up 7 000 KWh/yr., being the equivalent in monetary terms of 7 000 x 0.138 = 966 GEL.

The investment demanded to install the LED bulbs equals to 35 x 10 = 350 GEL (1 bulb = 10 GEL) and the reduction of CO_2 emissions corresponds to 7 000 x 0.104 = 0.728 t/yr. The profitability parameters of measure MB 1.2 are given in Table 30.

Table 30. Profitability parameters of measure MB 1.2

Measure	Investment Cost GEL	Payback PB	Internal Rate of Return IRR, %	Net Present Value Quotient	CO_2 reduction ton/yr.
Equipping lighting system with LED bulbs in 1 kindergarten	350	0.4	272	6.1	0.73
Equipping lighting system with LED bulbs in 9 kindergarten	3 150	0.4	272	6.1	6.55

Measure MB 3.1. Thermal insulation of building's ceiling in kindergarten

The energy saving as a result of this measure was calculated with the ENSI computer program and for the kindergarten located at 24(A) Alazani Avenue equals to 36 499 KWh annually with the equivalent CO_2 emission reduction of 36 499 x 0.202 = 7.4 t/yr.

In case of using natural gas as a source of energy its annual spending will amount to 36 499 / (8 x 0.9) = 5 069 m^3/yr. Accounting for the price of gas the annual expenses will be 5 069 x 0.9 = 4 562 GEL. The investment necessary for thermal insulation of the ceiling equals to 676 x 25 = 16 900 GEL. Profitability parameters of measure MB 3.1 are given in Table 31.

Table 31. Profitability parameters of measure MB 3.1

Measure	Investment Cost GEL	Payback PB	Internal Rate of Return IRR, %	Net Present Value Quotient	CO_2 reduction ton/yr.
Thermal Insulation of building's roof for one kindergarten	16 900	3.7	27.0	1.59	7.4
The same measure for 9 Kindergartens	152 100	3.7	27.0	1.59	66.6

Measure MB 4.1. Application of solar collectors in kindergarten

The solar energy collectors convert solar radiation into heat transferred then to water, which could be supplied to the building. The above-discussed measure aims to use solar collectors for supplying hot water to such municipal buildings as kindergartens.

In Telavi kindergartens on the average 4 000 liters of hot water are used daily, for the heating of which 24 907 KWh of energy is needed annually.

As it is known, the annual amount of solar radiant energy coming at 1 m^2 of horizontal surface in Telavi is equal to about 1 200 KWh. By orienting the surface of the collector perpendicular (90^0) to solar rays the received energy could be increased by 25% and may reach 1 500 KWh/m^2 yr. Considering that the efficiency of solar collector equals to 70%, the annual amount of energy obtained by this way could extend up to 1 050 KWh/m^2yr.in surroundings of Telavi.

In case of using vacuum solar collectors mounted at the roof of the building, a 24 m^2 total area could get annually 25 200 KWh of energy. The surface area of a standard solar collector is 2 $m^2$and it costs 1 300 GEL. In our instance 12 such collectors will be required, making total investment charges equal to 15 600 GEL.

To acquire the mentioned above amount of energy (25 200 KWh/yr) by burning the natural gas, it's demanded volume will be 25 200 / (8 x 0.9) = 3 583 m^3 costing 3 583 x 0.9 = 3 225 GEL. The reduction of CO_2 emissions in case of transfer to the clean solar energy will make 5.09 tons/annually.

The profitability parameters of the offered measure are given in Table 32. The use of solar energy for providing the hot water is envisaged in 9 kindergartens.

Table 32. Profitability parameters of measure MB 4.1

Measure	Investment Cost GEL	Payback PB	Internal Rate of Return IRR, %	Net Present Value Quotient	CO2 reduction ton/yr.
Hot water supply through solar energy	15 600	5.0	20.0	0.94	5.09
9 kindergartens	135 900	5.0	20.0	0.94	45.80

Measure MB 5.1. Application of high efficiency heat generator operating on bio-waste in municipal buildings (kindergartens).

The application of high efficiency heat generator operating on bio-waste is necessary to define optimal technical solutions, aimed at the further widespread introduction.

Average annual demand on energy for heating the kindergarten located in the building #24(A) Alazani Avenue amounts to 106 864 KWh/yr. The transfer from natural gas to biomass will result in the reduction of CO_2 emission by 106 864 x 0.202 = 21.6 tons annually.

In case of using natural gas its consumption for heating will equal to 106 864 / (8 x 0.9_ = 13 358 GEL/yr., costing under the present gas tariff 14 842 x 0.9 = 13 358 GEL/yr. If this amount of natural gas would be substituted with bio-fuel, its annual spending will be 106 864 / (4.7 x 0.9) = 25 263 Kg/yr., were 4.7 KWh/kg is the calorific capacity of 1 kg briquette of biofuel and 0.9 – the efficiency of heat generator (the pyrroles boiler).

Considering the price of a briquette (0.20 GEL/kg), the annual cost of biofuel makes up

25 263 x 0.20 = 5 053 GEL

Accordingly, in monetary terms, the annual saving will come to 13 358 – 5 053 = 8 305 GEL.

The implementation of this measure corresponds to the investment of 24 000 GEL for purchasing and installation of heat generator. The profitability parameters of MB 5.1 measure are given in

Table 33.

Table 33. Profitability parameter of measure MB 5.1

Measure	Investment Cost GEL	Payback PB	Internal Rate of Return IRR, %	Net Present Value Quotient	CO2 reduction ton/yr.
Substitution of natural gas with bio-fuel in 1 kindergarten	24 000	2.9	34.2	1.9	21.6
The same in 9 kindergartens	216 000	2.9	34.2	1.9	194.4

Measure RB 1.1. Installing one LED bulb in flats of 7 residential buildings

This measure is aimed at the distribution of one energy efficient bulb in each family living in pilot multi-apartment buildings (seven 9-story buildings) expected to be installed in a most frequently illuminated room where family members gather in the evenings and spend most of time.

The planned measure must be accompanied by the awareness raising activities among residents of pilot buildings about the features, as well as economic and ecological benefits of energy-efficient bulbs. It has to be noted that this measure will be implemented in the same residential buildings, in which the thermal insulation of entrances is planned.

The number of flats in the residential building was calculated on the example of 9-story standard one-entrance building, containing 9 x 3=27 flats / apartments. Consequently, in each building 27 LED bulbs will be distributed. In case of incandescent bulbs, if it is assumed that the annual consumption of each bulb is 365 x 10 x 0.1 = 365 KWh, their substitution by LED bulbs will reduce the consumption down to 146 KWh, saving 365 – 146 = 219 KWh of energy.

Total number of replaced in one building incandescent bulbs is 27, i.e. the energy economy will make 27 x 219 = 5 913 KWh and in 7 building this number will reach 5 913 x 7 = 41 392 KWh.

In monetary terms the saving per one building will constitute 5 913 x 0.138 = 816 GEL and for 7 buildings it totals 816 x 7 = 5 712 GEL, claiming the investment of 270 x 7 = 1 890 GEL.

The CO_2 emission cutback in 7 residential buildings will be 5 913 x 0.136x 7 = 4.3 tons/yr.

The profitability parameters of measure RB 1.1 are given in Table 34.

Table 34. Profitability Parameters of Measure RB 1.1.

Measure	Investment Cost GEL	Payback PB	Internal Rate of Return IRR, %	Net Present Value Quotient	CO_2 reduction ton/yr.

Lighting with energy-efficient bulbs in 7 buildings	1 890	0.3	297	6.74	4.3

Measure RB 2.1. Heat conservation of common spaces in seven 9-story residential buildings

The heat conservation measure incorporates the insertion of metal-plastic windows into each story of the entrances of 9-story buildings. The annual saving of energy by this heat conservation measure minimizing heat losses will amount to 88 MWh. The corresponding economy of natural gas makes up about 88 000 / (8.00 x 0.9) = 12 222 m^3, and the relevant emission reduction – 17.8 t/yr. In monetary expression this saving corresponds to 12 222 x 0.45 = 5 500 GEL per annum. According to this measure 9 x 1 x 7 =63 metal-plastic windows are to be installed each having a surface area of 1 m^2. The investment on these windows equals to 115 GEL / m^2 x 63 m^2= 7 245 GEL.

The profitability parameters of the measure RB 2.1 are given in Table 35.

Table 35. Profitability Parameters of Measure RB 2.1.

Measure	Investment Cost GEL	Payback PB	Internal Rate of Return IRR, %	Net Present Value Quotient	CO_2 reduction ton/yr.
Heat conservation of common spaces in residential buildings	7 245	1.3	75	6.23	18.8

Measure RB 2.2. Energy efficiency measures in private houses

Special programs developed for the population by Telavi City Hall intend the promotion of energy saving measures. Resulting from the energy audit conducted during the implementation of this plan two relatively cheap energy saving measures have been identified –thermal insulation of buildings and reduction of infiltration from the windows. Due to the draughts the room is cooled quickly and for its heating a large amount of energy is needed. The cool air flows into the room from gaps in doors and windows, while warm air is pouring out. Therefore, the hermeticity of doors and windows must be provided, allowing to save about 25-30% of energy necessary for heating the room. The application of relatively simple and inexpensive methods is available to coat the gaps and cracks on the doors and windows or to fill them with silicon, scotch or putty.

The annual saving of energy, resulting from these measures after the example of 2-story dwelling house at #8 Samachablo street, has been calculated using the ENSI computer program and turned to be 4 506 KWh with corresponding reduction of CO_2 emission by 0.9 t/yr. In monetary terms this economy is equivalent to 4 506 x 0.062 = 279 GEL per annum. This measure entails the sealing up with putting of windows on the total area of about 44 m^2 at the investment cost 2 GEL/m^2, resulting in overall expenses of 88 GEL.

As to the roof thermal insulation, the additional insulation of 2-story dwelling house, or the increase of roofing thermal resistance index from R=0.55 m^2deg/W to R=2 m^2 day/W, it will

save in this standard /typical house 9 566 KWh of energy annually, resulting in the reduction of CO_2 emissions by 1.9 t/yr. and in monetary terms saving of 9 566 x 0.062 = 593 GEL per annum. The expenses on investment and mounting works equals to 15 GEL/m^2, hence total investment will make up 122 m^2 x 15 GEL/m^2 = 1 830 GEL.

For the assessment of measure total cost it was assumed that it will be carried out in nearly 1 200 private houses. The profitability parameters of measure RB 2.2 are given in Table 36.

Table 36. The profitability parameters of measure RB2.2

Measure	Investment Cost GEL	Payback PB	Internal Rate of Return IRR, %	Net Present Value Quotient	CO2 reduction ton/yr.
Thermal insulation of roof in the typical private house (area of the ceiling 122 m²)	1 830	3.1	32	2.09	1.9
Reducing infiltration in typical private house (total area of windows 44 m²)	88	0.3	218	1.94	0.9
Thermal insulation of roofs in 1 200 private houses	2 196000	3.1	32	2.09	2 280
Reducing infiltration in 1 200 private houses	105 600	0.3	218	1.94	1080

Measure RB 2.3. Promoting the use of renewable energy in private houses

Such kind of activity is examined in the Measure MB 4.1 aimed at the use of solar collectors for the provision of hot water supply in kindergartens. Taking into consideration that the efficiency of solar collector equals to 70%, in Telavi conditions it is possible to get 1 050 KWh/m^2yr of energy annually in the absolutely clean form.

The standard solar energy collector has an area of 2 m^2 and costs 1 300 GEL. In our case each household will require 1 such collector and consequently the investment will make 1 300 GEL. The annual income/entry of energy per 1 collector is 1 050 x 2 m^2 = 2 100 KWh/yr.

To obtain this amount of energy from the combustion of natural gas, its required amount will be 2100 (8 x 0.9) = 292 m^3 costing 292 x 0.45 = 131 GEL. In case of transferring from natural gas to solar energy the reduction of CO_2 emission will be comprise 0.42 tons annually. The profitability parameters of offered measure are given in Table 37. The use of solar energy for the hot water supply is proposed in at least 100 households.

Table 37. Profitability Parameters of Measure RB 2.3.

Measure	Investment Cost GEL	Payback PB	Internal Rate of Return IRR, %	Net Present Value Quotient	CO2 reduction ton/yr.
Hot water supply through the solar energy, 1 household	1 300	10	9.3	0.09	0.42

1 000 households	1 300 000	10	9.3	0.09	420

5. STREET LIGHTING

5.1. Overview of the sector

In Telavi there are 165 streets and 109 impasses requiring lighting. Besides there are a lot of remarkable sites (Telavi Historic Museum, the Telavi Fortress, Telavi Theatre, etc.) which are illuminated outside.

Figure 141. Illuminated sights of Telavi

The energy consumption and expenses on street lighting in Telavi in 2014 are given in Table 38.

Table 38. Energy consumption and expenses of the Telavi Street Lighting sector in 2014

Infrastructure Units	Electric energy consumption (KWh)	Expenses, GEL
Telavi street lighting*	1 660 263	265 642.08
Other	173 770	27 803.20
Total	1 834 033	293 445.28

** Expenditure on the illumination of Telavi buildings, cultural monuments and other sights*

As it comes from the Table, in 2014 the consumption of electric energy by the Telavi street lighting system amounted to about 1.8 million KWh, costing more than 293 thousand GEL. All in all 5 065 streetlights are installed in the streets and squares of Telavi, the types and energy consumption of which are shown in Table 39.

Table 39. Types, features and number of streetlights applied in the Telavi street lighting system in 2012.

#	Existing lantern	Features		Number
		Capacity, W		
Street lighting				
1	Eco 85	85	688	85
2	LED	90	74	90
3	Metal-halogen - 70	70	218	70
4	DHaT-150	170	953	170
5	DHaT-250	290	341	290
6	DPA-250	290	184	290
Total street lighting				**2 570**
Decorative illumination of buildings				
1	LED (18 WT)	18	1 295	18

2	LED	18	412	18
3	LED	18	788	18
4	DHaT	84	112	84
Total				**2 495**
Grand total of streetlights				**5 065**

5.2. Methodology

In 2014 total number of Telavi streetlights comprised 5 065 units. The baseline scenario reflects the actual data on the number of lanterns in 2014, while till 2020 foresees the lighting of remaining streets, which up to now make only 10% of the total number of streets. Under this assumption total number of lanterns / lamps by 2020 will be 5 572. While constructing the baseline scenario it is assumed that the additional lamps will be non-energy efficient.

5.3. Base year (2014) inventory and GHG emissions baseline scenario (2015-2020)

In 2014 the consumption of electric energy by the street lighting system made up 1.66 GWh, being the equivalent of 172.7 tons of GHG emissions in CO_2 eq.

The value of emission factor for electricity is taken equal to 0.104 tCO_2/MWh that is grid average emission factor for 2014.

According to baseline scenario the energy consumption by street lighting will grow in future and by 2020 will make up 2.19 GWh, accompanied by the annual emission of CO_2 to 2020 equal to 228 t.

5.4. Emissions Reduction Action Plan for the Telavi Street Lighting Sector.

As it could be seen from Table 32, sufficiently high proportion of existing in Telavi streetlights is inefficient. The main idea of Action Plan consists of total substitution to 2020 of remaining inefficient bulbs with energy efficient LED lamps.

In Table 40 the number of existing inefficient streetlights is given versus the number, types, capacity and luminosity of lamps, which are to replace them.

Table 40. Existing in Telavi streetlights and their substitutes by their number, types, capacity and luminosity.

#	Existing streetlights				Substitute LED streetlights				
	Streetlight type	Number	Capacity, W	Total capacity, KW	Streetlight type	Number	Capacity, W	Total capacity, KW	Luminosity, Lm
Street lighting									

1	Eko-85	688	85	58.5	OCR54	688	54	37.2	5 700
2	Днат-150	953	170	162.0	OCR96	953	96	91.5	10 200
3	Днат-250	341	290	98.9	OCR96	341	96	32.7	10 200
4	Дрл-250	184	290	53.4	OCR96	184	96	17.7	10 200
	Total	**2 166**		**362.6**		**2 166**		**179.1**	
Buildings illumination									
1	Днат-70	112	84	9.4	OCR54	112	54	6.05	5 700
	Total;	**2 278**		**371.9**		**2 278**		**185.15**	

It is implied that the execution of the measure will start in 2016 and the existing for that time 2 501 inefficient streetlights will be gradually replaced by LED lamps in the period of 2016-2020, accompanied by the lighting with efficient bulbs of the remaining 10% of city streets. The total number of streetlights to be replaced is 2 924. Under the assumption that the substitution of one lamp on the average costs 320 GEL, the total expenditure on the measure makes up to 1 million GEL.

Along with the decrease of required active capacity during the application of LED lamps the loading losses in transformers and transmission lines are reduced as well.

The graph below (Figure 15) demonstrates GHG emissions in case of baseline scenario and in conditions of using LED lamps for streetlights, suggesting this measure as a priority activity of SEAP in this sector.

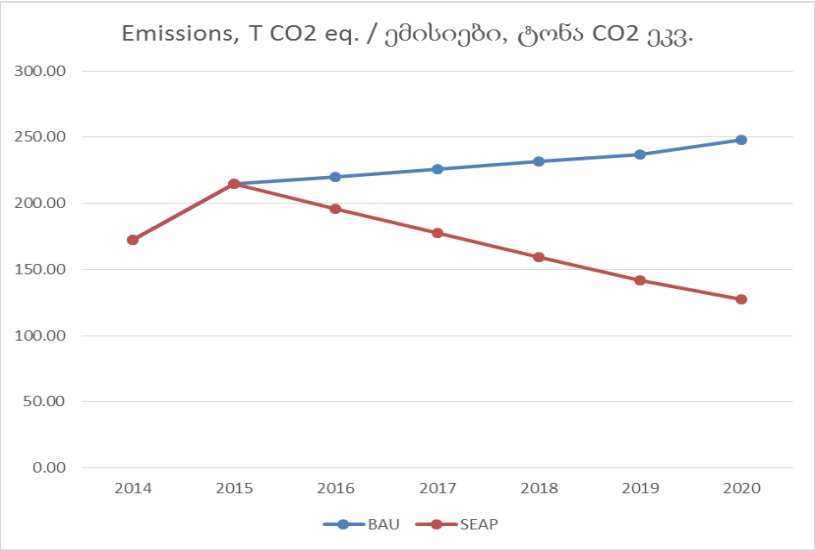


Figure 15. The CO_2 emissions from street lighting sector in case of BAU scenario and the SEAP scenario for Telavi

The next graph (Figure 16) clearly indicates the advantages of introducing this measure to the Telavi energy consumption sub-sector.

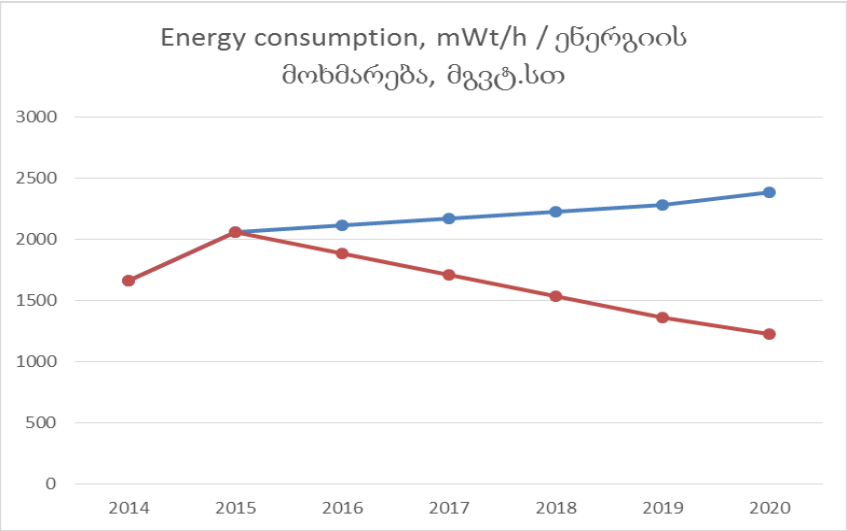


Figure 16. Energy consumption by the Telavi street lighting system in case of BAU scenario and the SEAP scenario

6. GREENING

6.1. The Existing Situation

As it has been mentioned in the Introduction, in 1940-es the Telavi planning and reconstruction project was developed and implemented, the authors of which-architects Nikolaishvili, Mindorashvili and Gogolashvili have designed the greening of streets as well[19]. The arrangement of different infrastructural sites has begun in Telavi, among them borders, lawns and squares, the greenery has been planted.

As of 2015 31% of the total area of the city (1 285 ha) is occupied by vegetation totaling 400 ha, from which 80 ha are covered with joined canopy trees. The mentioned 400 ha include greenery areas in recreation zones (50 ha), cemeteries (40 ha), yards of the residents and other sites (310 ha) (Table 41).

Table 41.Greenery areas of Telavi (as of 2015)

#	Green cover area	Greenery area, ha	%
1	Recreation zones (forest-park, parks, squires, lawns)	50	13
2	Cemeteries	40	10
3	Different sites in the city (personal plots, adjoining to buildings, slopes, suburbs)	310	77
The green cover		400	100
1	Including area of fragmentary verdure	320	80
2	Joined canopy planting	80	20

Up to 14 different recreation zones are disposed within the limits of the city, in particular 3 forest-parks, 2 parks and 9 squires, listed in Table 42.

[19]Rcheulishvili L., Telavi, 1963 (in Georgian)

Table 42. Telavi recreation zones and their areas

Name of the site	Covered by greenery area, (ha)
Forest-parks	
Leonidze str. (the Gigo hall)	19
Georgian University str. (Zuzumbo Forest-park)	21
Cholokashvili str. (Dabakhnebi)	1.5
Parks	
Kadoristr (Kadori park)	0.75
Biberakhi str. (Nadikvari Park)	2.9
Squares	
Tbilisi Freeway	0.7
Rustaveli str. (Luchita Square)	0.065
Rustaveli str. (Platanus Square)	0.55
Rustaveli str. (Batoni spring)	0.75
Erekle II str. (Old garden)	1.9
Erekle II str. (New garden)	0.75
T. Bagrationis str. (Gvtaeba Square)	0.095
Cholokashvili str. (April 9 Square)	0.085
I. Chavchavadze Ave. (Matsantsara Square)	0.095
Total	50.1

While reviewing the green cover of Telavi, first of all the year of 2012 should be mentioned, when a devastating storm has destroyed or damaged many kinds of tress (linden, horse-chestnut, cedar, etc.) leaving the city full of uprooted and broken plants. As a result of this natural disaster up to 390 m^3 of damaged perennials were cut down in the city. Later on, in 2013 the mass drying of pine has started, resulting in logging about 400 m^3 of dried pine-trees. At present the mass drying of pine continues to spread in Telavi recreation zones (about 50% of total pine coverage, i.e. 36 ha). It is urgently necessary to cut down all dried trees (being the hot-beds of the spread of diseases) and to plant new trees at their place.

In general the state of recreation zones in Telavi is unsatisfactory. In particular, firstly the situation in forest-parks should be mentioned, the planting of which has begun in 1930-1940-es, mainly focusing on pine-trees. Nowadays, the state of affairs at the territory of forest-parks is sufficiently grave. Especially unsatisfactory are conditions in the squares adjoining the Tbilisi Freeway (planted in 1960-1970-es, 0.7 ha) and Matsantsara (planted in 1970, 0.095 ha), while the conditions could be considered as satisfactory at the remaining sites:

- Kadori str. (Kadori Park), planted in 1960-1970 and present state is satisfactory (0.75 ha);
- Biberach str. (Nadikvari Park), planed first in 1920-1930, further reconstructed in 1970-1990-es. Latest reconstruction was carried out ii 2005-2012. At present the state of the park is satisfactory (2.0 ha);
- Rustaveli str. (Lukhuta Square), 1990-1995. At present the square is in satisfactory condition (0. 065 ha);
- Rustaveli str. (The Platanus/Plane Square), 1980-1985. Reconstruction in 2012. At present the state of the Square is satisfactory (0.55 ha);

- Erekle II str. (Old garden); Latest reconstruction carried out in 2005-2012. Present state is satisfactory (0.75 ha);
- T. Bagrationi str. (Gvtaeba square), reconstructed in 2005-2012. Present state is satisfactory (0.095 ha);
- Cholokashvili str. (April 9 Square), planted in 1992. Latest reconstruction – in 2012. Present state is satisfactory (0.085 ha).

Thus, from the listed above data it could be derived that from the total area of recreation zones (50 ha) the conditions at 37.4 ha (75% of total area) are unsatisfactory and at the remaining 25% (12.6 ha) the conditions are relatively better.

During the assessment of carbon stocks in the Telavi green zones and the potential of carbon deposition, the losses of carbon due to different causes were considered. Particularly, in case of Telavi, along with circumstances mentioned above, the losses in biomass, associated with trimming of trees were taken into account.

In this respect the spring of 2015 should be mentioned separately, when the plane-trees were trimmed across the city and as a result 80 m^3 of timber has been purveyed.

At the Telavi green areas main stocks of carbon are accumulated in different kinds of perennial arboreal plants, listed in Table 43.

Table 43. Areas of dominant arboreal plants in the Telavi green cover

№	Spices	ha	%
1	Pine	72.0	18
2.	Linden	68.7	17
3	Horse chestnut	59.7	15
4	Platanus/Plane	35.7	9
5	Cedar	33.9	8
6	Walnut	17.5	4
7	Other kinds	112.5	29
	Total	400.0	100

For the last 25 years no large-scale planting of arboreal kinds was carried out and is not planned yet. Taking into account the fact that since 2012, due to the described above causes the Telavi greenery is declining rapidly, the city faces a necessity for the mass planting of additional green cover. Considering this fact the planting of 2 ha of greenery annually till 2020 is planned in the frame of Telavi SEAP. As a result of this activity by 2020 the recreation zone of the city will be enlarged by 10 ha covered with various species acceptable for local conditions.

The carbon accumulation and absorption potential of the Telavi recreation zones' green cover was assessed using the IPCC 2003 methodology. As to the sequestration potential after carrying out of greening activities in the city, it was evaluated on the basis of CO2FIX model.

Base year accumulated carbon and absorption potential for the Telavi existing green cover

6.2. Methodology

The calculation of carbon accumulated in Telavi green cover and its annual accretion was performed using the IPCC methodological Guidelines. The calculations were conducted for so called "Live biomass" (including the underground biomass). Carbon stocks in the green cover were calculated separately for joint canopy and fragmentary plants. The losses in biomass due to falling down and trimming are also considered in calculations. Namely, the following equations were used in computations:

1. Equation calculating carbon savings in live biomass (including the underground and above ground love biomass):

$$C_F = [V \bullet D \bullet BEF_2] \bullet (1+R) \bullet CF$$

Where
V is the wood volume, m^3/ha
D_ Absolutely dry wood volume weight, tons of dry mass/ m^3;
BEF_2- Coefficient of converting commercial wood stock into the total stock of above-ground woody plants to get above-ground live biomass.
R_ Ratio of the trunk of a tree to its root mass;
CF_ Carbon content in dry substance/ ton C/ton dry mass.

2. Equations system to calculate annual increment in carbon stocks of biomass based upon the biomass accretion – decrease method (see Figure 15):

$$C_{F_{LB}} = (C_{F_G} - C_{F_L})$$

$$C_{F_G} = (A \bullet G_{TOTAL}) \bullet CF \qquad C_{F_L} = H \bullet D \bullet BEF_2 \bullet CF$$

$$G_{TOTAL} = G_W \bullet (1+R)$$

$$G_W = I_V \bullet D \bullet BEF_1$$

Figure 17. System of equations to calculate carbon accretion in biomass

Where
$C_{F_{LB}}$ is annual increase in carbon stocks due to biomass accretion, t C/yr.;
C_{F_G} –annual increase in carbon stocks due to biomass accretion, t C/yr.;
C_{F_L} –annual decrease in carbon stocks due to biomass losses, t C/yr.;
A- area covered by wood/plants;
G_{TOTAL}-average annual rates of total biomass increment, tone of dry mass/ha/year;

CF- share of carbon in biomass, t C/ton of dry mass;

G_W- aboveground biomass increment, t day mass;

I_V- biomass average annual increment, m^3/ha/year;

D- Absolutely dry wood volume weight, tons of dry mass/ m^3;

BEF_1- coefficient for converting average annual increment into the total aboveground biomass;

R-Ratio of the trunk of a tree to its root mass;

H- amount of annually purveyed timber volume, m^3/yr.;;

BEF_2- biomass increment coefficient for converting commercial wood stock into the total stock of above-ground biomass (including rind/bark).

Using the above given equations the carbon stocks in perennial plants of Telavi green cover and the annual sequestration of carbon have been determined.

6.3. Calculation outcomes

Since 2012 the greenery areas in Telavi underwent some changes, therefore calculations were performed for each year separately, considering the annual decrease in biomass.

As to the values of some coefficients used in calculations, they were taken from the Telavi Forestry taxation data, which correspond to the adjacent to the Telavi Municipality Forestry districts.

As the perennial arboreal plants in the Telavi green cover are represented both in joined canopy and in fragmentary forms, corresponding to both cases indexes were applied in computations. In particular, the data on average annual accretion and woody stocks were used from the taxation materials (see Table 44), while for the specific weight of the wood (D) the data on absolutely dry wood volume weight of the dominant species were taken from different reference sources. The values of other coefficients (BEF_1, BEF_2, Rand CF) were brought from the standard Tables of IPCC methodology, relevant to climate conditions of examined region.

Table 44. Indexes used in calculations and their sources

Main indexes applied in calculations	Used value of indexes	
	Fragmentary plants	Joint canopy plants
V- Tree stock m3/ha[20]	75	105
Iv- Woody plants (trees) mean annual increment, m^3 [21]	1.6	1.8
D - volume weight of totally dry wood, ton totally dry mass[22]		0.490

[20] "Land Use Planning „of Samegrelo Zemo-Svaneti Regional Department, 2008;

[21] Average taxation rates of Batumi wood and plants; Adjara Forest Inventory, 2004

"Global Wood Database" http:/datadryad.org; მახვილაძე ე. მერქანმცოდნეობა, თბილისი 1962; Боровников А.М., Уголев Б. Н., Справочник по древесине. «ЛеснаяПромышленность», Москва, 1989;

BEF_1- Coefficient for conversion of wood mean increment into total aboveground (including crown) mean increment [23]	1.15
BEF_2- Coefficient for conversion of commercial wood stock into the total stock of aboveground stock (including crown), for calculating aboveground living biomass.[24]	1.3
R - Ratio of root mass to trunk[25]	0.24
CF-carbon share in dry wood. [26]	0.5

Changes in Telavi green zones' biomass stocks due to natural hazards and trimming are given in Table 45.

Table 45. Changes in Telavi green zones due to the reduction of biomass stocks in 2012-2015.

Plants in the green zones	Area, ha	State to the beginning of the year				State to the end of the year		
		Biomass stock, m^3/1ha	Total stock, thousandm^3	Increment before the change, m^3/ha	Total accretion, thousand m^3	Reduction (due to natural hazards and trimming), thousandm^3	Changes in stocks considering the reduction, thousandm^3	Including stocks per 1ham^3/ha
2012								
Fragmentary plants	320.0	75	24.0	1.6	0.512	90	24.1	75.3
Joint canopy plants	80.0	105	8.4	1.8	0.144		8.5	106.2
Total	400.0	-	32.4	-	0.656	0.390	32.6	-
2013								
Fragmentary plants	320.0	75.3	24.1	0.6	0.192	-	24.3	75.9
Join canopy plants	80.0	106.2	8.5	0.8	0.064		8.6	107.5
Total	400.0		32.6		0.256		32.9	-
2014								
Fragmentary plants	320.0	75.9	24.3	1.6	0.512	0.400	24.6	76.8
Join canopy plants	80.0	107.5	8.6	1.8	0.144		8.7	108.7
Total	400.0		32.9		0.656	0.400	33.1	
2015								
Fragmentary plants	320.0	76.8	24.5	0.6	0.192	0.08	24.7	77.2
Join canopy plants	80.0	108.7	8.7	0.8	0.64		8.7	108.7
Total	400.0		33.2		0.256	0.08	33.4	

The calculations performed for 2011-2015 and obtained results are presented in Table 46 and Table 47, while the dynamics is shown in Table 48.

[23]Good Practice Guidance for Land Use, Land Use Change and Forestry, (IPCC 2003),Table 3A1.10,http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_files/GPG_LULUCF_FULL.pdf;
[24]Good Practice Guidance for Land Use, Land Use Change and Forestry, (IPCC 2003),Table 3A1.10;
[25]Good Practice Guidance for Land Use, Land Use Change and Forestry, (IPCC 2003),Table 3A1.8http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_files/GPG_LULUCF_FULL.pdf;
[26]Good Practice Guidance for Land Use, Land Use Change and Forestry, (IPCC 2003).

Table 46. Carbon stocks in Telavi green zones in 2012-2015

Plants in the green zones	Area, ha	Biomass stockm^3/ 1ha	D	BEF_2	(1+R)	CF	Total carbon stock, thousand t C
2012							
Fragmentary plants	320.0	75.3	0.490	1.3	1.24	0.5	9.5
Joint canopy plants	80.0	106.2					3.3
Total	400.0						**12.8**
2013							
Fragmentary plants	320.0	76.5	0.490	1.3	1.24	0.5	9.6
Joint canopy plants	80.0	108.7					3.4
Total	400.0						**13.0**
2014							
Fragmentary plants	320.0	76.8	0.490	1.3	1.24	0.5	9.7
Joint canopy plants	80.0	108.7					3.4
Total	400.0						**13.1**
2015							
Fragmentary plants	320.0	78.1	0.490	1.3	1.24	0.5	9.8
Joint canopy plants	80.0	110.0					3.5
Total	400.0						**13.3**

Table 47. Changes in carbon stocks taking place in Telavi green zones in 2012-2015

Coverage by plants	Area, ha	Increment, m^3/ha	D	BEF_1	(1+R)	CF	Total increment, t C	Decrease (due to natural hazards and trimming) thousand m^3	D	BEF_2	CF	ნახშირბადის კლება, Carbon decrease t C	Increment –decrease; Total increment, t C
2012													
Fragmentary plants	320.0	1.50	0.490	1.15	1.24	0.5	167.7	390	0.49	1.3	0.5	**124.2**	**90.4**
Joint canopy plants	80.0	1.68					46.9						
Total	400.0						**214.6**						
2013													
Fragmentary plants	320.0	1.53	0.490	1.15	1.24	0.5	171.0	-	-	-	-	-	**218.8**
Joint canopy plants	80.0	1.71					47.8						
Total	400.0						218.8						
2014													
Fragmentary plants	320.0	1.49	0.490	1.15	1.24	0.5	166.6	400	0.43	1.3	0.5	**111.8**	**101.5**
Joint canopy plants	80.0	1.67					46.7						
Total	400.0						**213.3**						
2015													
Fragmentary plants	320.0	1.48	0.490	1.15	1.24	0.5	165.4	80	0.60	1.3	0.5	**31.2**	**180.9**
Joint canopy plants	80.0	.67					46.7						
Total	400.0						212.1						

Table 48. Stocks of carbon accumulated in the Telavi green cover and the dynamic of its annual variation.

Parameter	Carbon stocks, tC/yr			
	2012	2013	2014	2015
Carbon accumulated in Plants	12 800	13 000	13 000	13 300
Annual increment of carbon in plants (considering accretion – decrease)	90.4	218.8	101.5	182.1
Total accumulated in plants	12 890.4	13 218.8	13 201.5	13 482.1

As it is seen from the Table, the carbon stocks to 2015 have increased by 4.6%. In assessing the potential of carbon accumulation in the Telavi green cover it was taken into account that trimming of trees in the city usually occurs once in about 5 years (piling nearly 80 m^3 of wood). Hence, the annual procurement of wood in the city has been taken equal to about 15 m^3. Later on, this value was considered while assessing the carbon deposition potential in the Telavi greenery up to 2020. The obtained results are given in the Summary of the Report.

6.4. Measures planned within the framework of the Action Plan

- CO2FIX V3.1. Model general overview and data calculated by the model.

The model has been developed under the project CASFOR II, which was financed by the European Commission programme INCO2. The project was additionally financed by the Ministry of Agriculture, Nature Management and Fishing of the Netherlands and the National Council on Science and Technology of Mexico (CONACYT).

The model CO2FIX V3.1 determines the amount of carbon accumulation in the nature using the called "Accounting Method" of carbon stock-taking. In particular, the model calculated changes in carbon stockpiles, taking place for the specific span in all carbon "reservoirs" existing in the forest. (The carbon "reservoir" is considered to be that part of the ecosystem where the accumulation of carbon is taking place – the living biomass, litter, organic soils and produced timber resources).

In the model CO2FIX V3.1 the calculations are performed for one year and one ha scale in existing 6 main modules:

1. Biomass module;
2. Soil module;
3. Produce of timber resources module;
4. Bioenergy modules;
5. Financial module;
6. Carbon credits accounting module (for CDM).

According to the model methodology, the carbon accumulation volume (CTt) in each (t) period is calculated as follows:

CTt = Cbt +Cst + Cpt (Mg C/ha), where
Cb_t - Total amount of carbon in underground and above-ground biomass of a plant (Mg C/ha);
Cs_t - Carbon stocks in organic soils (Mg C/ha);

Cp_t -Carbon stocks of woody products obtained from forestry works (Mg C/ha).

The structure of the model is given on the Figure 18.

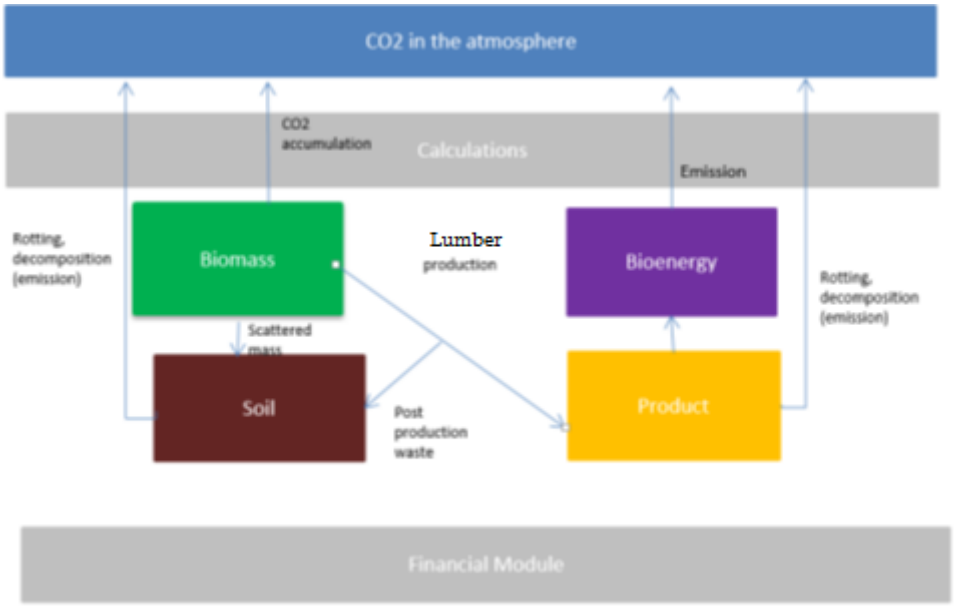


Figure 18. Model Structure

Two counting modules – biomass and soil modules have been applied to calculate accumulation potential as a result of greening activities.

Biomass module: The biomass module uses a "Cohort System" for calculations. Cohorts comprise one or various groups of woody plants. Growth, drying and other features separately characterize each cohort species.

As an example the values of the main coefficients used in 2014 calculations are given in Table 49.

Table 49. Values of indexes used in the biomass module for the project scenario in Telavi

Indexes used in the Biomass Module	Value of the index
Carbon content	0.5 t.C /t dry mass
Wood density t dry mass/m³	
Maple	0.655
Plotinus orientalis	0.720
Ash	0.645
Horse Chestnut	0.680
Linden	0.550
Cypress	0.540
Cedar	0.470
Initial carbon stocks	0 t C/ha
Growth correction factor	1
Turnover rate of phytomass	
Coniferous:	

Needles	0.3
Branches	0.04
Roots	0.03
Deciduous:	
Leaves	1
Branches	0.05
Roots	0.08

Soil module: The Yasso model is applied to determine carbon dynamics in soil. (http://www.efi.fi/projects/yasso/). The model (included into CO2FIX system) describes carbon decomposition and its dynamics in dry soil. It is calibrated for detection of total carbon stock in any soil layers. This model is suitable for coniferous, as well as for deciduous forests, and was tested in different countries with dissimilar climate zones to describe the influence of specific climate conditions on the decomposition process of the fallen leaves and branches.

Measure planned within the framework of the Action Plan

The planned measure implies planting of greenery at different sites of the city, including the recreation zones damaged by natural hazards in 2012 (total span of activities includes 5 years). In particular, saplings will be planted annually at the total area of 2 ha, resulting in the addition by 2020 of 10 ha of green cover to the city, from which 40% will be the dense planting (5 ha) and the remaining-fragmentary planting at different sites in the city.

Thick planting with the joined canopies will be undertaken mainly in the suburbs of Telavi, e.g. at the territory adjoining the western entrance to Telavi, on the western slopes of Telavi Ravine. Fragmentary plantings predominantly will occupy parks, forest-parks and squares on places devastated by the storm in 2012.

While designing the planting, the adequate selection of kinds of trees and bushes is an important issue. The right selection of trees requires taking into consideration of such elements as the type of soil and climate conditions, as well as the potential of CO_2 removal by the greenery and resistance to the exhaust gases. In case of Telavi, while selecting the verdure, the plants having good indices of development in local conditions were given the preference. These are: linden, horse-chestnut, cedar, cypress (being sparsely represented now in the green zone of the city) and the plane (platanus). It should be mentioned here that in spite of its allergic property, the plane-tree was included in the list due to its good potential of the development in Telavi environment and climate conditions, resistance to the wind and high ability of CO_2 removal from the atmosphere. And so it's advisable to plant this tree in small numbers away from the downtown, in suburbs of the city. At the same time, for enriching the biodiversity of Telavi green zones, the planting of maple and ash has been planned as well which are well suited to the Telavi natural conditions.

Considering the fact that at 1 ha of selected for planting territory 40% of area will be covered by thick planting and the remaining space-by fragmentary greenery, in total 1950 saplings will be needed to plant 1 ha of selected area.

It should be mentioned that for the implementation of described above activities the planting design must be developed, the necessary components of which are: schemes of planting, list of greenery selected for introduction and budget of all activities. The estimated spending related

with the conduction of planned measures at the project territory in the first year of activity are given in Table 50.

As it should be seen from the Table, the total price of planned measures estimated per 1 ha of project territory makes 30 915 USD. The values of carbon sequestration resulting from planting are given on the Figure 19, and the dynamics of carbon stockpiling are demonstrated on the Figure 20.

Table 50. Budget of scheduled activities per 1 ha of project territory

№	Description of expenditures	Site unit	Price of Unit (US $)	Total amount	Total price (US $)
I. Core expense					
1.	**Field activities**				
1.1	Cleaning of area from shrubs, offshoots, etc.	ha	300.0	1.0	300.0
1.2	Marking of area and digging	sapling	0.40	1950	780
1.3	Purchase of saplings	sapling	15.0	1950	29 250
1.4	Planting saplings	sapling	0.20	1950	390
1.6	Watering saplings	sapling	0.10	1950	195
	Total (USD)				**30 915**

	Sequestered Carbon Planting of ...	Sequestered Carbon Planting of ...		Sequestered Carbon Planting of ...	Sequestered Carbon Planting of ...		Sequestered Carbon Planting of ...	Sequestered Carbon Planting of ...
year [yr]	carbon [MgC/ha]	CO2 equiv. [MgCO2eq...	year [yr]	carbon [MgC/ha]	CO2 equiv. [MgCO2eq...	year [yr]	carbon [MgC/ha]	CO2 equiv. [MgCO2eq...
0	0.08	0.30	17	43.84	160.75	34	82.12	301.12
1	2.58	9.48	18	46.30	169.78	35	84.12	308.45
2	5.13	18.80	19	48.74	178.72	36	86.09	315.65
3	7.71	28.27	20	51.15	187.56	37	88.02	322.72
4	10.30	37.78	21	53.54	196.32	38	89.91	329.68
5	12.91	47.33	22	55.91	204.99	39	91.78	336.51
6	15.52	56.91	23	58.25	213.57	40	93.61	343.24
7	18.13	66.49	24	60.57	222.07	41	95.41	349.84
8	20.75	76.09	25	62.86	230.49	42	97.18	356.34
9	23.37	85.68	26	65.13	238.79	43	98.93	362.73
10	25.98	95.26	27	67.36	246.97	44	100.64	369.02
11	28.58	104.79	28	69.56	255.04	45	102.33	375.20
12	31.16	114.27	29	71.72	262.99	46	103.99	381.30
13	33.74	123.70	30	73.86	270.83	47	105.64	387.33
14	36.29	133.07	31	75.97	278.56	48	107.26	393.29
15	38.83	142.39	32	78.05	286.18	49	108.87	399.18
16	41.35	151.62	33	80.10	293.70	50	110.45	404.99

Figure 19. Sequestration of carbon and CO_2 removal per 1 ha of selected territory

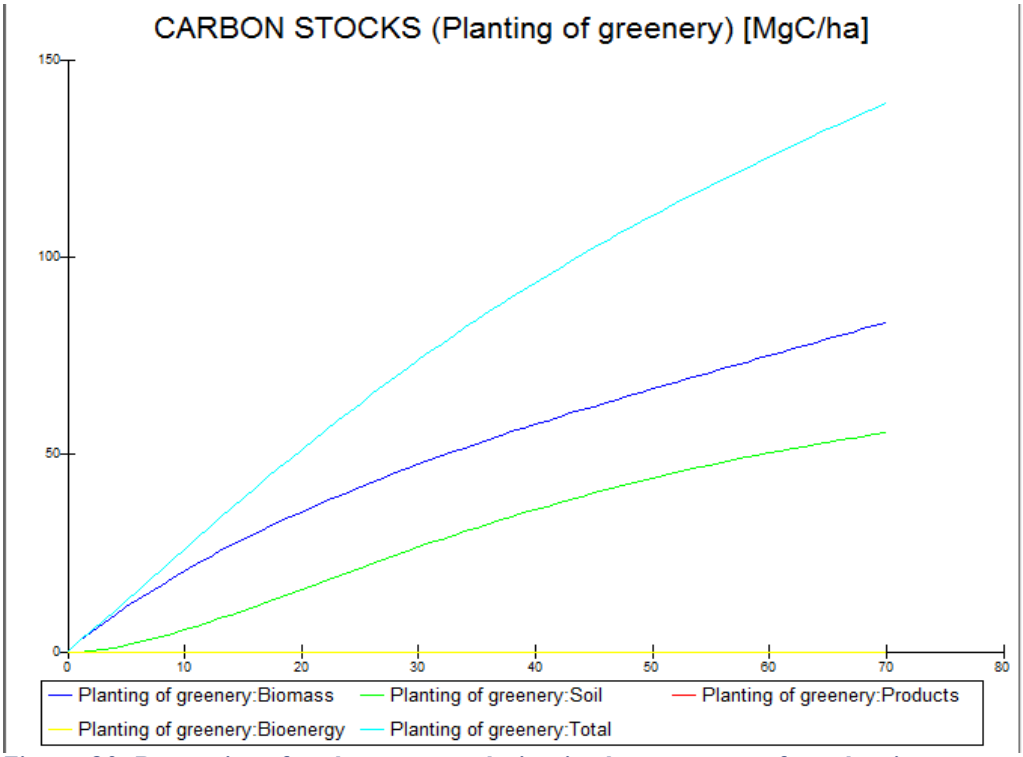


Figure 20. Dynamics of carbon accumulation in the greenery after planting

From the model calculations described on Picture 3, it comes that in the first year of planned planting 5.2 tons of carbon will be accumulated at the area of 2 ha. The dynamics of carbon sequestration at the gradually growing by 2 ha territory, reaching to 2020 a bench-mark of 10 ha is given in Table 51.

Table 51. Values of annual accumulation of carbon

Accumulated carbon, tC	2016	2017	2018	2019	2020
	5.2	10.4	15.4	20.6	26.0
		5.2	10.4	15.4	20.6
			5.2	10.4	15.4
				5.2	10.4
					5.2
Total annual deposition, t C	5.2	15.6	31.0	51.6	72.4
Annual removal of carbon dioxide, t CO_2	19.1	57.2	114.0	189.2	265.5

Obtained results

Table 52. Carbon accumulated in the Telavi green cover and carbon deposition potential resulting from the planned greening activities

	Annual accumulation of carbon, t C								
	2012	2013	2014	2015	2016	2017	2018	2019	2020
Carbon deposition in the green zones of the city (without taking additional measures)	12 890.4	13 218.8	13 201.5	13 482.1	13 663.0	13 843.9	14 024.8	14 205.7	14 386.6

Annual accumulation of carbon resulting from the additional greening of 10 ha in the city	-	-	-	-	5.2	15.6	31.0	51.6	72.4
Total	2 890.4	3 218.8	3 201.5	3 482.1	3 668.2	3 859.5	4 055.8	4 257.3	4 459.0
Corresponding amount of removed (sequestered) carbon dioxide, thousand t CO_2	47.3	48.5	8.4	49.4	50.1	50.8	51.5	52.3	53.0

7. AWARENESS RISING AND STAFF TRAINING STRATEGIES

The sustainable development of the energy sector is a field in which the national and local levels play equally important roles. Raising public awareness for renewable energy development and energy efficiency requires a complex and multilateral approach, and a relevant communications strategy. This is one of the most important components of the SEAP.

The SEAP preparation process for the city of Telavi, recently adjoined to the CoM, clearly revealed potential barriers to the effective implementation of strategies. Therefore, an evaluation of all identified barriers and overcoming ways are necessary. An assessment has defined that in the process of strategy implementation mainly three types of barriers will be dealt with:

1. Country level barriers, linked to bad past practices (especially for public awareness);
2. Lack of knowledge related with technologies;
3. Barriers specific to Telavi context, as well as concrete project proposals and technology related barriers;

The record of these barriers is given below on the scheme:

Barriers to Sustainable Energy Development Process in Georgia

1. Wasteful energy consumption. During Soviet times when energy was cheap, consumption was almost unlimited;
2. Lack of awareness or knowledge about sustainable development among local policy-makers and general public. Only a few people are aware of sustainable development concepts, which are directly engaged in these activities.
3. Absence of a common vision of the relatively long-term prospects of the energy sector development (different target groups have sharply contrasting positions, which often are not based upon real calculations);
4. There is no joint, well-considered and formulated vision of the role of energy efficiency and renewable energy resources in a short and long-term perspectives of Georgia's energy sector while in recent years the 10% growth rate in energy demand is being recorded. Correspondingly the potential of these resources (except hydro) is not defined as well as the directions of the development of this potential, there is no relevant legislation and declared objectives similar to gasification of the country or hydro-energetics.
5. The technologies market is inferior and contains several risks. Each failure of a new technology and demonstration project is seriously damaging follow-up prospects of the development in this direction. The long-run planning of energy sector does not consider the availability of technologies;
6. Activities in the field of energy efficiency and renewable energies (except hydro) conducted by separate non-governmental organizations are mainly uncoordinated and non-purposeful. Though it should be mentioned that the raise in energy efficiency, despite its chaotic character, is going on in the century that is partly facilitated by the market of contemporary technologies (mainly of domestic profile) and intrusion in Georgia of energy standards, existing on the international level.

While identifying these barriers it has been considered that the managerial team of Telavi Municipality has a vision of sustainable energy development prospects, demonstrates great interest to the adoption of modern, clean, energy efficient and renewable technologies, but lacks relevant knowledge and experience in managing present-day technologies. However, often the support by the Municipalities is not fully reasoned out and lacks eyesight of what could be done at local level and how concrete measures could realized effectively.

Barriers to the Telavi Sustainable energy development

1. The Kakheti Region and the Telavi Municipality in particular are facing almost the same obstacles to sustainable energy development as other regions or municipalities in Georgia, among them self-governing cities like Telavi. From these barriers first of all their complete dependence on the centralized energy supply in energy sector and full reliance on the private sector concerning other energy carriers should be mentioned. This dependence on centralized processes partly deals with the gas supply sector, where

municipalities mainly rely on the processes determined by plans worked out under the central government guidance. As to the gasoline, diesel and other kinds of fuel, this is the prerogative of private importers. Correspondingly, at this stage municipalities have no vision on their roles in the energy planning process, as well as on the risks related with centralized supply and do not plant measures to lessen these risks and hazardous. This is especially characteristic to the new self-governing cities like Telavi, which gained this status in 2014;

2. The Telavi Municipality has no complete statistics on the energy consumption by the city that would serve as a basic for the planning of growing energy demand of the town. There is no vision and strategy to foresee the energy supply of the city in case of failure of one of present rings of energy provision. Accordingly, the town has no sufficiently thought out energy efficiency substantiation, determining its role in the process of sustainable socio-economic development of the city. There is no vision of what problems the town could face in case of rapid growth of economy and number of population, as well as intensification of traffic. The last item, and in particular, the absence of public transport, is a serious problem for Telavi;
3. The Telavi Municipality has no relevant experience, knowledge and no sufficient expert potential to plan, manage and implement the energy sustainable development process. In particular, in the short-run strategy for the energy sustainable development process in Telavi, one of the priority sectors is the transport sector. However, to secure the painless transfer to clean/low emission public transport a serious public awareness raising campaign should be undertaken to demonstrate advantages related with public transportation, setting up the parking system and introduction of some restrictions for private transport;
4. Very important is as well the absence of additional funds. Most of the budget resources are used for infrastructure growth and social projects, that hampers the development of long-term energy policies;
5. The energy resources consumption sphere is unmanaged and chaotic at the Municipalities level and entirely in the country as well.
6. In the case of Telavi more or less all those barriers are acute, which are typical and general for the whole country;

As it was mentioned above, one of the main priorities in the process of GHG emissions reduction and sustainable development of the city of Telavi is the creation of public transportation network (Transport sector), followed by the Buildings sector, which consumes the largest amount of energy per 1 m^2 of residential area among all other cities having the sustainable energy development plans. Accordingly the awareness raising should be focused on these sectors.

Apart of discussed above barriers related with the general development of local technologies, their import and dissemination, there are specific barriers concerning each concrete technology, which are to be envisaged in the process of SEAP implementation for the assessment of applied technologies.

Barriers related to Technologies

1. Lack of knowledge about modern energy-efficient and renewable technologies available at the international market. Only a few technologies are assessed and studied for their adaptation in Georgia that significantly increases risks related with their introduction in the country. Private banks and in private sector are not willing take upon these risks. Consequently, the import of technologies, their dissemination and adoption is almost totally in the hands of non-governmental sector or those big investors who are interested in developing markets for their own technologies. Accordingly, high technologies, which are imported at the limited scale, are accompanied with large part of worthless technologies. At the same time this is mostly promoted by the cost of technology and unfortunately even for the short-time prospective;
2. Lack of knowledge about the local environment, in which certain technology should operate (e.g. energy-efficient bulbs become absolutely ineffective and economically unprofitable within old and improperly functioning electricity networks). Studies of these aspects bring additional burden to technologies;
3. Lack of knowledge and awareness on environmental and social counter-indications. The study of technical risks associated with technologies requires profound understanding of technology by the accepting party to insure relevant assessment of risks and their minimizing;
4. Lack of sufficiently trained local personnel which could be able to select correctly certain technology with respect to local conditions and provide its proper operation. This problem is especially acute at the municipalities and self-governing cities level;
5. Most renewable technologies are not sufficiently flexible and easily, adaptable to different environments. Majority of them market shape and their adaptation to local conditions requires additional funding and knowledge;

The analysis of stakeholders in the frame of Telavi SEAP has identified target groups for awareness raising and retraining, active collaboration with which is necessary to overcome the majority of listed above barriers. However, it should be noted that there are common to the country obstacles, the overpassing of which will be extremely difficult without the serious intervention from the side of the central government.

The target groups engaged in the awareness raised process, to which this strategy is addressed are as follows: Telavi City Hall staff and members of Telavi City Council/Assembly, persons/groups involved in the transportation business, city of Telavi population and private sector representatives/developers participating in the Construction sector activity.

At the present stage the main priority of Telavi Municipality is the development of local public transport and, in general, the transportation sector. Therefore, for implementing the Action Plan it is necessary to plan and carry out such measures, which require to inform and raise awareness of mentioned above target groups on energy efficiency actions in the transport sector and prospects of its sustainable development. In its turn this will provide retaining of safe environment for the population and encourage the attraction of tourists in Telavi.

The second important for Telavi direction is the Buildings and Construction Sector. The audit of buildings in Telavi has revealed that the existing buildings (including the private houses) do not satisfy even minimum requirements on energy efficiency, significantly affecting the budget of

population. The construction standards are very low, necessitating active work in this direction with the population and developers/builders.
In general, it is essential to explain to population the objectives of SEAP and the positive social and economic sequels, which could be obtained in case of its successful implementation. At a certain stage this will require to carry out some behavioral changes among the population, so to achieve maximum support from its side it is vital to provide its engagement in the process of SEAP development. Global practice has demonstrated that the higher is population's involvement at the early stage of the process, the stronger is the management on implementation stage and the public support.

At the initial stage of SEAP development the meetings and consultations with the population of Telavi (among which, presumably, the most part of behavioral changes will be needed) will be necessary to explain the expedience and benefits of the project implementation. During the consultations new project ideas could arise or the necessity of making corrections in the planned projects may be revealed.

While developing the Telavi SEAP the meetings with the Telavi Administration were already held. It is to be underlined that just the stakeholders, acting in specific sectors, are owing the major part of information necessary to develop and carry out the SEAP and they represent the basis determining the success of the entire project.

In the process of Telavi SEAP implementation the awareness raising and local staff training strategy consists of the following steps:

Short-term Strategy (2015-2018)

1. Constantly informing local authorities on the trends of energy consumption in the city, advantages of efficient use of energy, as well as the social and economic benefits of this initiative;
2. Training the Municipality personnel and external human resources to ensure successful implementation and monitoring of the SEAP;
3. Provision of Telavi with technical staff which will guarantee the development of energy efficient/ low emission projects in Transportation sector;
4. Carrying out information –educational campaign to raise public awareness, especially on the advantages of public transport. Explaining benefits of private transport restrictions in promoting the development of tourism in Telavi;
5. Provision of population with minimal construction standards, explaining the follow up cutback of their energy expenses by introducing these standards;
6. Preparation of information/education/illustration materials about successful experiences and modern technologies that are recommended for the green development of cities; Demonstration to the population the advantages of the introduction in different sectors of energy efficient measures and technologies;
7. Providing the involvement of private sector in the implementation of SEAP by supplying them with information on energy efficient and economically beneficial technologies, offering programs on cooperation between public and private sectors.

Long-term Strategy (2018-2020)

The introduction of regulations would be necessary in the long-term strategy requiring changes in awareness and more significantly – in behavioral norms of the population. The main directions of long-term strategy are:

1. Initiation of consultations with stakeholders (city population, private sector, non-governmental sector) on limitation measures in the Transport sector and introduction of energy efficiency standards relative to buildings, which should be gradually implemented by the City Hall. On the basis of consultations with stakeholders the barriers should be identified which could arise in the process of introducing the restriction measures and various types of standards;
2. Development and implementation of awareness raising and incentive programs to ensure the unimpeded introduction of standards and regulations (e.g. in energy efficiency).

Telavi Municipality Strategy in the Staff Training and Awareness Raising Field to Provide the SEAP Successful Implementation

Main strategic goals	Key target groups	Measures to be implemented	Potential leading organization(s)	Outcome	Potential donors
Short-term strategic Goals (2015-18). The main objective of short-term strategy is to facilitate awareness raising of city administration on the prospects of city public transport sector sustainable development and its socio-economic benefits, as well as on the provision of city population by construction standards; Maximum provision of target groups with information and its awareness raising; Assist city population and other stakeholders in getting advantage from this initiative and prepare adequate staff to provide SEAP implementation and monitoring.	• Telavi Municipality & the City Council • Groups involved in motor-car business; • Telavi population; • Construction companies operating in Telavi		• Telavi City Hall • Coordinators of the Covenant of Mayors in Georgia (Ministry of Energy and Ministry of Environment and Natural Resources Protection) • Various local and international programs going on in the frames of CoM and LEDS preparation initiatives	• Implementation of Telavi SEAP proceeds successfully; • Telavi City Hall continues the same activity after 2018 • Telavi population is informed on activities initiatives by city administration in the frame of this process.	• Telavi City Hall • Coordinators of the Covenant of Mayors in Georgia (Ministry of Energy and Ministry of Environment and Natural Resources Protection) • Various Local and international programs going on in the frames of CoM and LEDS ; • International donors promoting climate change mitigation, renewables, energy efficiency and sustainable development processes.
1. Staff Training					
Training for Telavi technical staff, which will be able to assist target groups to prepare project proposals in energy efficiency and to implement them under the term of co-financing, allotted by Municipality.	• Telavi City Hall Technical Group; • Special Service set up at the City Hall (it could be Energy Efficiency Centre), which will serve the City Hall as well as population and private sector in preparing project proposals on buildings energy	• Technical group/ service should be set up under the auspices of Telavi City Hall which will benefit both the City Hall and relevant target groups in developing energy efficient projects and offering modern energy efficient technologies; • Training program should be worked out for the technical group which must include the analysis of modern	• Telavi City Hall • Private sector representatives from different countries,	• Program and manual are developed/prepared to train personnel of City Hall Technical Group; • Staff is trained and selected by the competition; • Technical Group is actively engaged in exchange programs and international networks for getting	• Telavi City Hall • EC-LEDS Project • USAID • GIZ • EU

	efficiency and implementing these measure.	technologies, study of barriers hampering their introduction and survey of advantages of different energy efficiency measures; • Preparation of manual for Technical Group; • Insertion of Technical Group in exchange programs and different information networks to gain international experience.		the latest information on modern technologies and approaches in Energy Sector; • Technical Group is actively cooperating with target groups in the process of implementing energy efficient measures.	
Development of construction norms/standards relevant to Telavi climate conditions and provision of availability of these norms for population and builders	• Telavi City Hall Technical Group; • Special Service set up at the City Hall (it could be Energy Efficiency Centre), which will serve the City Hall as well as population and private sector in preparing project proposals on buildings energy efficiency and implementing these measure.	• Telavi City Hall. Technical group should be provided with modern construction standards, relevant to Telavi climate conditions; • Technical Group should secure introduction of modern energy efficiency standards and materials at the territory of Telavi; • Development of training program for Technical Group. The program must include the analysis of modern technologies, study of barriers hampering their introduction and survey of advantages of different energy efficiency measures; • Preparation of manual for Technical Group; • Insertion of Technical Group in exchange programs and different information networks to gain international experience.	• Ministry of Economy and Sustainable Development of Georgia; • Energy Efficiency Centre; • Sustainable Development and Policy Centre	• Construction standards relevant to Telavi climate zone are developed; • Program and manual are developed for City Hall Technical Group to train personnel in construction standards; • Technical group is actively involved in exchange programs and international networks for getting the latest information on modern technologies and approaches in Energy Sector; • Technical Group is actively cooperating with target groups in the process of implementing energy efficient measures.	• Telavi City Hall • EC-LEDS Project • USAID • GIZ • EU • EBRD

Training for Telavi professionals who will be able to perform skilled work and set up recommendations for technically successful implementation of CoM process.	• SEAP group at the Telavi City Hall; • Special service set up by the City Hall (it could be Energy Efficiency Centre or Energy Manager) which will serve the City Hall as well as population and private sector with recommendations	• Creation at Telavi City Hall or beside it of special group/service, which will attend the City Hall in implementing SEAP and its monitoring, as well as cooperate with target groups in offering modern technologies; • Working out of program for training this group. This program should include, at least, information on sustainable energy, climate change mitigation measures, EU directives and barriers to implement CoM requirements; • Preparation of manual for this group; • Insertion of Technical Group in exchange programs and different information networks to get international experience; • Possible appropriate applicants for this group as far as possible should be involved in the SEAP development process	• Telavi City Hall; • Ministry of Energy; • Ministry of Environment and Natural Resources Protection; • Representative of CoM process in Georgia (at this stage – the Energy Efficiency Center)	• Program and manual are prepared to train in the personnel for City Hall SEAP group; • Rights and obligations of this group and its work program are clearly formulated envisaging both assistance to City Hall and cooperation with citizens and private sector; • SEAP group is actively involved in exchange programs and international networks to get the latest information on modern approaches in transport and construction sectors; • Technical Group is ready to train necessary personnel for private sector	• Telavi City Hall • EC-LEDS Project • USAID • GIZ • EU
2. Public awareness raising and information					
Maximal information of public and its awareness raising. As a result of this process the public should be well informed on social and economic benefits, which could be achieved in the process of energy sustainable development. Main concern of the City Hall	• Organization operating in the transportation sector (including private sector); • Non-governmental sector and other public associations; • Population of Telavi	• Preparation of information materials for organizations operating in transport sector on the measures and technologies which could improve the transport sector's performance and facilitate the development of public transportation; • Preparation of information	• Telavi City Hall • NGOs	• Population of Telavi is informed on measures to be taken by Telavi Municipality in Transportation Sector including the development of transport infrastructure;	• **Telavi City Hall** • **USAID** • **GIZ** • **EU**

will be constantly informing the target groups on measures to provide sustainable development of public transport, consulting and supplying the latest information about processes going on at the international level in transportation sector and the best practices in the world.		material for target groups on the city of Telavi (e.g. capacity of the city in energy efficiency and green development building, and can the population facilitate these processes; • Preparation of information material for the city population on energy efficiency measures taken by cities – subscribers to CoM in general and for public transport development in particular.		• Updating of information for Telavi population is performed at the Municipality web-site (www.telavi-gov.ge) and the Facebook page; • Information booklets are prepared on the advantages of energy efficiency measures and their application; • A number of pilot projects are implemented providing maximal engagement of population (e.g. periodic blocking of certain central street and carrying out of entertainment measures).	
3. Providing maximum awareness of Telavi Municipality and City Council representatives					
Providing awareness of local authorities on preferences of energy sustainable consumption in the city and its perceptiveness, on the social and economic profitability of this initiative	• Telavi City Hall • Telavi City Council Assembly	• Holding information seminars for representatives of City Hall and City Council on the advantages and prospects of public transportation sector development in the city; • Carrying out information seminars for representatives of City Hall and City Council on the necessary of construction standards deployment in Telavi; • Facilitating participation of representatives of City Hall and City Council in national and international meetings	• Telavi City Hall • Telavi City Council • Regional Energy Efficiency Center • Ministry of Energy of Georgia • Ministry of Environment and Natural Resources Protection	• Illustrations are prepared for carrying out information meetings; • Information meetings are being hold (at least 2 times a year); • Experts from EU and other donor countries are invited to conduct seminars on modern technologies and approaches; • Decisions are made public by Mass-Media as well as discussed	• **EC-LEDS** • **USAID** • **EU-COM** • **GIZ** • **Partnership for mitigation** • **GHG reduction projects** • **Georgia's National Communications on Climate Change**

		and conferences on the issues of CoM process; • Incorporation of Mass Media representatives in high level meetings on CoM issues and informing by this way general public on current processes; • Provision of decision-making process in the frame of CoM on the basis of consultations with stakeholders.		projects and measures; • Representatives of City Hall and City Council are fully involved in processes going on at the country and international level; • At the Internet and Facebook sites information on current processes and projects is updated continuously.	
Long-term goals (2018-2020. Main objective of long-term strategy is to involve private sector in achieving the SEAP goals, maximally informing population and private sector on restrictions and standards, awareness raising on the role of regulations and standards in providing energy sustainable consumption	• Telavi City Hall • Telavi City Council • Telavi City Population • Private sector • NGOs		• Telavi City Hall • Telavi City Council • Ministry of Energy • Ministry of Environment and Natural Resources Protection • Energy Efficiency Center • Private Sector Initiative Groups • CoM's Programs and Projects		
1. Inclusion of the private sector in achieving the SEAP goals					
Enhancing the involvement of the private sector (esp. in Transport and Construction sectors) in Sustainable Energy Action Plan implementation by supplying them information on energy saving and economically beneficial technologies, and offering them programs on	• Private sector operating in the Transportation sector; • Private sector operating in the Construction sector; • Private sector	• Attraction of private sector interest to the application of innovative technologies by different stimulation mechanisms (e.g. setting some privileges in local taxation for companies introducing energy efficient and innovation technologies);	• Telavi City Hall • Energy Efficiency Center	• Different kind of measures are hold annually; • Stimulation mechanisms are worked out to provide the involvement of private sector in the	Telavi City Hall Private sector EU COM GEF UNFCCC programs

cooperation between public and private sectors	initiative groups operating in other sectors	• Provision of consulting services for private sector aimed at the reduction of risks; • Setting up of different funds for promotion of various measures in the transport sector to reduce possible risks related with changes in behavioral norms; • Encouraging creation of private sector initiative groups to facilitate maximal engagement of this sector in the CoM process.		process of new technologies development and introduction; • The Energy Efficiency and Technologies Centre is created which will provide consultations on new technologies and new norms of behavior; • Technologies re-insurance fund(s) is set up for the private sector; • Initiative groups are organized in different sectors being main ring between the state and private sector; • Representatives of private sector are engaged in international processes, unions and professional networks.	
2. Identification of barriers by consultations with stakeholders					

• Identification by consultations with stakeholders of barriers, which could arise in the process of adopting restriction measures and different types of standards.	• Telavi City Hall • Telavi City Assembly • Telavi city residents • Private sector operating in Telavi; • NGOs	• Identification of barriers by the consultations with population to the standards and restrictions for sectors examined in the Telavi SEAP; • Working out of measures to overcome identified barriers by consulting with different target groups (e.g. step-by-step restriction of traffic on selected streets and adaption of "pedestrian's days", etc. Although implementation of some measures, e.g. technical control of motor cars will be realized simultaneously under the Government Decree, etc.),	• Telavi City Hall • Telavi City Council	• Groups are trained (initiative group of private sector, non-governmental sector, Mass-Media) to carry out consultations; • Barriers are identified for each SEAP sector; • Measures to overcome identified barriers are developed in cooperation with target groups.	• Telavi City Hall • NGO sector
3. Enhancement of consultations with stakeholders in the process of restriction measures and standards introduction					
Intensification of consultations with stakeholders (city population, private sector, non-governmental sector) on limitation measures and standards, which are to be implemented by Municipality in different sectors (Transport, Construction).	• Telavi City Hall • Telavi City Council • Telavi population operating in Telavi; • Private sector • NGOs	• Presenting maximum explanations to population, private sector and other target groups on standards and regulations elaborated in Telavi SEAP for selected sectors; • Preparation of relevant information blocks and programs explaining social and environmental benefits got offer introducing the mentioned measures.	• Telavi City Hall • Regional Center on Energy Efficiency and Innovation Technologies	• Personnel, which will systematically collaborate with target groups, is trained; • Explanations and consultations are systematically going on about restrictions and standards, implementation of which is necessary for putting into effect the SEAP. Non-governmental sector is actively operating with population and target groups.	• Telavi City Hall • Telavi City Assembly
4. Awareness raising of decision makers, representatives of public and private sectors on the role of limitations and standards in providing energy sustainable consumption					

Development and implementation of awareness raising and stimulating programs for different target groups aimed at provision of unimpeded deployment of standards (e.g. energy efficiency) in practice. This part of the program will be more relevant for raising awareness among decision-makers and implementers and their preparedness to these processes.	• Telavi City Hall • Telavi City Council • Telavi city residents • Private sector operating in Telavi	• Inform decision makers and implementers on successful and failed practices; • Participation of decision makers and implementers in CoM and LEDS international processes; • While preparing information materials for decision-makers and implementers attention should be focused on regulations and standards, as well as the necessity of energy sustainable consumption for securing Georgia's independent energy supply; • While discussing via Mass-media regulations and new standards for the population social and environmental issues are to be underlined together with promotion of tourism; • While discussing through Mass-media constraints for private sector and decisions concerning transfer to new standards attention should be focused and priority must be given to economic effects in the long-run prospective.	• Telavi City Hall • Programs and projects of the CoM	• Decision makers and implementers are involved and well informed on current international processes, Georgia's commitments in the sphere of climate change and energy efficiency; • Information portfolios are prepared analyzing in detail the CoM process in the context of fulfillment of EU directives; • Good Practice manuals are compiled; • The involvement of foreign consultants in the process will be necessary.	Government of Georgia EC-LEDS EU-CoM GIZ Clima East And other programs to be proposed in future

Implementation Structure

- This Strategy is approved and its execution, as a part of City Development Acton Plan, is monitored by the City Council/Assembly;
- Telavi City Hall is responsible for updating and implementation of the Strategy;
- Responsibility over the training of local personnel for enacting the Strategy and its monitoring will be entrusted to the City Hall Technical Group, planned to be created by the City Hall. Its structure is presently under consideration taking into account current local or international programs going on in the frames of CoM;
- Preparation of materials on awareness raising and information dissemination should be conducted mainly by applying external resources (non-governmental sector).

8. MONITORING, VERIFICATION AND REPORTING ON THE IMPLEMENTATION OF SEAP AND GHG EMISSIONS REDUCTION IN TELAVI

To plan and carry out the monitoring measures for SEAP and to reduce GHG emissions, the way local government reforms are carried out is of significant importance. This is also true of the internal organizational structure of its executive body (compliance to legislative amendments). The effectiveness of local financial and human resource development and growth are of great importance to self-governing units, especially to those, which gained the self-governing status in 2014, e.g. the city of Telavi. If these resources are lacking and appropriate technical skills and knowledge are not present, the successful implementation of SEAP is compromised.

That is why, in this transitional phase, the monitoring plan can include several options, however a distribution of functions and clear separation of rights and responsibilities between internal structural units of municipalities and external resources will be most effective. An effective approach uses both internal and external resources for monitoring. Creating the action plan showed that one of the most important problems of Telavi and other cities in Georgia is obtaining data on energy consumption from the necessary sectors for the base year emissions inventory. In many cases, no data accounting system existed since they were not previously used to evaluate economic parameters. Sometimes the database needs additional processing, which can only be done by the owners of the source data because there is always additional commercial information that could be confidential. Generally, the collection of necessary data requires significant time and human resources, but municipalities do not have well organized statistical/analytical tools or analytical departments.

With the exception of some larger municipalities, there are no municipal-level statistics offices in Georgia, and this impedes SEAP implementation and monitoring. To reduce the risks from a lack of data, the "Monitoring" section of the Telavi SEAP offers a performance methodology that seeks to compensate for these lacunae. One measure is to create a data register for monitoring baseline scenarios that is updated regularly with systematic information from the

Telavi SEAP monitoring group[27]. Thus monitoring, verification and reporting will take a minimum of time as they can use regular updates from available data.

For internal monitoring and analysis, the responsible department/divisions within Telavi City Hall should have software that is easy to use for non-specialists that calculates baseline scenario emissions and quantities of reduced emissions for different measures or combined data from the BAU scenario. Local staff will undergo software training to ensure effective use of the program.

When periodic monitoring reports on the SEAP implementation are being created, based on conditions from the CoM, the involvement of invited experts should be considered especially for the first mandatory reporting process.

Main activities included in the Monitoring and Reporting process of Telavi are:

1. Regular updating of the Baseline Scenario (BAU);
2. Assessment of emissions reduced after taken measures and implemented projects;
3. Development of final report;
4. Determine how to simplify the monitoring system in future.

Under the current action plan the parties responsible for these activities are:

1. The Telavi Municipality: responsible for obtaining statistical information about main parameters (GDP, population, per capita income, portion of economic activities/economic sectors in GDP, etc.), and describing city development processes. To calculate the baseline scenario, external technical assistance could be approved by the municipality for carry out this work. The calculation of the baseline scenario and a renewal methodology plan as well as the simplified computer program (MUNI – EIPMP) will be sent to the City Hall under the LEDS by the Georgian Government and coordinated with the CoM. Emissions factors will also be aligned with the responsible authority of the UN Framework Convention on Climate Change in Georgia.
2. Implementing Unit/Project owners who will collect information needed to calculate reduced emissions. The Municipality will provide them with the data collection methodology and will ensure periodic verification. The Municipality is responsible for calculating and verifying final emissions, although the work can be done either by the Municipality, or by external expertise accredited by the CoM. Periodic verification of activity data provided by the project executor is the responsibility of the Municipality as well.
3. The City Hall, which is responsible for a final report that must be approved by the City Council, after which it will be submitted to the EU. The Report will include monitoring results, general parameters that have to be monitored during the SEAP implementation,

[27]Aimed at this task, while preparing the SEAP the City Hall special appointed responsible person who will continue to coordinate the monitoring process, while the main unit in statistics gathering will be the Telavi City Hall Property Management, Economic Development, Statistics, Infrastructure, Spatial Arrangement, Architecture and Construction Service (from now on mentioned as Economic Development Service). At the present stage the second option is also discussed, according to which a special group should be set up in the Telavi Municipality, incorporated in certain LLC or a new LLC could be organized exceptionally for implementing and monitoring of the SEAP.

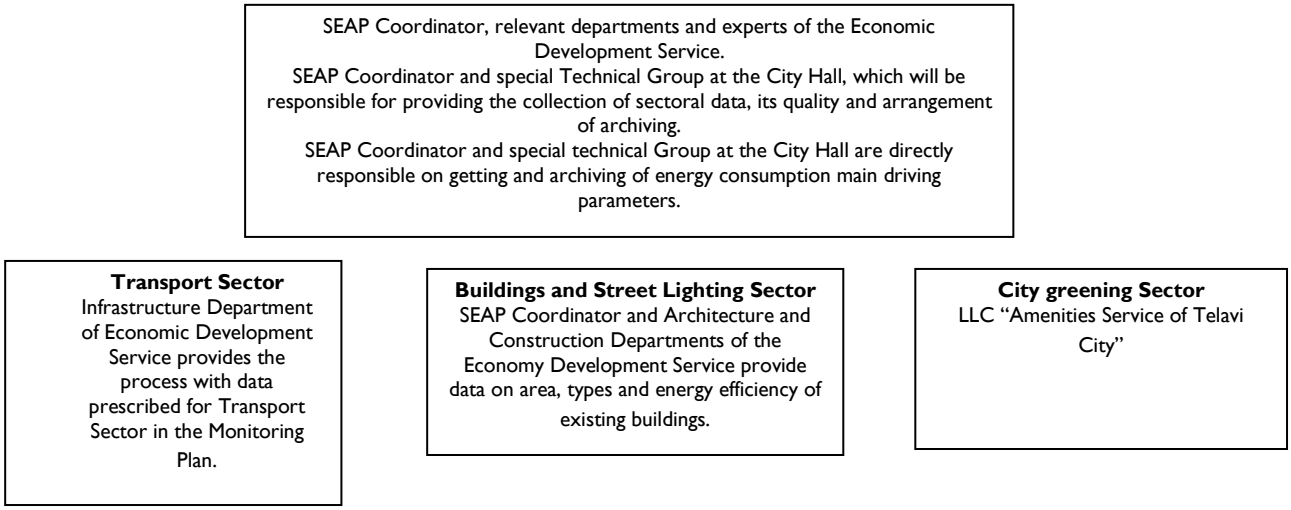
quality control and quality assurance (QA/QC) procedures and emissions factors. Based on this, a specific year baseline scenario will be updated and reduced emissions calculated.

8.1. The Telavi Unit Responsible for Monitoring

The overall responsibility for preparing and implementing the CoM and SEAP, and for updating them falls under the Property Management, Economic Development, Statistics, Infrastructure, Spatial Arrangement, Architecture and Construction Service (from now on mentioned as Economic Development Service). This department is responsible for carrying out, monitoring and analyzing results, then integrating the results into the revised action plan. They must verify and monitor data then prepare and submit the Final Report for approval to the City Council before it is submitted to the EU. The Department is also responsible for organizing data collection, supporting data quality improvement, updating them and finding new data sources. The Department can make use of other divisions and LLCs in the Municipality or certified external personnel. Resources from the nearest Regional Center of Energy Efficiency could be used initially[28].

There are four main sectors considered within the Sustainable Energy Action Plan of Telavi: Buildings sector, Transportation sector, Street lighting sector and increasing emission sinks by green area development (greening sector). In order to evaluate each sector's baseline scenario, information on activity data is necessary. Each implemented project and measure must be monitored for its quantitative emissions reduction value and its total emissions savings compared with the baseline scenario. The amount of final emissions reductions can then be analyzed. At this stage, Telavi City Hall is considering two options for monitoring and collecting sector-related data: a) Collect and provide statistical data according to each City Hall department; b) Archive data and carry out primary processing by the City Hall technical group and Energy Manager, planned to be set up in the nearest future.

Figure 16 demonstrates departments of City Hall and LLC-es, which will be responsible to collect data for monitoring.



[28]Setting up of such Regional Centers is planned in the frames of current EC-LEDS project.

Figure 21. Monitoring Process Management

Four types of data will be collected and evaluated to prepare monitoring reports for each sector:

- Annual emissions in CO_2equivalent;
- Measures and project implementation status and emissions savings for a given period;
- Driving parameters of the baseline scenario (for example, in the transport sector: population, GDP, income growth and passenger-kilometers according to transport types;
- Economic and social effects of the measures taken.

In addition to these types of data other primary parameters can be considered for the monitoring process, taken from different sources and secondary data, and then automatically calculated with muni_EIPMP software. An approved special Technical group and Energy Manager from the Telavi Municipality will be responsible for annual reporting. These will be compiled every two years and submitted to an independent third party for verification[29]. It is implied that the third party will be provided by EU Covenant of Mayor Office. The monitoring report structure is already worked out by the EU Research Centre, however it is expected that for the perfection of monitoring process new approaches and methodologies will be gradually introduced. In this case, where it will be relevant, the results obtained under the old methodology must be recounted with the new one to provide the conformity of results acquired in different years to be BAU data.

8.2 Monitoring of main driving parameters featuring GHG baseline inventory (BEI), BAU scenario and GHG baseline inventory monitoring (MEI).

The purpose of discussed below parameters is to conduct the MEI and update the BAU scenario in view of important social and economic changes going on in the city. Information presented in Tables below refers to 2014, taken as a base year for the GHG inventory in the Telavi SEAP. On the bases of these parameters and their 2014 values the Telavi energy consumption development scenario (BAU) has been developed for 2020. In comments it is explained how to update these parameters for the compilation of SEAP Monitoring Report.

Data/Parameter # 2.1	**Population through the monitoring year**
Data unit:	Number of population
Description:	Primary data[30]; Annual monitoring.
Source of data used:	Annual statistics (www.Geostat.ge) and local statistics
Value applied in SEAP:	**21 500 (2014)**
Any comments	On the basis of number of population in the monitoring year the increment should be calculated relevant to 2014 and the compliance with the reality of SEAP assumption on population growth must be assessed. This information will be used later in the comparative analysis of new and old BAU scenarios aimed at revealing the causes of deviation.

[29]The CoM Office determines the frequency of monitoring reporting. At this stage it is decided that the report on the monitoring of taken measures must be submitted at least with 2-year periodicity and complete monitoring report with calculations of reduction emissions – once in every 4 years.

[30]Data is considered primary if it is not calculated in the monitoring process and is taken from different sources. Primary sources may be calculated, but has to be drawn from a specific source and implementers should get the finished data.

Data/Parameter # 2.2	**Gross Domestic Product (GDP) in the monitoring year**
Data unit:	Million GEL
Description:	Calculated data; Annual monitoring
Source of data used:	Statistical annual (www.Geostat.ge) and local statistics. This SEAP source was Telavi Municipality.
Value applied:	**This value has not been used in SEAP, because it did not exist, but must be evaluated for future monitoring.**
Any comments	National Service on Statistics publishes information only about annual GDP of the Region. In this case, using the Kakheti Region's GDP and its total population, the per capita GDP in this Region could be evaluated, multiplied further by the number of population in Telavi. Besides such assessment more precise methods could be used which must be well described as well. The value of GDP in the monitoring year is used for recounting the BAU scenario, additional check-up of different quantities and their observation, data control and monitoring of emissions trends per unit of GDP, assessment of emissions intensity in the process of economy development.

Emission Factors

Data/Parameter # 2.3	**Grid emission factors t CO_2 MWh**
Data unit:	tCO_2/MWh
Description:	Primary data. Calculated at the national level and provided to municipalities
Source of data used:	Calculated especially for SEAP, but there is also a value calculated for the Kyoto Protocol's Clean Development Mechanism projects (Ministry of Environment and Natural Resources Protection of Georgia)
Value applied:	**0.104 t CO_2/MWh**
Any comments	The emissions factor is calculated using average method by dividing annual emissions from the power sector by annual electricity generation. This emission factor is calculated centrally in order to monitor low emissions and is delivered to municipalities for their SEAPs. During SEAP preparation the used grid emissions factor has been calculated by averaging since Telavi does not produce electricity independently but receives it from the centralized energy system of Georgia.

Data/Parameter # 2.4	**Natural Gas (NG) emission factors**
Data unit:	t/TJ, or Kg/TJ
Description:	Primary data
Source of data used:	At this stage, the IPCC calculated typical value is being used (applied for Tier 1 calculations)
Value applied:	**55.78 CO2 T/TJ; 5 CH4 Kg/TJ; 0.1 N2O Kg/Tj.**
Any comments	It is recommended to use the national calculated value that depends on the natural gas calorific value (NCV). This should be updated constantly during the monitoring process using information about gas caloricity consumption.

Data/Parameter # 2.5	**Gasoline emission factors**
Data unit:	t/TJ, Kg/TJ
Description:	Primary data
Source of data used:	At this stage, the IPCC calculated typical value is being used (applied for Tier 1 calculations)
Value applied:	**68.6 tCO2/Tj; 20 Kg CH4/Tj; 0.6 Kg N2O /Tj.**
Any comments	It is recommended to use the national calculated value that depends on the carbon content of gasoline, and should be updated constantly during the monitoring process according to information on imported gasoline caloricity.

Data/Parameter # 2.6	**Diesel emission factors**
Data unit:	t/TJ, Kg/TJ
Description:	Primary data
Source of data used:	At this stage, the IPCC calculated typical value is being used (applied for Tier 1 calculations)
Value applied:	**73.3 tCO2/Tj; 5 Kg CH4/Tj; 0.6 Kg N2O /Tj.**
Any comments	It is recommended to use the national calculated value that depends on the carbon content of diesel, and should be updated constantly during the monitoring process according to information on imported diesel caloricity.

Data/Parameter # 2.7	**Net Calorific Value of Different Fuels (NCV for NG, Gasoline, Diesel)**
Data unit:	TJ / Unit of fuel
Description:	Primary data. These data will be collected at the national level from fuel importers.
Source of data used:	These data should be collected for each type of fuel used in the country. The information sources are mainly fuel importers and distributors.

Value applied:	**At this stage, typical values are used in the SEAP provided by the IPCC**
Any comments	Systematic update is recommended taking into account fuel parameters. It would be better to use these typical data if local data are unavailable.

8.3 Activity Data Necessary for Monitoring the Telavi Transport Sector

Public Transport (Mini-buses)

Data/Parameter # 3.1.1	**Number of public transport mini-buses (according to fuel)**
Data unit:	Number of mini-buses in the monitoring period (annual value)
Description:	Primary data
Source of data used:	Data for the SEAP is provided by the Service Agency of the Ministry of Internal Affairs and concerns the Telavi Region in general. Department of Infrastructure of the Economic Development Service at the Telavi City Hall.
Value applied:	**Total 161, including** - **15 (gasoline)** - **36 (natural gas)** - **110 (diesel)** **Among them operating in the city of Telavi** - **4 (diesel)**
Any comments	Passenger transportation is carried out by 4 diesel powered private mini-buses at 2 shuttle routes. This transport is non-organized and has no contacts with the City Hall. Calculations were performed only for these 4 diesel powered mini-buses working for Telavi population.

Data/Parameter # 3.1.2	**Average distance traveled by one mini-bus per year by fuel type (gasoline, diesel, gas)**
Data unit:	Km/year
Description:	Primary data
Source of data used:	Information provided for SEAP by independent expert on the basis expert judgement after questioning private companies.
Value applied:	**43 800 km (4 mini-buses operating inside the city)**
Any comments	It is recommended that this data be taken by the monitoring group directly from the mini-bus drivers or their companies. Responsible entity will be the Infrastructure Service of the Telavi Municipality as a city traffic regulating body. The Telavi City Hall intends to set up public transport in the city and organize corresponding Transportation Service..

Data/Parameter # 3.1.3	**Total distance traveled by all mini-buses annually (by fuel type)**
Data unit:	Km / year
Description:	Secondary data, calculated by the MUNI_EIPMP.
Source of data used:	3.1.3=3.1.1.*3.1.2
Value applied:	**175 200 km/yr**
Any comments	

Data/Parameter # 3.1.4	**Average consumption of fuel by 1 mini-bus per 100 km (by fuel types)**
Data unit:	m^3/100 km (natural gas) l/100 km (gasoline, diesel)
Description:	Primary data
Source of data used:	Information to the SEAP provided by independent expert on the basis of expert judgement after questioning the owners of mini-buses and filling stations
Value applied:	**12l/100 km (gasoline)** **10l/100 km (diesel)** **12 m^3/100 km (natural gas)**
Any comments	As a matter of fact this data must be rechecked with the technical certificate of mini-bus and be explained in case of significant discrepancy. These mini-buses are second-hand, several times altered, operating on a very poor roads and thus their fuel consumption is differing considerably from the initial data of technical certificate.

Data/Parameter # 3.1.5	**Annual consumption of fuel by all mini-buses by fuel type (gasoline, diesel, natural gas)**
Data unit:	M^3/year l/yr.

Description:	Secondary data. Is to be calculated by the Monitoring group.
Source of data used:	Calculated by the MUNI_EIPMP software. Number of diesel-powered mini-buses multiplied by the fuel consumption per 100 km, multiplied by the annual run of 1 mini-bus and divided by 100.
Value applied:	**17 520 L (diesel)**
Any comments	The data is calculated by the Monitoring Group.

Data/Parameter # 3.1.6	**City mini-bus passenger load factors**
Data unit:	Passenger.km/trans.km
Description:	This parameter should be evaluated by statistical methods and surveys. It could be calculated by Parameter 3.1.7. or estimated by another method
Source of data used:	In case of Telavi SEAP this parameter was not assessed and used
Value applied:	**Not assessed**
Any comments	This parameter is used only to assess GHG emissions reductions after measures are taken in the sector. The GHG annual inventory from the transport sector is not dependent on it. These data can be assessed through surveys, bus tickets sold at public transport stops, etc. If Parameter 3.2.7 (mini-bus mobility) is known, it can be calculated.

Data/Parameter # 3.1.7	**Annual passenger turnover per mini-bus**
Data unit:	Passenger.km/year
Description:	Secondary data is usually calculated through the load factor
Source of data used:	Total distances traveled by buses per year is multiplied by one bus load factor
Value applied:	**In the Telavi SEAP at this stage this parameter was not estimated.**
Any comments	This parameter is calculated by City Hall Transport Department, transportation companies or Statistics National Service for entire country

Private (passenger) Cars

Data/Parameter # 3.2.1	**Number of private cars registered in Telavi (by fuel types)**
Data unit:	Number of cars
Description:	Primary data
Source of data used:	Ministry of Internal Affairs giving up information on the number of passenger cars registered in the Telavi Region (city and villages). Number of cars registered in the city was assessed under the questioning in the frame of EC-LEDS project, when residents of the city and villages were questioned separately and according to which about 30% of cars concentrated in the city. The same number is obtained when calculating number of cars according to the number of population. The distribution of cars of fuel is also based upon the EC-LEDS questioning.
Value applied:	**4 776 (total):** **2 192 (on gasoline); 158 (diesel); 2 426 (gas).**
Any comments	It is important for the future to identify and count cars registered only in the city of Telavi.

Data/Parameter # 3.2.2	**Average annual distance traveled by one vehicle (by fuel type is recommended)**
Data unit:	Km/year
Description:	Primary data
Source of data used:	Estimated on the basis of EC-LEDS questioning results
Value applied:	**7 900 Km/year**
Any comments	In future the National Statistics Office and interviews with drivers could be used to learn average daily run, then to make yearly calculation. Surveys should meet reliability criteria. Interviews and surveys to determine daily run and the SEAP implementation will be conducted simultaneously.

Data/Parameter # 3.2.3	**Average distance traveled by all passenger cars per year (by fuel types)**
Data unit:	Trans.km/year
Description:	Calculated data
Source of data used:	Calculated by the MUNI_EIPMP Data # 3.2.1 and 3.2.2
Value applied:	**37 730 444 (total):** **17 316 800 (gasoline); 1 248 200 (diesel); 19 165 400 (natural gas).**
Any comments	Annual run od passenger car multiplied by total number of passenger cars

Data/Parameter # 3.2.4	**Fuel consumption per 100 km (by fuel type)**

Data unit:	l/100 km m3/100 km kW.h/100 km
Description:	Primary data
Source of data used:	In general, this parameter is taken from the registration certificate of a motor vehicle. While developing the Telavi SEAP data has been provided based upon the results of EC-LEDS questioning
Values applied:	**Gasoline -9.5 l/100 km** **Diesel-10 l/100 km** **Natural gas-9 m³/100 km**
Any comments	As a matter of fact, this data must be rechecked via registration certificates of private cars (according to their types) and be explained in case of significant discrepancy. Large part of private cars in Telavi are second-hand, operating on a very poor roads and thus their fuel consumption differs considerably from the initial data of technical certificate

Data/Parameter # 3.2.5	**Fuel annual consumption of all passenger cars by fuel types (gasoline, diesel, gas)**
Data unit:	l/year
Description:	Secondary data. Will be calculated by the monitoring group.
Source of data used:	Calculated by the MUNI_EIPMP: 3.2.5 = 3.2.1. * 3.2.2. * 3.2.4/100 Number of gasoline powered passenger cars multiplied by fuel consumption (100 km) multiplied by one car annual run and divided by 100.
Value applied:	**1 645 234 l (Gasoline)** **124 510 l (Diesel)** **1 725 034 m³ (Natural gas)**
Any comments	This data is calculated by the Monitoring group and should be compared to the spent fuel in the city. Significant error is expected, however. At this stage is calculated by "Remissia"

Data/Parameter # 3.2.6	**Transport Load Factor**
Data unit:	Passenger.km/ trans.km
Description:	This parameter should be evaluated by statistical methods and surveys. It could be calculated from Parameter 3.2.7. if it is assessed, or estimated by another method
Source of data used:	While preparing the Telavi SEAP this parameter was not assessed
Value applied:	**Not evaluated**
Any comments	This parameter is used only to assess GHG emissions reductions after measures taken in the sector. The GHG annual inventory from transport sector is not dependent on it. This data can be assessed as a result of a survey if Parameter 3.3.7 is known (mobility of private passenger cars) and calculated : #3.2.7/3.2.1/3.2.2

Data/Parameter # 3. 2.7	**Total number of passengers transported by all passenger cars a year (annual mobility of private cars)**
Data unit:	Passenger.km/year
Description:	Secondary data calculated through the load factor
Source of data used:	While preparing the Telavi SEAP this parameter was not assessed
Value applied:	**Not evaluated**
Any comments	Number of vehicles is multiplied by one car's annual run and multiplied by the average load factor of a car.

Municipality- Owned Vehicle Fleet

Data/Parameter # 3.3.1	**Telavi municipality service vehicles (by fuel type)**
Data unit:	Amount of vehicles
Description:	Primary data
Source of data used:	Provided to the SEAP by Telavi Municipality
Value applied:	**Total 27** **On gasoline -18;** **diesel- 9**
Any comments	Telavi Municipality Economy/Transport service is responsible for this data

Data/Parameter # 3.3.2	**Average distance traveled by one vehicle a year (by fuel and transport types)**
Data unit:	km/ year

Description:	Primary data
Source of data used:	Provided to the SEAP by Telavi Municipality's Economic Development Service/Department of Infrastructure
Value applied:	**5 500 km/yr**
Any comments	Telavi Municipality Economic/Transport service is responsible for this data

Data/Parameter # 3.3.3	**Average distance traveled by the municipality service vehicles annually**
Data unit:	Trans.km/year
Description:	Calculated data.
Source of data used:	Calculated by the MUNI_EIPMP Data # 3.3.1 and 3.3.2
Value applied:	**99 000 km (gasoline)** **49 500 km (diesel)**
Any comments	Verification should be performed bycomparing the run with consumed fuel

Data/Parameter # 3.3.4	**Fuel consumption per 100 km (by fuel and transport types)**
Data unit:	l/100 km or m^3/100km
Description:	Primary data.
Source of data used:	Provided to the SEAP by Telavi Municipality
Value applied:	**Gasoline -10** **Diesel – 10**
Any comments	Telavi Municipality Economic Development/Infrastructure Service is responsible for these data. Could be checked by the vehicle certificate data

Data/Parameter # 3.3.5	**Annual fuel consumption of the entire municipal fleet (by fuel type)**
Data unit:	l/yr. – m^3/year
Description:	Secondary data. Calculated by the monitoring group. At this stage calculated by "Remissia"
Source of data used:	Calculated by the MUNI_EIPMP: 3.3.5 = 3.3.1. * 3.3.2. * 3.3.4/100
Value applied:	**9 900 (Gasoline)** **4 950 (Diesel)**
Any comments	Verification will be performed in accordance with consumed fuel costs

Commercial Transport (Taxi)

Data/Parameter # 3.4.1	**Number of taxi cabs operating inTelavi by fuel type**
Data unit:	Number of taxis by fuel type
Description:	Primary data
Source of data used:	Provided to the SEAP by independent expert and taking into consideration questionings in the frames of EC-LEDS project
Value applied:	**564 (total run)** **34 (gasoline); 50 (diesel) 480 (natural gas)**
Any comments	Telavi Municipality Infrastructure Development (Transport) Service will be responsible for getting thisinformation. Primary verification of these data is the responsibility of the City Hall Infrastructure Service, but they can control officially registered taxis only, thus the reliability of the data is very low. More likely this is to in reflected by total amount of fuel sold.

Data/Parameter # 3.4.2	**Average distance traveled by one taxi annually (by fuel types)**
Data unit:	km/year
Description:	Primary data.
Source of data used:	Provided for the SEAP by independent expert on the basis of questionings
Value applied:	**10 950**
Any comments	The TelaviMunicipality Economic Department/Infrastructure (Transport) Servicewill be responsible for collecting these data. These data for officially registered taxis can be obtained from the Revenue Service or taxi unions. Estimations should be made by questioning drivers and observations. Present data is obtained by observations and questioning/survey

Data/Parameter # 3.4.3	**Average distance covered by all taxis annually (by fuel type is recommended)**
Data unit:	Trans.km/year
Description:	Calculated data.
Source of data used:	Calculated by the MUNI_EIPMP

	data # 3.4.1 and 3.4.2
Value applied:	**6 175 800 total run** **372 300 (on gasoline);** **547 500 (on diesel)** **5 256 000 (on natural gas m³)**
Any comments	At this stage calculated by "Remissia". Further will be calculated by the monitoring group

Data/Parameter # 3.4.4	**Fuel consumption by transport type**
Data unit:	l/100 km m³/100 km
Description:	Primary data
Source of data used:	Provided for the SEAP by independent expert. Based upon expert judgment and other sources, private companies
Value applied:	**Gasoline 10l/100 km** **Diesel 8l/100 km** **Natural Gas 10 m³/100 km**
Any comments	Registration certificate could be used for verification, but majority of taxis are second-hand and their real consumption differs from certificate data

Data/Parameter 3.4.5	**Annual fuel consumption by taxis (by fuel types)**
Data unit:	l/year m³/yr.
Description:	Secondary data
Source of data used:	Calculated by the MUNI_EIPMP: 3.4.5 = 3.4.1. * 3.4.2. * 3.4.4/100
Value applied:	**37 230 l(Gasoline)** **43 800 l (Diesel)** **525 600 m³ (Natural Gas)**
Any comments	Number of gasoline (or gas) fueled taxis multiplied by fuel consumption per 100 km, multiplied by one taxi annual run and divided by 100. At this stage calculated by "Remissia". Further will be calculated by the Monitoring group.

Data/Parameter # 3.4.6	**Passenger load factor of taxi cabs (load factor)**
Data unit:	Passenger.km/ trans.km
Description:	This parameter should be evaluated by statistical methods and surveys. It could be calculated from Parameter 3.5.7. if it is assessed by other method.
Source of data used:	Was not assessed for Telavi SEAP
Value applied:	**Not estimated**
Any comments	

Data/Parameter # 3. 5.7	**Total number of passengers carried by all cabs a year (annual mobility of cabs)**
Data unit:	Passenger.km/year
Description:	Secondary parameter
Source of data used:	Calculation must be conducted by the monitoring group
Value applied:	**Not assessed**
Any comments	3.4.7. = 3.4.1. * 3.4.2. * 3.4.6.

Commercial Transport Light-Duty Trucks (down to 2 tons capacity)

Data/Parameter # 3.5.1	**Light-duty trucks driving inside Telavi by fuel types**
Data unit:	Number of light-duty trucks by fuel type
Description:	Primary data
Source of data used:	Total number of trucks is calculated for the SEAP based upon the Ministry of Internal Affairs data, same as for passenger cars. The share of light-duty trucks and their distribution by fuel type is provided by independent expert using data of private transportation companies.
Value applied:	**259 (total)** Gasoline-13; Diesel-281; Natural gas-65
Any comments	Responsible for the initial verification of these data is the City Hall's Monitoring group.

Data/Parameter # 3.5.2	**Average distance traveled by one light-duty truck a year (by fuel type is recommended**)
Data unit:	km/year
Description:	Primary data

Source of data used:	Provided for the SEAP by independent expert. Information obtained under questioning of private companies and expert judgement.
Value applied:	**7 300**
Any comments	Responsible for the initial verification of these data will be the Transportation Service of Telavi City Hall Economic Development Department or the Monitoring Group

Data/Parameter # 3.5.3	**Average distance traveled by light-duty trucks a year (by fuel type is recommended)**
Data unit:	Trans.km/year
Description:	Secondary data
Source of data used:	Calculated with the MUNI_EIPMP by "Remissia" Data# 3.5.1 and 3.5.2
Value applied:	**9 125 000 km Total run** **2 051 300 (diesel), 94 900 (gasoline), 474 500 (natural gas)**
Any comments	

Data/Parameter # 3.5.4	**Fuel consumption by light-duty trucks according to vehicle types**
Data unit:	l/100 km m^3/100km
Description:	Primary data
Source of data used:	Provided for the SEAP by independent expert on the basis of questionings, expert judgment and survey among private companies.
Value applied:	**Gasoline-12l, Diesel – 10l, gas – 12 m^3**
Any comments	This data should be checked with registration certificate of each motor vehicle and analyzed in case of significant discrepancies.

Data/Parameter # 3.5.5	**Annual fuel consumption by vehicle and fuel types**
Data unit:	l/year m^3/year
Description:	Secondary data
Source of data used:	Calculated withthe MUNI_EIPMP by "Remissia": 3.5.5. = 3.5.1. * 3.5.2. * 3.5.4/100
Value applied:	11 309l (Gasoline), 56 544 m^3 (natural gas) 205 234l (Diesel)
Any comments	Number of light-duty trucks powered by different types of fuel multiplied by fuel consumption per 100 km/ multiplied by annual run of the truck and divided by 100

Data/Parameter # 3.5.6	**Light-duty trucks load factor**
Data unit:	ton.km/ trans.km
Description:	This parameter should be evaluated by statistical methods and surveys. It could be calculated from Parameter 3.5.7. if it is assessed or estimated by another method
Source of data used:	While preparing the Telavi SEAP this parameter was not assessed
Value applied:	**Not estimated**
Any comments	Essential in calculations of measures taken

Data/Parameter # 3.5.7	**Transported freight by all light-duty trucks in a year (annual freight turnover)**
Data unit:	Ton.km/year
Description:	Secondary data
Source of data used:	Calculated with the MUNI_EIPMP by "Remissia": Data #3.5.1*3.5.2*3.5.6.
Value applied:	**Not assessed**
Any comments	Number of light-duty trucks (down 2 ton capacity) multiplied by their annual run, multiplied by transported fight per one vehicle (ton). This parameter can be verified through freight actually transported and the relevant run by vehicles.

Commercial Transport (Heavy-Duty Trucks up to 2 ton capacity)

Data/Parameter # 3.6.1	**Number of heavy-duty trucks operating in Telavi**
Data unit:	Number of heavy-duty trucks by fuel type
Description:	Primary data
Source of data used:	Calculated same as for light-duty trucks
Value applied:	**293 (total)** **9 Gasoline,** **235 Diesel,**

	49 Gas
Any comments	Primary verification of these data will be the responsibility of the City Hall Transport Department and the Monitoring group

Data/Parameter # 3.6.2	**Average distance covered by one heavy-duty truck a year (by fuel type is recommended)**
Data unit:	Km/year
Description:	Primary data
Source of data used:	Provided to the SEAP by independent expert based upon questioning of private companies and expert judgment
Value applied:	**3 650**
Any comments	Primary verification of these data is the responsibility of the City Hall Transport Service

Data/Parameter # 3.6.3	**Average distance covered by all heavy-duty trucks a year (by fuel type is recommended)**
Data unit:	Trans.km/year
Description:	Calculated data
Source of data used:	Calculated by the MUNI_EIPMP (Remissia): Data # 3.7.1 and 3.7.2
Value applied:	**1 069 450 (total run)** **32 850 (Gasoline)** **857 750 (Diesel)** **178 850 (gas)**
Any comments	

Data/Parameter # 3.6.4	**Fuel consumption by vehicle type**
Data unit:	l/100 km. m^3/100km
Description:	Primary data
Source of data used:	Registration Certificate of a motor car. Provided to the SEAP by independent local expert founding upon expert judgement, questioning of private companies.
Value applied:	**30l (gasoline)** **25 l (Diesel)** **30 m^3 (gas)**
Any comments	

Data/Parameter # 3.6.5	**Annual fuel consumption by vehicle and fuel types**
Data unit:	l/year
Description:	Secondary data
Source of data used:	Calculated with the MUNI_EIPMP by"Remissia"
Value applied:	**10 377 L (Gasoline),** **214 798 L (Diesel)** **53 139 m^3 (gas)**
Any comments	

Data/Parameter # 3.6.6	**Heavy-duty trucks load factor (load factor)**
Data unit:	Ton-km/ car-km
Description:	Primary data
Source of data used:	While developing the Telavi SEAP this parameter was not assessed
Value applied:	**Not estimated**
Any comments	Required to assess emissions savings from measures implemented during the monitoring period.

Data/Parameter # 3.6.7	**Transported freight by all heavy-duty trucks in a year (annual freight turnover)**
Data unit:	Ton.km/year
Description:	Secondary data
Source of data used:	Calculated with the MUNI_EIPMP by "Remissia": Data #3.6.1*3.6.2*3.6.6.
Value applied:	**Not assessed**
Any comments	These parameters can be verified through actual annually transported freight and relevant total run of trucks

Data/Parameter # 3.6.8	**Total amount of fuel consumed in Telavi Transport Sector by fuel type**

Data unit:	l/year (MW.h) m³/year (MW.h)
Description:	Secondary data calculated during monitoring and SEAP preparation process
Source of data used:	Calculated by the SEAP team (Remissia) using emissions raise index derived by the EU Research Center
Value applied:	**Consumed throughout 2014 under the SEAP:** **44 217 MWh equivalent fuel, corresponding to 10 143 t CO_2 eq. emissions;** **In 2020 emission of 13 794 t CO_2 eq. is projected**
Any comments	This is one of the most important data for balance verification during the monitoring period.

8.4 Greening

Data/Parameter # 4.1	**Total planted area in Telavi (203)**
Data unit:	ha Number of plantings by species
Description:	Primary parameter
Source of data used:	Telavi City Hall Infrastructure Service
Value applied:	400 ha are covered by plants within the limits of the city 80 ha are of joint canopy, 320 ha are covered by fragmentary planting
Any comments	Total area of 400 ha includes cemeteries on 40 ha, recreation zones – 50 ha, other territories comprising population orchards – 310 ha. Up to 14 different recreation zones are registered at the territory of Telavi – 3 forest-parks, 2 parks and 9 squares – in total 50 ha

Data/Parameter # 4.2	**Annual carbon dioxide sequestration from Telavi territory against the background of greening activities in baseline 2013**
Data unit:	$tCO_2/yr.$
Description:	Secondary Parameter
Source of data used:	Calculated during the SEAP development process
Value applied:	**Annual sequestration 840.4 t CO_2/yr. Total amount of carbon accumulated in 2013 at the entire area of 400 ha equals to 13 200 tC.**
Any comments	

Data/Parameter # 4.3	**Annual Planting since 2016, 2 ha per annum**
Data unit:	Area planted, ha; Number of plantings by species; Increase of carbon sinks.
Description:	Primary parameter
Source of data used:	Telavi City Hall Infrastructure Service
Value applied:	**Kinds and number of plants: maple, ash, linden, cypress, horse chestnut, cedar, cypress (poorly represented in the city green zone) and plane/platanus. All in all 1950 saplings at 1 ha area.** **In sequel by 2020 from this 10 ha territory the removal of CO_2 will increase by 266 t compared to "no action" case.**
Any comments	Resulting from this measure till 2020 the equivalent of 10 ha territory (actually the damaged territories will be planted) should be covered by greenery. Among them 40% (5 ha) will be planted by thick verdure and the rest – by fragmentary vegetation.

Data/Parameter # 4.4	**Annual cutting/trimming of tress by spices**
Data unit:	m³
Description:	Primary parameter
Source of data used:	The Telavi City hall Infrastructure Service
Value applied:	**Trees were trimmed in 2015** **About 80 m³ were cut down**
Any comments	Trimming is to be considered in the monitoring

Data/Parameter # 4.5	**Annual fires or other causes of damage to plants**
Data unit:	m³
Description:	Primary parameter
Source of data used:	The Telavi City hall Infrastructure Service
Value applied:	**390 m³ were destroyed in 2012** **400 m³ were destroyed in 2014**

Any comments	In 2012 and 2014 severe storms have destroyed in total 790 ha of planted area.

Data/Parameter # 4.6	**Annual monitoring of CO_2 sequestration changes**
Data unit:	t CO_2/yr.
Description:	Secondary parameter. Calculated by the monitoring group
Source of data used:	At this stage calculated by the SEAP developing group
Value applied:	**Telavi greening area in 2013 constituted 400 ha (320 ha fragmentally covered by plants and 80 ha – by joint canopy plants). By 2013 about 13 200 t of carbon were deposited at the territory (parameter 4.2).**
Any comments	To 2020 as a result of taking various measures 14 886 t C will be deposited at the territory of Telavi

8.5 Street Lighting Sector

Data/Parameter # 5.1	**Total amount of electricity consumed for street lighting annually**
Data unit:	KWh/yr.
Description:	Primary data
Source of data used:	Telavi City Hall Infrastructure Service. This Department is responsible for the supply and accounting (monthly or annually) of electricity required for street lighting
Value applied:	**1 660 263 KWh (2014)** **2 386 786 KWh (projection for 2020)**
Any comments	The data should be compared with paid amounts; The projection for 2020 is calculated by the SEAP developing group

Data/Parameter # 5.2.	**Carbon dioxide emission from street lighting sector**
Data unit:	t CO_2/yr.
Description:	Secondarydata
Source of data used:	Calculated by the Monitoring group
Value applied:	**172.7 t CO_2eq (2014)** **248 t CO_2eq (projection for 2020)**
Any comments	At the present stage to calculate carbon sequestration by greenery default values are taken of the forests in similar regions (biomass increment, dry biomass quantity). Continuous monitoring for all used parameters is to be carried out and relevant changes in calculations required in case of parameters update should be made

Data/Parameter # 5.3	**Number of energy efficient (LED) bulbs to partially replace inefficient/old bulbs and to be used in new installations**
Data unit:	Number of LED bulbs
Description:	Primary data
Source of data used:	Project/measure implementing unit
Value applied:	**2 924 bulbs**
Any comments	According to the SEAP, 5 572 streetlights will be needed by 2020 for illuminating Telavi streets. By this time 1 813 incandescent and 688 economy bulbs should be replaced and they will be withdrawn from the Telavi street lighting network to 2020. To calculate correctly the emissions reduction, in case of carrying out this measure it should be cleared up what will happy to these bulbs – are they to be commissioned/written off or transferred to other customer.

Data/Parameter # 5.4	**Type of the bulb used before taking the measure and one bulb energy consumption in 1 hour.**
Data unit:	KW
Description:	Primary data
Source of data used:	Telavi Municipality Infrastructure Service
Value applied:	Incandescent bulb – 0.294 KW Economy bulb – 0,085 KW
Any comments	

Data/Parameter # 5.5	**Energy consumed by 1 LED bulb in 1 ha**
Data unit:	KW
Description:	Primary data

Source of data used:	Bulb Technical Certificate
Value applied:	**0.052 KW**
Any comments	

Data/Parameter # 5.6	**Operational duration of bulb/street lighting system**
Data unit:	hr/day or hr/year
Description:	Primary data
Source of data used:	Telavi Municipality Amenities Service
Value applied:	**10 hr/day** **3 650 hr/year**
Any comments	Street lighting includes lighting of streets and illumination of buildings

Data/Parameter # 5.7	**Emissions saving by 2020 with implemented measure (installing LED bulbs)**
Data unit:	T CO eq.
Description:	Secondary data. Calculated annually by the Monitoring Group
Source of data used:	**SEAP developing group**
Value applied:	1 160 MWh of electric energy will be saved by 2020, being the equivalent of retaining 120.6 t CO_2eq
Any comments	

8.6 Buildings Sector

Data/Parameter # 6.1.	**Area of municipal buildings according to their purpose (kindergartens, administrative, etc.)**
Data unit:	m^2
Description:	Primary parameter
Source of data used:	SEAP Development Coordinator appointed by the Telavi City Hall and City Hall Architecture, Construction and Statistics Services
Value applied:	**Total – 37 568** **Kindergartens – 9 486** **Municipal administrative buildings – 28 082**
Any comments	Information possessed by the City Hall

Data/Parameter # 6.2.	**Annual consumption of electric energy by municipal buildings**
Data unit:	MWh/yr.
Description:	Primary parameter
Source of data used:	The Telavi City Hall. Final accuracy of data is under the responsibility of Telavi SEAP Coordinate.
Value applied:	**Municipal buildings – 219.4**
Any comments	This data should be revised at the Kakheti Energy Distribution company and by energy audit assessments

Data/Parameter # 6.3.	**Areas of Telavi residential buildings by types (one – and two-storey private houses, multi-storey buildings, etc.)**
Data unit:	m^2
Description:	Primary parameter
Source of data used:	Provided to SEAP group by the Telavi City Hall Architecture/Urban Development Service. Information on the multi-storey buildings possesses City Hall's Economic Development Service, which implements different types of social projects for these buildings Information on the number of private buildings (mainly one-and two-storey) is preserved at the Architecture/Urban Development Service. The total area of such buildings was assessed by the expert.
Value applied:	**Total – 479 705** **Residential buildings – 71 133** **Private residential houses – 408 572**
Any comments	

Data/Parameter # 6.4.	**Annual energy consumption by residential buildings according to their types**
Data unit:	MWh/yr.
Description:	Primary parameter
Source of data used:	Assessment under the energy audits
Value applied:	**Total – 16 892**
Any comments	Acquiring data on energy consumption only for the city and separately for different types of buildings proved to be impossible, hence the assessment was performed using the energy audit data. It's important to get in future information from the distribution on energy consumption solely by the city.

Data/Parameter # 6.5.	**Total area of commercial buildings in Telavi**
Data unit:	m^3
Description:	Primary parameter
Source of data used:	SEAP group was provided with the data by Telavi City Hall. Part of commercial areas was assessed using the cleaning tax value mostly determined by the area, and the remaining areas – by estimation at the site. Earlier schools belonged to the City Hall and accordingly areas of schools were assessed by this old data as they were not significantly altered in recent years
Value applied:	**Total – 39 823** **Schools – 23 678** **Other state buildings – 11 520** **Other commercial buildings – 4 625**
Any comments	

Data/Parameter # 6.6.	**Annual energy consumption by commercial buildings**
Data unit:	MWh/yr.
Description:	Primary parameter
Source of data used:	This case concerns only state buildings (schools, University, Court, Patrol service, etc.), the data on energy consumption of which was gathered by Telavi City Hall.
Value applied:	**385.6**
Any comments	This data could be revised by the questioning in commercial buildings and energy audit assessments

Data/Parameter # 6.7.	**Annual consumption of natural and liquid gas by municipal buildings**
Data unit:	m^3/yr.; Kg/yr. (MWh/yr)
Description:	Primary parameter
Source of data used:	Telavi City Hall Financial Service. Final quality of data is under the responsibility of Telavi City Hall
Value applied:	**41 111 m^3**
Any comments	Can be verified at the gas supply company

Data/Parameter # 6.8.	**Annual consumption of natural and liquid gas by residential buildings**
Data unit:	m^3/yr.; Kg/yr. (MWh/yr)
Description:	Primary parameter
Source of data used:	Gas distribution company serving Telavi. Final quality of data is under the responsibility of Telavi City Hall
Value applied:	**Natural gas – 4 356 650 m^3**
Any comments	

Data/Parameter # 6.9.	**Annual consumption of natural gas by commercial buildings**
Data unit:	m^3/yr.; Kg/yr. (MWh/yr)
Description:	Primary parameter
Source of data used:	Concerns only state buildings. Information collected by Telavi City Hall
Value applied:	**Natural gas – 295 651 m^3**
Any comments	This data can be checked by questioning in commercial buildings and energy audit assessment

Data/Parameter # 6.10.	**Annual consumption of liquid gas and diesel by municipal buildings**
Data unit:	m^3/yr.; Kg/yr. (MWh/yr)
Description:	Primary parameter
Source of data used:	Information obtained from the Telavi City Hall
Value applied:	**Not used**
Any comments	

Data/Parameter # 6.11.	**Annual consumption of firewood in residential buildings**
Data unit:	m^3
Description:	Primary parameter
Source of data used:	EC-LEDS questioning
Value applied:	**Firewood total – 27 000 m^3/yr.** **Private residential houses – 27 000 m^3/yr**
Any comments	Firewood is mainly consumed in 2-storey private houses. Data should be revised by periodic questionings and according to issued vouchers.

Data/Parameter # 6.12.	**Annual consumption of liquid gas and diesel by commercial buildings**
Data unit:	m^3 (MWh.yr)
Description:	Primary parameter. Annual
Source of data used:	Telavi city hall
Value applied:	**63 m^3 of firewood**
Any comments	This data could be verified by questioning in commercial buildings

Data/Parameter # 6.13.	**Annual monitoring of CO_2 from all three sectors**
Data unit:	t CO_2/yr.
Description:	Secondary parameter. Annual
Source of data used:	Calculated by the Monitoring Group 2014 base year
Value applied:	**2014 baseline year – 12 190** **2020 year – 16 578**
Any comments	

Data/Parameter # 7.14	**Savings in the Buildings Sector under the enacted measures**
Data unit:	MWh/per single measure
Description:	Secondary parameter. Calculated annually or in the monitoring period for each measure separately.
Source of data used:	Project executors (population, municipality, head of commercial building)
Value applied:	**This parameter is calculated when carrying out each specific measure in accordance with the monitoring plan accompanying each measure.**
Any comments	The assessment/measurement of energy consumption with the corresponding CO_2 baseline scenario and actual measurements are required for all buildings and fuel types. Energy consumption can be reduced due to various reasons (technical disconnections, cutting off because of unpaid bills, etc.). Therefore, proving that reduction has actually resulted from fulfilling a measure without the interference from other sources is important. Emissions savings estimation methods should be described separately for each measure. Preliminary theoretical estimates of saved emissions are presented in the SEAP.

8.7 Sustainable Development Criteria

Monitoring reports should also include the results of observations on sustainable development criteria/indicators, as listed in general:

1. Strengthening of local capacities in Telavi Municipality (staff, plans);
2. Increase in population's quality of life and energy expenditure savings (per capita hot water consumption, expansion of heated areas/space, approximations of per area energy consumption to European standards etc.);
3. Promotion of residential condominiums;
4. Improved comfort and energy savings in municipal/commercial buildings (heat, electricity, hot water consumption per area unit);
5. Introduction of modern waste recycling technologies;
6. Expansion of per capita green areas;
7. Reduction of local pollutants (mainly in the transport sector);
8. Increased number of jobs;
9. Better gender equality;
10. Demonstration and piloting new technologies;
11. Promoting private sector development;
12. Municipalities able to report on additional criteria that were influenced by measures carried out within the SEAP framework;
13. Overcoming main barriers hampering the plan implementation and steps towards achieving success.