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for Climate Change Mitigation and Sustainable Development**

Case study

GEORGIA

MUNICIPAL ENERGY EFFICIENCY POLICY REFORMS IN GEORGIA

Developed by:
Energy Efficiency Center Georgia



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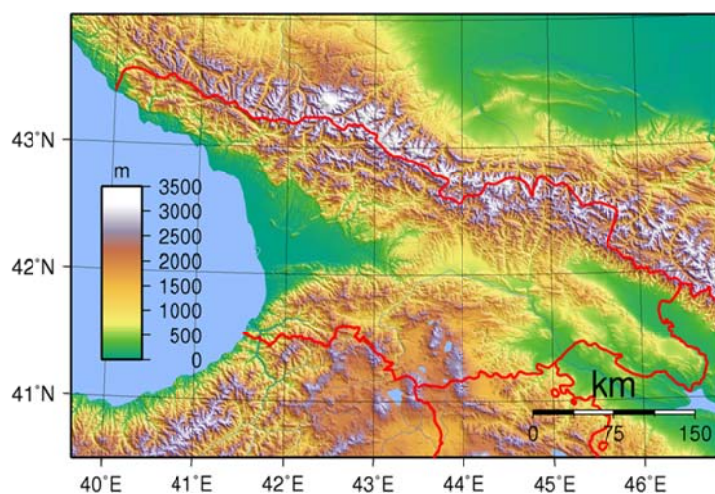
Geographical and climate characteristic of republic of Georgia

Georgia since 1991 is an independent country in the South Caucasus region. It is located at the crossroads of Western Asia and Eastern Europe, bounded to the west by the Black Sea, to the north by Russia, to the south by Turkey and Armenia, and to the southeast by Azerbaijan. The capital of Georgia is Tbilisi. Georgia is a unitary, semi-presidential republic, with the government elected through representative democracy.



Georgia covers a territory of 69,700 km²,

and its population is about 4.4 million. The capital, Tbilisi has population of about 1.15 million. There are four other cities with population greater than 100,000 – Kutaisi, Rustavi, Batumi and Zugdidi¹. All of mentioned cities except Zugdidi Municipality have a status of self-governing city. Georgia is divided into 9 regions, 1 city (capital), and 2 autonomous republics. These in turn are subdivided into 60 districts.



The climate of Georgia is extremely diverse. There are two main climatic zones, roughly separating Eastern and Western parts of the country. The Greater Caucasus Mountain Range plays an important role in moderating Georgia's climate and protects the nation from the penetration of colder air masses from the north. The Lesser Caucasus Mountains partially protect the region from the influence of dry and hot air masses from the south as well².

Tbilisi is the administrative and economical capital and Georgia's largest city lying on the banks of the River Mtkvari. The city covers an area of 726 km² (280 sq mi) and has 1,480,000 inhabitants.

Geography

The geography of Tbilisi is complex located in the South Caucasus at 41° 43' North Latitude and 44° 47' East Longitude. The city lies in Eastern Georgia on both banks of the Mtkvari

¹"In-Depth Review of Energy Efficiency Policies and Programmes" – page 23

²[http://en.wikipedia.org/wiki/Georgia_\(country\)](http://en.wikipedia.org/wiki/Georgia_(country))

River. The elevation of the city ranges from 380–770 meters above sea level (1246–1968 ft) and has the shape of an amphitheater surrounded by mountains on three sides. To the north, Tbilisi is bounded by the Saguramo Range, to the east and south-east by the Iori Plain, to the south and west by various endings (sub-ranges) of Trialeti Range.³

Rustavi is situated on the Qvemo Qartli plain on the both sides of the river Mtkvari at the altitude of 370 m. The Mtkvari (Kura) river, divides the city of Rustavi into two parts, with length of 4 km in the city's territory. The River valley with approximate area of 1028 hectares is occupied by the natural forest with broadleaved trees. Rustavi's culture and leisure park occupies part of this forest. On the territory of the park there is an artificial lake as the city has no natural lakes or ponds. In the populated area of the city the broadleaved trees, including black pine, cedar, and ash-tree have been artificially planted. In the squares and the division lines of central roads there are various floral and cultural plants.⁵

Climate

The climate of **Tbilisi** can be classified as moderately humid subtropical. The city's climate is influenced both by dry (Central Asian/Siberian) air masses from the east and humid subtropical (Atlantic/Black Sea) air masses from the west. Tbilisi experiences relatively cold winters and hot summers. Because the city is bounded on most sides by mountain ranges, the close proximity to large bodies of water (Black and Caspian Seas) and the fact that the Greater Caucasus Mountain Range (further to the north) blocks the intrusion of cold air masses from Russia, Tbilisi has relatively mild micro-climate compared to other cities that possess a similar continental climate along the same latitudes.⁴

Rustavi– self-governing city of Rustavi is a city in the southeast of Georgia, in the province of Qvemo Qartli, situated 25 km southeast of the capital Tbilisi. It has a population of 116,384 (2002 census) and is dominated by the Rustavi Metallurgical Plant. Rustavi is built in barren steppe area. The climate is transitional between the Mediterranean Sea and the Steppe climate. It is characterized by moderately cold winters and dry, hot summer. In January average temperature of +0.3 degrees, in July up to +25.3 degrees. Average precipitation is 390 mm per year. It should be noted that the city is characterized by sunny dayduration.⁵

Sector Characteristics

In Georgia different types of energy resources are available, however, except of rich hydro resources, their number is relatively limited. From reserves of fossil fuels just a coal makes possible to use it with the purpose of industrial production and usage. There are relatively limited oil and gas reserves as well as a peat and geothermal water reserves. Hydro resources are considered as the cheapest and environmentally friendly local resource. Georgian energy policy oriented on the utilization of local resources and the production of electricity to

³GEO-Cities Tbilisi: an integrated environment assessment of state and trends for Georgia's capital city - prepared within UNEP and OSCE project- page 3

⁴<http://en.wikipedia.org/wiki/Tbilisi#Climate>

⁵http://rustavi.ge/?page_id=195&lang=en

insure full satisfaction of national power demand. Also after the upgrade of interconnections with neighbouring countries is envisaged power/pick power⁶exports mostly in summer period.

| | RESERVE | RESOURCE |
|-------------------|---------------------------------|--------------------------|
| Coal, (m toe) | 185 | 300 |
| Lignite (m toe) | 20 | - |
| Oil (m toe) | 42.5 | 850 |
| Natural Gas (bcm) | 8.4 | 180 |
| Hydro (TWh) | 32 (maximum economic potential) | 80 (technical potential) |

Table 1. Energy Resources of Georgia⁷

Oil extraction and exploration works are conducted by Georgian and foreign companies. In 2010⁸ in Georgia the total crude oil production was 51,393 tons, while natural gas production totaled 7.8 mln. m³.

Georgia's national economy largely depends on the imported hydrocarbons. Hydro energy sector is one of the important local resources, technical potential of which is approximately estimated at 80 million kWh. Currently, only 12 % of hydro resources is yet used.

National energy sector is composed of natural gas transportation and distribution sectors, power generation plants, state electro system of Georgia, up to 50 natural gas distribution companies and 4 large power distribution companies⁹.

Before consideration of the energy consumption by sectors in the country, as well as by target municipalities, it should be noted that in Georgia the annual energy consumption has significantly reduced compared with data of the 1990s. Along with the collapse of the USSR a sharp drop in energy consumption was caused by the economic and social crisis during the first years of the country's independence followed by Russian occupation (about 20%) of its territory.

Since 2003 with support of International Development Agency (IDA) within the Electricity Market Support Project, the government transformed the energy sector into a financially viable, modern and functionally healthy. For the last few years, this sector became capable to deliver uninterrupted 24-hour power supply to its customers including households, the public sector in remote areas.

Electric power supply of Georgia and Tbilisi

The installed generation capacity in Georgia totals 4,470 MW of which 62% is Hydro Power Plants. The other 38% are thermal power plants mainly used to meet winter demand. The

⁶Georgian Oil and Gas Trunk Pipelines by T. Gochitashvili, T. Javakhishvili – page 25

⁷Georgian Oil and Gas Trunk Pipelines by T. Gochitashvili, T. Javakhishvili – page 25

⁸“In-Depth Review of Energy Efficiency Policies and Programmes” – page 33

⁹ Energy Balance of Power Sector of Georgia – page 5

average annual electricity generation in 2010-2012 totaled 10,184GWh, of which approximately 78% was generated by hydro plants, 21% was generated at thermal power plants and rest was imported.¹⁰

The distribution of electric energy in Georgia is carried out by three (3) distribution companies: JSC Company "Telasi" in Tbilisi City, JSC Company «Energo-Pro Georgia" almost in all regions of Georgia and JSC Company "Kakheti Energy Distribution" in one of the region of Georgia (Kakheti).

As to capital city Tbilisi is the largest consumer of electricity that receives electricity from a national grid. As it was mentioned electricity in Tbilisi is distributed by the JSC Company Telasi. The major shareholder of Telasi is Inter RAO-UES JSC of the Russian Federation. JSC Telasi distributes about 2 billion kilowatt-hours of energy to 416,500 individual, public and commercial customers per year.¹¹

Natural gas supply and heating system in Georgia and Tbilisi

In 2011, 75% of the supplied primary energy was imported, out of which 43% was natural gas and 29% oil products. Imported gas is mainly used for heating and cooking by households and power generation. In rural area of Georgia the main primary energy used for heating and cooking is local biofuels mostly firewood.

Most of Tbilisi is covered with natural gas distribution network. In Tbilisi natural gas is distributed by the Ltd "Kaztransgas". Natural gas consumption in Tbilisi was more than 2.05 billion m³ in 1989. Gas import and consumption dropped dramatically in the 1990s. The natural gas supply has improved in recent years. Currently annual consumption is about 500 million cubic meters. There is a trend of increasing gas consumption in the city. The major consumer is the household sector¹². The central heating system in Tbilisi and main cities of Georgia collapsed in the 1990s due to the fuel shortages and lack of maintenance on the distribution network. At present the central heating system does not exist in Georgia and households usually use individual heating equipment.

Table 2. Final energy consumption pattern in Georgia

¹⁰www.minenergy.gov.ge

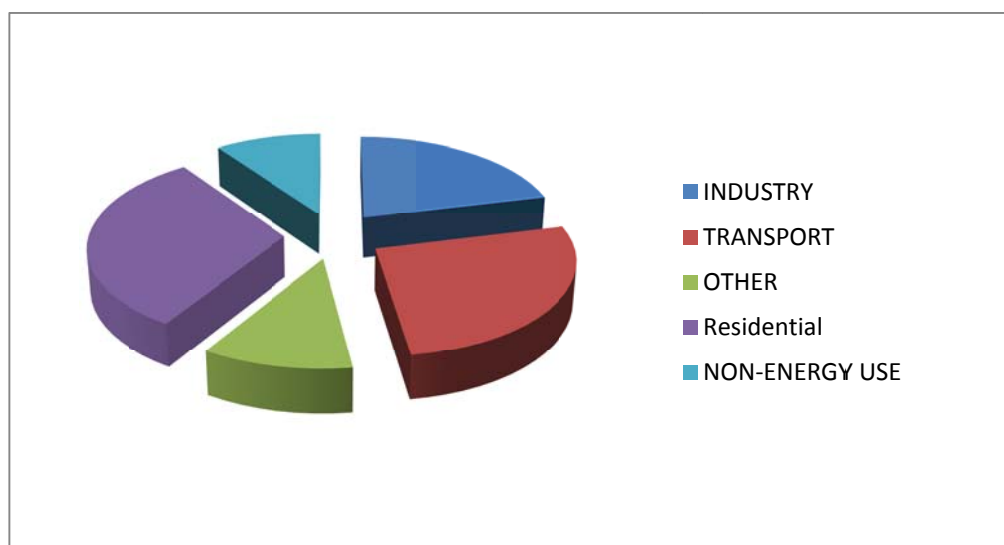
¹¹GEO-Cities Tbilisi: an integrated environment assessment of state and trends for Georgia's capital city – prepared with project of UNEP and OSCE.

¹²GEO-Cities Tbilisi: an integrated environment assessment of state and trends for Georgia's capital city – prepared with project of UNEP and OSCE

Chart 1.Total Energy Consumption Pattern in Georgia 2011 based on IEA data

| Coal | Oil products | NG | Non Comb. Renewable | Biofuels | Electricity | Total |
|------------------------|--------------|------------|---------------------|------------|-------------|-------------|
| Tons of oil equivalent | | | | | | |
| 63 | 997 | 956 | 9 | 315 | 696 | 3036 |
| | | | | | | |

Chart 2. Energy Consumption by Sectors 2011 %



| TFC | 3036 Toe |
|----------------|----------|
| INDUSTRY | 643 |
| TRANSPORT | 809 |
| OTHER | 332 |
| Residential | 953 |
| NON-ENERGY USE | 299 |

Current Policy;

In many countries energy efficiency policy is considered as one of the important components of the country's energy policy development. Accordingly energy efficiency policy has great importance for both public and private sector that has been reflected not only through practical implementation of various energy efficiency measures but within of different (political) programs supported by developed governments and international financial institutions. Countries in transition including Georgia, made first steps towards energy efficiency back in 1994-1995 through the various AID programs included European Union supported program - "Technical Assistance to the Commonwealth of Independent States".

Provided technical assistance in the sphere of development of Georgian energy policy did not envisaged any improvements in energy efficiency as Georgia's countrywide ineffective energy management systems could not support bill collection of and hindered the implementation of energy policy reforms. In 1996-1997, several small scale energy-savings programs were implemented and in 1998, the Energy Efficiency Center Georgia (EECG) began its operations as a not-for-profit organization¹³; also several other organizations

¹³www.eecgeo.org;

worked on energy efficiency issues primarily on an ad hoc basis implementing small grant short term programs.

Unfortunately, for many years significant basic alterations in terms of legislation on energy efficiency and/or practical implementation of energy efficiency measures have not occurred from Georgian government side if not consider a number of international, multilateral and bilateral agreements that require concrete energy efficiency and conservation actions from Georgia such as:

- Energy Charter Treaty and Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects (PEEREA);
- Framework Convention on Climate Change and the Kyoto Protocol;
- Clean Development Mechanism (CDM) under the Kyoto Protocol;
- European Neighborhood Policy;
- Memorandum of Understanding signed with Kingdom of Denmark in 2004;

These agreements could serve as roadmaps for Georgia to chart its short- and long-term development incorporating energy efficiency into the country's future. The Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects (PEEREA) is a legally binding instrument that was signed together with the Energy Charter Treaty in December 1994, by the same fifty-one states that signed the Treaty itself (including Georgia). It requires signatories to formulate energy efficiency strategies and policy aims that establish appropriate regulatory frameworks; moreover, signatories must develop specific programs for the promotion of efficient energy usage and the reduction of harmful environmental practices in the energy sector.

The policy for the efficient utilization of the power resources is defined in the Resolution of the parliament of Georgia (June, 2006) on “Main Directions of State Policy in the Power Sector of Georgia” (<http://www.menr.gov.ge/en/4546>). According to this document a sound legislative basis and institutional framework should be created for the improvement of energy efficiency in the country. So far neither legislation nor state funded projects in the energy efficiency field have been put in place.

There is no unified energy law in place for all types of energy. The important energy resources - coal and oil products, as well as renewable sources of energy and energy-efficiency are left beyond Georgian energy legislation. Due to the lack of adequate institutional and legal framework, studies produced by such organizations as Union “Energy Efficiency Center” and “World Experience for Georgia” are treated as recommendations and have little influence on energy efficiency policy of the country.

The Energy Charter Secretariat “In-Depth Review of Energy Efficiency Policies and Programmes” (2012) contains a set of recommendations on the development of future energy strategies and energy efficiency policies, creation of relevant institutional framework to lead development of legislation and promote sustainable energy within the government, development of energy market regulation to support effective energy services, continue

dialogued with IFIs and donors to strengthen the focus on energy efficiency and renewable energy, development and implementation of specific energy efficiency programs to enhance energy performance of building stock, introduction of energy efficient measures in transport, promotion of public awareness on energy efficiency among local communities and citizens.

Georgia is the only country in the region, which has not adopted energy efficiency and renewable energy laws, and this is more a sign of underdevelopment, rather than of economic policy. Indeed, this field is related to modern technologies, research and development, advanced institutions, commercial, and banking systems and commercial companies. Its implementation requires a high energy consciousness and the subtle mechanisms of economic incentives, which are characteristic of a highly developed society. This is one of the essential elements for European energy cooperation and refusing it means rejecting development and international technological and financial assistance.

Very first official EE related paper was produced in Tbilisi. In 2007 Tbilisi municipality council approved a concept of “Municipal Energy Efficiency Planning” (MEEP) covering energy efficiency aspects of municipal buildings developed by the Energy Saving International (ENSI) Norwegian energy efficiency and energy business development consulting company in cooperation with “Energy Efficiency Center Georgia” (EECG) and financial support of the Norwegian Government. But Tbilisi MEEP implementation followed up by Municipality.

Initial excitement and interest for the Tbilisi City Hall to get acquainted and be involved in common municipal energy policy issues caused the project: “Management of Domains Related to Energy in Local Authorities (MODEL)” financed by EU Commission. The project started in 2010 with the financial support of the European program CIUDAD and participation of 6 pilot cities Lviv, Kamyanyets-Podilskyi, Drochia, Spitak, Tbilisi, Lutsk) as well as non-governmental organizations from various countries including Georgia. In Georgia Economic Policy Department of Tbilisi City Dutch NGO “Energy Efficiency Center Georgia” are jointly working on the project implementation. Within the project framework the energy team was created at the Economic Policy Department. The team is actively involved in the implementation of energy efficient measures within the municipality. Team members periodically collect energy data (electricity, natural gas and water consumption). The buildings with overconsumption of energy have been identified, energy use analyzed and relevant energy efficient measures have been planned and are being implemented.

Main positive changes in terms of energy efficiency policy have taken place in 2010 by Tbilisi Municipality with signing of Covenant of Mayors and taking the commitments to reduce CO₂ emissions by 20% by 2020. As Covenant of Mayors signatory city Tbilisi municipality elaborated the SEAP which envisages the implementation of energy efficiency measures in building and infrastructure sectors. Similar situation is in other Georgian municipalities with regards to current energy efficiency policy. Apart from Tbilisi municipality four other Georgian municipalities (Rustavi, Gori, Kutaisi & Batumi municipalities) signed the Covenant of Mayors. Currently, only Rustavi self-governing city has developed SEAP, while in other cities such plans are being developed. It is anticipated

that prepared SEAPs will envisage implementation of energy efficiency measures and activities.

All above listed and considered international, multilateral and/or bilateral agreements do not require and oblige government of Georgia to implement concrete energy efficiency and conservation actions in Georgia. The obligation is not determined through the law on energy efficiency as well, as it does not exist in Georgia. Moreover, for the buildings sector in Georgia, new national construction standardization documents (codes) have not been developed and adopted yet. The primary importance during development and construction is given to structural stability, because the country is located in a seismically active zone. Old Soviet-style codes for structural stability of buildings are used for engineering calculations. The old Soviet Codes for thermal engineering of buildings are used on a voluntary basis. The elaboration of new Georgian codes in the field of construction thermal engineering has been postponed many times¹⁴.

Energy Efficiency Potential

When talking about assessment of possible energy savings through the implementation of municipal energy management policy in Georgia, only two (2) Georgian municipalities (Tbilisi municipality & Rustavi municipality) worth recalling in this regard as the ones that have developed their own sustainable energy action plans (SEAPs) envisaging specific energy efficient measures and defined possible energy saving potential.

Tbilisi identified as being critical in improving the City’s overall energy performance such sectors as: building sector, urban transport (private vehicles and public transportation), public lighting, municipal waste & waste water treatment management, and electricity & gas distribution networks and green spaces. In case of Rustavi such sectors as buildings, transport and infrastructure, including lighting and green spaces have been identified as sectors with high potential of achieving the energy saving.

The table 3 represents achievable energy saving and CO2 emission reductions for Tbilisi municipality through the implementation of various energy efficiency measures envisaged in SEAP.

Table 3. *Achievable energy saving and CO2 emission reductions for Tbilisi municipality*

| By sectors for Tbilisi Municipality | Expected energy saving [MWh] | Expected Renewable Energy production [MWh] | Expected CO2 reduction [thst] in 2020 |
|-------------------------------------|------------------------------|--|---------------------------------------|
| Transport Sector | 2094.6 | - | 513.0 |
| Building Sector | 825255.5 | 64745 | 188185.4 |
| Street Lighting Sector | 28 727.9 | - | 11.11 |
| Municipal Landfills | - | - | 246.112 |
| Waste Water Treatment (WWT) | - | - | 163.87 |
| Green Spaces Sector | - | - | 3534.0 |

¹⁴Sustainable Energy Action Plan City of Tbilisi For 2011- 2020 – page 44

In 2011 the developed SEAP for Tbilisi was submitted to the Joint Research Centre (JRC) (the group within the European Commission responsible for providing technical and scientific support to the CoM initiative). The submitted SEAP was approved officially on November 25, 2011 by the European Commission and adopted as a guidance document for the city.

Selected sectors for reduction of emissions for Rustavi are: Building and transport sectors, as well as land use planning, as an additional sector. Selection of these sectors was conditioned by their high potential of energy saving, along with lower expenses required for measures to be taken, as well as time constraints (before 2020 year).

As for Rustavi municipality as a baseline is selected 2011 year as the closest year from signing the Covenant, with relevant data available. This selection is in compliance with the methodology defined for East European countries, issuing from specifics of development of these countries since 1990 year up today, distinguishing them from developed countries. Measures to implement in this sector have been selected according to their energy saving potential, low cost and feasibility criteria.

The below table represents achievable energy saving and CO2 emission reductions for Rustavi municipality through the implementation of various energy efficiency measures envisaged in SEAP.

Table 4. Achievable energy saving and CO2 emission reductions for Rustavi municipality

| By sectors for Rustavi municipality | Savings (kWh) | Emission reductions by 2020 (tCO ₂ eq) |
|--|----------------|---|
| Municipal Buildings | | |
| -Improvement of insulation in municipal buildings;(2 buildings a year) | 377424 | 551 |
| -Installation of solar collectors in kindergartens; | 10500 | 10.6 |
| Residential Buildings | | |
| -Improvement of insulations in residential buildings;(14 buildings a year) | 4833929 | 9228 |
| -Installation of energy efficient light bulbs; (2700 bulbs in 50 pilot building) | 243024 | 35.6 |
| -Construction of low-emission pilot building (social hostel); | 56937 | 76 |
| Outdoor (street and traffic) lighting | 350425 | 101.27 |
| Improvement of infrastructure | N/A | 124020.87 |
| Total land-use planning | 5872239 | 134023.3 |

Very important measures which both municipalities will implement are working with stakeholders and public awareness-raising activities as well as measures aimed at enhancement of civil monitoring. These measures will create necessary conditions for implementation of the SEAPs and also build basis for continuation of long-term policy of energy efficient improvements and greenhouse gas reductions.

Assessment Methodology

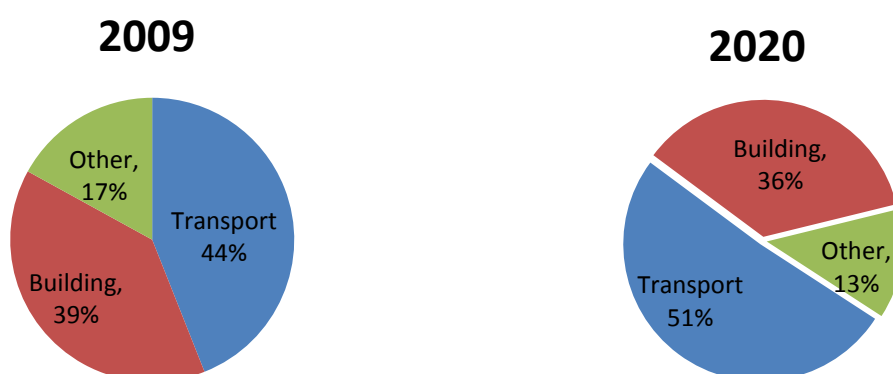
Due to the absence of energy efficiency incentives at national level there were no comprehensive studies made for assessment of national wide EE potential. At the same time after signing of Covenant of Mayors by Georgian municipalities very first drivers of EE stipulation have been created at the local level.

In one hand having obligations to develop SEAP's and on another hand absence of relevant methodology for evaluation of EE and CO₂ emission saving potentials for eastern neighborhood countries, which in nearest historic past were responsible for high energy intensity and high GHG emissions. Later on, due to collapse of USSR that resulted sever

economic crisis in post-soviet countries currently belonging to EU eastern neighborhood resulted significant drop down of energy & GHG intensity available EU methodologies became irrelevant.

When works on developing of Tbilisi's SEAP started, structure of UNFCCC CDM methodology log framework was used but instead of selection of baseline year methodology so called baseline scenario has been developed. For Tbilisi the so called "business as usual" (BAU) scenario was selected and anticipated changes in the consumption of energy were taken into account. The Reference Scenario identified possible development trends diverging with the initial state in case there is no energy program implemented. The Baseline Emission Inventory (BEI) quantifies the amount of CO2 emitted due to energy consumption in the territory of Tbilisi (Covenant Signatory) in the baseline period of 2000-2009. The Reference Scenario assesses the GHG trends for the period of 2010-2020 and allows for the quantification of the overall CO2 reduction effort to be accomplished by signatories to meet their commitment under the Covenant of Mayors. The Reference Scenario and subsequent Monitoring Emissions Inventories (MEI) allow for the identification of the principal anthropogenic sources of CO2 emissions and prioritization of the reduction measures accordingly.

The charts below describe the CO2 emissions share of the major sectors in Tbilisi municipality for the base year of 2009 and for year 2020 if no energy efficient measures are fulfilled.



Source: Presentation - "Tbilisi CoM after 2 years" made at Tbilisi Local Economic Development(LED) 6th Forum, slide 9. Presenter- M.Salukvadze, Tbilisi City Hall Economic Policy Department

Based on the Baseline Emission Inventory (BEI) for 2009 and the projection of the increase in CO2 emissions by 2020 conducted within the framework of the Tbilisi SEAP, strategies and main actions for each sector were elaborated. Fast economic development of Tbilisi, the population growth rate and increasing GDP per capita were taken as main assumptions while developing the reference scenario for 2020 and planning the concrete measures in order to decrease the energy consumption and CO2 emissions of the city. According to the BEI of 2009, the major source of CO2 emissions in Tbilisi was from the local transport sector.

In transport sector for the period 2011-2015 Tbilisi SEAP envisages the implementation of the following measures targeted at the decrease of energy consumption and reduction of CO₂ emissions: rehabilitation and development of transport infrastructure; increase the share of public transportation within a total passenger turnover; decrease the mobility of private cars and encourage low emission cars by means of various restrictions and incentives.

For Tbilisi building sector as being second largest emitter of GHGs after the transport sector the following strategies for the period 2011-2020 were identified and proposed as having potential for energy saving and decrease of emissions. These measures include: increase efficiency of heating systems and the share of renewable energy in the heating sub-sector within the municipal building stock, then expand these measures for public buildings and with the increase of energy efficiency increase share of renewable energy in residential housing.

The strategy for municipal infrastructure for 2011-2020 aims at capturing methane (CH₄) from municipal landfills and waste water treatment plants, burning or using captured methane as an energy source, increasing energy efficiency and the share of renewable energy in the outdoor lighting and developing green spaces throughout the city.

Thus, if the actions proposed in the SEAP are implemented by 2020, the overall CO₂ emissions in Tbilisi can be potentially reduced by 24%. In addition, the number of natural sources of CO₂ emission absorption, such as forest areas surrounding the capital and parks within the city, will increase and be further developed. In conjunction with the Covenant of Mayors, Tbilisi City Hall aspires to make Tbilisi the “Green Capital” of the South Caucasus¹⁵.

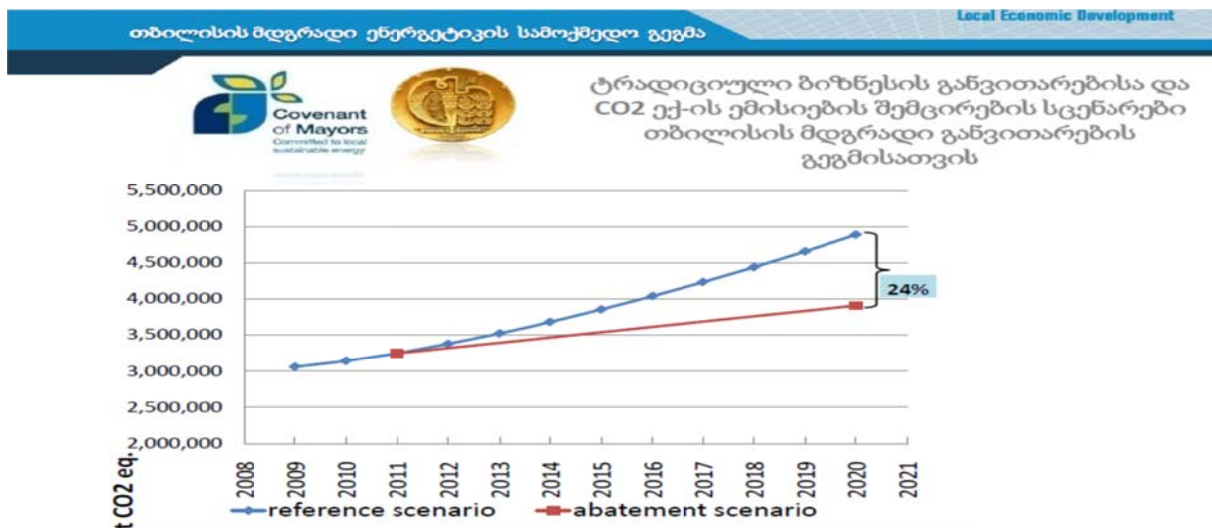


Fig:BAU and CO₂ emission reduction scenarios for Sustainable Development Action Plan of Tbilisi

In Tbilisi SEAP, its BAU scenario was developed using the LEAP tool (Long range Energy Alternatives Planning System). Based on used LEAP tool the baseline year for Tbilisi municipality was selected to be 2005.

¹⁵<http://winrock.ge/en/projects/previous/nateli/energy-efficiency>

LEAP is fast becoming the de facto standard for countries undertaking integrated resource planning and greenhouse gas mitigation assessments, especially in the developing world. The United Nations recently announced that more than 85 countries have chosen to use LEAP as part of their commitment to report to the U.N. Framework Convention on Climate Change (UNFCCC).

The Baseline Emission Inventory (BEI) quantifies the amount of CO₂ emitted due to energy consumption in the territory of Tbilisi (Covenant Signatory) in the baseline period of 2000-2009. The Reference Scenario assesses the GHG trends for the period of 2010-2020 and allows for the quantification of the overall CO₂ reduction effort to be accomplished by signatories to meet their commitment under the Covenant of Mayors. The Reference Scenario and subsequent Monitoring Emissions Inventories (MEI) allow for the identification of the principal anthropogenic sources of CO₂ emissions and prioritization of the reduction measures accordingly.

As to Rustavi municipality as a baseline year is selected 2011 as the closest year from signing the Covenant, with relevant data available. This selection is in compliance with the methodology defined for East European countries; follow from the specifics of development of these countries since 1990 up today, distinguishing them from developed countries. Unit of estimates and mandatory reduction value: mandatory reduction shall be measured in quantity, in tons of carbon dioxide equivalent (tCO₂eq) and not by calculating per capita. This choice is caused by selecting all three greenhouse gases for estimation and slow growth tendencies of Rustavi population, and is conservative approach¹⁶.

At present “Energy Efficiency Center Georgia” in partnership with the Association “Energy Efficient Cities of Ukraine” (EECU) is implementing the project “Covenant of Mayors Capacity Building Model for Ukraine and Georgia: Model Solution for Eastern Partnership and Central Asian Countries” launched within the Program of the European Commission “Covenant of Mayors going East. The purpose of the project is to support local authorities in Ukraine and Georgia, in this particular case - Gori and Rustavi municipalities, in improving their energy security, reducing greenhouse gases emissions, diminishing dependence on fossil fuels, and improving their citizens’ quality of life.

Target groups include selected officials (mayors and deputies), staff and the general public of 5 project cities, staff of the newly established Covenant Supporter in Georgia and the non-profit Covenant Energy Agency in Ukraine, and selected Ukrainian and Georgian energy professionals. Within the project framework the guidelines assisting municipalities for effective participation in the Covenant of Mayors and relevant methodologies/software tools will be developed and adapted to Georgian conditions. The project also plans to establish energy management system for municipal public buildings, including CO₂ inventory tool.

¹⁶Sustainable Energy Action Plan City of Rustavi – Page 10

The chosen methodologies and tools will assist Gori and Rustavi signatory cities in building their internal energy management capacity, to prepare energy and CO₂ emission inventories, and to set up and implement SEAPs.

Also “Energy Efficiency Centre Georgia” with the support of GIZ to Georgia is implementing project “Development of a CO₂ Calculation Tool for Georgian Municipalities”.

The project aims at the development and pilot implementation of a tool that can be used by Covenant of Mayors signatory Georgian municipalities to calculate their CO₂ emissions and to build up their institutional capacity for the application of this tool. This tool will assist municipalities during SEAP development phase as well as in the SEAP implementation monitoring process.

The developed tool will be based on widely recognized in Europe “ECOREgion” tool providing series of CO₂ and energy balances and adapted to the Georgian conditions. The EU Commission officially recognizes ECOREgion as an efficient tool for the CoM by means of an automatic function relevant balancing data can be exported to the Baseline Emission Inventory of the SEAP template. ECOREgion is used by more than 800 local authorities¹⁷.

Economic, Environmental and Policy Analysis:

As mentioned above only two cities in Georgia have developed Sustainable Energy Actions Plans and identified sectors and relevant measures for implementation. Thus this paper will consider in detail only these municipalities and analyze the planning and implementation of energy efficiency measures in the two municipalities. It is noteworthy, that the Georgian municipalities are currently working on the creation of the CO₂ calculation tool that will assist them during SEAP development phase as well as in the SEAP implementation monitoring process. Another issue to be considered in this regards is that Tbilisi municipality doesn't have in place approved methodology for calculation and monitoring of SEAP implementation process.

As for the Rustavi municipality, its SEAP is currently under the consideration by the Joint Research Centre and speaking about specific results in CO₂ reduction is not realistic. At the same time the municipalities have started the implementation of the measures included in SEAPs and presented paper provides the analysis of those measures with indication of expected emissions reductions.

In case of Tbilisi building sector, urban transport (private vehicles and public transportation), public lighting, municipal waste & waste water management treatment, and green spaces as being critical in improving the City's overall energy performance will be considered.

¹⁷<http://toolbox.climate-protection.eu/search/?cmd=view&uid=ad9bf8e1>

For Rustavi, as identified by SEAP, sectors with high potential of achieving the energy saving such sectors as buildings, transport and infrastructure, including lighting and green spaces will be considered.

Policy measures impact in municipal transport sector

A Strategic Plan for Future Development of Tbilisi has been developed based on the Baseline Emission Inventory (BEI) for 2009 and the projection of the increase in CO₂ emissions by 2020 using the SEAP framework.

A rehabilitation and development of transport infrastructure was identified as the short-term strategy (2011-2015) for the sector that comes in full accordance with the Strategic Plan of Tbilisi. It will result in a partial decrease of CO₂ emissions from the transport sector.

The mid-term strategy (2012-2018) is to increase the share of public transportation within a total passenger turnover. Special attention will be paid to the development of an electric transport network since the energy intensity of electric transport (such as tram and subway) per passenger per kilometer is much better compared to other modes of public transport.

The long-term strategy (2018-2020) of the transport sector aims at decreasing the mobility of private cars and encouraging low emission cars by means of various restrictions and incentives (it is implied, that this will happen by the time the public transport and street infrastructure is well developed and meets society's need in terms of speed, convenience and accessibility). Sustainable energy strategy in transport sector for Rustavi implies the following:

- ❖ Development and improvement of infrastructure;
- ❖ Limitation of private transport use by means of encouraging public transport use, improvement of its service and popularization;
- ❖ Renovation of municipal and public transport fleet (medium-term strategy);

Some of the measures included in Tbilisi and Rustavi SEAPs have already been implemented, or are under implementation. Among measures that are being implemented in Tbilisi is traffic lights management system which is supporting the “green ways” for vehicles on six very busy streets and avenues. Such system decreases the moving time for vehicles, number of stops at traffic lights and as a result reduction in fuel consumption. Every year 15-20 traffic lights will be added to the system with final number of 160 traffic lights managed from the Traffic Lights Management center. Total investments necessary for the complete implementation of Traffic Lights Management center is estimated at 32,697,341 GEL (19,697,193 USD) and



Picture 3: Traffic lights System in Tbilisi City

estimated energy savings in 2020 of about 490 MWh and emissions reduction of about 12.85 thousand tons of CO₂.

Very important role in Tbilisi SEAP is devoted to the improvement of road infrastructure, including intensification of the roads, construction of new roads and tunnels, like Gelovani-Agmashenebeli tunnel or new road from Hero's square which have been already constructed and other similar measures to be implemented in the near future will enable Tbilisi to reduce annual energy consumption in transport sector by 2094MWh with expected reduction of CO₂ in 2020 of about 513 thousand tons.

Improvement of infrastructure falls within the priorities of the Rustavi city development strategy as well. Such measures which foresee construction and rehabilitation of roads together with and other means of optimization of traffic in the city (management, creation of „green” ways, management of traffic lights) are to be finalized by 2015 that will set a base for implementation of other measures. In 2012 in Rustavi more than 3 km in length streets were constructed & rehabilitated. But the work in this direction will continue till 2015. Estimated emission reductions resulting from this measure according to SEAP will make up 10% of baseline emissions from transport and amount to 32628 tCO₂eq. Like in Tbilisi, measures on improvement of traffic management have been started and will continue after 2020. These measures include: creation of traffic lights management center, intensive movement and „greenways” sections, installation sensors in traffic lights and their management will reduce fuel consumption and reduce emissions by 5% or 1630 t CO₂ eq.

Improvements in public transport services are important activities implemented in Tbilisi which in addition to attracting more passengers result in fuel consumption and emissions reductions. One of the important measures implemented in this direction is introduction of a fleet of Ford Transit minibuses in 2011. The yellow minibuses have electric route display boards, well organized technical inspection services, increased safety requirements and drug & alcohol test for drivers. Such improved services increased the attractiveness of public transport among the population and decreased use of private cars. The activities which already have been implemented by the Tbilisi Transport Company include optimization of bus routes by decreasing the number of bus lines from 125 to 92, improving ticketing system by introducing common payment system for bus, minibus and metro and introduction of top up machines at bus stops. Planned piloting of dedicated bus lanes will be introduced after feasibility study.

One of the implemented measures aimed at boosting public transport ridership was creation of a network of electronic display boards placed in all of the major bus stops, which tell potential riders when the next bus will arrive. Such a system has worked well in increased public transport ridership, as with such information people have precise information how long they have to wait for the bus. In 2012 new SMS service enabling passengers to get information on the bus arrival time at specific bus stop was introduced. In 2013 the development of special transport application for mobile phones enabling passengers to enjoy such services as trip planning, bus in real time, information on bus stops, bus arrival time in real time, timetables, etc. In 2013 the integration of the information on Tbilisi bus routes, bus stops, timetables in Google system (Google Transit) will be finalized and passengers could plan the trips, get the information on bus routes and bus stops on Google Map.



Picture 3: Electronic Display Board in Tbilisi City

All buses have been equipped with GPS systems, which monitor their progress along routes as well as displaying accurate time on the monitors. The introduced GPS system can also be used to monitor daily travel patterns and improve routes to reduce fuel consumption. In addition to energy efficiency improvements, there are plans underway to continually expand the system, so that more and more people come to rely on public transport. Right now, most people are within 300 m of a public transport station, but local authorities plan to lower that distance even more and to increase service speed and quality.

The above measures are aimed at making public transport more comfortable and easier to use. They don't directly affect the emissions, but act as a powerful tool to amplify the effects of actions, which will be introduced at the late stage (like private car restricting actions). It was estimated that these actions will increase the modal share of public transport in Tbilisi by 4% by 2020.

Rustavi SEAP envisaged the optimization of public transport services represented by buses and route mini-buses, including optimization of fleet number, lengths of routes and movement schemes, providing transport network to become simultaneously comfortable, energy saving and environment-friendly. As a result of works carried out in this direction today municipal buses serve passengers on 6 routes. All the busses on these routes are equipped with modern GPS tracking systems intellitrac A1, and at 23 bus stops electronic display boards have been placed informing passengers on bus routes. As estimated such measures as optimization of city transport operations can result by 2020 in at least 3% reduction (9788,53t CO₂eq.) from entire road transport baseline emissions. Rustavi also plans to renovate its mini bus fleet in coming years and thus estimates to reduce emissions.

According to Rustavi SEAP the implementation in transport sector of such planned measures as improvement of roads and traffic management, optimization of city transport and renovation of both public and municipal transport fleet can result by 2020 in the emissions reductions of about **124020 t CO₂ eq.**

Another important improvement in public transport which was also included in Tbilisi SEAP was replacement of old big buses with new busses consuming less fuel being more energy efficient. Tbilisi Transport Company is currently running 3 bus parks responsible on the repair of the buses. As the bus fleet grows older the company is working on the creation of the repair & maintenance center for the yellow busses equipped with necessary machinery to provide all the necessary services for the buses. Rustavi also plans to renovate its bus and mini bus fleet in 2011-2014 and thus estimates to reduce emissions.

Tbilisi's most widely used public transport-metro system has two main lines – Line 1 (red line) and Line 2 (blue line), with 27 km of double-track and 22 stations. The project for the extension of metro line 2 by 1.5 km and opening of new station "University" started back in the 1980s and has almost been completed. As one of the measures of Tbilisi SEAP this station will be finished. It is expected that the extension will add 4.4 million passengers per year to the metro network. The investment cost of the project is 30 million USD that will be provided by the Asian Development Bank (ADB) as a loan to the municipality. In 2013 Tbilisi Transport Company plans the modernization of its dispatch center, modernization of additional 14 compartments and will continue further till the complete modernization of the fleet is achieved.

The tram and trolleybus network was well developed and widely used in Tbilisi during Soviet times. After gaining independence, due to an energy crisis, the electric transport system in Georgia declined and could not offer regular services to passengers. However, these modes of transportation maintained popularity among its citizens. In 2006, by the decision of the Tbilisi City Hall, the tram and trolleybus system was abolished and removed. However, as a part of SEAP measures, the tram network will be reintroduced and promoted as an eco-friendly means of transportation. A modern electric tram system is: safe, less pollutant than other means of transport, less noisy, comfortable for passengers, has large capacity as can carry about 3000-15000 passengers per hour in one direction, consumes less energy. Initially it was planned to construct the tram network by 2014 but as the works have never been started it is not clear when this project will start.

Georgian citizens including prefer having private cars considering this more convenient and time saving than public transport. According to the SEAP Baseline Emissions Inventory for 2009, Tbilisi city commuters travelled 7544 million passenger-kilometers in total, 73% of

which travelled by private cars and 27% by public transport. Within the public transport about 50.3% of the mobility was provided by minibuses, 25.1% by busses and 24.6% by subway.

It is notable that in recent years as reported by the Tbilisi transport company due to the improvement of passenger services in recent years in 2012 in comparison to 2011 on average the number of passenger ridership by public transport, including buses and metro increased by 12%. In spite of increase of number of passengers using public transport the private car share is still very high.

The large majority of cars in Tbilisi as well as in Rustavi are old (almost half of them are 20 years or older), and they are highly fuel inefficient and polluting. Since there are no laws in place restricting vehicle emissions, people usually buy second-hand cars that run on leaded petrol (which is cheaper than unleaded gas).

SEAPs developed for Tbilisi and Rustavi contain a set of measures targeted at the decrease of usage of private cars in both cities. These measures include: creation of “environmental islands” where the private traffic is prohibit/penalized, decrease of roads available for private cars, limitation of speed; introduction of fee for driving in the city center; parking management & development of several parking structures. As for today 40,000 parking spaces with annual fee of about 30 USD have been created in Tbilisi. As estimated these actions might decrease the modal share of private transport by 5% by 2020. Re-introduction of obligatory technical inspection of cars planned for 2015 will help to replace highly polluting gasoline and diesel vehicles and decrease emissions.

One of the measures planned for implementation in both cities is municipal fleet renovation: in Tbilisi 80% of municipal personal service cars will be substituted with smaller 1.1 motor capacity cars while in Rustavi all 6 obsolete vehicles will be replaced in 2013-2014.

Policy Measures Impact in Building Sector

Like in many cities, in Tbilisi & Rustavi building sector is agreed to have a huge energy saving potential dispersed in heating, lighting and insulation. Tbilisi & Rustavi SEAPs have identified and recommended measures that should result in energy savings and decrease of emissions for both municipal buildings and residential housing, in particular:

Municipal buildings:

- Installation of space heating systems-local boilers operating on natural gas and use of bio-waste briquettes for heating;
- Installation of efficient lighting systems;

- Refurbishment/renovation of buildings-development of energy passports, building exterior insulation, low energy pilot building, replacement of doors & windows with PVC ones, repair of roofing;
- Utilization of solar energy for hot water supply-installation of solar collectors in sports schools, kindergartens and hospitals.

Residential buildings:

- Installation of central heating systems, utilization of geothermal energy for heating & hot water supply, use of bio-waste briquettes for heating
- Renovation/refurbishment-weatherization of common property areas, insulation of roofs and building exterior, low energy pilot building-social hostel;
- Installation of energy efficient light bulbs;
- Utilization of solar energy for hot water supply- installation of solar collectors on pilot site;

As the implementation of the measures recommended by SEAPs are in initial stage, the presentation of any actual results at this time is not realistic and thus the energy savings and emissions reduction figures presented below in the table are rather expected than already achieved. Moreover, start date for implementation of several planned measures is 2013 and beyond.

Table 5.Expected energy savings and emissions reductions from planned energy efficient measures in Tbilisi & Rustavi building sector

| Municipality | Type of building | Measures | Cost of measure GEL | Expected energy savings MWh/y | Expected renewable energy production MWh/y | Expected CO2 reduction (t/y) in 2020 |
|--------------|------------------|--|---------------------|-------------------------------|--|--------------------------------------|
| Tbilisi | Municipal | Installation of space heating systems | 1780 000 | 1055 | 6305.3 | 1482.9 |
| | | Installation of efficient lighting systems | 41760 | 1147.5 | | 447.9 |
| | | Refurbishment/renovation of buildings | 1925293 | 3642.95 | | 753.8 |
| | | Solar energy for hot water supply | 117000 | | 189 | 37.8 |
| | Residential | Installation of central heating systems | 7696000 | | 57200.7 | 11506.37 |
| | | Renovation/refurbishment | 262829520 | 698381 | | 141659.6 |
| | | Installation of energy efficient lighting | 1000000 | 29410 | | 11730 |

| | | | | | | |
|---------|-------------|---|---------|--------|------|--------|
| | | Solar energy for hot water supply | 650 000 | | 1050 | 210 |
| Rustavi | Municipal | Refurbishment of buildings- replacement of windows & doors with PVC ones, insulation of roofs | N/A | 377.4 | | 550.9 |
| | | Solar hot water supply in kindergartens | N/A | 10.5 | 10.5 | 10.6 |
| | Residential | Improvements of insulation- entrance doors, repair of roofs & entrance doors | N/A | 4833.9 | | 9227.8 |
| | | Installation of energy efficient lighting | N/A | 243 | | 35.6 |
| | | Construction of low emission pilot building- social hostel | N/A | 56.9 | | 76.1 |

Source: Tbilisi and Rustavi SEAPs

As could be seen from the table the offered measures, except maybe of installation of energy efficient light bulbs to replace existing incandescent light bulbs, are high cost measures. The analysis of Tbilisi SEAP shows that the payback period for implementation of measures for building exterior refurbishments which are high cost measures is up to 8 years which is good indicator.

Very important measure recommended in SEAPs for Georgian municipalities is arrangement of space heating with local boilers operating on natural gas. After the SEAP development the situation with the majority of municipal buildings, especially in kindergartens, has drastically changed and the autonomous heating systems operating on natural gas have been installed. It should be noted here that implementation of this measure separately might not result in substantial energy savings, as before the introduction of central heating systems only several rooms were heated. When combined with refurbishment of the building, including insulation of building envelope, the expected energy savings and emissions reductions are achievable.

The measures envisaged by Tbilisi SEAP for central heating of residential buildings include pilot projects with the utilization of the renewable energy sources (geothermal, biowaste) have not been fulfilled yet. Currently Tbilisi municipality is working on the implementation of the demonstration project for one apartment building which will include such measures as: insulation of building envelope, construction of central heating for the building working on natural gas, installation of solar thermal systems for hot water supply.

Other example of arranging central heating for the residential buildings is in new environmentally friendly Green LISI Town. The Green Lisi Town will occupy area of about 400 acres around the Lisi Lake in Tbilisi and besides residential buildings include big recreational zone. The construction works started in the autumn of 2011 and only the first phase of works has been completed.

These are just pilot developments and talking about wide scale character of construction of central heating in residential sector is too early. Currently due to low solvency and the lack of low cost financial mechanisms to finance the central heating systems, the population prefers low investment solutions and higher operation costs options with less comfort and safety. Another problem is low organizational level of associations of apartment owners. Such organizations have been created in Tbilisi but mainly they worked in partnership with municipality which provided up to 70% financing for the rehabilitation of leaking roofs and elevators in multi-storied buildings. In case long-term low cost financial mechanism is created by the municipality it seems probable that in partnership with associations of apartment owners projects for construction of central heating systems for apartment buildings on a wide scale might become reality.

In October, 2011 under the umbrella of the Europe and Central Asia Sustainable Cities Initiative (ECA SCI) TRACE analysis was carried for Tbilisi municipality.

TRACE (Tool for Rapid Assessment of City Energy) is a simple and quick diagnostic tool that is used to assess a city's energy performance in six service areas (urban transport, municipal buildings, water and wastewater, solid waste management, public lighting, and power and heat), and to provide recommendations for improving energy efficiency. TRACE consists of three modules: an energy benchmarking module which compares key performance indicators (KPIs) among peer cities, a sector prioritization module which identifies sectors that offer the greatest potential with respect to energy-cost savings, and an intervention selection module which functions like a “playbook” of tried-and-tested EE measures and helps select locally appropriate EE interventions.

The benefit of the TRACE analysis is that it adds an economic point of view to the environmental perspective that is at the core of the SEAP framework. Thus, whereas SEAP focuses on GHG abatement potential, TRACE helps determine energy and cost savings potential in six service areas that are traditionally under the control of local authorities. Moreover, TRACE allows the prioritization of energy efficiency investments, based on cost saving potential, and drawing on a list of recommendations that range from low-cost to high-cost.

TRACE report prepared for Tbilisi municipality contains some recommendations that can result in decrease of electricity bills and allow for a fast amortization of investment costs. Relatively low cost recommended energy efficient measures for Tbilisi municipal buildings include: replacement of inefficient light bulbs with LEDs, introduction of inexpensive automatic shut-off systems that turn off the light when nobody is in the room, acquisition of energy efficient appliances. It is also recommended that planned pilot programs are followed by more complex programs aimed at reduction of heating needs¹⁸.

¹⁸ ECA Sustainable Cities: Improving Energy Efficiency in Tbilisi, TRACE Study report. p.30.

Policy Measures Impact in Other Municipal Sectors

Street Lighting Sector

Street Lighting Sector is considered by both municipalities to be the an area in which due to performed energy efficient measures considerable energy savings and emission reductions are achievable.

Nowadays Tbilisi is known as city of lights in which almost all streets, avenues, parks, historical & government buildings are illuminated with about 125,000 fixtures at night while in 2005, there were about 25,000 fixtures illuminating mostly the city center. As mentioned above in Tbilisi SEAP the base year for calculation energy consumption and relevant GHG emissions is year 2009. In 2009 there were 92560 light fixtures in Tbilisi consuming 46800 MWh of electricity and street lighting sector accounted to 18720 tons of CO₂ eq. Annual growth of fixtures assumed in Tbilisi SEAP is equal to 1.1%. According to the baseline scenario estimated electricity consumption in 2020 might reach 52780 MWh and CO₂ emissions equal to 21111 tons.

As recommended by Tbilisi SEAP the introduction of smart street light management systems can reduce electricity consumption by 40-60%. The implementation of this measure has been started and currently 800 digital and centrally controlled distance management units, which assess the need for street lighting during certain hours between 2 AM and 5 AM and adjust luminosity accordingly, are in place. The cost of this measure as estimated is 3 000 000 GEL and the implementation of this measure will be completed by the end of 2013. Annual estimated electricity consumption in 2020 will be 26390 MWh and CO₂ emissions 8450 tons, or 12661 tons of CO₂ decrease.

Another alternative measure recommended in Tbilisi SEAP is gradual introduction of LED lighting systems with the total cost of measure amounting to 76,000,000 GEL. As a pilot project LED lighting systems have been introduced on some streets, but with the consideration of high investment and maintenance costs the expansion of such experience didn't follow. With endorsement of the carried and planned measures TRACE study for Tbilisi municipality contains some recommendations related to improvement of energy efficiency in this sector such as: solar powered street lights for infrequently travelled areas, light poles with automatic switches with motion detectors and dimmers. In addition, local authorities are recommended to develop a procurement guide for new street lights by the time the installed lights grew older and require replacement¹⁹.

As for Rustavi municipality, in 2011 the electricity consumed by this sector amounted to about 5256 MWh producing emissions of about 767 tons of CO₂. As an effective measure to decrease electricity consumption and reduce associated emissions, according to Rustavi SEAP the city is planning to replace 10% of its high pressure mercury street lights with sodium

¹⁹(ECA Sustainable Cities: Improving Energy Efficiency in Tbilisi, TRACE Study report. pp.32-33.

light bulbs thus improving efficiency 2-2.5 times. This measure will result in annual decrease of energy consumption by about 350 MWh and emissions reduction by 51.27 t CO₂ eq.

As alternative or additional measures replacement of incandescent halogen lamps with LED light bulbs, reducing consumption more than by 50% and introduction of sensor management of street lighting, including regulation of streets' illumination in accordance with street traffic intensity is also considered by Rustavi SEAP.

Municipal Landfills

This is sector in Tbilisi municipality where many improvements has taken place recently. Most important among them include:

- Consolidation of four operating landfills into one servicing the whole Tbilisi. The new Norio Landfill which was opened in 2011 is designed to handle the waste generated not only currently but with the consideration of waste quantities growth due to increased consumption, population growth and inclusion of Tbilisi suburbs in the landfill service area. The new landfill is fenced in (to prevent the access of scavengers and cattle), it is organized around several individual cells equipped with protective linen against leachate that could contaminate soil and groundwater and drainage system. The cells are equipped with devices for methane capture. The captured methane is then flared.
- Introduction of about 10 000 metal garbage cans spread throughout the city
- Introduction of new energy efficient garbage trucks to enable city to reduce fuel consumption,
- Optimization of waste collection routes every time new truck is added to the network and introduction of transfer station where waste is consolidated in large transfer trucks which go to landfill. Such measure resulted in approximately 20% fuel savings for the municipality.

According to SEAP among measures for Norio Landfill the Construction and Operation of LFG Recovery System at Norio Landfill is also envisaged. The landfill will be equipped with an LFG collecting system and then use the recovered gas (inner use, consumption for electricity and/or heat, use in transport, etc). According to SEAP the timeframe for the implementation of this measure with the total estimated cost of about 12 ml euro is 2012-2015.

As for the two closed landfills in Gldani and Iagluja SEAP envisages the Construction and Operation of LFG Collection and Flare Systems at these currently closed sites.

In case all the planned measures, including: Landfill Gas Collection (LGC) and Flare from closed Gldani 2 & Iagluja sites an Construction and operation of LFG flaring system at Norio landfill are implemented then the sector could reach the target for CO₂emissions reduction for this sector in 2020 equal to about 249000 tons (Source: Tbilisi SEAP, p.117)

Key improvement in Tbilisi waste management system is introduction of tariffs and collection of payments as collections permit investments in the sector for further improvements.

Until recently the households were charged a percentage of their electricity bill, though currently the city council is discussing the option of charging households fixed sum for each family member. Commercial users and institutions are billed at a higher rate according to the type of organization and carried activities.

Waste Water Treatment

“Georgian Water and Power” (GWP) is a private company that is responsible for delivering drinking water to Tbilisi and its neighborhoods and providing wastewater services. As stated in TRACE study report overall, the Tbilisi water system is very energy intensive when compared to other cities, having one of the highest energy expenditures for every cubic meter of potable water produced. (TRACE report)

However, while the Tbilisi water system is energy intensive, the energy itself is not a big cost item for GWP. The company owns two hydro-plants (Zhinvali and Tetrichevi), which not only cover its own energy costs, but also produce surplus energy which is sold to the grid.

Because of that, there are few incentives for GWP to make the system more energy efficient. The company hopes to none-the-less increase efficiency in coming years, by investing in the rehabilitation of the existent infrastructure, and by introducing water meters to all end-consumers.

As far as sewage is concerned, over 97% of people in Tbilisi are covered by a sewage network, and the city is serviced by a wastewater at Gardabani treatment plant. The plant was constructed in 1986 with a capacity of 1.0 million m³/day, and in recent years it did little more than just mechanical cleaning of the discharge water. As of 2011, none of the received wastewater was being treated, and no energy was spent in the sector.

SEAP developed for Tbilisi envisages either partial or complete rehabilitation of the waste water treatment plant to its design capacity in the period 2012-2020 with estimated investments of about 20mil.euro. Another proposed option is to renovate the plant to meet the modern standards, purchase new parts and devices and substitute the obsolete ones at investment cost of 10 mil. euro. The estimated emission CO₂ equivalent reduction target in 2020 will be 163.87 tons.

Rustavi municipality SEAP before 2020 includes such sectors as buildings, transport and infrastructure, involving lighting and green spaces as having high potential of energy saving, along with lower expenses required for implementation of these measures and doesn't consider neither municipal landfills nor waste water treatment.

Creation of green spaces

In 2011 Tbilisi City hall started the campaign “Plant a tree, make Tbilisi green”. Within the campaign which was supported by the Catholicos Patriarch Ilia II who called the population for free planting 150 000 trees were planted. This process continues and annually.

Currently within the WWF funded year project 100 hectares of forests would be restored in Tbilisi suburbs. The works on greening of the adjacent territories of the Tbilisi University, Tbilisi sea, former Gldani landfill will continue and more trees to current 30000 already planted will be added. Within Tbilisi about 100 public gardens and parks have been rehabilitated. In 2013 the rehabilitation works in Vakepark and Bukia garden have started. In order to develop Tbilisi greening policy the special map to conduct inventory of plants and trees was created. Expected CO₂ reduction resulting from tree planting, in particular: 11,400 trees/plants planted in 2011 will amount to 3534 thousand tons in 2020. (Source: Tbilisi SEAP p.135)

Further plans for creation of green spaces include integration of Mziuri Park and Tbilisi Zoo into one massive green area in city centre, rehabilitation and development of the Khudadovi Forest to a 66.5 ha area in total (3 hectares in 2011), rehabilitation of forest in Turtle Lake Area up to 29.2 ha forest area. Currently all the forests around the city are managed by the Department for ecology and greening within Tbilisi municipality.

Rustavi SEAP among the city greening measures envisages planting of 1200 trees in parks, yards and other places of the city. The implementation of this measure will be carried out gradually with wide public involvement to raise awareness among citizen on importance of greening. Implementation of planned "greening" measures will result in absorption of about 1500 t CO₂eq emissions.

Public Awareness Activities

Very important measures carried out both in Tbilisi and Rustavi are public awareness activities promoting energy efficiency and by this way to remind public at large on the renewable energy and energy efficiency potential for the mitigation of the global and local environmental, social and economic problems. Beginning from 2011 Tbilisi municipality supports activities (exhibition of thematic posters, exhibition of students' works “Sustainable Energy in Architecture”, kid's renewable energy & energy efficient projects, marathons, etc.) implemented within Georgian Sustainable Energy Weeks organized annually as a part of European campaign and registered in the



Picture 4: “Intelligent Energy Day” in Rustavi Municipality

European Sustainable Energy Week agenda. As a part of Tbilisi Municipal Intelligent Energy Days the European Display Campaign- a voluntary labelling scheme, initiative encouraging municipalities to publicly display environmental performances of their municipal buildings was launched and with assistance of Energy Efficiency Center Georgia, display posters were developed for 10 municipal kindergartens. Rustavi municipality in partnership with NGOs beginning from 2012 organizes periodically Intelligent Energy Days including such events as: “Let’s Save Energy “for ethnic groups living in Georgia; organization of renewable energy & energy efficiency training workshops in several schools, organization of thematic exhibitions of young artists.

Policy Design Considerations

As described in chapter above both municipalities have started the implementation of the measures proposed in their SEAPs though it is noteworthy that due to voluntarily/non commitment nature of CoM policy, implemented energy efficient measures has a bit chaotic character. Achieving relevant energy efficiency /energy savings envisaged in Georgian SEAPs and granting to CoM policy more flexibility and viability steps towards creation of comprehensive legal framework providing for the implementation of the envisaged energy efficient measures and planning of such measures on country wide scale should be done by the country government.

The major policy document defining efficient utilization of the power resources in Georgia is the Resolution of the Parliament of Georgia (June, 2006) on “Main Directions of State Policy in the Power Sector of Georgia” (<http://www.menr.gov.ge/en/4546>). Unfortunately since then a sound legislative basis and institutional framework for the improvement of energy efficiency in the country hasn't been created. Georgia is the only country in the region, which has not adopted energy efficiency and renewable energy laws. Nowadays, Georgian government can't postpone the elaboration of the comprehensive energy policy or strategy, which would guide the development by providing clear and justified objectives, priorities, estimate of acceptable risks, and the framework for improvements. Recently Ministry of Energy has announced that it started work on the elaboration of the state energy policy and started drafting the energy efficiency and renewable energy laws.

National Environmental Action Programme (NEAP) for the period 2012-2016 sets long term goals, short-term targets and provides respective activities for various themes, among them climate change, waste, water resources, forests. The plan stresses the importance of the coordination between the national and municipal levels. For the creation of favorable conditions for the reduction of GHG emission NAEP stipulates implementation of donor supported pilot projects in cooperation with Tbilisi City Hall in increasing the energy efficiency in housing sector, promote utilization of renewable energy sources by creation of pellet production facility, carry out technology needs assessment.

In spite of the lack of adequate institutional and legal framework for the energy efficiency development on the country level, on municipal level the efforts towards municipal energy efficiency plan covering energy efficiency aspects of municipal buildings in Tbilisi were made within the international donor assisted programs back in 2007. Though the plan was not fulfilled to the required extent, it created necessary preconditions for the city to join in 2010 the Covenant of Mayors.

As Covenant of mayors signatory city, Tbilisi municipality elaborated SEAP envisages the implementation of energy efficiency measures in transport, building and infrastructure sectors taking the commitments to reduce CO₂ emissions by 20% by 2020. The fact that Tbilisi was followed by several other Georgian municipalities (Rustavi, Gori, Kutaisi & Batumi) in joining the CoM is good indication that the municipalities are seriously thinking on adoption of energy efficient measures in order to reduce energy consumption as well as GHG emissions.

As indicated in previous chapters of the paper the transport is the biggest pollutant both in Tbilisi and Rustavi and other cities as well. There are number of laws, decrees, and orders regulating the transport sector and its environmental impact on the territory of Georgia: Georgian Law on Traffic, Georgian Law on Traffic Safety; Georgian Law on Ambient Air Protection; Presidential Decrees on "Improvement of Environmental Safety of Road Transport" and on "The Conception of Transport Policy of Georgia". However, the lack of coordination between responsible agencies at national and local hinders efficient enforcement of the existing legal mechanisms. Moreover, municipal transport departments (companies) do not have their own special strategic documents that would define long- and mid-term objectives within the transport sector that hinders the efficient and systematic development of the transport network and infrastructure in the cities. With apparent increase of private cars throughout the country and people's preference for using cars over other means of transport there is need in proper regulation for car energy and engine performance. Streets in the cities are congested and polluted by car exhaust. Re-introduction of obligatory technical inspection of cars planned for 2015 might help to replace highly polluting gasoline and diesel vehicles and decrease emissions.

To counteract congestion, local authorities have put a series of measures in place to ease traffic. But the more space was created on city streets for cars, the more people started using cars. The municipalities plan the implementation of certain measures that will restrain traffic and parking and encourage alternative modes of transportation.

Such policy measures as introduction of traffic lights management system, optimization of bus fleet, extension of subway line, improvement of public bus services, improved road infrastructure, activities on popularization of public transport use which have been planned and successful implementation started in Georgian municipalities will decrease the energy consumption in transport sector and result in emission reductions.

Analysis of SEAPs prepared by the Georgian municipalities indicates that the building sector is among major sectors requiring implementation of energy efficient improvements while new national construction standardization documents (codes) have not been developed and adopted yet. The primary importance during development and construction is given to

structural stability, because the country is located in a seismically active zone. Old Soviet-style codes for structural stability of buildings are used for engineering calculations. The old Soviet Codes for thermal engineering of buildings are used on a voluntary basis. The elaboration of new Georgian codes in the field of construction thermal engineering has been postponed many times²⁰.

The change with this regard might occur when the “Code of Spatial Planning and Construction Activities” is being developed. Currently with the support of German Technical Assistance Program GIZ and involvement of local and international experts, Ministry of Economy and Sustainable Development of Georgia is working on the development of such a code. As envisaged one of the chapters of the code will be devoted to the policy of energy efficiency regulation. It is expected that in a few months the “Code of Spatial Planning and Construction Activities” will be elaborated and sent the Parliament of Georgia for consideration and adoption by the autumn 2013.

Municipal waste & waste water management treatment are among the important sectors considered in Tbilisi SEAP. Though many improvements have taken place in this sector in Tbilisi for the whole Georgia this not a case. There is no specific law on waste management that would regulate the sector on a national level. The main laws regulating this sector are: “Law on Environmental Protection” and “Law on Healthcare”. On a local level, according to the Georgian Organic Law on Local Self-Government (2006), the planning and implementation of collection and disposal of household waste is the responsibility of local-government entities. However, legislation does not require municipalities to develop municipal waste management plans or clarify the legal status of these plans if they are developed. Cities dump waste in individual open landfills, without any further treatment. In small towns and villages the waste is dumped in wild dumps. With overall consumption increase in the country, solid waste quantities will grow becoming a problem - even for Tbilisi.

Very important issue is the capabilities of the municipalities necessary for successful energy management. For instance, current municipal energy management system mechanism at Tbilisi Municipality doesn't meet the common contextual meaning as it doesn't provide for: collection and creation of database, analysis and assessment of database, methods of analysis and evaluation of available information, determination of information sources and all other steps related to municipal energy management that would allow the city to establish, develop and implement an integrated municipal energy management system useful for carrying out relevant energy efficiency measures.

²⁰Sustainable Energy Action Plan City of Tbilisi For 2011- 2020 – page 44

According to the information provided by the Economic Policy Department at Tbilisi Municipality, the city is considering the establishment of a new more modernized department and/or agency for municipal energy management. Presumably the obligations identified in the CoM are major stimulating factors for this new effort.

National Association of Local Authorities of Georgia (NALAG) plays a very important role for capacity building of local municipalities throughout Georgia on municipal development programs.

In order to facilitate Georgian signatory municipalities' effective participation in the CoM policy and to increase their capacity for addressing the Covenant commitments through the development and implementation of local sustainable energy policy and Sustainable Energy Action Plans (SEAPs) several international donor supported projects are being implemented by local non-governmental organizations. The project "Covenant of Mayors Capacity Building Model for Ukraine and Georgia: Model Solution for Eastern Partnership and Central Asian Countries" implemented by "Energy Efficiency Center Georgia" in partnership with the Association "Energy Efficient Cities of Ukraine" (EECU) in addition to providing local municipalities with necessary guidelines and methodologies for effective implementation of energy efficient activities, the project will support cities in establishing energy management system, training of energy managers.

Another project that currently is being implemented with the support of GIZ to Georgia is "Development of a CO2 Calculation Tool for Georgian Municipalities". The aim of the project is development and pilot implementation of a tool that can be used by Georgian municipalities that have joined the Covenant of Mayors for calculating their CO2 emissions and to build up their institutional capacity for the application of this tool.

When joining the Covenant of Mayors Tbilisi, Rustavi and other cities of Georgia took ambitious energy and environmental plans. As the municipalities lack capacity to develop large investment projects and bring the plans to reality institutions like the European Local Energy Assistance (ELENA) facility can assist. ELENA provides financial and technical assistance to help local and regional authorities attract funding for sustainable energy projects. Run by the EIB, it is funded through the European Commission's Intelligent Energy-Europe programme and supports energy efficiency and renewable energy projects. ELENA covers up to 90% of the technical support cost needed to prepare, implement and finance the investment programme. This could include feasibility and market studies, programme structuring, energy audits and tendering procedure preparation. With solid business and technical plans in place, this will also help attract funding from private banks and other sources, including the EIB (European Investment Bank). In the period February-June, 2012 ELENA has been on mission trip in Georgia and conducted market study.

In 2012 EIB opened credit line in the amount of 50 million Euro for Georgian TBC bank to finance energy and environmental projects carried out by SME, mid-caps and public entities through leasing schemes (<http://www.eib.org/projects/loans/2011/20110303.htm>).

The Eastern Europe Energy Efficiency and Environment Partnership (E5P) is a multi-donor fund managed by the EBRD designed to promote energy efficiency investments in Ukraine and other eastern European countries.

(<http://www.easternpartnership.org/ru/publication/economy/2011-04-04/e5p-partners-efficient-energy-sector>). The fund will complement energy efficiency loans provided by financial institutions including the European Bank for Reconstruction and Development, the European Investment Bank, the Nordic Investment Bank, the Nordic Environment Finance Corporation and the World Bank Group. Grants under E5P are allocated to four priority areas: district heating, other energy efficiency projects, environment projects in Ukraine as well as additional projects in other eastern European countries. The partner countries of E5P are; Ukraine, Moldova, Belarus, Armenia, Azerbaijan and Georgia. In addition to promoting energy efficiency in district heating projects, funding will also support other investments aimed at making substantial energy savings. Environmental projects, such as waste water or renewable energy, are also within the scope of the grant funding. Recently signed memorandum will enable Georgia to enjoy the financial resources of E5P. The financially profitable projects having positive effects on energy efficiency and the environment will be funded –part of the financing will be grant from E5P fund and the other part will be loan from IFIs.

On November 30, 2012 the EIB loan in the amount of 40 ml. euro was approved. The project aims to improve the continuity of water supply, reduce water leakages in the water supply system and improve water quality across 49 cities in Georgia served by United Water Supply Company. In addition to these investments in the water supply system, some most urgent investments in waste water disposal system might also be undertaken, as necessary.

Another IFI which can assist Georgian municipalities in attracting funding for its energy efficiency and renewable energy projects is Green for Growth Fund (GGF) (<http://www.ggf.lu/likecms.php?dir=&site=site.html&siteid=94&nav=62>). The Green for Growth Fund, Southeast Europe is a public-private partnership established to promote energy efficiency in its target region and to reduce CO2 emissions. GGF's investments seek to achieve a 20% reduction in energy consumption and/or a 20% reduction in CO2 emissions, by provision of dedicated financing to businesses and households via partnering with financial institutions and direct financing to non-financial institutions such as renewable energy companies or projects, energy service companies, and energy efficiency service and supply companies.

The Green for Growth Fund, Southeast Europe is currently active in thirteen Target Partners in Southeast Europe, as well as in the nearby European Neighborhood region comprised of Armenia, Azerbaijan, Georgia, Moldova and Ukraine. GGF provides innovative methods to finance municipal energy infrastructure and helps municipalities to address the challenges they confront. It offers infrastructure financing mechanisms that are complementary to government financing. GGF has currently implementing two projects in Armenia helping local banks in conducting energy audit services and development of strategy, product and marketing concept energy efficient lending. In Georgia GGF is active in hydro power sector.

Conclusions and Recommendations

There is an urgent need for the Georgian government to elaborate the comprehensive energy policy or strategy, which would guide the development by providing clear and justified objectives, priorities, estimate of acceptable risks, and the framework for improvements. The policy should reflect the potential contribution of energy efficiency in satisfaction of increased energy demand, improvement of energy security of supply and support economic growth and environment.

Energy Efficiency Policies, Legislation and Programmes

The Government of Georgia should:

- take steps towards development and enforcement legislation, policies, measures and programmes to promote energy efficiency.
- consider the experience of other countries in transition as well as Eastern European experience, effectively utilize technical and financial assistance provided by various domestic and international institutions.
- adopt and ensure enforcement of new national construction standardization documents (building codes) for new and existing buildings, taking into consideration thermal engineering of the structures.
- develop specific programs for improving energy efficiency in the various sectors of economy.
- take actions towards modernization of existing building stock, energy efficiency improvements should also result in better comfort and safety.
- Ensure efficient enforcement of the existing legal mechanisms in transport sector and initiate the re-introduction of obligatory technical inspection of cars to decrease emissions.

Georgian Municipalities

- To meet the obligations to reduce emissions by 20% by 2020 the municipalities should develop special strategic documents that would define long- and mid- term objectives focusing on energy efficiency and environmental aspects within the transport building and infrastructure sectors;
- As there is no specific law on waste management that would regulate the waste management on a national level, the government should start development and adoption

of such law that will require municipalities to develop and implement waste management plans.

- Both at national and local levels the initiatives should be taken to enhance knowledge and awareness on efficient consumption of energy through targeted energy efficiency education campaigns and actions.

Institutional Framework

- The Government should strengthen the capacity of the Ministry of Energy to develop and implement energy efficiency and renewable energy strategies and programmes;
- The Government should strengthen the capacity of the ministries and other institutions responsible for the development and enforcement of the necessary legal framework in the building, transport, infrastructure and waste management sector;
- In response to taken challenging obligations to reduce emissions by 20% by 2020 the municipalities should develop and implement an integrated municipal energy management system useful for carrying out relevant energy efficiency measures.
- All state institutions both at national and local level should ensure better coordination of efforts among each other and with non-governmental organizations acting in the area of energy efficiency;
- The government should ensure that all state institutions both at national and local level have adequate resources and mandate for the implementation of the energy efficiency policies and programmes.

Financing Energy Efficiency

The government should analyze opportunities created by various international financial institutions to provide resources for funding energy efficiency programs. Such resources should be used to establish attractive financial mechanism by provision of dedicated financing to businesses and households via partnering with financial institutions and direct financing to non-financial institutions such as renewable energy companies or projects, energy service companies, and energy efficiency service and supply companies.

Table 6.

| Abbreviations and acronyms | |
|-----------------------------------|---|
| ADB | Asian Development Bank |
| BAU | Business As Usual |
| BEI | Baseline Emission Inventory |
| CDM | Clean Development Mechanism |
| CIUDAD | Cooperation in Urban Development and Dialogue |
| E5P | Eastern Europe Energy Efficiency and Environment Partnership |
| EBRD | European Bank for Reconstruction and Development |
| ECA SCI | Europe and Central Asia Sustainable Cities Initiative |
| EECG | Energy Efficiency Center Georgia |
| EECU | Energy Efficient Cities of Ukraine |
| EIB | European Investment Bank |
| ELENA | European Local Energy Assistance |
| ENSI | Energy Saving International |
| EU | European Union |
| GDP | Gross Domestic Product |
| GGF | Green for Growth Fund |
| GHG | Greenhouse Gas |
| GIZ | Gesellschaft für Internationale Zusammenarbeit |
| GPS | Global Positioning System |
| GWP | Georgian Water and Power |
| IDA | International Development Agency |
| IFI | International financial institutions |
| JRC | Joint Research Centre |
| JSC | Joint Stock Company |
| KPI | Key performance indicator |
| LEAP | Long range Energy Alternatives Planning |
| LED | Light-emitting Diode |
| LFG | Landfill Gas |
| LGC | Landfill Gas Collection |
| MEEP | Municipal Energy Efficiency Planning |
| MEI | Monitoring Emissions Inventories |
| MODEL | Management of Domains Related to Energy in Local Authorities |
| NAEP | National Environmental Action Programme |
| NALAG | National Association of Local Authorities of Georgia |
| NGO | Non-governmental Organizations |
| PEEREA | Protocol on Energy Efficiency and Related Environmental Aspects |

| | |
|---------|---|
| PVC | Polyvinyl chloride |
| RAO-UES | Unified Energy System of Russia |
| SEAP | Sustainable Energy Action Plans |
| SMS | Short Message Service |
| TRACE | Tool for Rapid Assessment of City Energy |
| UN | United Nations |
| UNFCCC | United Nations Framework Convention on Climate Change |
| USSR | Union of Soviet Socialist Republics |
| WWF | World Wildlife Fund |

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