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**HYDRO POWER AND ENERGY  
PLANNING PROJECT (HPEP)**

# WHITEPAPER

## ENERGY STRATEGY OF GEORGIA (2015-2030)

3 YEAR ACTION PLAN (2015-2018)

Initial Draft

July, 2014

This publication was produced for review by the United States Agency for International Development. It was prepared by Deloitte Consulting.

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DELOITTE CONSULTING LLP

USAID/CAUCASUS OFFICE OF ECONOMY, ENERGY AND  
ENVIRONMENT

JULY, 2014

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## 1.0 LIST OF TERMS AND ACRONYMS

AMR	Automatic Meter Reading
AYPEG	Association of Young Professionals in Energy of Georgia
BBL	Barrel
BEI	Baseline Emissions Inventory
BM	Balancing Market
BOPD	Barrels of Oil Per Day
BP	British Petroleum Company
CSO	Civil Society Organization
CBM	Coal Bed Methane
DAM	Day-Ahead Market
EBRD	European Bank for Reconstruction and Development
EC	European Community
EC-LEDS	Enhancing Capacity for Low Emission Development Strategies
EE	Energy Efficiency
ENTSO-E	European Network of Transmission System Operators for Electricity
ENTSO-G	European Network of Transmission System Operators for Gas
EPIAS/PMUM	Energy Exchange in Turkey/Market Financial Reconciliation Center
ESCO	Electricity System Commercial Operator
ETM	Electricity Trading Mechanism
EU	European Union
GDP	Gross Domestic Product
GEMM 2015	Georgia Electricity Market Model 2015
GGTC	Georgian Gas Transportation Company
GHG	Greenhouse Gas
GMO	Gas Market Operator
GNERC	Georgian National Energy and Water Supply Regulatory Commission
GoG	Government of Georgia
GOGC	Georgian Oil and Gas Corporation
GSE	Georgian State Electrosystem
HICD	Human and Institutional Capacity Development
HPEP	Hydropower and Energy Planning Project
HPP	Hydro Power Plant
JSC	Joint-Stock Company
LDV	Light Duty Vehicle
LTD	Limited Company
MARKAL	Market Allocation software model
MO	Market Operator
MoE	Ministry of Energy
MW	Megawatt
NEEAP	National Energy Efficiency Action Plan
NREAP	National Renewable Energy Action Plan

NSGP	North-South Gas Pipeline
O&M	Operations & Maintenance
OGA	Oil and Gas Agency
OSCE	Organization of Security and Cooperation
PPP	Purchasing Power Parity
PSA	Production Sharing Agreement
PV	Photovoltaic
RD&D	Research, Development & Demonstration
RES	Renewable Energy Sources
SCP	South Caucasus Pipeline
TANAP	Trans-Anatolian gas pipeline
TSO	Transmission System Operator
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
DSM	Demand-Side Management
WVO	Waste Vegetable Oil

## 2.0 OBJECTIVES OF THE STRATEGY

This document provides short (2015-2017) and medium term (2018-2023) strategies and a long-term (2030) vision for Georgia that are aligned with and support the National Energy Policy of Georgia, adopted by Parliament on \_\_\_\_\_, 2014. The *Energy Policy for Georgia* sets out a strategic policy framework that addresses the priorities and challenges in the energy sector of Georgia. The energy strategy's intent is to meet the country's long-term needs for secure, clean and affordable energy through competitive markets that operate in accordance with the best long-term interests of consumers and the nation. These main directions in energy strategy are designed to improve energy security, to meet long-term needs for clean and affordable energy, to facilitate governmental and private investment decisions and to be flexible enough to address technological improvements and social, economic and environmental impacts.

The main objectives of the National Energy Strategy are to provide reasonably priced and sustainable energy solutions for the citizens of Georgia, and to improve the quality and reliability of the energy provided. The ending of the electricity black outs and long gas interruptions by the mid-2000's was a major milestone for Georgia, but ensuring that Georgia does not slip back into the same situation in the future will require the Government of Georgia to develop and properly implement these energy strategies in a timely manner.

The former practice of making discretionary decisions incompatible with economic expedience impeded private investments in the energy sector of Georgia. For this reason, the government intervention shall not be limited to the task of creating transparent and unbiased rules encouraging commercial activity and safeguarding public interests, while investment decisions will be determined by the expected demand and investors will be those to shoulder the large share of market risks. However, the best international experience has demonstrated the need for careful drafting of laws and regulations, as well as for pursuance of a well-defined strategy towards attraction of new investments. As the investments will have their bearing on the costs and, respectively, on the energy prices, the main challenge for the GoG in mid-term will be to avoid focusing on attracting investments for the sake of its own, but to provide, instead, the appropriate sequence of those investments, making sure that projects will be implemented only after a stable legal and regulatory environment and market structures are put in place. The failure to meet the basic rule prescribing that a market should be ruled under clear-cut, pre-set rules can lead to severe backlash. The wrong combination of market mechanisms and price control can also have a harmful effect.

Energy is a prerequisite for every nation's social and economic prosperity. A competitive energy sector is therefore vital to the entire economy's competitiveness and productivity. The present National Energy Strategy (2015-2030) reflects the Georgian National Energy Policy that is based on a clear vision of building a secure, resilient and efficient energy system through the following policy directions:

- Strengthen the legislative and regulatory framework through gradual compliance with the EU's Energy *acquis* and regional power markets;
- Improve and sustain a strong national energy security including strengthening the financial viability of the government-owned energy entities;
- Rationally utilize renewable energy resources;



- Facilitate Georgia’s importance as a transit route;
- Establish Georgia as a regional green electricity platform using Low Emission Development Strategies (EC-LEDS);
- Development of natural gas storage facilities;
- Strengthen electricity and natural gas market design and further energy trading mechanism implementation;
- Continually support implementation of cost effective energy efficiency; and,
- More actively explore, commercialize and develop Georgia’s own oil & gas resources (both conventional as well as unconventional) for them to play an important role in the country’s energy security.

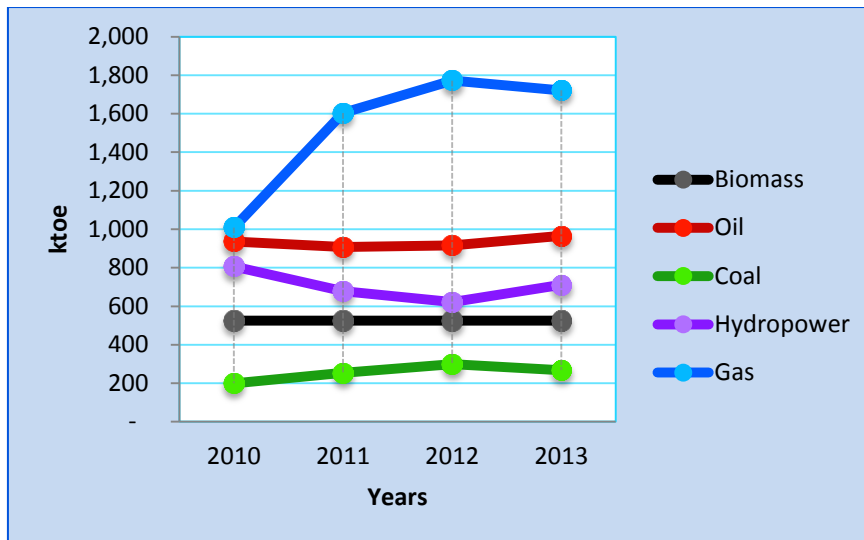
The Energy Strategy of Georgia restates the Government of Georgia’s long-term energy sector vision and outlines actions to deliver prosperity, security and sustainability to its residents and market players while conforming to the Energy Community pillars.

All of the above-listed priorities are integrated towards the goal of achieving a national energy system based on competitiveness that meets the European criteria, at the same time making the best possible use of the available resources in Georgia and its location, while also protecting the Georgian consumers to the highest degree possible. To achieve these goals, the role of the GoG is promoting competition in the energy market along with establishing the proper legal and regulatory framework.

### **3.0 CURRENT STATUS OF GEORGIAN ENERGY SECTOR**

Georgia’s geographical location positions the country as an expanding transit corridor for oil, natural gas and electric power, enhancing economic growth of the country and facilitating private investment. However, Georgia covers about 2/3 of its gross energy demand by imported energy sources, this indicator being over 65% for 2012. Figure 1 shows Georgia’s total energy supply by source from 2010 to 2013, which reinforces the increased dependence on imported natural gas and oil.

Georgia receives Azerbaijani natural gas from Shah Deniz field through the South Caucasus Pipeline (SCP), while the gas produced by other fields owned by “SOCAR” is transported by the Azerbaijan-Georgia main gas pipeline system. Transit of Russian gas to Armenia is carried out through the North-South Gas Pipeline (NSGP). State-owned Georgian Oil and Gas Corporation (GOGC), as well as Georgian Gas Transportation Company (GGTC) play a significant role in the gas market. GOGC is the owner of the country’s main gas pipeline system. It supplies the optional and supplemental gas received for transit via the South Caucasus Pipeline (SCP) as well as the gas received for the Russian gas transit by GGTC to the household consumers of the regulated segment of the market and electricity generation facilities, through “SOCAR Gas Export-Import”. GOGC also ensures supply of locally produced gas to the competitive segment of the market. According to the Agreement signed with the Russian “GasExport” (subsidiary of “GasProm”), the North-South Gas Pipeline operator company – GGTC receives the fee for services provided for natural gas transit from Russia to Armenia in-kind on an annual basis.

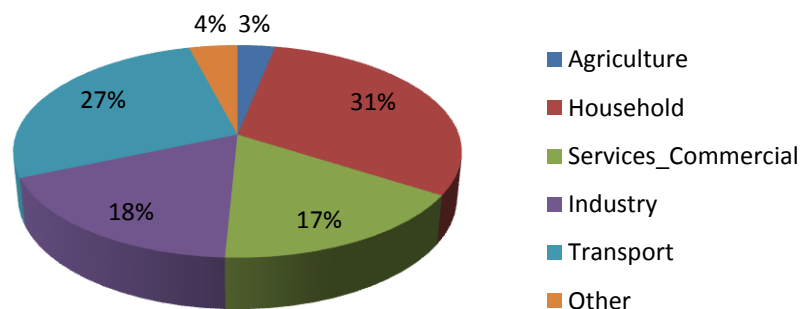


**FIGURE 1: Georgia's total primary energy supply between 2010 and 2013**

Georgia's dependence on imported natural gas grew by 58% in 2011 making up 41% of total primary energy supply of the country.<sup>1</sup>

The share of fossil resources in the energy balance for 2012 totaled 72%. The significant domestic energy sources are hydro resources (15%), wood (13%) and coal (6%).

This structure of the energy balance which when combined with the seasonality effect of Georgia's hydro-system causes concerns for the energy security of the country. The energy consumption for 2012 was led by the household sector followed by the transport sector (Figure 2).



**FIGURE 2: Energy consumption of Georgia by sector for 2012**

Georgia is currently being explored for deposits of oil and natural gas, though only at a moderate to low activity level. Licenses have been issued for up to 7 independent oil companies. Nevertheless, it must be noted that Georgia's resources remain underexplored and underexploited. One of the reasons is the challenging geological environment, which requires further exploration and investment from specialized companies. Although new oil discoveries were made (some of them could be considered significant even as per International standards) by the licensees in Georgia since the 1990s, none of these reserves yet have been commercialized.

<sup>1</sup> Ministry of Energy, Energy Department, June 2014.

Oil production for 2012 was the lowest recorded for the past 35 years. The annual extraction of oil is close to 50 thousand tons (up to 400,000 BBLs) and is likely to continue to decrease. This is due to the fact that this production is from the fields discovered during Soviet times, which have been gradually depleting. Further modern techniques such as sophisticated 3D geophysical surveys, horizontal drilling and modern completion techniques are required to further develop those fields and increase the recovery factors.<sup>2</sup>

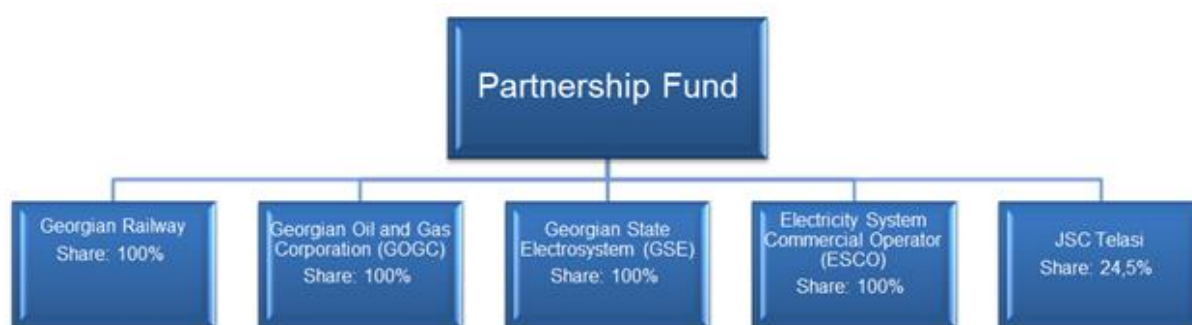
The electricity generating capacity in Georgia exceeds the generating capacity requirement of the country. The Cross Border Energy Trading Agreement (CBETA) between the governments of Turkey and Georgia was signed in January 2012, the CBETA sets out the general agreement of the parties regarding the cross border trading of electricity on the Black Sea Transmission Project, a high voltage direct current (HVDC) transmission line that connects the power systems of Georgia and Turkey.

From renewable energy resources, hydro is the dominant resource in the country. Biomass is the second largest energy source produced locally. While there have been some initiatives made to develop wind power, new renewable resources like solar, wind and geothermal remain strictly underdeveloped.

Georgia has seven coal mines, but only three of them are active at the time. One of them is in Tkvarcheli, Abkhazia, which has a small quantity, but high quality coal. The other two active mines are located in Tkibuli and Vale.

### Government-owned entities of the energy sector of Georgia

The JSC Partnership Fund was created by the GoG to acquire, manage, evaluate and sell shares in companies carrying out business activities in the areas of production, extraction, transmission, transiting, storage, management, distribution, sale and/or purchase of natural gas, coal, electricity, heat and other forms of energy and raw materials. Currently, JSC Partnership Fund owns 100% of the transmission/dispatch company GSE, ESCO, GOGC and Georgian Railway and 24% of shares of electricity distribution company Telasi (Figure 3).



**FIGURE 3: Ownership of Key Government-Owned Energy Entities**

In terms of regulation of the energy sector, GNERC regulates the downstream activities of the natural gas sector and entire electricity sector, including licensing and tariffs. Upstream activities are regulated by Oil and Gas Agency (OGA), which is currently a subsidiary of the Ministry of Energy. OGA is also responsible for creating

<sup>2</sup> Mikheil Nibladze, interview with the oil and gas sector expert, Managing Director, Schulze Global Investments, June 2014.

an enabling environment and regulating the oil and gas sector in accordance with the Oil and Natural Gas Law.

The key challenges in the Georgian energy sector, to which this document proposes solutions, include: deforestation and illegal wood cutting in the biomass sector, lack of regulation and pollution in the oil sector, growing dependence on a single source and lack of competitive market in the gas sector, lack of competitive market to attract investment in hydropower and under exploration and production of domestic coal and hydrocarbon resources.

#### **4.0 REFORMS IN THE LEGISLATIVE AND REGULATORY FRAMEWORK**

The GoG should achieve greater economic and gradual regulatory harmonization with the EU. The GoG will seek harmonization of its energy related legislation with the EU acts and other international instruments. Mainly, the compliance of Georgian legislation with the EU energy *acquis* will be governed by the five Energy Community (EC) pillars, namely: electricity, natural gas, oil, competitiveness, and environment.

EU-Georgia Association Agreement declares a priority in the Georgian Government's foreign policy agenda to achieve greater economic and regulatory harmonization with the EU via political association and economic relations. The Agreement on the Accession to the Energy Community requires even stricter standards, i.e., compliance with certain regulations of the EU Energy *acquis*.

Robust and transparent competitive energy markets in developed nations have proven over long term periods to keep energy prices down and encourage private investment into necessary infrastructure. None of the Georgian energy markets show true signs of energy competition. Even the oil market is really an oligopoly with minimal price differentiation from one supplier to another. Attempts to open the electricity and natural gas markets to competition have resulted in providing reduced prices to a select few entities and there is currently no semblance of competitive market design or structure. It is the GoG's goal that aspects of competition in all activities of the energy markets are prevalent in Georgia.

Every competitive market needs specific "rules of the road" including rules regulating the quality of energy delivered. Energy suppliers must be licensed so that their delivery of service can be monitored and if necessary, sanctions must be applied by an independent regulator to ensure that customers are protected at all times. Best international practices need to be applied to the legal and regulatory framework in Georgia to allow prices to be competitively set and to ensure that consumers are provided high quality energy and related services.

The long-term goal for the electricity and natural gas markets is for the GoG to provide the enabling environment for competitive energy trading, allowing consumers to pick their retail suppliers; and ensuring that the potential investors of new generation facilities are provided market price signals that encourage timely construction of power plants or new sources of natural gas, from inside and outside of Georgia. By doing so, the GoG will comply with the EU Third Energy Package, ensuring liberalized pricing and protection of vulnerable consumers during market opening.

In each sector, the proper institutions need to be developed - transmission system operators and market operators to support energy traders in meeting their customer's energy requirements. The TSOs will abide, respectively, by the rules of

the ENTSO-E and ENTSO-G and the market operators will establish market rules that comply with the EU's Third Energy Package. Network owners must not be in control in any fashion of retail supply or generation facilities.

In order to reach this goal, the GoG will develop and implement a transition plan for the electricity and natural gas sectors. Network owners will provide equal access to regulated and competitive suppliers. The energy markets will be gradually opened for eligible consumers to select competitive suppliers. Energy producers and traders will be given the opportunity to supply energy directly to eligible consumers or sell to competitive suppliers. The GoG will establish transitional entities called Public Traders that will handle long-term electricity and gas agreements signed on behalf of the GoG for security of supply purposes.

Establishing competitive energy trading also requires development of appropriate trading mechanisms such as Balancing Markets (BM) and Day-Ahead Markets (DAM) in accordance with EU Energy *acquis*. Preparation of these trading mechanisms requires gradual transformation of energy markets and the path should be divided into several stages. Along with the energy markets transformation, new clearing (collateral) mechanism should be introduced in the market and new IT software should be installed in order to support competitive energy trading on an hourly basis.

The main purpose for harmonization with the EU Energy Directives and Regulations is to establish a competitive energy market, with adopted network tariffs, which will facilitate cross-border energy flows, free trade under conditions of maximum transparency, continuous and non-discriminatory third party access to infrastructure, and the energy security of Georgia. Current Georgian legislation does not fully correspond to the main provisions of the Directives, some of which are completely new to the Georgian legislation and require detailed and comprehensive study for preparation of final recommendation for their introduction.

The following key actions will be undertaken:

- The Georgian primary and secondary legislation will reflect reforms in electricity, oil and gas sectors for compliance with the EU Energy *acquis*. The compliance will be in accordance with the EU-Georgia Association Agreement and the Energy Community Treaty Accession Agreement and will consider the regional market structures as well;
- Competition in the energy sector will be promoted and enforced, anticompetitive conduct will be sanctioned;
- Plans will be developed and implemented for building new energy infrastructure;
- Laws and rules related to EE programs and effective utilization of renewable energy sources will be developed and adopted;
- Regulatory independence will be strengthened.

The foundation of strengthening the legislative and regulatory framework will be fully realized through the various sectors development in near and long-term horizons. A pragmatic approach to the energy strategy will be key to its success. For that purpose, the 3 year implementation plan for legislative and regulatory framework can be found in Table 2 in Annex 1.

## 5.0 ACTIONS & EXPECTED RESULTS

The long-term actions and expected results include the following:

- Establish a targeted increase of the renewable energy source (RES) share that is consistent with the EU policies and meets the targets in a pre-determined timeframe;
- Establish electricity exchange by 2018 and natural gas exchange by 2020;
- Achieve 60% freely negotiated quantities of electricity in the internal market by 2020;
- Achieve higher reliability, performance standards and predictable prices for energy supply;
- Attain improved standards for security of energy supply and environmental protection;
- Attract investments in the sector;
- Fully harmonize the national legislation with the acts of the EU Energy/Climate Package;
- Fully harmonize the national legislation with the acts of the Third Energy Package of the EU;
- Ensure that the energy network operators are independent of the production, trading and retail supply activities;
- Ensure a sustainable supply of wood for energy purposes and rational use of biomass;
- Establish a working and capitalized National Energy Efficiency Fund;
- Establish an efficient and independent energy regulatory oversight;
- Develop or improve social programs towards achieving protection of the interests of the energy consumers including an improved system for social protection of vulnerable energy users;
- Achieve increased energy security level through diversification, external risk mitigation and internal resources;
- Develop and Implement the National Energy Efficiency Action Plan (NEEAP);
- Develop and Implement the National Renewable Energy Action Plan (NREAP);
- Improve Georgia's energy intensity per GDP towards inclusive economic growth;
- Strengthen and maintain the financial viability of the government-owned energy sector entities.

## 6.0 LONG TERM VISION

The GoG aims at improving and sustaining the security and stability of the Georgian energy system. To achieve this goal, the diversity of energy sources, particularly for electricity generation needs to increase; energy supply, control and management of demand will need to be transformed; and, sufficient energy supply with stable long term prices needs to be sustained. To achieve the implementation of sustainable reforms in the sector, the following changes must be implemented in the long run:

- Develop an integrated and competitive energy market: the key area will be the enhancement of the competitiveness of Georgia's energy in the South Caucasus region, through integration in the regional energy market including Turkey;
- Increase Georgia's role as an energy transit hub: Georgia is situated at a crossroads between the South Caucasus and South-Eastern Europe through

which natural gas, oil and electricity are transported to the West. The location of the country needs to be used more strategically;

- Deliver competitively priced energy to all Georgian residents and develop social programs and measures to protect vulnerable consumers;
- Establish clear energy policy and legal framework to provide stability and instill market confidence in the long run, which can lead to decreased cost of investment and lower the cost to consumers.

### **Energy Security**

National energy security will be achieved through the diversification of energy supply sources and transfer routes, management and risk reduction of external disruptions development and utilization of new domestic energy sources and the establishment of competitive energy markets. The GoG will utilize forward planning to balance energy supply and demand, anticipate future demand and plan for additional capacity, maintain the quality of networks, and establish measures to cover peak demand and to deal with shortfalls of one or more suppliers.

- Further utilization of Georgia's strategic geographic location between the South Caucasus and South-Eastern Europe will further strengthen the security of supply for Georgia;
- Storage capacity for energy resources will be developed to balance seasonal demand, and to maintain energy reserves in case of supply interruptions and emergencies;<sup>3</sup>
- The domestic production of primary energy sources will be enhanced through further development of renewable resources like hydro, solar, wind and geothermal power. Additionally, conventional and unconventional resources like shale gas, coal bed methane (CBM) and shale oil will be harvested in an efficient manner;
- A competitive energy market will be established by means of harmonization with the EU Energy Directives and Regulations resulting in the facilitation of cross-border energy flows, free trade under conditions of maximum transparency, and continuous and non-discriminated third party access to infrastructure. Competition will lead to greater security of supply as it leads to diversification of energy providers.

### **Electricity Sector**

The goal of the MoE will be to promote new electrical generation capacity and maximize domestic power generation potential in order to minimize dependence on Russian and other foreign electricity imports. The MoE's goal is to further attract investment to utilize local primary energy resources, i.e. hydro and construct thermal power plants as needed.

Competitive market forces are the best means to provide the flexibility needed to respond to future developments. Energy demand and energy supply can only be optimized under a competitive economy and a competitive energy market. Therefore, GoG's long-term vision is to implement competitive and liberalized energy markets. Synchronization of the Georgian legislation with regional energy markets is crucial for further regional energy cooperation.

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<sup>3</sup> Jsc. Georgian Gas International Corporation – GIC, *Construction of Underground Gas Storage in Georgia*, March 2004.

Electricity sector development will involve establishing and enhancing Georgia's role as a regional green electricity platform. The GoG will continue facilitating private sector led development of Georgian hydropower and the establishment of a competitive electricity power market with a regulatory structure to protect investors and consumers.

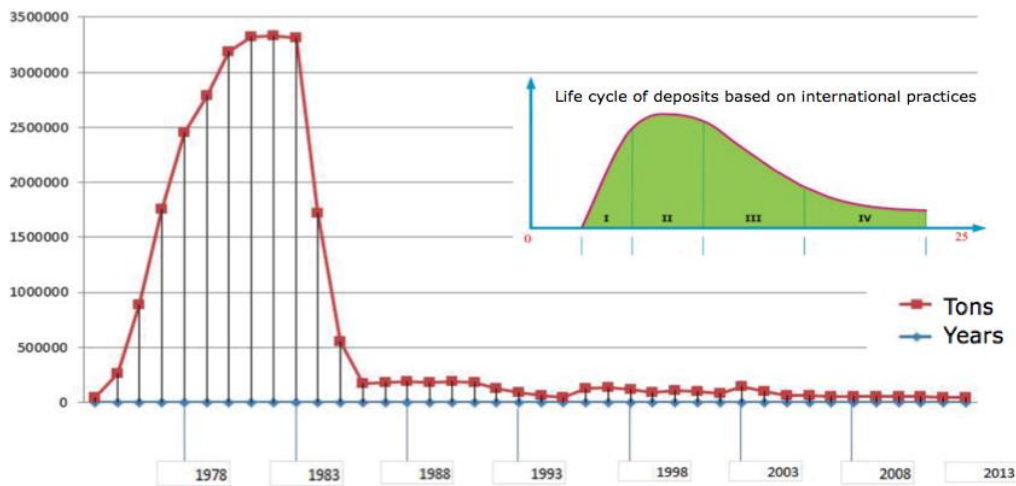
In addition to the establishment of a competitive electricity market under the principles of the Georgia Electricity Market Model 2015 (GEMM 2015), other key areas that require development include: increasing export opportunities through optimizing capacities and reducing system costs, establishing an electricity trade mechanism with Turkey and commercial restructuring and commercialization of activities. The Electricity Trading Mechanism (ETM) will provide transmission paths, trading tools and risk mitigation options so investors in new electricity generating plants can sell their electricity into the Turkish and other regional electricity markets. A competitive electricity market will provide high reliability and quality of electricity supply and transparent and fair allocation of market benefits. Consequently, with the goal of strengthening national energy security and competitiveness, the strategies for Georgia's energy development will focus on efforts to transform the country into a regional green electricity platform. Georgia needs to take the following steps:

- Implement a competitive electricity market with:
  1. Third party access network
  2. Take or pay bi-lateral contracts
  3. Balancing, day ahead and intraday trading markets
  4. Active competitive cross-border electricity trading
- Develop rules and regulations according to ENTSO-E and the EU third energy package
- Unbundling of electricity generation, transmission, distribution and retail supply in accordance with EU regulations
- Remove government and cross-subsidies from electricity tariffs between sectors to give proper price signals and incentivize investors, but in the meantime protecting vulnerable energy consumers
- Evaluate off-grid solutions for isolated populations

### **Oil & Natural gas Upstream Sector**

Although Georgia currently does not have large-scale proven oil and gas reserves or production (current production – approximately 1,100 BOPD), it must be noted that history has shown Georgia is within a hydrocarbon basin. The country is located geologically in the so-called upper Kura Basin, which is the east part of the same geological basin as neighboring Azerbaijan and contains the same reservoir and source rocks as the North Caucasus Basins. Up to 17 oil and 3 natural gas commercial fields have been discovered in Georgia so far. Indeed back in early 1980s, the country was producing sizeable amounts of hydrocarbons, up to 70,000 BOPD at peak (which was mostly derived from one field called Samgori discovered in late 1970s by State Oil company "Georgian Oil"). Exhibit 1 illustrates Georgia's oil production from 1974 to 2013 with a dramatic trough from 1983.



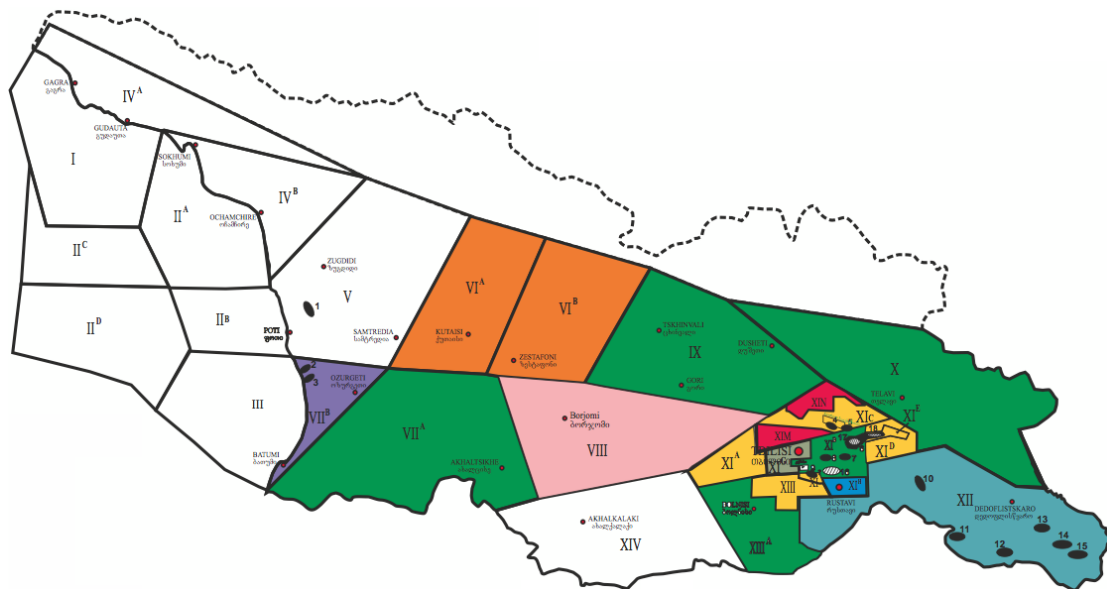


**EXHIBIT 1: Georgia’s Oil Production between 1974 and 2013<sup>4</sup>**

Publicly available information suggests significant reserve and especially resource potential within Georgian License Blocks (Figure 4). For example:

- Blake/MND JV (Blocks XIC, XID, XIE, XIF & XIII) total gross in-place best guess prospective and contingent resources ~ 2.4 billions of barrels of oil equivalent;
- Frontera Resources (Block XII) “Technical 3P reserves” of up 180Mln BBLs plus total resource base >2.0 billion barrels of oil equivalent;<sup>5</sup>
- Range Resources/Strait Oil & Gas (Blocks VIA and VIB) >2.0 billion barrels of oil in-splace prospective resources.<sup>6</sup>

**FIGURE 4: License Blocks of Georgia**



Georgia’s local upstream sector has the potential, once the successful commercialization and development of its own existing resources is achieved, if not to make the country completely self sufficient, to play an important role in the

<sup>4</sup> Ministry of Energy, Oil and Gas Agency, June 2014.

<sup>5</sup> Oil barrel Conference, London, November 2011.

<sup>6</sup> Range Resources Annual General Meeting, November 2012.

country's energy mix and energy security going forward. In addition, there is the potential for a minor gas supply to the Georgian market from the locally discovered Rustavi and Samgori-Patardzeuli-Ninotsminda fields.

Although Georgia has no large-scale oil production, it can generate revenues from oil transit because of its geo-strategic location. The country's 15 oil fields have confirmed reserves of about 8.3 million tons but larger oil reserves are only assumed to exist. In order to successfully commercialize above resources and transfer them into reserves a number of coordinated actions must be made:

- The development of upstream activities of the oil sector is regulated by the Oil and Gas Agency (OGA) under the Ministry of Energy. As Georgia moves closer to compliance with the EU 3<sup>rd</sup> Energy Package, the Agency must be re-established as an independent national regulatory authority regulating upstream activities in oil and gas sector;
- Increase International awareness about the industry's potential and opportunities in Georgia;
- Enhance research and development, particularly in upstream oil activities;
- Initiate the new integrated national geological study using modern approaches;
- Making the data on license holders publically available after the six-year confidentiality requirement per Oil and Gas Legislation of Georgia.<sup>7</sup>

### **Natural Gas Downstream Sector**

Due to the county's seasonality of demand for heating and the lower levels of generation from run-of-river HPP's, natural gas import during the winter period is substantial. The import of natural gas from Russia at a commercial price is not economically feasible and the Georgian gas demand is being supplied by Azerbaijan. To ensure that forecasted demand is met in the future, further diversification of routes and supply as well as development of gas infrastructure is required. The terms and conditions of the long-term contract with the provider of this resource needs to guarantee gas supply throughout the year and balancing of inequality between seasonal supply and demand, which is otherwise impossible to achieve due to the absence of domestic gas storage. The planned expansion of the South Caucasus pipeline will connect TANAP, while a second pipeline through the territory of Georgia with additional compressor stations is being considered.

Georgia's natural gas sector is growing rapidly through the rural areas of the country, where it is mainly used for cooking currently. The existing market design is tightly managed with a few entities allowed to trade at the wholesale level. The natural gas market is to be fully opened by December 31, 2017. All consumers and all new sources of natural gas are to be liberalized. Existing gas purchase agreements are exempt from market opening.

Many of the companies providing different services have the same owners (state agency and companies, "Telasi", "SOCAR" and subsidiaries), in opposition to the recommended European model. The concentration of main distribution facilities in the hands of foreign state companies ("SOCAR", "KazTransGas") and the difficulty of foreseeing the consequences of long term agreements concluded with them poses a significant risk to national energy security.

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<sup>7</sup> Mikheil Nibladze, oil and gas sector expert, interview.

Well-functioning gas markets are the most effective mechanism for guaranteeing adequate investment in infrastructure and satisfying the increased demand for gas consumption. The Introduction of a clear and appropriate market structure and regulatory system and guarantees for non-discriminatory access to the transmission network and storage facilities will facilitate the successful development of the gas sector of Georgia.

### **Oil & Oil By-Products Downstream Sector**

Oil & oil-byproducts strategies include:

- Establish an independent oil sector regulator for upstream activities (i.e. OGA) and authorize GNERC to regulate downstream;
- Improving downstream regulation including protection of consumers and environment;
- Reform current legislation to facilitate local oil refinery potential in a competitive market;
- Develop an emergency oil stock plan for 90 days in accordance with EU Energy *acquis*;
- In addition, the 3<sup>rd</sup> Energy Package requires regulations over some downstream activities as well. Georgia will develop and maintain a legal and regulatory framework for the oil and oil-by-products sector, which will protect the interests of consumers and include the maintenance of a strategic oil reserve.

### **Coal Sector**

Georgia has significant coal reserves, which should be exploited efficiently through use of clean coal technologies. Coal use should be considered for use for different economic activities like electricity generation, industry use, commercial and household heating.

- Using of low grade coal and developing the full cycle of utilization, including the Coal Bed Methane (CBM) and Coal Mine Methane (CMM);
- Developing legislation on licenses for harvesting CBM/CMM;
- Maximum and efficient utilization of available resources;
- Introduction and utilization of clean coal technology best practices;
- Targeting potential export markets such as Turkey and Armenia.

### **Demand-Side management (DSM)**

Economic growth can be an important driver of energy use in the country. Currently, there exist varying forecasts of future GDP growth rates in the country. Ministry of Finance of Georgia is forecasting a 5% steady GDP growth rate for the next four (2014-2017) years, while the Economic Council<sup>8</sup> is expecting about 6.6% growth and the World Bank's projection ranges between 5% and 6% for the next four years<sup>9</sup> (Table 1). As there is no information on expected specific sector growth or the elasticities for them, there is no real basis to project the energy use growth in the future. For credible forecast of future energy use and to determine the relationship between the economic growth and energy use, elasticities would need to be calculated first.

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<sup>8</sup> Socio-Economic Development Strategy of Georgia, "Georgia 2020", June 2014.

<sup>9</sup> The World Bank, Country Partnership Strategy for Georgia FY2014-FY2017, April 9, 2014.

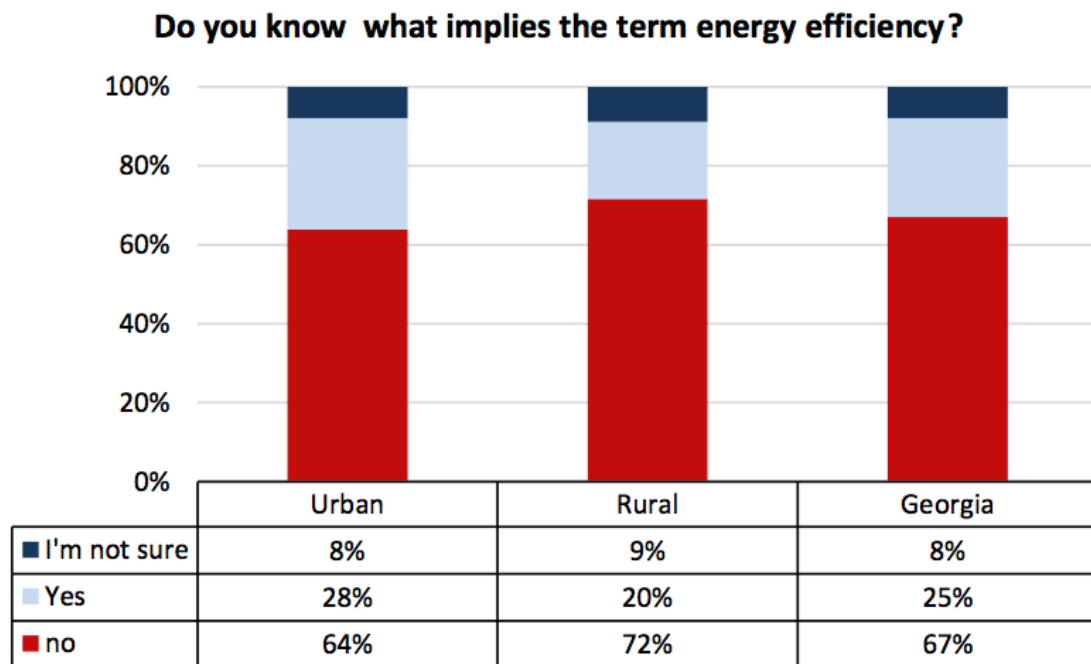
**TABLE 1: Forecasted GDP Growth rates 2014-2017**

	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>
<b>Ministry of Finance</b>	<b>5%</b>	<b>5%</b>	<b>5%</b>	<b>5%</b>
<b>World Bank</b>	<b>5%</b>	<b>5.5%</b>	<b>6%</b>	<b>6%</b>
<b>Economic Council</b>	<b>6.6%</b>	<b>6.6%</b>	<b>6.6%</b>	<b>6.6%</b>

Another important aspect of the strategy, in addition to economic growth and increasing production capacity, involves improving the efficiency of domestic consumption. Energy Efficiency measures contribute to security and the energy intensiveness of GDP. Demand-Side Management (DSM) entails the modification of consumer demand for energy through various customer programs. DSM tools including energy efficiency programs are fundamental to curbing peak energy demand and managing the country's energy consumption dynamics. They require an integrated approach to market reform that provides efficient signals to guide behavior, along with the right incentives for energy services. Effective DSM requires education of consumers on how to conserve energy and creation of financial incentives, for example lower tariffs for nighttime electricity use. The goal of the GoG is to determine and promote the use of DSM programs to meet Georgia's growing energy needs. National energy efficiency policies have not yet been well developed and implemented, and steps should be taken by the government to prepare and implement legislation, policies, measures and programs to promote energy efficiency within the market-oriented framework.

Under the EU-Georgia Association Agreement, Georgia will fulfill the Directives 2006/32/EC on energy end-use efficiency and energy services, 2010/31/EU on energy efficiency of the buildings and 2012/27/EU on energy efficiency. Energy efficiency is not an end in itself, but a means to reduce costs, improve competitiveness and security of the energy supply and protect the environment. To achieve this, emphasis will be placed on market forces and on result-oriented proactive measures. Governmental objectives and priorities for improving energy efficiency should be supported by appropriate resources. Initiatives should be taken to enhance all consumers' knowledge and awareness of energy consumption and how to make it more efficient. As the USAID survey has demonstrated, currently 67% of the population is not informed even about the meaning of the term energy efficiency (Figure 5). The GoG can help by creating an attractive environment for research, development and demonstration (RD&D), and by safeguarding the drivers of innovation in this field.

**FIGURE 5: Understanding the term energy efficiency**



DSM (or customer implemented) programs are underutilized in Georgia. There has been little analysis and scarce promotion of DSM programs. Some energy intensive companies have installed energy efficient equipment to reduce their overall energy costs, but reaping the large potential benefits from a multi-sector implementation of demand-side programs is still unrealized. These benefits not only include a direct economic return on investment, but also a significant increase in local employment opportunities, the reduction of GHGs, the reduction of imported fossil fuels and the improvement in the balance of trade. The goal of the GoG is to determine and promote the use of DSM programs to meet Georgia's growing energy needs and to contribute to the climate change mitigation.

The use of demand-side management programs often provides low-cost options for resource planning. Several options will be analyzed and developed by the GoG, including:

- 1) Promotion of energy efficiency measures across all economic sectors and for residential customers;
- 2) New equipment and building standards and labeling consistent with EU Energy *acquis*;
- 3) Implementation of cost effective energy saving measures in all government facilities;
- 4) Policy and legal framework relating to energy tariffs (seasonal, nighttime) to provide proper price signals to customers on the marginal cost of increased energy consumption;
- 5) Use of large consumers to support electricity system operating reserves through load control measures;
- 6) Solar hot water heating to supplement fossil fuel heating;
- 7) Off-grid solutions;
- 8) Evaluation of smart metering to allow for controlling when and what type of energy to purchase;

- 9) Utilization of locally available renewable sources for island systems in off-grid settlements (mostly in Georgian highland areas).

Georgia must develop a primary demand side management legislative framework and invest in research and development and promotion of consumer programs at the governmental level. Taking into account the fact that energy efficiency policies are not yet defined and implemented, steps should be taken by the government to prepare and implement legislation, policies, measures and programs to promote energy efficiency within the market-oriented framework of energy policy.

Energy efficiency will reduce domestic demand for energy. With the advent of new renewable energy technologies such as individual solar PV installations, some consumers will not require as much electricity from the network and in fact will occasionally be delivering to the network. This impact on dampening domestic electricity demand will create a reduced need to build new power plants. Some of the key actions towards EE measures will be:

- A Law on Energy Efficiency will be adopted;
- National Energy Efficiency Action Plan, which will aim final energy consumption reduction, will be developed for implementation;
- The work on energy statistics and implementation of energy efficiency indicators will be straighten since this is a basis for end-use policy analysis, which is necessary for the development and implementation of energy efficiency policies;
- The GoG will develop supportive strategies on fuel economy and overall pollutant emissions performance of its light duty vehicles (LDV), such as taxation regime for vehicle imports, which will incentivize cleaner and more efficient vehicles.

The targeted energy savings from new energy efficiency programs is a reduction of total energy consumption and peak demand by at least 20% by 2030. The State and local governments will have an active role in the achievement of that target.

Additionally, the GoG will support private initiatives to increase the energy self-sufficiency of public and residential buildings such as thermal retrofitting of the buildings, along with promotion of renewable energy utilization in building sector (installation of solar water heaters, biomass based local heating systems, and geothermal energy sources).<sup>10</sup>

### **Renewable Energy Sources**

By signing the Association Agreement Georgia has agreed to abide by the Directive 2009/28/EC on the promotion of the use of energy from renewable sources.

Renewable energy sources (RES) can help reduce reliance on gas imports, improve the security of the energy supply, help meet global commitments to protect the environment, reduce the GHG emissions and contribute to employment generation. Moreover, the RES (biomass, hydro, geothermal, solar and wind) have technical and economic potential that are currently underutilized; their share in the total gross energy consumption of the country is still low. The potential hydro-power production, which is Georgia's natural comparative advantage is estimated roughly 7.27 MWh per capita, which remains largely unexploited. Without a determined and coordinated effort to mobilize the country's renewable energies, this potential will not be realized,

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<sup>10</sup> Giorgi Abulashvili, interview with the Director of Energy Efficiency Center, July 2014.

resulting in missed opportunities to develop this sector and to reduce GHG emissions significantly.

Access to electricity networks for renewables at fair prices is a critical step for the development of RES. The greatest support is rendered to producers of electricity from RES, for whom the following is provided: priority connection to the grid, guaranteed purchase of the generated electric power, guaranteed payoff through feed-in tariffs of the generated electric power, credit incentives and administrative procedures. The current levels of RES in Georgia are approximately 13% wood, 15% hydropower and 1% other. Targets need to be set to be able to measure progress. The GoG's RES goals are to maintain at least 25% of the total national energy portfolio and achieve a 30% target share of RES by the year 2030. However, the lack of a legal and sustainable forest management program is problematic and a sustainable firewood action plan (ensuring that all firewood is cut legally) needs to be developed. Public awareness on efficient use of wood, promotion of efficient wood burning stoves and the development of wood plantations using PPP would further the goals in this area. The lack of a regulatory framework to encourage private investment in new HPPs and the targeted program to encourage diversity of renewable energy without significantly impacting consumer retail tariff and power system operation is also an issue. The country has the potential for utilizing other renewable resources through legislative and regulatory frameworks to facilitate private investments in renewable energy. Research and development of RES, including institutional capabilities, should be facilitated.

### **Customer Protection**

Reforms in the energy sector are mainly governed by economic drivers. The strong focus on economic improvement tends to overshadow social policy considerations, with the hope that social problems will be solved once the economy improves. Evidently, reforms in Georgia cannot be carried out without concurrent arrangements for social protection and social guarantees. Taking into account the key role played by social protection in the successful implementation of the reforms in the energy sector, a system for social protection of consumers will be implemented. As markets transition from regulated to competitive, often there are short-term negative impacts that need to be mitigated, especially for the most vulnerable part of the population. The goal of the GoG is to ensure that the entire population of Georgia has equal access to energy sources and will have the ability to purchase the energy required to meet the minimum standards of living.

Effective social protection will be achieved through shifting government subsidies from the producer to the consumer, through energy efficiency measures and introduction of socially-oriented tariffs; encourage competitive retail markets for delivering outcomes that are in the long-term interests of consumers as we move to an energy sector that delivers services rather than just a commodity to consumers. Energy networks must provide energy to consumers at specified standards of quality, reliability and service.

The energy policy for sustainable and reliable essential goods and services is designed to benefit all the consumers of Georgia. A key prerequisite for the development of competitive markets is cost-reflective pricing. As Georgia moves to greater cost-reflectivity, it will be important to develop policies and programs to assist consumers likely to have difficulty in meeting their energy bills.

## **Environmental & Social Protection**

Georgia needs to focus on stopping de-forestation and there are several options that can be used, for example, use of high efficiency wood stoves and boilers, gasification, fast growing poplar plantations, solar heat and hot water panels, and even PV possibly in a few years when it gets cheaper. CO<sub>2</sub> emissions will decrease as renewables are developed and used more. Energy efficient technology use will also contribute to environmental sustainability. Small and medium size hydropower plants will avoid large environmental impacts. Consideration of social concerns, informing the public that can be potentially impacted from energy production and adequate compensation will be critical for social protection.

Georgia will need to achieve greater economic and regulatory harmonization with the EU via political association and economic relations as the compliance of Georgian legislation with the EU Energy *acquis* will be governed by the five Energy Community (EC) pillars, one of which is environment. Increase the supply of grid and off-grid energy in rural areas; Discontinue the practice of venting gas which is a by-product of coal production and either flare the gas released after coal harvesting or ideally capture it for local consumption needs. Addressing the problem of deforestation through developing plantations of fast growing poplar trees.

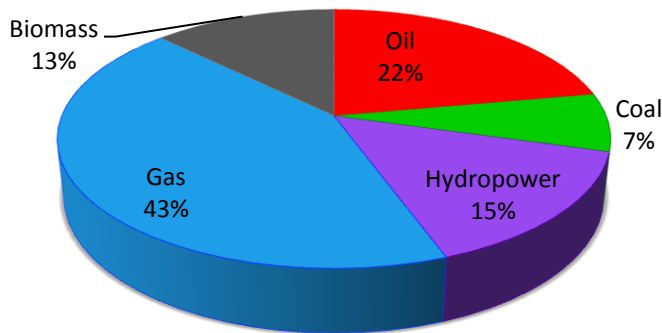
## **Innovation & Technological Development**

Well-designed and targeted technology policies on both the supply and demand sides are a fundamental ingredient in a strategy to accelerate innovation. Georgia will have an established institutional system that will support innovation and technology development across all aspects of the energy sector. The Innovation and Technology Agency established under the Ministry of Economy should take on the responsibilities in this area.

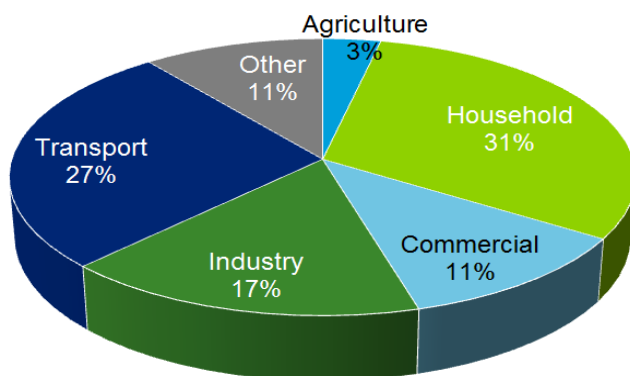


## 7.0 LONG TERM ENERGY BALANCE

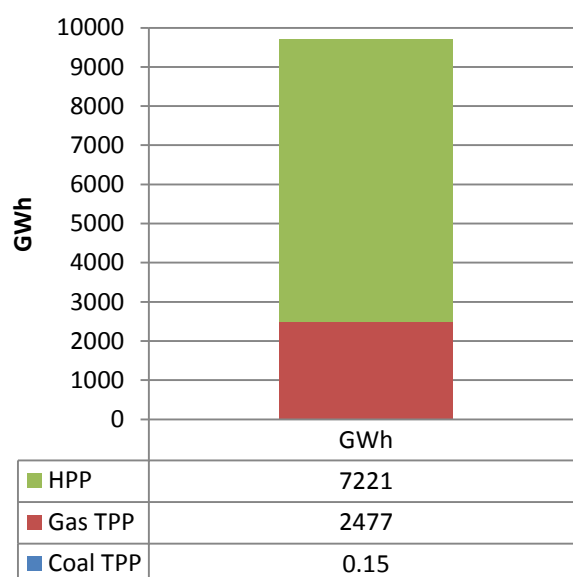
In Georgia households represent the largest consumers of energy and natural gas is the largest resource used. Figure 6 illustrates the distribution of the total primary energy supply of Georgia in 2012, while Figure 7 shows that the household and transport sectors were the largest energy consumers in 2012. Figure 8 shows domestic electricity generation by source in 2012, which mainly relies on hydropower.



**FIGURE 6: Total Primary Energy Supply 2012**



**FIGURE 7: Energy Consumption by sectors, 2012**



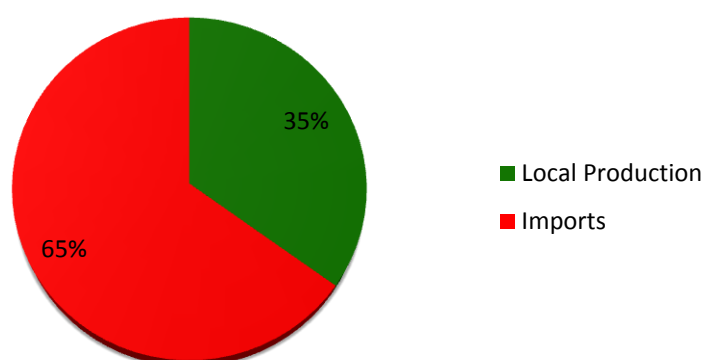
**FIGURE 8: Electricity generation by source of energy, 2012**

## Energy Balance of Georgia for 2012

The Energy Balance of Georgia for 2012 is the first official energy balance for the country since 2006 and it is entirely based on the available data and accounting information for Georgia provided by the MoE, GEOSTAT and energy sector entities. Table 2 details Georgian Energy Sector Statistics from 2008 to 2012.

Reliance on hydro would minimize domestic demand requirements for external sources of natural gas, and thus increase energy security for the country. Even though hydro power may have high capital costs, this is the local source which has to be further utilized. At the same time, Georgia also has potentially high capital costs for service of its domestic gas distribution loads. Georgia's strong dependence on imported energy resources and low energy security is demonstrated below by Figure 9. In 2012, local energy production constituted about 35%, lead by hydropower, coal and biomass, while imports made up 65% with large gas and oil imports.

**FIGURE 9: Georgia's Energy Balance in 2012**



Macroeconomic/Energy Parameters	2008	2009	2010	2011	2012
Population (thousands)	4 382.1	4 385.4	4 436.4	4 469.2	4 497.6
Real GDP (at constant 2003 prices), mil. USD	8382.5	7195.4	7164.4	8118.1	8801.5
Real GDP growth, percent	2.3	-3.8	6.3	7.2	6.2
Exchange rate GEL/USD	1.49	1.67	1.78	1.69	1.65
Export (FOB), Mil USD	1495	1134	1677	2189	2377
Import (CIF), Mil USD	6302	4500	5257	7058	7842
Annual average inflation (CPI), percent	9.2	10	1.7	7.1	8.5
Total Final Energy Consumption, ktoe	2702.00	2616.00	2663.00	3033.00	3495.00
Share of Renewables in Electricity Generation	85%	88%	93%	78%	74%
Per Capita Electricity Consumption, KWh	1842.67	1742.61	1902.70	2071.19	2085.42

**TABLE 2: Georgian Energy Sector Statistics, 2008-2012**

### Energy Balance (2012-2030)

Table 3 illustrates the projected Energy Balance from 2012 to 2030. Following assumptions were used in making the projection for future energy supply and demand.

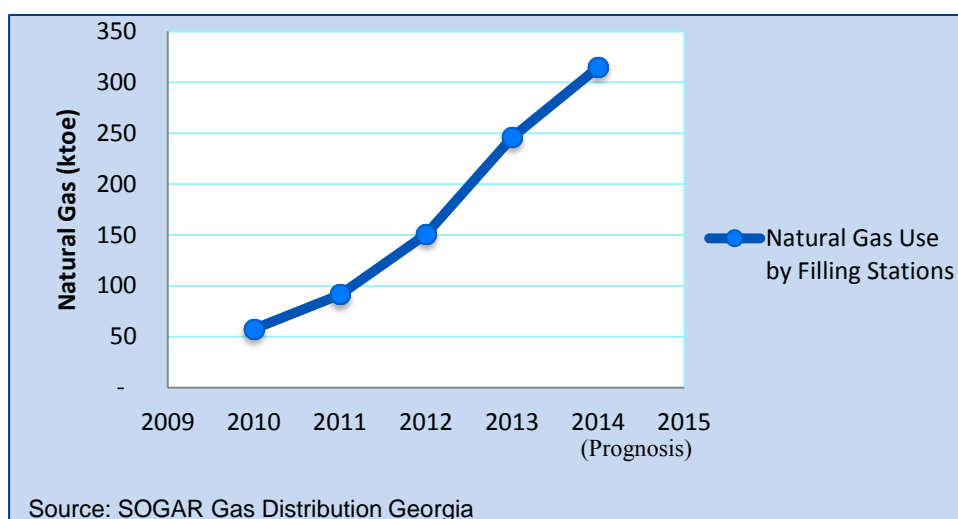
## SUPPLY

- Supply of wood will decline gradually as the timber supply declines due to deforestation;
- Coal resources are likely to increase slightly with more exploration and production to meet the increasing energy demand for industrial use;
- As the demand for electricity steadily increases and the capacity of hydropower generation improves, we project a 3% annual increase in hydropower generation;
- Oil supply is expected to grow at a low rate as natural gas is becoming a more widely used fuel source;
- Natural gas is a major source of energy for heating in urban areas and it is mainly used for cooking in rural areas. As many of the villages gain access to natural gas, we project the supply to rise further at 5% growth rate per year;
- New renewables such as wind and solar are only a small part of Georgia's energy supply at the time. From 2015 as these new options become more widely available and commercially viable, the energy supply from new renewables will increase at about 5% per year.

## DEMAND

- The World Bank and the GoG estimate a GDP growth rate above 5%, which means that the demand for energy will increase. As the economy develops, the demand for energy is expected to rise across all sectors;
- Natural gas use in the transport sector alone increased by 445% since 2010. The growth rate of gas use in this sector has been increasing linearly as illustrated by figure 10.

**FIGURE 10: Natural Gas Use by Filling Stations (2010-2014)**



- Agriculture is one of the drivers of growth in Georgia. As this sector grows and adopts more advanced technology, energy use is expected to increase;
- As the standard of living improves with economic growth, more consumers will use modern technologies, increasing the households' energy use;
- Industrial use of energy will increase for production of goods as the country industrializes.

**TABLE 3: Energy Balance of Georgia 2012-2030**

(ktoe)

						<b>Georgia's Energy Balance</b>													
<b>Supply</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	<b>2028</b>	<b>2029</b>	<b>2030</b>
Coal	300	268	273	279	284	290	296	302	308	314	320	327	333	340	347	354	361	368	375
Wood	525	520	515	510	505	500	495	490	485	480	475	470	466	461	456	452	447	443	438
Hydro	621	711	732	754	777	800	824	849	874	901	928	956	984	1,014	1,044	1,075	1,108	1,141	1,175
Oil	916	966	976	985	995	1,005	1,015	1,025	1,036	1,046	1,056	1,067	1,078	1,089	1,099	1,110	1,121	1,133	1,144
Natural Gas	1,772	1,720	1,806	1,896	1,991	2,091	2,195	2,305	2,420	2,541	2,668	2,802	2,942	3,089	3,243	3,405	3,576	3,755	3,942
Other Renew.	-	-	-	20	21	22	23	24	26	27	28	30	31	33	34	36	38	40	42
<b>Total Supply</b>	<b>4,134</b>	<b>4,185</b>	<b>4,302</b>	<b>4,444</b>	<b>4,573</b>	<b>4,708</b>	<b>4,848</b>	<b>4,995</b>	<b>5,148</b>	<b>5,309</b>	<b>5,476</b>	<b>5,651</b>	<b>5,834</b>	<b>6,024</b>	<b>6,224</b>	<b>6,433</b>	<b>6,651</b>	<b>6,878</b>	<b>7,117</b>

<b>Demand</b>																			
Agriculture	372	377	387	400	412	424	436	450	463	478	493	509	525	542	560	579	599	619	640
Residential	1,282	1,297	1,334	1,378	1,418	1,459	1,503	1,548	1,596	1,646	1,698	1,752	1,808	1,868	1,929	1,994	2,062	2,132	2,206
Industrial	744	753	774	800	823	847	873	899	927	956	986	1,017	1,050	1,084	1,120	1,158	1,197	1,238	1,281
Commercial	703	711	731	756	777	800	824	849	875	902	931	961	992	1,024	1,058	1,094	1,131	1,169	1,210
Transport	1,034	1,046	1,076	1,111	1,143	1,177	1,212	1,249	1,287	1,327	1,369	1,413	1,458	1,506	1,556	1,608	1,663	1,720	1,779
<b>Total Demand</b>	<b>4,134</b>	<b>4,185</b>	<b>4,302</b>	<b>4,444</b>	<b>4,573</b>	<b>4,708</b>	<b>4,848</b>	<b>4,995</b>	<b>5,148</b>	<b>5,309</b>	<b>5,476</b>	<b>5,651</b>	<b>5,834</b>	<b>6,024</b>	<b>6,224</b>	<b>6,433</b>	<b>6,651</b>	<b>6,878</b>	<b>7,117</b>

## 8.0 ENERGY SECURITY

### 8.1 SHORT TERM ACTIONS

The energy sector needs significant investments for the improvement of the existing infrastructure whose current status is also the result of low levels of investments during the past decade. Private investment represents a powerful instrument through which this goal can be achieved. The limited investment capacity of the state (direct financing, revenues from privatization of energy assets or loan guarantees) will be used in the next several years for projects and areas of activity where economic benefits are significant, but the existing legal, regulatory or other barriers are still making such projects less attractive for foreign investors at this transition stage. This applies, for example, to energy efficiency projects where changes in the tax law are needed to create an environment favorable for companies providing energy efficiency services.

For this reason, the government will step up to initiate the pace of the strategic management processes in the energy sector.

Based on this, the GoG will strengthen the country's energy security through the following:

- Further utilization of Georgia's geographic location: Georgia is situated at a crossroads between South Caucasus and South-Eastern Europe through which transit natural gas, oil and electricity are laid to the west and which connects with Turkey's natural gas grid and in the future with the European;
- Enhance the domestic production of primary energy sources: efforts will be to secure for further RD&D on local fields for oil, coal and gas exploration including storage reserves on fossil fuels;
- Increase the supply of grid and off-grid energy in rural areas;
- The energy system will be approximated with European technical standards, including: reduction in transmission, distribution and end losses of electricity, as well as for better efficiency and extended life cycle of the key power plants and rehabilitation of the grids; technical safety criteria and technical rules shall be defined of the transmission and distribution networks;
- The GoG/MoE will ensure monitoring of security of supply: balance of supply and demand on the national market, the level of expected future demand and envisaged additional capacity being planned or under construction, as well as measures to cover peak demand and to deal with shortfalls of one or more suppliers;
- The uncertainty surrounding Enguri HPP needs to be resolved.

The 3 year implementation plan covering energy security can be found in Table 1 in Annex 1.

### 8.2 MID-TERM ACTIONS

Lack of human resources in this sector is problematic. Human and Institutional Capacity Development (HICD) will identify performance gaps of institutions and helping them to increase performance and achieve their objectives more efficiently.<sup>11</sup> The 3 year implementation plan for institutional development can be found in Table 8 in Annex 1.

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<sup>11</sup> USAID, *Human and Institutional Capacity Development Handbook*, October 2010, accessed May 2014. <[http://pdf.usaid.gov/pdf\\_docs/PNADT442.pdf](http://pdf.usaid.gov/pdf_docs/PNADT442.pdf)>.

- Commercialization of all energy sector entities
- Developing markets
- Monitoring process to maintain energy security
- Implement proposed actions for emergency fuel stock plan in accordance with EU energy *acquis*

Commercialization of government-owned entities is crucial for the long-term sustainability of the energy markets. The key actions will consider:

- Preparing the entities by commercializing;
- Transfer of ownership aiming to attract investments and to bring the management practices in line with improved standards;
- Developing O&M plan that will ensure efficient and effective operation of the assets for their intended lives;
- Divestiture of the GoG's ownership at least in most of the electricity generation and distribution segments of the market.

### **Gas storage:**

Natural gas storage is needed for balancing seasonal demand and supply of gas and obtaining the full benefit of SCP agreement. For gas storage possible sites include Rustavi, Samgori, Patardzeuli and Ninotsminda. Feasibility studies for Ninotsminda gas storage have been conducted by Millennium Challenge and a Danish company Ramboll in 2009-2010, while Rustavi and other sites have been less examined. Ninotsminda oil deposits were chosen because it is the largest with its capacity of 500 million cubic meters and has a potential of becoming a regional scale gas-reservoir increasing its capacity to five billion cubic meters. The study found the cost of 300-700 million cubic meter of gas capacity to cost approximately \$400 million. Since costs are very high, commercialization may be the only way to push forward such a venture.<sup>12</sup>

## **9.0 ELECTRICITY SECTOR**

### **9.1 SHORT TERM ACTIONS**

Georgia's electricity sector is just eight years away from the time of rolling blackouts, large commercial losses and extreme lack of investment into the sector. Though the power system operation has greatly improved, the sector is still quite fragile and requires vigilance on behalf of the GoG. The following steps needs to be taken in this area:

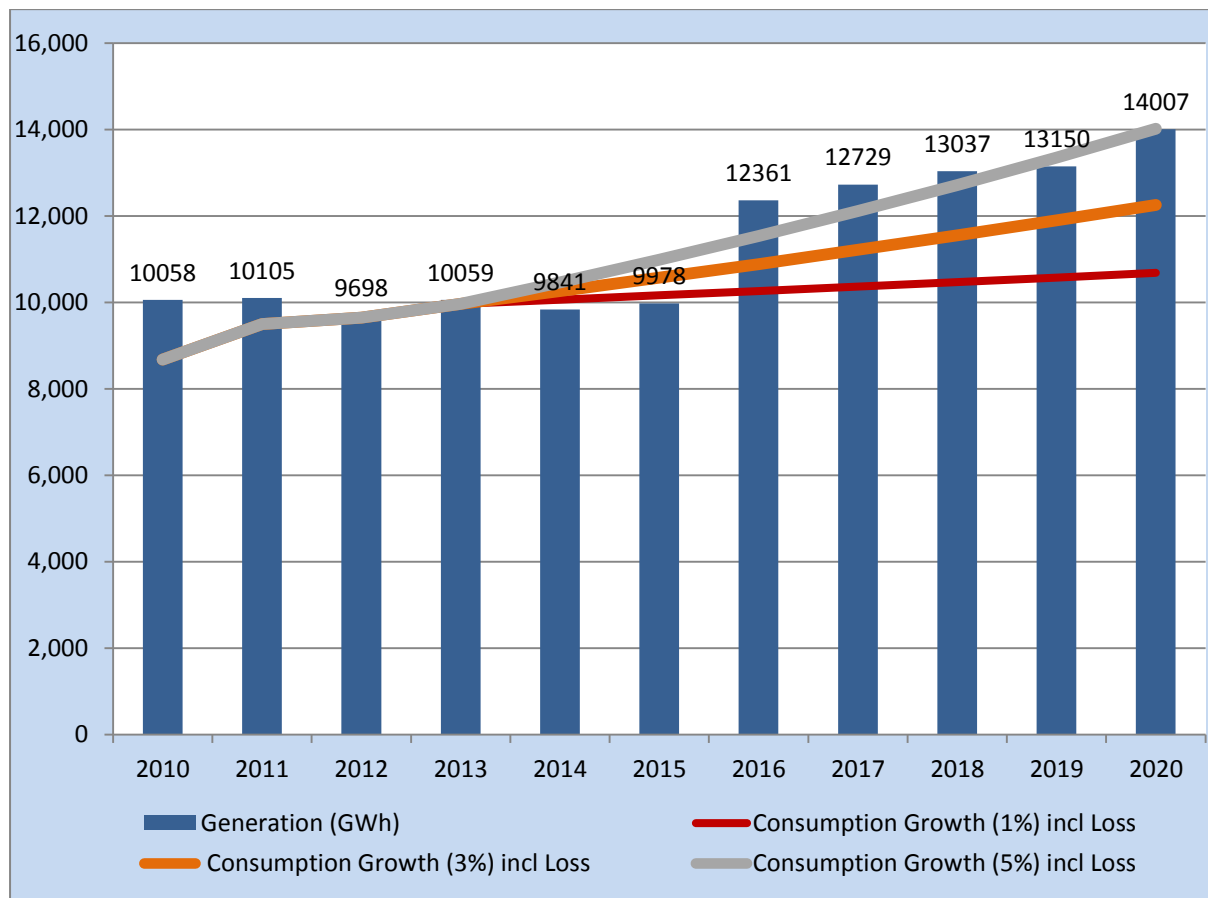
- 1) Create a market operator
  - a. Establishment of Market Operator in Georgia
  - b. Establishment of Day-ahead Scheduling
  - c. Finalize Automatic Metering Reading (AMR) System
  - d. Establishment of Day-ahead Planning
  - e. Implementation of balancing and settlement rules
  - f. Introduction of Hourly/Daily Settlement
  - g. Establishment of Balancing Market
  - h. Introduction of licensed traders
  - i. Finish commercial metering

<sup>12</sup> Georgian News, *Gas Storage Project Shelved*, October 2011, accessed May 2014. [http://www.georgianews.ge/index.php?option=com\\_content&view=article&id=6257:gas-storage-project-shelved-&catid=4:economy&Itemid=6](http://www.georgianews.ge/index.php?option=com_content&view=article&id=6257:gas-storage-project-shelved-&catid=4:economy&Itemid=6).

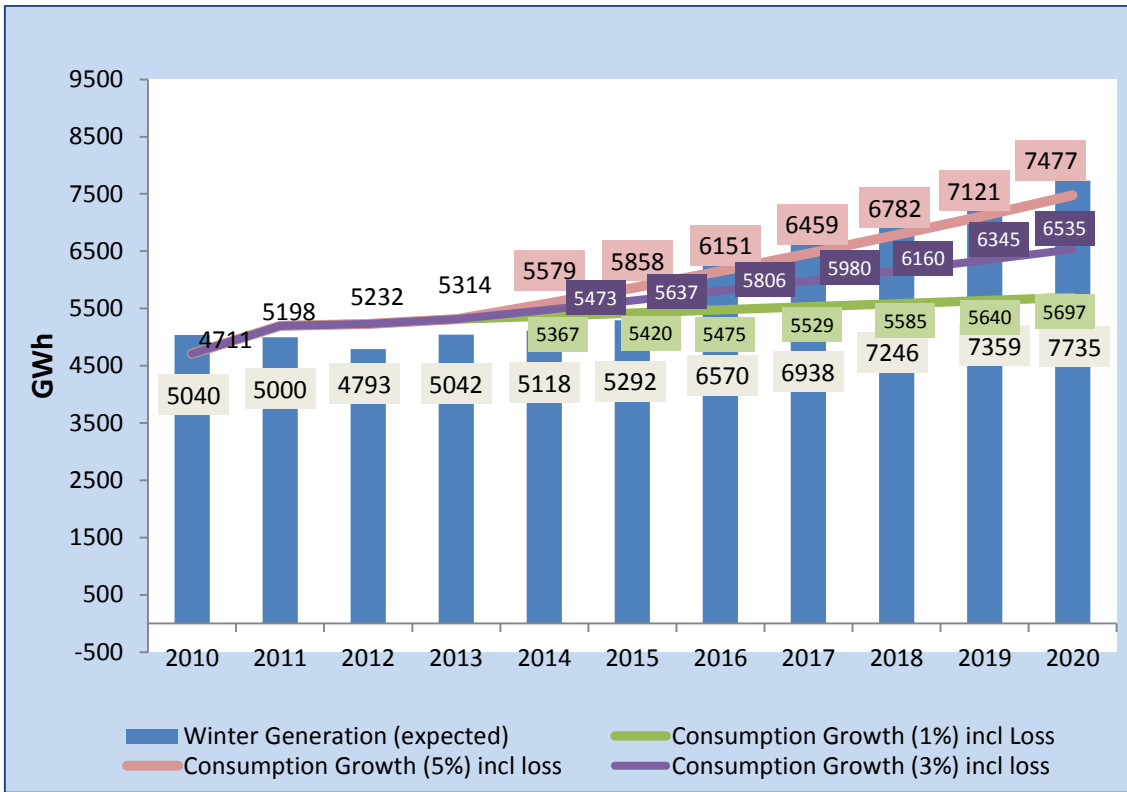
- j. Adopt market trading software
  - k. Transform monthly to day ahead scheduling (scheduling, then day ahead settlement, eventually hourly settlement) on the wholesale level
  - l. Gradual market opening to reach at least 30% by the end of the 2017
- 2) Develop a stronger relationship with ENTSO-E, the European network of transmission system operators;
  - 3) Develop and meet targets for improved key performance indicators;
  - 4) Completely open electricity generation and retail sales to competition by December 31, 2017;
  - 5) Mandate the unbundling of electricity supply and generation from network entities in accordance with the EU's Association Agreement Protocol;
  - 6) Establish competitive trading by implementing the legal basis for energy traders, competitive electricity suppliers and the requisite market structures necessary for robust competition;
  - 7) Evaluate off-grid solutions compared to traditional electricity service for Georgia's isolated population;
  - 8) Establish a clearing mechanism for trading to ensure that the competitive market is financially stable and sustainable.

As illustrated by Figures 11-13, to ensure security of supply in the electricity sector Georgia should continue to promote investments in hydropower.

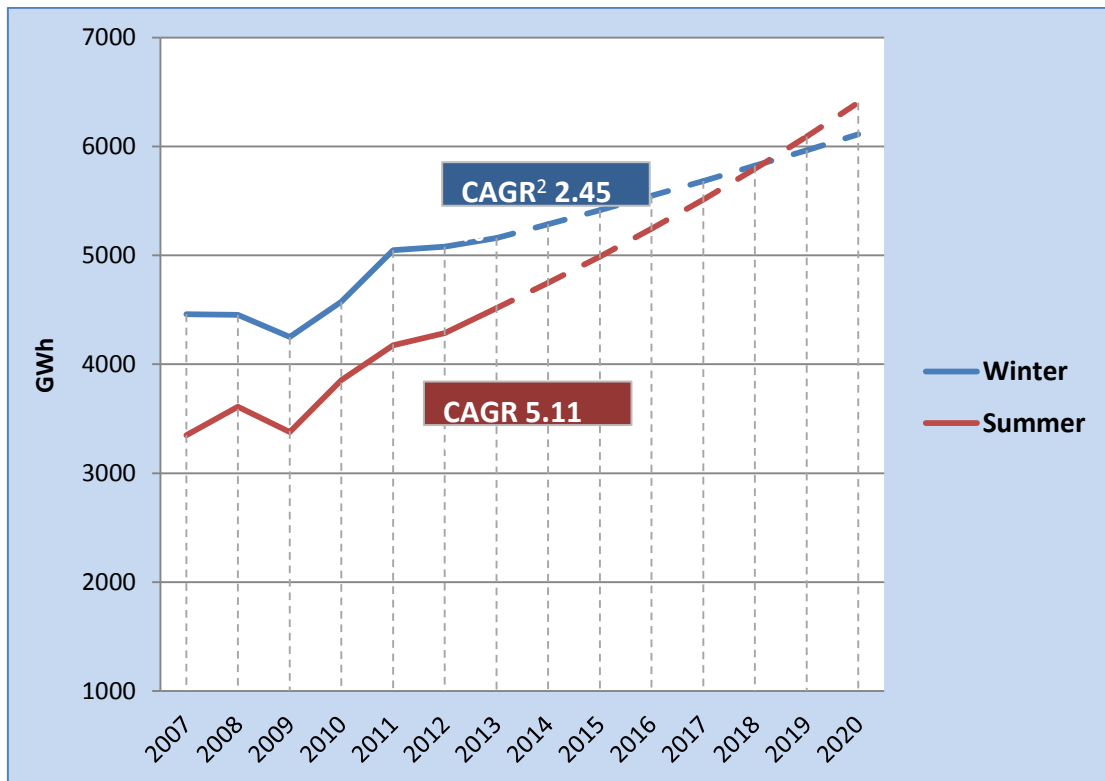
**FIGURE 11: Electricity generation production vs. consumption**



**FIGURE 12: Electricity generation vs. consumption in the winter**



**FIGURE 13: Growth of consumption of electricity during winter<sup>13</sup> and summer<sup>14</sup> periods**



<sup>13</sup> Winter period includes: November, December, January, February, March, April

<sup>14</sup> Summer period includes: May, June, July, August, September, October

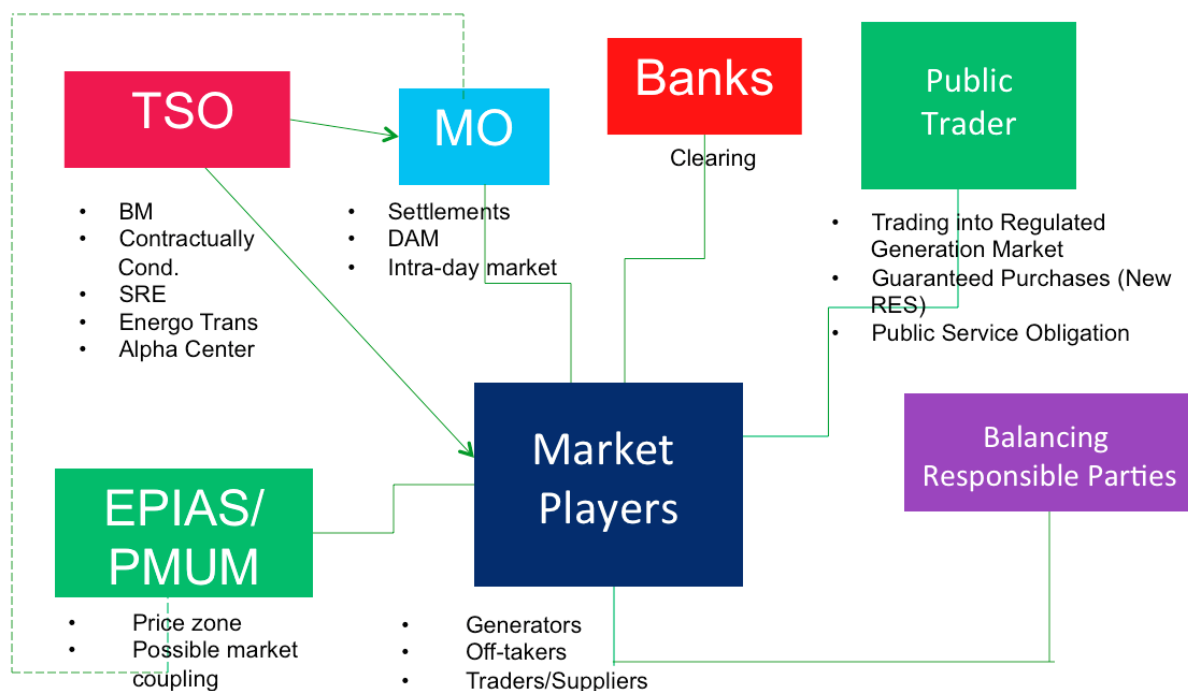


A competitive market model for the development of the internal and external electricity market will be operating under a pre-set and legally regulated schedule. The unique nature of the forthcoming reform is that concurrently and in a short time it will be necessary to achieve the following:

- Market development: Further development of a competitive electricity market;
- Export: Increase the export opportunities through efficient use of the capacities towards reduced system cost and improved performance; Establishment of electricity trade mechanism with Turkey in near term;
- Institutional development and strategic management;
- Commercialization of activities: prices for the population are much lower than the cost of energy supply at low voltage, which represents a barrier to the introduction of commercial incentives for efficiency and quality, particularly in distribution companies.
- High level of customer protection shall be ensured, customer switching rules will be elaborated and enforced;
- Transmission and distribution tariffs will be set according to transparent criteria;
- Electricity Trading Mechanism will be in place and will provide clear rules and procedures;
- The Transmission System Operator (TSO) should adopt efficient system planning in compliance with ENTSO-E requirements;
- The integrated structure of the power supply into generation, transmission, distribution and supply activities within the entities will be unbundled;
- Enhancement of transmission lines efficiency.

Figure 14 illustrates the proposed competitive power market structure, which should be implemented within six months timeframe. The 3 year implementation plan for the electricity sector can be found in Table 3 in Annex 1.

**FIGURE 14: Proposed power market structure**



## 9.2 MID-TERM ACTIONS

### Merchant plant development

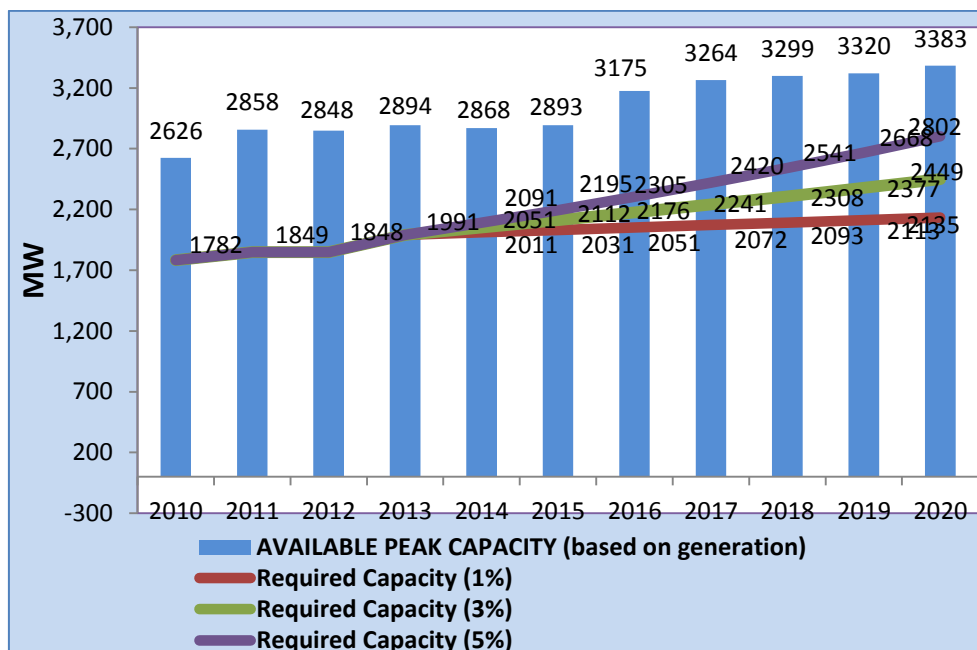
Competitive markets must be free from any interference, else the price needed to attract investors and keep prices competitive will be distorted. Market price formation should be free of:

- ✓ Subsidies,
- ✓ Price caps,
- ✓ Restrictions on free entry and exit,
- ✓ Public service obligations,
- ✓ Market abuse/control, special conditions for selected power plants and
- ✓ Any other interference.

The responsibilities of the national authorities are to design and develop the regulations of the market so the markets are truly competitive and none of the above interferences exists in setting the competitive market price. Electricity services divided into several markets and priced separately, such as:

- ✓ Electricity (energy) sales;
- ✓ Reserve Capacity;
- ✓ Balancing;
- ✓ Voltage Control (Provision of reactive power);
- ✓ Black start;
- ✓ Frequency Control.

When national authorities determine that a security of supply risk is imminent, the national authority can call for a tender to solicit for specific service to be provided, such as black start capability. In most EU countries, reserve capacity or some other form of capacity market is created to ensure that energy is available at the time of system peak loads. The energy from any capacity market resource must be sold into the spot energy market at a price of zero. Figure 15 shows the available peak capacity versus the required peak capacity in Georgia.



**FIGURE 15: Available Peak Capacity vs. Required Peak Capacity**

Competitive electricity markets require a TSO to handle the technical issues of the market, an MO to organize the spot markets and a clearing mechanism to ensure all payments are 100% secured. These are prerequisites for any competitive market.

The EU does allow for some consideration relating to protection of indigenous resources, up to 15% of the electricity consumed. But this protection cannot impact the setting of the electricity (energy) market price. *“A Member State may, for reasons of security of supply, direct that priority be given to the dispatch of generating installations using indigenous primary energy fuel sources, to an extent not exceeding, in any calendar year, 15% of the overall primary energy necessary to produce the electricity consumed in the Member State concerned.”*<sup>15</sup>

Energy spot markets do not operate in isolation. The price on one spot market is influenced by prices on another market. In theory, if transmission line capacity was limitless, there would need to be a single spot market in Europe and a single market price. A single EU electricity market is the vision of the EU. But market prices rarely get to equilibrium as the transmission capacity between the markets is not sufficient to raise up the low price market and lower the high price market to a point where the prices are the same. This is what the HPEP study tour found in Slovenia – that the Italian and Slovenian markets were coupled but the price still remained different, as the transmission capacity between the two markets was limited.

By examining the relationship between various competitive energy market prices such as those in Italy and Slovenia, a proxy can be developed for Georgia using the Turkish market prices.

Investors into new generation will review the historical aspects of the electricity market prices for the various services, especially energy spot market and use the ten-year network development plan as a guide to what merchant electricity resources can be constructed and sold into the market.

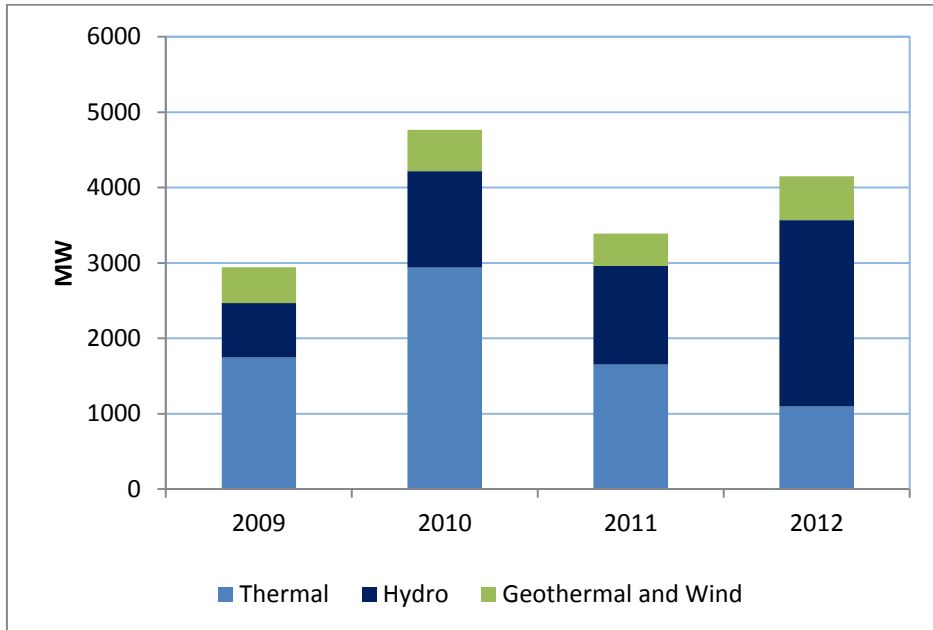
There are plenty of examples across Europe where small, medium and large power plants including large reservoir plants have been built since the opening of the various competitive markets. These include:

- ✓ Turkey (Figure 16)
- ✓ Lithuania
- ✓ Romania
- ✓ Slovenia
- ✓ Italy

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<sup>15</sup> EU Directive 2009/72/EC, Article 14, Paragraph 4.

**FIGURE 16: New power plants having commenced operation in Turkey since 2009**

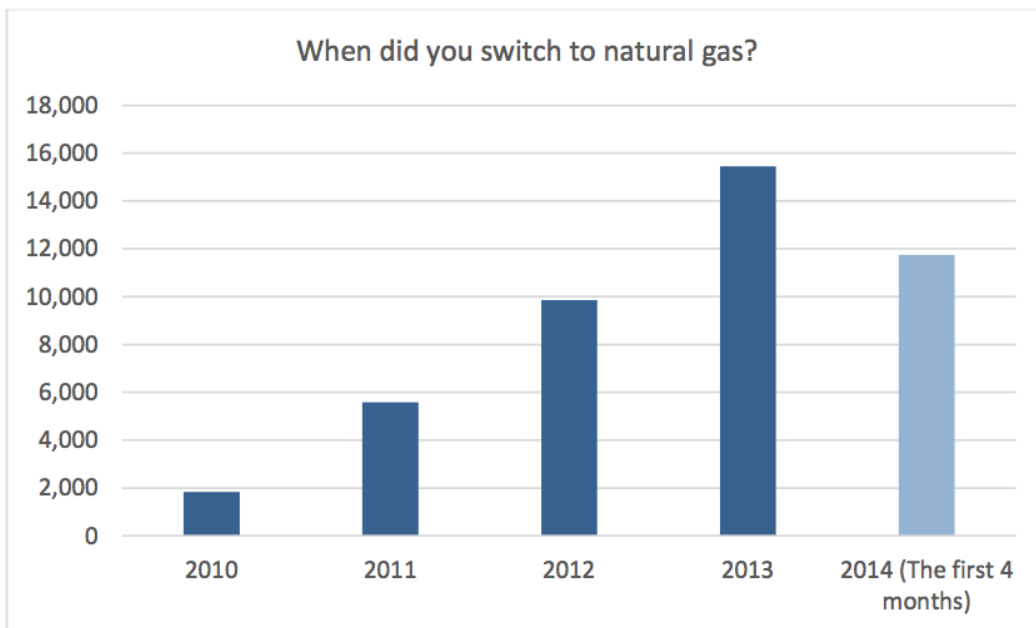


## 10.0 NATURAL GAS & OIL UPSTREAM SECTOR

### 10.1 SHORT TERM ACTIONS

The natural gas sector has been expanded to transportation more and more; natural gas stations for cars are being developed. USAID's survey results show that the rate of car conversion from petroleum to natural gas is increasing (Figure 17). An increase in gas use will worsen energy dependence. More gas is used for retail supply than power generation. Use of electric cars using hydropower at nighttime could be one mitigation strategy.

**FIGURE 17: Car Conversion Rate to Natural Gas**



## **Exploration of unconventional resources:**

Due to complex geological structure, which requires steel lining for drilling, thus slowing down the process and making it more expensive, conventional natural gas resources were not exploited in Georgia. However, this area presents an opportunity as new technology and methodology is becoming available. Horizontal drilling and hydraulic fracturing (fracking) could facilitate the extraction of unconventional gas resources in Georgia. Regulatory reform is the first and the most important step to create an enabling environment and attract investment and allow for development of shale gas production.

GoG will review international best practices relating to exploration of unconventional resources.

- Enhance research and development in the field in particular upstream oil activities;

State law should make it clear that the state is the effective owner of all natural resources in the country and it provides the rights for exploration and exploitation of the hydrocarbon resources. Legislation should also regulate the production process for unconventional resources: whether hydraulic fracturing is allowed, whether the by-product gas can be flared and if so the standards and amounts need to be specified for this process. Regulation should cover both offshore and onshore exploration and the terms for exploration should be created. The legislation on unconventional resource exploration and development should also address consequent water management questions:

- How much water can be used per year in the process of hydrocarbon resource production;
- Control and licensing for water use;
- Water disposal/conservation & recycling of drilling and fracturing fluids;
- Measures for avoiding underground water pollution.

A separate independent agency (National Agency for Development of Hydrocarbon Resources) should be established to work towards facilitation of development of hydrocarbon resources both conventional and unconventional and provide favorable climate for investors. The National Agency for Development of Hydrocarbon Resources should develop fiscal and other incentives to facilitate exploration and attract investment. The agency should also devise and implement shale gas and oil development plan. The Ministry of Finance should work closely with the Hydrocarbon Resource Development Agency to jointly set and carry out fiscal policy for unconventional resources, which will include tax and other incentives for exploration and exploitation of shale oil and gas in Georgia.

Within the hydrocarbon development agency should be created a State Geology & Subsurface Service that will be responsible for granting special permits for exploration of unconventional resources and providing estimates of the existing reserves in Georgia.

Georgia needs to explore and develop its unconventional resources as it has a strong need to achieve energy efficiency, energy security, price stability and give its economy a boost through job creation. The hydrocarbons development agency should have a separate division serving as a point of contact for the investors in unconventional oil and gas. The government needs to create every incentive for the investors in the unconventional sector as the costs are higher at the beginning.

Even though production-sharing agreement for conventional resources exist, a different approach is needed for unconventional resources to attract investors.

### **Upstream regulator:**

Upstream regulator needs to be independent. National Regulatory Authority (NRA) needs to act in accordance with EU Energy *acquis*. Separate legislation needs to be developed to regulate unconventional resources and licensing. As the geology of shale play has a tendency to vary substantially throughout the basin, thus requiring constant exploration and drilling, exploration and exploitation agreements for conventional resources will not be suitable for unconventional ones. For shale gas exploration, longer periods of time and greater resources are required as more exploration and appraisal wells need to be drilled compared to conventional gas. As shale gas exploration is ongoing, it cannot stop when the production process starts, as continuous exploration is necessary to maintain commercially viable production. Thus, companies need a right to continue exploration during exploitation process too.<sup>16</sup>

Improve PSA/license monitoring. There should be a regulation introduced, where companies must meet a deadline or lose their license. Strong legally based contracts on licenses are needed along with strong monitoring and sanctions for non-compliance.

- Create a single integrated electronic database system for more diligent evaluation and analysis. This will allow the government to better evaluate the resource potential and promote potential projects to the suitable investors;
- Improve tender process through back-in option and by introducing more technical program evaluation to avoid speculator problem;
- Technical competency evaluation in the process of choosing companies in tender.

The 3 year implementation plan for natural gas sector can be found in Table 4 in Annex 1.

## **10.2 MID-TERM ACTIONS**

Given the volatile situation in the region and increasing dependence on imported oil and gas, the exploration of unconventional resources is one of the strategic priorities. Government position on unconventional resources needs to be made clear. New laws need to be devised on unconventional resources encouraging commencement of exploration and attracting foreign experienced companies that can bring the technology and know-how for the development of these unconventional and offshore resources. Tax and other economic incentives could attract more investment for developing unconventional resources.<sup>17</sup> Unconventional resources should be legally differentiated from the conventional resources.

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<sup>16</sup> Baker & McKenzie, *Shale Gas International Guide*, 2014, accessed May 2014, pg. 8.

<sup>17</sup> King & Spalding Energy Newsletter, *Upstream Developments*, April 2013, accessed May 2014. <<http://www.kslaw.com/library/newsletters/EnergyNewsletter/2013/April/article2.html>>.

## 11.0 OIL AND OIL-BYPRODUCTS DOWNSTREAM SECTOR

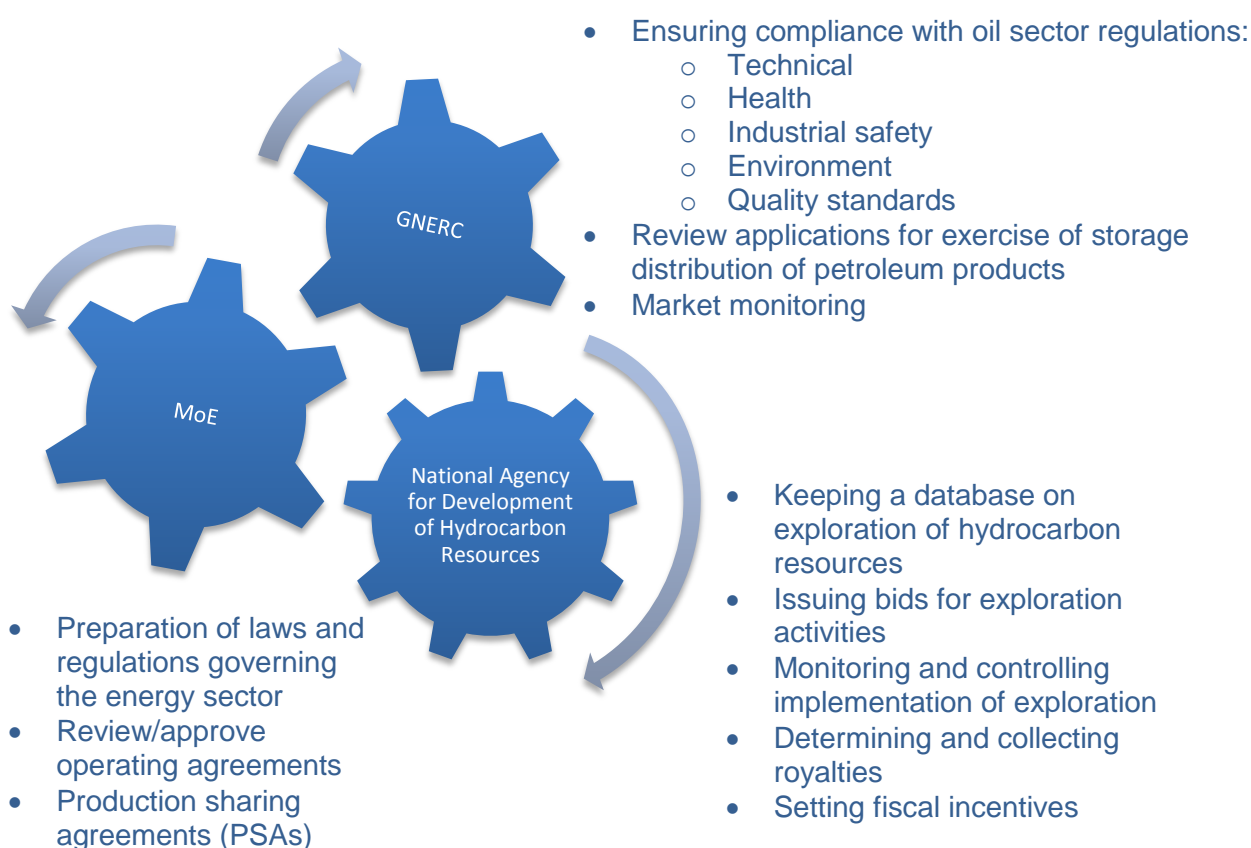
### 11.1 SHORT TERM ACTIONS

- Create an independent oil and gas sector regulator;
- Amendments to current legislation for realization of local oil processing potential in a competitive environment;

Currently, the Oil and Gas Agency, which is a subsidiary of the Ministry of Energy, governs the rules and regulations for both development of hydrocarbon resources and control and regulation of activities in the hydrocarbons sector. GNERC also has some role in market monitoring for the gas sector, however it has no role in the oil sector. Oil sector needs to be regulated by an independent agency that governs safety, quality standards and monitors the market. GNERC's role should be expanded to the oil sector for downstream regulation for safety, quality of the products and market monitoring. A separate entity should work on creating an enabling environment as shown by Figure 18.

The 3 year implementation plan for the oil and oil by-products sector can be found in Table 5 in Annex 1.

**FIGURE 18: Proposed oil market administration structure**



The above two branches will collaborate with the MoE closely. Current law on hydrocarbon resources does not cover unconventional resources. Adequate legislative background will be important in creating an enabling environment for the investors.

## 11.2 MID-TERM ACTIONS

GNERC should take on the responsibility of regulating downstream oil sector as well and control the quality standards of:

- services
- energy
- safety

Assign responsibilities and execute them  
monitoring and sanctioning

- Emergency procedures and plan:

To make sure price is not increased under the presumption that there is a shortage

- Strategic oil reserve
- Support development of refinery facilities to improve balance of trade and increase value added products exported from Georgia

Directive 2009/119/EC imposing an obligation on Member States to maintain minimum stocks of crude oil and/or petroleum products. Deadline identified by the GoG is January 1, 2023 according to the draft Protocol Concerning the Accession of Georgia to the Treaty Establishing the Energy Community.

The emergency stock requirements will be reviewed and implementation of the plan developed in the short-term will be implemented. A gradual increase in required oil stocks will occur each year in order not to significantly impact the State Budget. A monitoring program will be in place to ensure compliance with the program, no leakage from the storage containers and that the quality of the fuel has been maintained.

## 12.0 NATURAL GAS DOWNSTREAM SECTOR

### 12.1 SHORT TERM ACTIONS

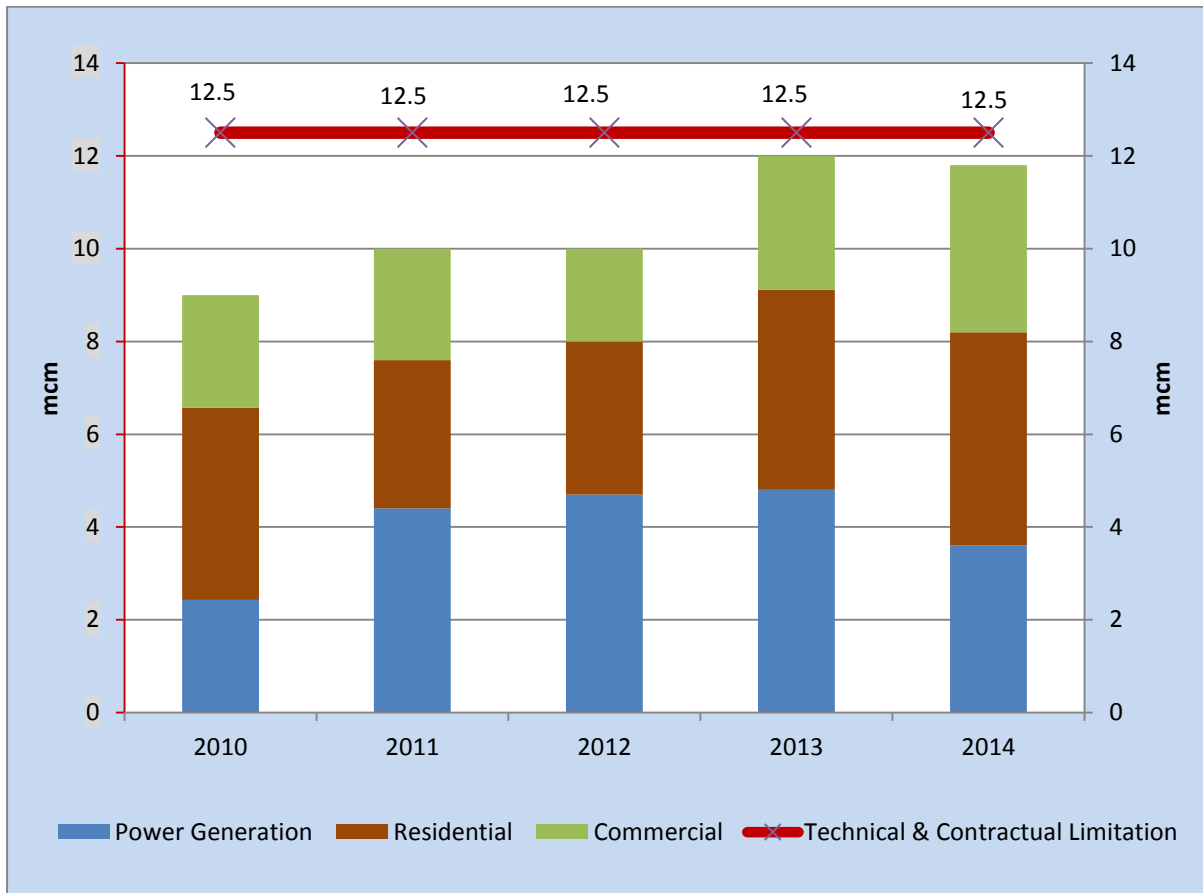
Improve Performance standards, technical standards, service quality, monitoring and sanctioning:

Better gas quality will be needed if Georgia is to join the EU Energy Community as the EU's gas quality standards are significantly higher. Quality standards should be under the jurisdiction of GNERC. It is important to establish the role of GNERC in the monitoring and enforcement of strict energy quality standards.

Technical and contractual limits from gas pipelines restrict the ability to deliver gas to the TPPs during the peak times in the winter. Figure 19 shows the increasing daily peak gas consumption compared to the static technical and contractual limitations.



**FIGURE 19: Daily peak gas consumption vs. technical and contractual limitations**



There are a number of gas allocation companies serving Tbilisi, the major ones being: KazTransGas Tbilisi with over 230,000 customers,<sup>18</sup> and LTD Didi Digomi, LTD Varketilairi, JSC Energokavshiri, LTD Gama and LTD Kamari serving the rest of 81,500 consumers. Based on 2013 statistics, 388,240 of these consumers are from residential sector and about 13,250 from non-commercial. According to EU standards, if there are over 100,000 consumers then the distributor and supplier should be separate companies.<sup>19</sup>

#### **Gas use in transportation sector:**

Gas equipment inspections and conversion equipment regulation is necessary. The regulation of conversion equipment should be handled by the transport division of the Ministry of Economy for public safety. Inspections should be conducted to ensure that installation is correct.

- Open natural gas to the wholesale market and retail sales to competition by December 31, 2017 in accordance with the protocol to the Association Agreement;
- Energy networks must provide energy consumers with natural gas at specified standards of reliability and service;

<sup>18</sup> KazTransGas, *About Us*, accessed June 2014. <[http://ktg-tbilisi.ge/?page\\_id=204](http://ktg-tbilisi.ge/?page_id=204)>.

<sup>19</sup> GNERC, *Annual Report 2013*, accessed May 2014. <[http://gnerc.org/uploads/1angarishi2013\\_.pdf](http://gnerc.org/uploads/1angarishi2013_.pdf)>.

- Energy suppliers must provide energy consumers at specified standards of quality and service;
- Explore and develop a legal and regulatory framework that will allow for non-conventional natural gas to enter into the local market;
- The independently formed regulator will be responsible for promoting competition within the natural gas markets; for approval of tariff methodologies, long-term transmission development plans, and natural gas market rules. The independently formed regulator will establish control over the conditions of the licensing within the natural gas sectors of Georgia, and to facilitate the organization and coordination of activities, with regard to mandatory certification within the energy sector;
- GOGC and GGTC will be compliant with the EU directives on unbundling issues;
- Unbundling in transmission and distribution will be conducted across natural gas sector;
- Completion of the accounting unbundling of the GOGC functions, i.e. supply, transmission, storage and distribution, as a prerequisite for the introduction of clear and appropriate tariffs for transmission and storage;
- Natural gas storage will be promoted to meet EU requirements;
- Risk assessment and crisis management plans within GOGC and GGTC will be adopted in case of occurrence of possible critical situations;
- Opening of the natural gas market through allowed access of third parties to the transmission network on a non-discriminatory basis and through the provision of large consumers with the opportunity to directly contract supplies, including also supplies from other countries.

## 12.2 MID-TERM ACTIONS

### **Unbundling:**

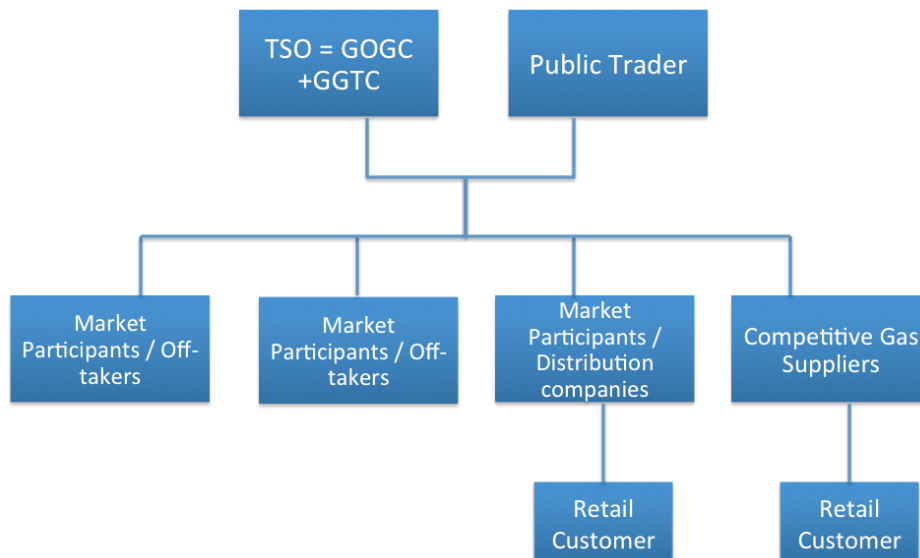
Presently, Georgian Oil and Gas Corporation (GOGC) owns the transmission side and is a public trader of oil and gas. GOGC has a daughter company Georgian Gas Transmission Company (GGTC), which operates and manages the pipelines. GOGC owns them, but GGTC dispatches them. In order to bring Georgian law into conformity with the EU law, Georgia has to harmonize with the 3<sup>rd</sup> package EC/73/2009 and unbundle the gas sector. Public trade has to be separate from GOGC through legal separation. Separate independent public trader has to be created in the market. GOGC will still own transmission, GGTC will still dispatch, but the two will be merged to create one TSO. Figure 20 illustrates the proposed gas market structure for Georgia.

The natural gas market should be opened at least to all industrial and commercial customers by end of 2021. The gas distribution companies with more than 100,000 retail consumers will legally unbundle distribution activities from retail supply activities. The legal and regulatory framework must allow for gas traders, competitive gas suppliers, a grid code covering transmission and distribution activities, a market operator and rules for switching suppliers and supplier of last resort.

- Market opening
- Gas sector commercialization
- HICD
- Gas market operator (GMO) is needed.

Single market operator starts as an electricity market operator and then takes on gas.

**FIGURE 20: Proposed gas market structure**



## 13.0 COAL SECTOR

### 13.1 SHORT TERM ACTIONS

The coal sector now provides 6% of the total energy of the country. There is the possibility to not only maintain this level for the foreseeable future, but also to increase its share of the market. The main consumers of coal in Georgia include metal and construction companies, hospitals, schools, municipalities and monasteries.

The Ministry of Energy will undertake several studies to determine if expansion of the coal supply is in the best interest of Georgia. The studies will include but are not limited to:

- Detailed assessment of the potential reserves
- Assessment of quality and most efficient means of use
- If the analysis is favorable, state program on coal development will be devised

### 13.2 MID-TERM ACTIONS

A single investor controls the majority of the coal reserves in the country. The GoG, based on the results of the studies to be completed in the short term, will undertake:

- Renegotiation with the investor on investment terms (devise specific targets for coal mining and infrastructure development);
- Evaluate the possible construction of a coal-fired thermal power plants;
- Determine the viability and feasibility of coal bed methane, and modify the energy legislation to develop a separate licensing scheme for CBM.
- A pilot program for a new clean coal facility will be operational, supplying power to one or more cities within the Covenant of Mayors (CoM).

## 14.0 DEMAND-SIDE MANAGEMENT

### 14.1 SHORT TERM ACTIONS

Governmental objectives and priorities should, to the extent that they are feasible, be supported by appropriate resources for ensuring stability of the electricity system and grid. Demand Side Management (DSM) is an integrated approach, which incorporates energy efficiency and demand response measures and aims to reduce energy consumption in the country by implementing various programs. Depending on the program, energy efficiency measures can facilitate modifying consumers' energy consumption by changing their behavior and integrating more energy efficient technologies for energy use. On the other hand, demand response programs engage electricity generators who can switch to backup generation, thereby reducing demand on the grid. This integrated approach provides efficient signals to guide behavior, along with the right incentives for energy services. Energy efficiency of end-use equipment is part of demand-side management. Supply-side energy efficiency is within utility commercialization and performance improvement goals established by the energy regulator, which is part of the regulatory strategy. Energy efficiency policies and programs will be integrated into the National LEDS.

Incentives for generating facilities to do supply-side energy efficiency is greatest during competitive markets particularly so with the power markets. The measures for DSM will be supported by the following steps:

- The GoG will conduct an in-depth study and analyses at the end user level for formulation of DSM policy goals; develop reference data for each group of consumers; and develop and implement an energy efficiency policy. Appropriate instruments to utilize this energy efficiency potential will be evaluated, introduced, developed and included in the Low Emission Development Strategy (LEDS) for Georgia. Implementing these instruments will have a beneficial effect on the security of energy supply, but also on Georgia's foreign trade balance in which the import of energy sources amounts to 14%;<sup>20</sup>
- The GoG will adopt a Law on Energy Efficiency based on policies included in the National LEDS and Sustainable Energy Action Plans (SEAPS) of Municipalities that have committed to the EU's Covenant of Mayors and other relevant initiatives. The GoG will develop a National Energy Efficiency Action Plan (NEEAP), which will aim to reduce final energy consumption in compliance with the Service Directive 2006/32/EC; a NEEAP is intended to propose concrete measures, a roadmap and actions in order to set and monitor delivery of national energy efficiency targets implemented under current EU requirements as well as energy efficiency policy priorities for the economic sectors and the country as a whole;
- Create a "Lead by Example" program that highlights energy and budget savings by implementing energy efficiency programs in government buildings;
- The GoG should strengthen the work on energy statistics and implement energy efficiency indicators since this is the basis for end-use policy analysis, which is necessary for the development and implementation of energy efficiency policies;
- Creation of energy audit systems that will include developing energy audit companies, a certification board of energy audit companies, auditing of

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<sup>20</sup> Imports under HS code digit level 4 for petroleum based on 2013 data, Geostat.

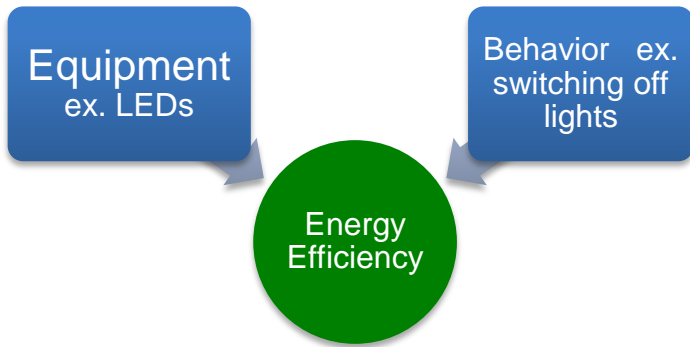
- energy intensive companies and development of a database on energy use, energy equipment and other relevant data;
- The GoG should develop specific programs for improving energy efficiency in the various sectors of the economy, which should include specific targets and monitoring systems for continuous evaluation of their implementation. These programs should be incorporated into the National LEDS. Coordination mechanisms, such as evaluation, influence the quality and effectiveness of energy efficiency policy outcomes;
  - The GoG should adopt and ensure the enforcement of building standards for new and existing buildings, taking into consideration cost effective thermal efficiency levels. These plans should be included in the National LEDS;
  - Initiatives should be taken to enhance all consumers' knowledge and awareness of energy consumption and how to make it more efficient;
  - The GoG should create an attractive environment for research, development and demonstration (RD&D), and by safeguarding the drivers of innovation; Well-designed and targeted technology policies on both the supply and demand sides are a fundamental ingredient in a strategy to accelerate innovation;
  - Auto-fuel economy measures should be included in the National LEDS and adopted by the relevant Ministries;
  - Individual metering and informative gas and electricity receipts should be required of utilities operating in Georgia.

Wood is heavily used in Georgia as an energy source, which should be substituted by more efficient and environmentally friendly renewable resources. Fuel switching is DSM, but not necessarily energy efficiency; however, efficient technologies for using wood, such as efficient wood stoves for heating and cooking are included in DSM. The impacts of fuel switching and efficient use of wood should be included in the National LEDS.

Energy efficiency is using less energy for same output, while DSM includes programs to improve system costs such as shifting of loads to periods of the day when electricity generation is less expensive (i.e. off-peak).

k). Various programs can be adopted by utilities, including lower tariffs to encourage off-peak consumption. This can also include promotion of smart technology and information that enables consumers to respond to the price signals by controlling different equipment or technical assistance to assist companies in adopting technologies that shift energy from peak to off-peak times. Energy efficiency is about equipment and behavior as shown in Figure 21. Water conservation is also another aspect of energy efficiency. Promoting water meters will be the first step to decreasing energy consumption for water pumping.

Government policy-makers and regulators should consider the appropriate role for utilities in promoting energy efficiency, water efficiency, fuel switching and load shifting, all of which can be considered DSM. These policies and programs will be developed by the relevant Ministries and incorporated into the National LEDS.



**FIGURE 21: The concept of Energy Efficiency**

Demand-Side management, including customer energy efficiency, is focused on customer energy use. On the customer side, energy efficiency measures include insulation, making processes more energy efficient, efficient hot water heaters, motion detectors, efficient motors, etc.

The 3-year implementation plan for demand-side programs can be found in Table 6 in Annex 1.

#### 14.2 MID-TERM ACTIONS

Elimination of gas subsidies, implementing proper pricing:

The best method would be giving people proper price signals, so if the costs are too high, they can switch to lower price equipment, etc. Presently people are not getting a right price signal and they have wrong incentives. Everyone should have properly operating meters and appropriate tariffs.

Georgia needs to develop and implement an energy efficiency strategy that will outline the energy efficiency projects. Such initiatives need to be supported first by legislative framework.

#### 15.0 RENEWABLE ENERGY SOURCES

Table 4 lists the stage of development for different types of renewable energy in Georgia. Suitable accompanying measures will be considered in order to foster the development of RES.

- Develop and adopt Renewable Energy Law and NREAP;
- Environmental assessments

Conceptual	Emerging	Developing	Mature
	<ul style="list-style-type: none"> <li>• FUEL CELL</li> <li>• HYDROGEN CARS</li> </ul>	<ul style="list-style-type: none"> <li>• BIOGAS</li> <li>• GEOTHERMAL</li> <li>• BIOFUELS               <ul style="list-style-type: none"> <li>• Biodiesel</li> <li>• Bioethanol</li> </ul> </li> <li>• SOLAR               <ul style="list-style-type: none"> <li>• Concentrated</li> <li>• Photo Voltaic</li> <li>• Parabolic</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• HYDRO</li> <li>• WIND</li> <li>• WOOD</li> <li>• SOLAR (hot water)</li> </ul>

**TABLE 4: The extent of development of different types of renewable energy resources in Georgia**

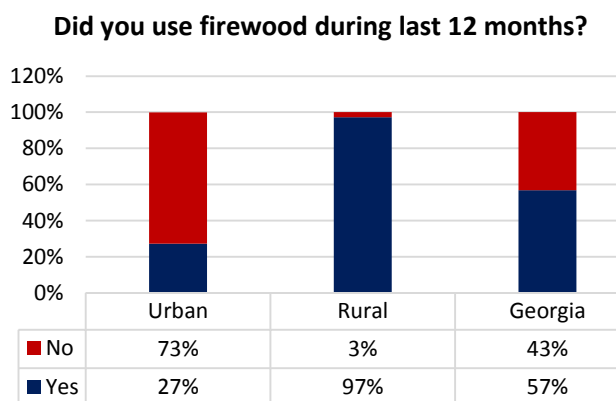
For energy infrastructure projects of large-scale social and environmental impacts, including large hydro power plants, prudent and best international practices will be followed. These will include alternative designs with cost-benefit analyses and environmental and social impact analyses and participatory consultations with affected communities. All information will be accessible, mitigation methods for social impact and environmental effects including the climate change effects and sustainability and cumulative effects on a watershed basis will be clearly defined and independently monitored during and after the construction process.

- The GoG should analyze the opportunities for the long-term cost effective use of RES in the process of diversifying the energy supply to meet national policy objectives;
- Increase in the share of energy generated by renewable energy sources in the national energy balance;
- A policy for the promotion of renewables requires across-the-board initiatives encompassing a wide range of policies: energy, environment, employment, taxation, competition, research, technological development and demonstration, agriculture, and regional policies;
- Measures of legislative and financial support of highly efficient utilization of firewood
- Devise incentive measures encouraging purchase of power generated by renewable energy, for example, provision of tax credit, privilege, and subsidies;
- Support research and development (R&D).

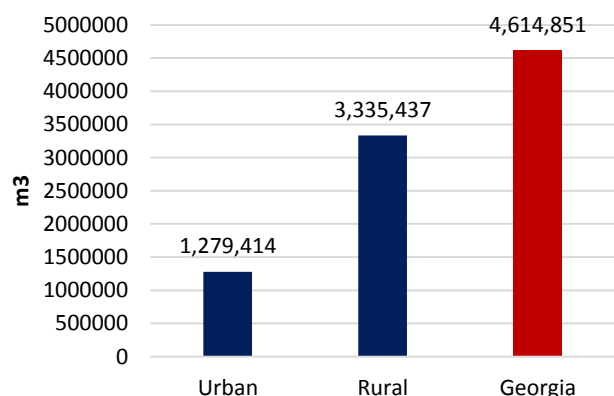
### 15.1 BIOMASS

Short-term strategy is increasing efficiency of heating systems since this resource is widely used in Georgia. USAID’s household energy end-use survey implemented by AYPEG, showed that 57% of households used firewood during last 12 months for water heating and/or space heating and/or cooking purposes, across Georgia. 97% of rural settlements consumed firewood. Figures 22 and 23 show the trends in firewood use over the last 12 months in Georgia. Wood is a significant energy source for space-heating, water-heating and cooking; results show that wood consumption is five times more than estimated by National Statistics Office of Georgia. Such heavy use of wood is a contributor to deforestation.<sup>21</sup>

**FIGURE 22: Use of firewood in Georgia**



**FIGURE 23: Average wood used by a Household during last 12 months (m<sup>3</sup>)**



<sup>21</sup> Caucasus Environmental NGO Network (CENN)

While a renewable resource wood needs to be conserved and used efficiently, there is high potential in Georgia to improve wood use practices and make it more efficient. Insulation and use of more efficient stoves would dramatically decrease amount of wood used to produce the needed amount of heat.

The wood stoves used in Georgia vary in design and effectiveness. The most commonly used stoves are the basic tin stoves. It is estimated that about 60% of the population uses these inefficient and low-quality stoves. This type of stove usually has a compartment for cooking, but can be unsafe to use due to high temperatures. The efficiency of these basic stoves is about 15-35% and much of the heat is lost to inefficient combustion and air leakage. These cost from 20GEL to 70GEL and about have a lifespan of about 2-3 years with regular use.

The more efficient “Svanetian” stoves are produced by small, private manufacturers. These stoves are made of thicker and stronger iron plate walls and are more energy efficient. They are used mostly in the colder highland areas and a single load of wood can fuel the stove for 6-8 hours. The Svanetian stove has an efficiency of 40-50% using seasoned wood. These stoves cost from 300 GEL to 500 GEL and are available in the Svaneti regions and in Tbilisi. There are also a small number of imported Turkish stoves used in Georgia. These are less effective than the Svanetian stoves and have an estimated efficiency of 40-45%.

Several local manufacturers have demonstrated the capacity to produce high-quality, efficient wood stoves. These stoves are approximately 80% efficient, according to USAID testing and certification. One example is the NGO “Bioenergia” stove certified at 80% efficiency by USAID (Exhibit 2). These stoves are designed for high efficiency combustion with the following features: reflective inner surfaces and insulation of the combustion chamber allowing for high combustion temperatures; air intake control and air preheating; and a large surface area for heat transfer to the cooking compartment and to the heated environment.<sup>22</sup>



**EXHIBIT 2: An advanced and updated wood stove by Bioenergia**

**Promotion of efficient biomass use as an energy source:**

Biomass is an important energy source in Georgia like in other developing countries. Modernized biomass technologies can contribute to cleaner energy, environmental protection, decreasing use of fossil fuels and improving living conditions.

The use of biomass in the energy sector has many potential benefits: it is a renewable and environmentally sustainable resource with low green house gas emissions; it is readily accessible and relatively inexpensive compared to fossil fuels; it can be converted to various forms for storage and use; and development of biomass can benefit the economy by creating local jobs.

Advances in wood burning technology can make biomass a clean and efficient renewable energy

<sup>22</sup> Ministry of Environment, *Technology Needs Assessment and Technology Action Plans for Climate Change Mitigation*, September 2012, accessed May 2014.



source. Efficient wood and pellet stoves that burn biomass in the form of compressed sawdust and branches from forests and lumber mills can have an energy efficiency of 70-85%.<sup>23</sup> Advanced wood heating equipment is effective in reducing smoke and particle pollution. Testing has proven that the emission of polycyclic aromatic hydrocarbons are emitted at significantly lower concentration using newer technology as compared to older style wood burners. Conventional wood stoves commonly used in Georgia typically vary in efficiency from 35% to 55%.<sup>24</sup> Table 5 shows cost and efficiency characteristics of several types of wood stoves and advanced stoves.

**TABLE 5: Main heating equipment and their efficiency**

	HEAT TYPE	INSTALLED COST	EFFICIENCY	FUEL UNIT	FUEL COST (PER UNIT)	HEAT PER UNIT (MM BTU)	FUEL COST (PER MM BTU)
WOOD STOVE	Traditional Svanetian wood stove	300-500 GEL	50%	CUBIC METER	80 GEL	2.85	28.07 GEL
	Simple wood stove	20-70 GEL	15-35%		80 GEL	1.42	56.14 GEL
	Sawdust stove	40 GEL	40%		30 GEL	1.99	15.04 GEL
ADVANCED STOVE	Pellet stove*	1850-13200 GEL	80-85%	TON	265 GEL	4.70	56.35 GEL
	Efficient upgraded stove (Bioenergia)	250-300 GEL	75-80%	CUBIC METER	80 GEL	4.42	18.11 GEL

\* For pellet stove Bulgaria was used as a proxy for Georgia

Pellets are products obtained by pressing wood waste and burned as an energy source for heating and cogeneration. The pellets are made from crushed and dried wood chips / sawdust, compressed at high temperature and pressure. Wood pellets are dry, small cylinders, usually with a length of 2 cm and a diameter of 6-12 mm, but their energy content is not small - about 18-19 MJ / kg or 4300-4500 kcal / kg. Use of sawdust and wood waste that normally gets discarded is an environmentally friendly and effective solution.

A pellet stove looks like a traditional wood stove, but can work in automatic mode by modern microprocessor control that provides a clean and efficient combustion. Heated by the stove burner and has built an integrated reservoir pellets, which in most cases covers the week consumption. Modern pellet stoves have an efficiency 80-85%, and are effective even at low loads.

There need to be programs similar to those of the Energy Efficiency Center that demonstrate the benefits of modern energy equipment to the population, why it is better to purchase modern energy equipment. Informational programs would demonstrate how much less wood will have to be used and the lower costs compared to old and less efficient equipment. Stove manufacturers need to be trained in making more efficient stoves. Stove testing programs need to be launched to convince potential customers with real evidence that advanced stoves are better.

<sup>23</sup> Popular Mechanics, *Is Wood the Best Renewable Fuel for Heating?* January 2014, accessed May 2014. <<http://www.popularmechanics.com/home/improvement/energy-efficient/is-wood-the-best-renewable-fuel-for-heating>>.

<sup>24</sup> Wood Heat, *The Argument In Favor Of Wood Heating*, accessed May 2014. <<http://www.woodheat.org/argument.html>>.

Stove certification programs should be started that also test the stoves and their efficiency based on best practices. Several options of efficient stoves need to be designed and manufacturers need to be trained to provide customers with a choice.

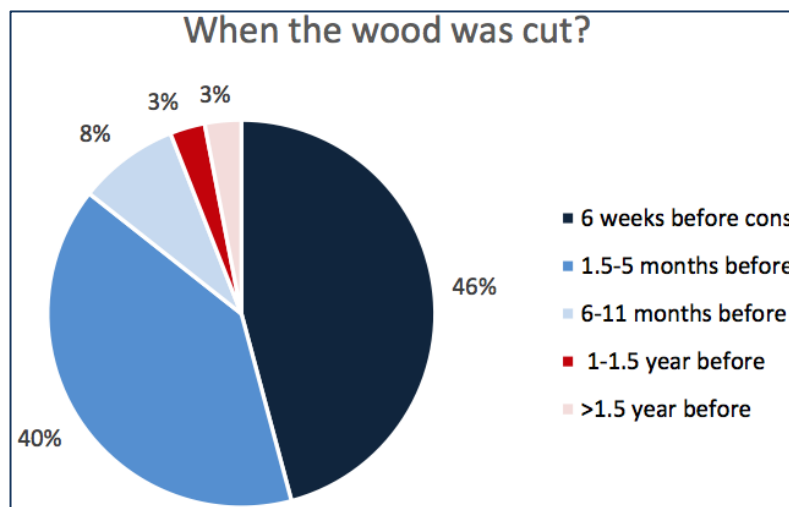
Pellet stoves need to be introduced first as an import and through transfer of knowledge production of the stoves should also start locally. Pellets will be an efficient way to manage wood waste and sawdust. It needs to be demonstrated to the population how insulation and filling in drafts around doors and windows can help conserve energy. Combustion chamber needs to be insulated and there needs to be inlet air control. A secondary combustion chamber needs to be added for higher efficiency of stoves. With current primitive wood stoves that are just metal boxes with a pipe much of the energy gets wasted. Airtight combustion chambers that control inlet air have efficiency as high as 55%. Projects similar to that of BP/USAID/OSCE Energy Bus should be more systematic to inform population about possible means of achieving more energy efficient homes. EBRD offers 15% loan coverage when consumers buy energy efficient technology. Awareness needs to be improved and more financial incentives established for the population to be encouraged to use new and more efficient technology.

The Energy Bus Project focuses on educating people on energy efficiency. The Energy Bus will demonstrate a model of an improved modified stove to consumer. The benefits to heating costs, improved comfort and safety should be emphasized. To improve the energy efficiency of available stoves, a program should be implemented to simply measure the efficiency of small stoves, the stove manufacturers are shown how to build improved stoves, and the efficiency of the improved stoves are verified. A program should be developed to address household energy efficiency. Rural Georgian homes are poorly insulated and drafty. Improving household energy efficiency could also save as much or more wood as improving woodstove efficiency.

Consumers need to be able to control stove combustion rate. Currently they use open doors and windows to regulate temperature as the heat is irregular with the existing stoves. Smoke chambers will increase the efficiency through increasing the surface area of heat transfer. To achieve a more constant temperature of the stove, thermal mass needs to be added to the walls and the floor of the stove. Stoves with the above characteristics will increase efficiency and reduce emissions as less combustion products get emitted through increasing secondary combustion and heat transfer area. Such advanced stoves are available in the more developed countries. For Georgia to be able to introduce and develop such stoves, national stove standards would need to be developed as well as testing and cooperation with the foreign developers of such stoves from whom Georgia can learn. With Georgian stoves even with Svanetian stoves, which are considered most efficient in Georgia, the door does not seal completely and it does not keep the air out thus it is not airtight. There are three components that determine woodstove efficiency: combustion efficiency, heat transfer efficiency, and system efficiency. Combustion efficiency refers to the energy released during the combustion process. Heat transfer efficiency is the fraction of heat released by combustion that is used to heat the room. The system efficiency of a wood stove is calculated by the combined combustion and heat transfer efficiency. Combustion efficiency is less of a problem in Georgia than heat transfer efficiency. However, use of green wood is still a problem as illustrated by Figure 24. Population should be educated to allow the fuelwood to dry for at least 6 months before use as green wood provides much less

energy. They should be encouraged to use other biomass waste for fuel source like hazelnut shells and other waste.

**FIGURE 24: Wood used for consumption**<sup>25</sup>



As the supply is demand driven, it is important to ensure that the population understands the importance of the advanced stoves and their longer term benefits. Thus, education and public awareness is the first step, followed by financial incentives to ensure that new technology is affordable. Consumer survey will be a key in developing a design of new

stoves that will be attractive to them. Surveys should also determine the price ranges people would be willing to pay and design accordingly. Another short-term solution includes adding insulation and modifications to existing stoves that will make them more efficient. Stove efficiency can be improved by 10 to 20% by utilizing an airtight combustion chamber, inlet air control and additional heat transfer area (smoke chambers).

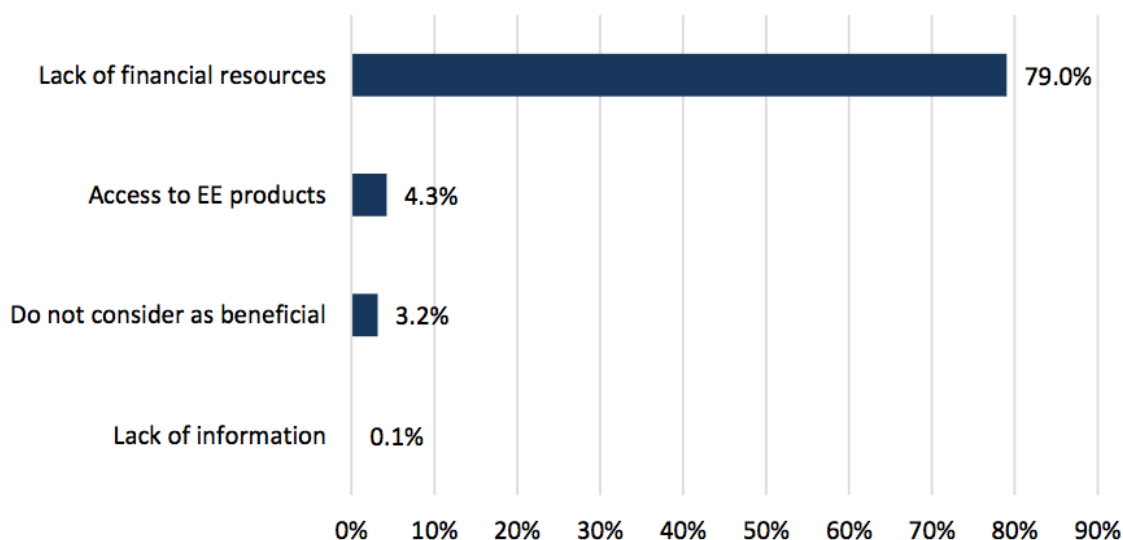
The above steps are immediate actions that can improve efficiency given the equipment that the population already has. The next step in improving the energy efficiency of Georgian homes is working with stove manufacturers to test and validate efficient stove designs. The goal of the energy efficiency program over the next several years is to educate consumers in choosing high efficiency products, and assist manufacturers in building improved stoves. On the near term goals should focus on designing and building a small efficient stove that can operate at high power intervals for heating water and cooking; developing an energy efficiency testing procedure and a certification program for labs to do this testing, and implementing an efficiency incentive program where certified stoves would be eligible for micro credits, energy credits for purchase of efficient wood stoves and subsidies, encouraging consumers to buy efficient stoves and manufacturers to produce them. As USAID's survey has shown, financial reasons are the main hindrance to achieving energy efficiency goals (Figure 25). In the medium term, pellet stoves and other high efficiency stoves should be introduced and produced in Georgia as well as other advanced stoves that are consistent with the best US and European practices. Wood heating can be cost-effective, practical and environmentally friendly when modern, energy efficient stoves are used, when wood is harvested sustainably, and when homes are well insulated and energy efficient.<sup>26</sup>

<sup>25</sup> USAID's survey implemented by AYPEG, June 2014.

<sup>26</sup> Interview with Winrock International experts: David Gvenetadze, Anna Sikharulidze & Kakha Karchkhadze, June 2014.

**FIGURE 25: The main barriers to use of energy efficient technology**

Please specify the reasons for not implementing some of the mentioned measures



Promoting the use of biomass in the energy sector could be achieved through pilot programs like:

- The building of biomass pellet and briquette plants, which can be built in regions throughout the country.
- Wood waste and waste from hazelnut plantations, which is one of the main exports of Georgia, should be used as an alternative fuel source particularly in the Samegrelo region, where they grow hazelnut.

Forests need to be managed sustainably through methods like uneven-aged selective harvesting, which leaves gaps between mature trees, thus allowing younger trees to grow;<sup>27</sup> selectively thinning high density strands and culling substandard trees, while maintaining seed trees of all present species and ages, and clearing dead trees to enhance habitat for wildlife.<sup>28</sup> It has been measured that a healthy, well-managed forest can yield 1.8 cubic meters of wood per 4 thousand square meters annually. Use of local fuelwood for energy production boosts local economic activity as more jobs and income are generated when fuelwood replaces imported fuels.

The Samegrelo region is estimated to produce approximately 1,500-2,000 ton/yr of sawdust waste. While this quantity is insufficient to support a sawdust based pellet industry on its own, it could be combined with other industries to provide the needed supply of raw material. UNDP estimates that the biomass waste material from hazelnut prunings and hazelnut shells, combined with that of two regional forestry enterprises, could support a 10,000 ton/yr. plant.

<sup>27</sup>University of Florida, *Uneven-aged Management - A "Natural" Approach to Timber*, accessed June 2014.  
<[http://sfrc.ufl.edu/extension/florida\\_forestry\\_information/forest\\_management/uneven\\_aged\\_management.html](http://sfrc.ufl.edu/extension/florida_forestry_information/forest_management/uneven_aged_management.html)>.

<sup>28</sup>Forest Stewardship, *Thinning Pine Plantations*, accessed May 2014.  
<<http://www.gfc.state.ga.us/resources/publications/PineThinning.pdf>>.

It is important to start manufacturing pellets first before bringing in pellet stoves to sell in Georgia. Once pellets are being produced locally, if there is not enough demand, excess production can be exported until sufficient local demand develops as people start switching to more energy efficient stoves.<sup>29</sup>

Georgia currently under-utilizes significant biomass resources in the form of forestry and wood processing residues, and agricultural waste. The forestry sector accounts for the largest portion of this biomass, with about 120,000 m<sup>3</sup> per year of wood residues<sup>30</sup> from logging sites. With an estimated 0.7 ton/m<sup>3</sup> density of residue, this yields about 80,000 ton/yr. of wood waste available per year. Sawdust waste in Georgia, which is usually dumped near sawmills or into the closest river, may equal almost 15,000 tons per year. Hazelnut shells are another form of agricultural biomass residues that are abundant in Georgia and amount to an estimated 20,000 tons of biomass waste per year. Wood waste from harvesting sites amount to about 0.75 m<sup>3</sup>/ha, therefore the annual waste biomass from Samegrelo region could amount to 15,000 m<sup>3</sup>, or approximately 10,000 tons.

Hazelnut shells already account for the heating needs of about 20% of the population in the Samegrelo Zemo Svaneti region. On an annual basis, approximately 12,000 tons of shells are available for use as fuel with a cost of 120 Lari/ton.<sup>31</sup>

The 3 year implementation plan for renewable energy resources can be found in Table 7 in Annex 1.

## 15.2 BIOFUELS

Biofuels are a renewable source of liquid fuels derived from plants or waste matter. There are two main types of biofuels: bioethanol and biodiesel. Bioethanol is used as a replacement for gasoline and biodiesel is used as a replacement for diesel. Biofuels play an important role in the world in replacing fossil fuels and they have been proven to have a large potential in Georgia with no negative impact on food prices or welfare of the farmers.

Biodiesel is a renewable, non-polluting fuel. In contrast with fossil fuels, it does not contain lead and its use does not pollute the atmosphere with heavy metals, sulfur dioxide, and various carcinogen harmful gases. At present biodiesel combustion engines are the most eco-friendly choice. Biodiesel can be used either blended in or clean; In Europe and the US B20 fuel is especially popular, which is twenty percent of biodiesel mixed with gasoline diesel.

The main ingredient in the production of biodiesel is vegetable oil, which is an additional incentive to the development of agribusiness. Its biodiesel production is beneficial in many ways - the country will have its own source of renewable alternative fuels and reduce its dependence on imported oil. In addition, biofuels are environmentally sound, they increase the country's energy independence, create new businesses and therefore jobs. Biofuels can also be produced from used cooking oil.

Biodiesel is mainly made from plants that, as scientific studies have revealed, absorb as much carbon dioxide as is produced during biodiesel combustion (and also these

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<sup>29</sup> UNDP, *Report II: Technical Feasibility Study for Biomass Fuel Supply and Demand*, March 2011, accessed June 2014.

<sup>30</sup> FAOStat, 2008.

<sup>31</sup> UNDP, *Report II*.

plants produced oxygen, as much as its biodiesel consumed during combustion). This is a clear example of why biodiesel and biofuels are renewable, sustainable and eco - friendly choice.

Many cities in the US and Europe try to find environmentally friendly solutions and use biofuels to reduce emissions. Some of the examples include Perry in Georgia, US and Graz in Austria. The municipal transport of Graz works on biodiesel. This was an effort called “Ecomovement” by the citizens, restaurants, fast food restaurants, cafes and all facilities where the kitchens collected used oil. Another example is Stockholm, Sweden where over 60% of urban and suburban buses run on biofuels.

Apart from a number of investors who have tried growing canola and other plants suitable for biofuel production, Tbilisi’s own Ilia University conducted a project in 2010 in which they grew canola, harvested it, refined it to biodiesel and had a university bus drive 200 kilometers using it as a fuel. As a part of this project, the university built the canola plantations in Eastern Georgia, Kakheti. They note the exceptional suitability of the Georgian climate for the growth of this plant. According to the agro-economic calculations of the university 1 hectare of plantation of canola produces on average enough raw material to produce one ton of biodiesel.

Canola is also a substitute for wheat culture, which means that wherever wheat has been planted for two years, the third year canola will be planted; Canola further enriches the soil planted with wheat and other minerals yielding a good harvest. Once oil is extracted from canola, leftovers make a nutritious feedstock for animals. So, the introduction of this new culture will be an important impetus for the further development and diversification of agribusiness. The university calculations show that small-scale enterprises in its canola biodiesel plantations can be implemented with the creation of jobs in rural areas.

Very serious attention is paid to the development of biofuels in the EU, with the EU's goal of 5% of the fuel consumed in 2015, and in 2020, 10% of the consumed fuel to be produced from renewable bioresources base.

And, despite the fact that this regulation is not mandatory, as Georgia aspires to the EU, we should consider that European standards will be implemented in Georgia.

Obviously implementing large-scale biodiesel production would require the adoption of regulations and a legislative framework. Ilia State University demonstrated theoretically and practically that canola biodiesel is a feasible alternative, renewable, non-polluting fuel that can be produced in Georgia.<sup>32</sup> However, government support would be needed to encourage large cities across Georgia to adopt greener agendas and start using biofuels for at least public transport sector.

Production of biogas from future sewer treatment plants and landfill gas should also be explored taking the example of Batumi, which has made a commitment in this area under Covenant of Mayors.

By signing the Covenant of Mayors in 2010, Georgia has made a commitment to reduce CO<sub>2</sub> emissions by 20% with the help of renewables and energy efficiency. Signatory cities in Georgia include: Batumi, Gori, Kutaisi, Poti, Rustavi, Tbilisi, Telavi and Zugdidi. All of the above cities have developed action plans except for Kutaisi,

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<sup>32</sup> Kakha Karchkhadze, interview with the Head of Department of Innovations and Commercialization, Ilia Chavchavadze University, June 2014.

Poti, Telavi and Zugdidi.<sup>33</sup> Those that already have an action plan should incorporate use of biofuels (biodiesel and biogas) in municipal and public transport and the cities that do not yet have an action plan should incorporate use of biofuels as their aim for becoming a green city. Action plans are subject to review every two years and Tbilisi's Sustainable Energy Action Plan should include biofuel and biogas use targets for 2015.

### 15.3 SOLAR

Solar technologies are maturing. The most mature type are solar hot water and heating units, now prevalent around the world for residential and some commercial applications. The GoG will encourage manufacturing of solar panels and associated equipment for the domestic and regional market and all designs of new government structures should incorporate the use of solar hot water and heating when it is economical to do so.

Solar PV prices have dropped drastically over the last 5 years with the emergence of large manufacturing plants in the US, China and Europe. This technology should be considered for off-grid solutions rather than the construction of new power lines. The construction of new PV farms should start slow to allow the cost to continue to fall and not have a major impact on consumer tariffs.

Other solar technologies are in the emerging phases and the GoG should follow the advancement of these technologies going forward. The most promising of these technologies are the concentrated solar technologies that use mirrors to focus the strength of the sunlight on a single point, thereby allowing for steam production and the turning of generators.

### 15.4 WIND

The GoG will continue to encourage wind power farms. A 20 MW farm is under development in the Gori region. A wind assessment study of several sites across Georgia is now underway. The GoG will be completing several studies in cooperation with the electricity TSO to evaluate the impacts of wind-power projects on both the local networks as well as the national electricity system.

The GoG will determine what is the maximum MWs of wind that can be added in the future and provide that information to potential investors. The new wind facilities (up to 3 MW per tower) will probably not need feed-in support and can enter into the competitive power market once Government fully implements the enabling environment for competitive electricity trading.

### 15.5 GEOTHERMAL

Geothermal technology has moved from an emerging technology to a developing technology over the last ten years. Several countries have used the technology effectively and the costs have somewhat lowered, yet not at commercially viable price that can be offered into the Georgian competitive market. Georgia has some potential for geothermal plants and potential investors should be encouraged to test the most promising areas.

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<sup>33</sup> Covenant of Mayors, *Signatory profiles from Georgia*, accessed June 2014.  
<[http://www.eumayors.eu/about/signatories\\_en.html?q=&country\\_search=ge&population=&date\\_of\\_adhesion=&status=>](http://www.eumayors.eu/about/signatories_en.html?q=&country_search=ge&population=&date_of_adhesion=&status=>).

- Tbilisi, Samegrelo and other areas of Georgia have strong geothermal potential. Geothermal heat pump can be developed in medium term.

## 15.6 HYDRO

Without doubt, hydropower technology is the most mature technology. The cost of equipment and the efficiency of the turbo-gen equipment see little gains over time. Georgia has a long-term experience in running hydropower plants and by far it is the most important source of electricity for Georgia.

Georgia has many HPPs under MoU, under development, under construction and operation. At present there is more than 3300 MW of HPP generating capacity operating on the system with the potential to add several more 1000's of MWs in the future. As the competitive market develops and a price emerges, new HPPs can be brought on line as merchant plants with strong financial returns without the need of any governmental support mechanisms.

- Micro hydros should be used for off-grid solutions as it has minimal environmental impact
- In the long run, large hybrid power generation should be developed with the use of wind in winter months and solar in the summer months
- Investigate hydro-kinetic power potential along the coast of Black Sea

## 16.0 CUSTOMER PROTECTION

### 16.1 SHORT TERM ACTIONS

The system will:

- Efficient social protection through shifting government subsidies from the producer to the consumer, through energy efficiency measures;
- Provide those in need with timely and sufficient energy subsidies;
- Have a broader scope than the existing system and that scope will change flexibly depending on the income and price levels;
- Be based on up-to-date schemes: individual vouchers, two-component tariffs, energy saving measures, consumption restrictors etc., which will simplify the provision of assistance and improve its efficiency;
- Recognize the important role of consumers and their ability to exercise more choice in how they use energy and the types of energy services they receive;
- It also recognizes the importance of competitive retail markets for delivering outcomes that are in the long-term interests of consumers as we move to an energy sector that delivers services rather than just a commodity to consumers;
- The State will ensure the rights and obligations that are linked to vulnerable costumers.

### 16.2 MID-TERM ACTIONS

Government needs a program that will identify the vulnerable part of the population without access to electricity and develop a way to provide them with this support. Government owned generation – currently Enguri generation is being sold at a regulated price; Enguri generation needs to be sold at a competitive price and the obtained revenue should be used for the benefit of vulnerable populations. Government owned generation should enter the competitive power market and the proceeds should go to helping this population.



The 3 year implementation plan for public service obligations can be found in Table 9 in Annex 1.

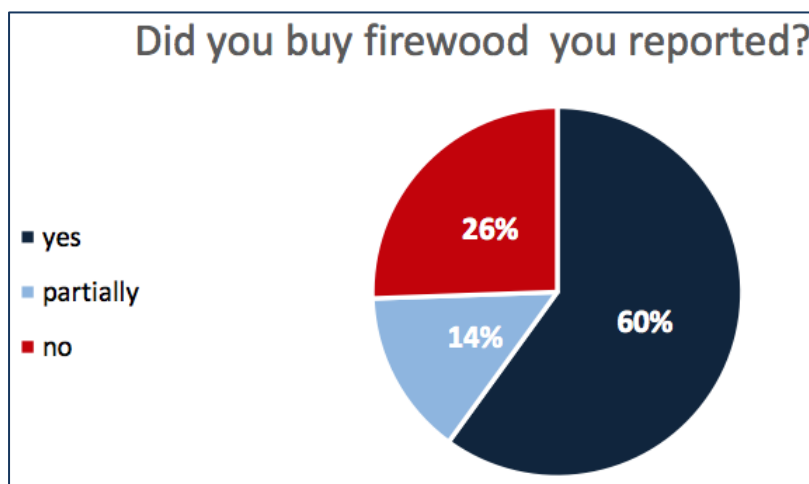
## 17.0 ENVIRONMENTAL AND SOCIAL PROTECTION

### 17.1 SHORT TERM ACTIONS

The government's goal of providing affordable energy should not result in sending the wrong message to the market in the areas of subsidy and energy efficiency. Affordable energy should not result in cheaper energy and increased energy consumption. While higher prices can curb consumption, they can also adversely affect financially vulnerable population. A possible way to implement cost reflective pricing can be through direct subsidies to the vulnerable populations. This matter is most serious in the largest concentration of the energy mix, the natural gas area. Because of the favorable inter-government agreements relating to the natural gas transits, Georgia has been able to cost-average the natural gas imports at half of the regional gas market price. Increased gasification of the country is a required goal to reduce the green house gas emissions from biomass-based fuel consumption, but the lower prices on the other side is in the way of increasing consumption. A proper mix of regional price-based tariffs can curb unnecessary consumption and provide a means to subsidize vulnerable populations.

Starting from the 1990s forest degradation and deforestation reached unprecedented levels in Georgia. Part of the explanation is a massive decrease in timber imports from Russia and the rise in illegal logging spurred by increasing demand for fuel.<sup>34</sup> USAID's survey showed that only 60% of the population bought their firewood (Figure 26).

**FIGURE 26: Source of firewood used**



The above problem can be addressed through the development of large-scale plantations of fast growing poplar trees, which can grow as fast as 90 feet in 6 years.<sup>35</sup> This can reduce illegal logging and stealing. Poplar trees provide an efficient means to utilize all of the wood; normally people involved in logging leave the leaves and take only

the stem part of the trees, which causes disease by creating a suitable environment for the spread of pests in the forest and is inefficient. Our proposed idea will solve this inefficiency while eliminating the negative impact on the environment.

<sup>34</sup> University of Gothenburg, School of Business, Economics and Law, *Georgia Environmental and Climate Change Policy Brief*, 2009, pg. 3. <<http://sidaenvironmenthelpdesk.se/wordpress3/wp-content/uploads/2013/04/Georgia-EnvCC-Policy-Brief-Draft-090130.pdf>>.

<sup>35</sup> Purdue University, *Fast-growing trees could take root as future energy source*, 2006. <<http://www.purdue.edu/uns/html4ever/2006/060823.Chapple.poplar.html>>.

Reversing deforestation through poplar tree growth would require government involvement in a public-private partnership. It would increase local employment as less machinery and more labor would be used to make it cost effective.

Poplar trees can also be used for biofuels. Incentivizing sustainable biomass production for biofuels could also utilize Georgia's strong agricultural sector for the production of energy dense biomass like canola seed and eucalyptus trees.

## 17.2 MID-TERM ACTIONS

The Black Sea is polluted by agricultural runoff, inadequate waste management practices, oil spills and sewage.<sup>36</sup> To protect Georgia's environment and eliminate water pollution, improved water management and waste management practices are essential. These problems are largely due to lack of adequate regulation and implementation of environmental protection laws.

The transportation sector is the largest contributor to GHG emissions in Georgia. Establishing green cities across the country will decrease Georgia's environmental impact. Utilization of used cooking oil as fuel and growing canola for the production of biodiesel will allow increased use of renewables while decreasing emissions. The climate and environment in Georgia is extremely favorable for the growth of canola.<sup>37</sup> A number of cities in the US have adopted an alternative fuel program that diverts the problematic fats, oils and grease from sewers to diesel fuel production. For example, the city of Perry in Georgia, US runs a waste vegetable oil (WVO) recovery program, which converts the oil into diesel. As a part of this program, the Perry Public Work Department has established waste oil stations where the used oil collected from commercial establishments like restaurants and city residents is filtered and heated to be converted to diesel.<sup>38</sup> Similar citywide initiatives would allow Georgian cities to improve their own energy security and contribute to the larger goal of environmental sustainability.

Based on the calculations of Baseline Emissions Inventory (BEI) the major source of CO<sub>2</sub> emissions in Tbilisi is the transport sector. Tbilisi's Sustainable Energy Action Plan emphasizes the need to focus on issues in the transport sector and mitigate it by developing electric transport network (ex. trams and subway).<sup>39</sup> Electric cars could run on hydropower at nighttime. The Sustainable Energy Strategy of Batumi aims to introduce use of electric taxis and develop other new categories in the transport sector like trams. Currently the number of cars that can be charged on solely electricity is below 10 in Georgia, while the number of hybrids is around 300. For a transition to electric cars to happen, awareness will be an important factor. This change cannot take place overnight and first step would be more emphasis on biofuel use, then hybrids and at a later stage, electric cars.<sup>40</sup> When the technology eventually becomes affordable and public awareness becomes more widespread, Georgia should adopt the use of electric vehicles.

With 2009/28/EC Georgia has agreed to increase its share of renewables in the transport sector to 10%. This Directive also obliges the country to facilitate the

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<sup>36</sup> University of Gothenburg, *Georgia Environmental and Climate Change Policy Brief*, pg. 3.

<sup>37</sup> Field Crops Manual, *Canola: environment requirement*, accessed May 2014.

<<http://www.hort.purdue.edu/newcrop/afcm/canola.html>>.

<sup>38</sup> WVO Program, *Biofuel Program Overview*, accessed May 2014. <<http://www.perry-ga.gov/wvo.php>>.

<sup>39</sup> Sustainable Energy Action Plan for Tbilisi, 2011, accessed June 2014.

<sup>40</sup> Davit Takidze, interview with the shareholder of Toyota, June 2014.

development of biofuels. There are three main types of vehicles in the transport system: urban public, private and municipal fleet. Georgian cities should follow the examples of other green cities and try to switch from fossil fuels to biofuels in the municipal fleet and public transport sectors.

Poor quality of fuel is another reason for high pollution due to the transport sector. This could be mitigated through increased regulation of fuel that is imported into the country. The government needs to create quality standards for different types of fuels. Technical inspection of cars should be introduced as planned for 2015. Developing and enforcing emission control practices for vehicles will help to further reduce emissions.

Directive 2009/33/EC on clean and energy efficient transportation facilities aims towards the introduction and development of cleaner transport systems. The government plan to introduce technical checks for cars and their emissions should further the goals of this directive if implemented in a fair and impartial manner.

The 3 year implementation plan for environmental and social protection can be found in Table 10 in Annex 1.

## **18.0 INNOVATION AND TECHNOLOGICAL DEVELOPMENT**

### **18.1 SHORT TERM ACTIONS**

Policies for promoting innovation and technological development on both the supply and demand sides are fundamental to advancement in this area:

- Introduction of energy efficient technologies;
- Connection with educational institutions and establishing programs encouraging R&D in this field.
- New innovative policies, for example creating innovation funds, stricter enforcement of intellectual property rights and patent law to encourage private investment in R&D, innovative education, etc.
- Facilitate education and professional growth in the energy sector; incentivize specialization in this field through scholarships and programs.

### **18.2 MID-TERM ACTIONS**

- Creating R&D centers, technology parks for bringing together science, education and business for developing, testing and commercializing new ideas;

The 3 year implementation plan for technology and innovation can be found in Table 11 in Annex 1.

## **19.0 RELATIONSHIP TO OTHER GOVERNMENT STRATEGIES**

The *Energy Strategy White Paper* builds on existing key government strategies, such as the Socio-Economic Development Strategy of Georgia (“Georgia 2020”). In this sense, it accepts the established GoG positions on issues such as economic indicators and projections for short and medium term.

However, the White Paper recognizes that other government strategies and the policies intersect closely with energy strategy, and that it is important to be clear about the nature of their interrelationships and ensure that they are delivering mutually supporting outcomes as efficiently as possible.

## **20.0 MONITORING AND UPDATING**

The energy sector is developing in a dynamic environment, requiring adequate and timely governmental decisions. For this reason the performance of the priorities and actions set in this *Energy Strategy Paper* will be monitored with a view to identifying any need for changes in the envisaged mechanisms, as well as in the legislative basis.

Monitoring will be performed on the basis of a system of quantitative and qualitative indicators, including energy, economic, social indicators and indicators for environmental impact assessment in the process of application of the Strategy.

On this basis, annual monitoring reports will be developed, including analysis of the performance of the set actions and responsible entities, proposals for changes in the existing mechanisms and legislative environment with a view to correcting the improper implementation of the strategy and updating the projected energy balance.

## 21.0 ANNEX I: TEMPLATE 3 YEAR IMPLEMENTATION PLAN (2015 - 2017)

Table 1. Energy Security						
Area	Topic	Actions	Responsible person	Supporting Entity	Deadline	Comments
Electricity	<ul style="list-style-type: none"> <li>Commercialization</li> <li>Board of Directors</li> </ul>	<ul style="list-style-type: none"> <li>Planning process developed</li> <li>Financial planning developed</li> <li>Budgeting process developed</li> </ul>	Minister of Energy Minister of Economy	Ministry of Economy Ministry of Energy	December 2016	
	<ul style="list-style-type: none"> <li>Internal Generation Evaluation</li> </ul>	<ul style="list-style-type: none"> <li>CBA for the rehabilitation of old HPPs</li> <li>Analyze renewables potential</li> </ul>	Minister of Energy	Owners of HPPs	December 2015	Requires considerable funds for performing studies
	<ul style="list-style-type: none"> <li>Reliability Assessments</li> <li>Initial 10-year Network Development Plan (TYNDP)</li> </ul>	<ul style="list-style-type: none"> <li>Develop process TYNDP</li> <li>Analyze domestic electricity grid in the context of new generation capacity expansion</li> <li>Analyze domestic electricity grid in the context of load increase</li> <li>HICD</li> <li>Software</li> </ul>	Director of GSE	Sakrusenergo/ Energotrans/ Energo-Pro Georgia	6/1/2015	
	<ul style="list-style-type: none"> <li>International Interconnection &amp; Trading</li> </ul>	<ul style="list-style-type: none"> <li>Analyze regional electricity market developments and power flows</li> </ul>	Director of GSE	Sakrusenergo/ Energotrans/ Energo-Pro Georgia	12/1/2015	Maybe to move this section to C.E.M.
Government Owned entities	<ul style="list-style-type: none"> <li>Financial viability</li> </ul>	<ul style="list-style-type: none"> <li>Competition in all aspects of procurement and service delivery</li> </ul>	Director of MO Director of GSE Director of GOGC Director of GGTC Director of EnguriHES	Ministry of Energy	12/2016	
		<ul style="list-style-type: none"> <li>Increase capacity of government-owned entities to create &amp; deliver services to the market</li> </ul>	Director of MO Director of GSE Director of GOGC Director of GGTC Director of EnguriHES	Ministry of Energy	12/2015	
	<ul style="list-style-type: none"> <li>Improving technical and commercial service quality</li> </ul>	<ul style="list-style-type: none"> <li>Develop standards for network performance</li> <li>Develop investment programs consistent to the performance standards</li> <li>Monitor progress meeting these standards</li> <li>Develop standards to harmonize with ENTSO-E and ENTSO-G</li> </ul>	Director of GSE Director of GGTC	Ministry of Energy	07/2015	

Natural Gas	• Gas Storage Options	Analyze and provide recommendations on developing a gas storage facility in Georgia.	Director of GOGC	MoE	6/1/2015	
	• Long-term GPAs	<ul style="list-style-type: none"> <li>Review all existing long-term GPAs and provide a recommendation for additional similar arrangements</li> <li>Review of previous gas strategy developed by USAID in the context of energy security</li> <li>Analyze EU energy community standards for new GPAs</li> </ul>	Minister of Energy	GOGC	December 2015	
	<ul style="list-style-type: none"> <li>Diversity of Sources and pipelines</li> <li>Emergency Planning</li> </ul>	<ul style="list-style-type: none"> <li>Complete a study on the various sources and pipelines of natural gas to examine the risk of non-supply to Georgia and propose mitigation measures to reduce the possibility of supply interruptions.</li> </ul>	Minister of Energy	GOGC	September 1, 2015	
	<ul style="list-style-type: none"> <li>Reliability Assessments</li> <li>Initial 10-year Network Development Plan</li> </ul>	<ul style="list-style-type: none"> <li>Develop process TYNDP</li> <li>Analyze gas pipelines in the context of new capacity expansion</li> <li>Analyze gas pipelines in the context of gas demand increase</li> <li>HICD</li> <li>Software</li> </ul>	Director of GSE	MoE	June 1, 2015	
Oil	Strategic Oil Reserve (SOR)	Analyze and recommend a plan for ensuring a non-military SOR for Georgia	Minister of Energy	GOGC	12/1/2015	
	Downstream regulator to oversee SOR and other oil related issues	Analyze and propose establishment of oil downstream regulator to cover at least the issue mandated by the EU Third Energy Package	Minister of Energy	N/A	February 1, 2016	
Coal	Evaluation Potential for Clean Coal Technologies	<ul style="list-style-type: none"> <li>Assessment of clean coal technologies and their applicability for Georgia</li> </ul>	Minister of Energy	Ministry of Economy and Sustainable Development Ministry of Environment and Natural Resources Protection	December 2016	
	Market Development	<ul style="list-style-type: none"> <li>Coal sector development strategy</li> </ul>	Minister of Energy	Ministry of Economy and Sustainable Development Ministry of Environment and Natural Resources Protection	December 2016	
Research and	R&D of local coal	<ul style="list-style-type: none"> <li>Seek financing for R&amp;D</li> </ul>	Minister of Energy	GOGC	December	

Development	reserves	<ul style="list-style-type: none"> <li>• Tender for a cost benefit analysis on coal exploration and extraction in Georgia</li> </ul>			2015	
	R&D of local oil reserves	<ul style="list-style-type: none"> <li>• Seek financing for R&amp;D</li> <li>• Tender for a cost benefit analysis on oil exploration and extraction in Georgia</li> </ul>	Minister of Energy	GOGC	December 1, 2015	
	R&D of local natural gas reserves	<ul style="list-style-type: none"> <li>• Seek financing for R&amp;D</li> <li>• Tender for a cost benefit analysis on natural gas exploration and extraction in Georgia</li> </ul>	Minister of Energy	GOGC	October 2015	
	R&D of local shale gas and other unconventional gas reserves	<ul style="list-style-type: none"> <li>• Seek financing for R&amp;D</li> <li>• Develop and implement relevant legal framework in line with EU standards</li> <li>• Tender for a cost benefit analysis on shale gas exploration and extraction in Georgia</li> </ul>	Minister of Energy	GOGC	April 2016	Private investments?
	R&D of local shale oil reserves	<ul style="list-style-type: none"> <li>• Seek financing for R&amp;D</li> <li>• Develop and implement relevant legal framework in line with EU standards</li> <li>• Tender for a cost benefit analysis on shale oil exploration and extraction in Georgia</li> </ul>	Minister of Energy	GOGC	May 2016	

**Table 2. Legislative and Regulatory Framework**

Area	Topic	Actions	Responsible Person	Supporting Entity	Deadline	Comments
Energy <i>acquis</i>	Legal Basis for Electricity Market Competition	Draft Primary and secondary Legislation for competitive market development to include requirements consistent with the Association Agreement Roadmap for: <ul style="list-style-type: none"> <li>➤ Monitoring</li> <li>➤ Sanctions</li> <li>➤ Grid Codes</li> <li>➤ Market Rules</li> <li>➤ Regional Harmonization</li> <li>➤ Switching Rules</li> </ul>	Minister of Energy	Ministry of Foreign Affairs / The Department of European and Euro-Atlantic Integration	July 1, 2015	
	Legal Basis for Natural Gas Market Competition	<ul style="list-style-type: none"> <li>➤ SOLR Rules</li> <li>➤ Customer Protection</li> <li>➤ Public Service Obligations</li> <li>➤ Transparency and confidentiality</li> <li>➤ Tendering procedures</li> </ul>		GNERC		

Energy Statistics	<ul style="list-style-type: none"> <li>Data creation, collection and analysis</li> <li>Energy balance (historical and long-term forecast)</li> <li>Reporting (IEA)</li> </ul>	Comply with regulation (EC) No 1099/2008 on energy statistics. GEOSTAT should develop methodologies in line with EUROSTAT	Geostat	Minister of Energy, Energy Sector entities	December 31, 2016	
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**Table 3. Electricity Sector**

Area	Topic	Actions	Responsible Person	Supporting Entity	Deadline	Comments
Transmission System Operations	<ul style="list-style-type: none"> <li>Creation of a single TSO for electricity</li> </ul>	<ul style="list-style-type: none"> <li>TOs to sign agreement with GSE dispatch to be the designated TSO</li> </ul>	Director of GSE	MoE TOs	July 1, 2015	
Cross border harmonization with regional electricity markets	<ul style="list-style-type: none"> <li>Continue to improve process for capacity auctions</li> <li>Evaluate increased interconnection capacity</li> <li>PX price zone with Turkey</li> <li>Synchronization of technical standards</li> </ul>	<ul style="list-style-type: none"> <li>Capacity building,</li> <li>Software development,</li> <li>Procedures</li> </ul>	Director of GSE Director of MO	Ministry of Energy	January 2016	
Competitive Electricity Market Development	<ul style="list-style-type: none"> <li>Develop Hourly Day-ahead scheduling</li> <li>Finalize and maintain state of the art AMR</li> <li>Develop Balancing Market</li> <li>Develop ancillary services market</li> <li>Establishment of Public Trader and Market Operator</li> <li>Legislative amendments during transition of the market</li> <li>Instruction of Day-ahead Market Development of clearing mechanism</li> </ul>	<ul style="list-style-type: none"> <li>Train market participants</li> <li>Adopt procedures required for different market types</li> <li>Develop and implement IT platforms required for different market types</li> <li>Sell virtual trading rights to each generator of Enguri and Vardnili HPPs</li> <li>Release increasing small amounts of Enguri and Vardnili HPPs to the market</li> </ul>	Minister of Energy	MO, GSE, market participants	March 2016	
Market Opening	<ul style="list-style-type: none"> <li>Compliance with EU Directive 2009/72/EC</li> </ul>	<ul style="list-style-type: none"> <li>Development of plan to open the market by 2018</li> </ul>	Minister of Energy	Electricity Distribution Companies	December 31, 2017	



Distribution system operations	<ul style="list-style-type: none"> <li>Unbundling of the distribution companies</li> </ul>	Amend the legal framework to allow for competitive retail public suppliers	Minister of Energy	Electricity Distribution Companies	July 1, 2015	
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**Table 4. Natural Gas Sector**

Area	Topic	Actions	Responsible Person	Supporting Entity	Deadline	Comments
Develop Competitive Market	Unbundling <ul style="list-style-type: none"> <li>Accounting unbundling</li> <li>Managerial unbundling</li> <li>Legal Unbundling</li> </ul>	Develop a plan for unbundling of the natural gas sector through stages	Director of GOGC	Ministry of Energy	July 1, 2015	
	<ul style="list-style-type: none"> <li>TPA <ul style="list-style-type: none"> <li>Transparent rules</li> <li>Market operation</li> </ul> </li> </ul>	Develop specific rules and procedures for creation of TPA for all non-household consumers	Minister of Energy	Ministry of Energy Ministry of Economy	September 1, 2015	
	<ul style="list-style-type: none"> <li>Natural gas storage for competitive market development</li> </ul>	Review previous studies and recommend a plan for attracting investment in natural gas storage facilities to support natural gas trading, system security and system balancing	Director of GOGC	Ministry of Energy	November 1, 2017	
Regulation	Upstream regulator	<ul style="list-style-type: none"> <li>Study, develop and implement a report on analysis of an upstream regulator for natural gas sector</li> <li>Develop a regulatory framework to allow sale of unconventional gas in local market</li> </ul>	Minister of Energy	N/A	March 2017	

**Table 5. Oil and Oil-Byproducts Sector**

Area	Topic	Actions	Responsible Person	Supporting Entity	Deadline	Comments
Oil transit	Potential to increase flows	Facilitate transit of oil and oil products through Georgia	Director of GOGC	GOGC	January 2017	
Oil Sector Development	Oil refinery inside Georgian territory	Evaluate possibility of developing local oil processing facilities and develop a plan for attracting investment into a domestic oil refinery facility	Minister of Energy	Ministry of Economy and Sustainable Development Ministry of Infrastructure and Regional Development	12/1/2016	
Regulation	Upstream regulator	Study and develop a report on analysis of an upstream regulator for oil sector	Minister of Energy	N/A	November 2016	
Shale Oil	Research and Development	Tender for a cost benefit analysis on shale oil exploration and extraction in Georgia	Minister of Energy	N/A	December 2015	

**Table 6. Demand-side Management**

Area	Topic	Actions	Responsible Person	Supporting Entity	Deadline	Comments
Energy Efficiency	Lack of data	Data collection and analysis	LEDS Committee	Ministry of Energy Geostat	October 2015	
	Definition of potential EE programs Analysis of alternative programs	Using Georgia MARKAL, fully examine a wide range of potential EE programs for Georgia and report on the results of the examination.	Minister of Energy	LEDS Committee	March 215	
	Developing energy efficiency indicators	Research and analysis of international and EU best practices	Minister of Energy	LEDS Committee	November 2015	
	Legal Basis	Develop a draft Law on EE, consistent with EU <i>acquis</i> ;	Minister of Energy	Ministry of Economy and Sustainable Development/ LEDS Committee	December 2015	
	Regulatory Basis	Develop and adopt regulations, consistent with EE Law;	Minister of Energy	Ministry of Economy and Sustainable Development	January 2016	
	Government EE Programs Lead by example – Government building EE improvement program	<ul style="list-style-type: none"> <li>Draft a Government EE program implementation plan including proposals for financing the programs</li> <li>Create certification procedures for Energy Auditing</li> </ul>	Minister of Energy	LEDS Committee	August 2015	
	Competency within the GoG	Create capabilities within MoE to monitor State EE program implementation	Minister of Energy	MoE	July 2015	
	EE Implementation	<ul style="list-style-type: none"> <li>Support EU's Covenant of Mayors Activities in Georgia</li> <li>Finalizing a SEAP</li> </ul>	Tbilisi and other municipalities		September 2015	
Fuel Switching	Price elasticizes of different fuels	<ul style="list-style-type: none"> <li>Research and analysis of price elasticity of different fuels in Georgia</li> <li>Analyze the impact of gasification on wood consumption</li> <li>Evaluate fuel switching magnitude and timing</li> </ul>	Minister of Energy/ Head of Analytical Department	MoE/AD	October 2015	
Peak Shaving	System reliability and reserve margins	<ul style="list-style-type: none"> <li>Analyze peak shaving potential in different energy intensive sectors</li> <li>CBA analysis of peak shaving</li> </ul>	GSE	MoE/ AD	August 2015	

**Table 7. Renewable Energy Sources**

Area	Topic	Actions	Responsible Person	Supporting Entity	Deadline	Comments
Legal	<ul style="list-style-type: none"> <li>• Law on RES</li> <li>• R&amp;D on new RES</li> <li>• Off Grid evaluations</li> <li>• Energy acquis Compliance</li> </ul>	<ul style="list-style-type: none"> <li>• Implement Directive 2009/28/EC</li> <li>• Guarantee of origin</li> <li>• Evaluation of promotional incentives for RES development</li> </ul>	Minister of Energy	LEDS Committee	December 31, 2017	
Integration	Renewable energy integration into the electricity system	Develop a strategy on how to develop this intermittent and highly seasonal RES potential (regional cooperation, matching consumption, storage, etc.)	Minister of Energy	MoE	May 2017	
Regulatory	Feed in tariffs	Examine and make recommendations for the need, if any, for feed-in tariffs to encourage the development of non-hydro, non-biomass renewable energy sources	Director of GNERC	GNERC/ Ministry of Energy/LEDS Committee	April 2017	
Resources	Solar/wind/geothermal	<ul style="list-style-type: none"> <li>• Study and analyze potential for renewable energy sources</li> <li>• Assessment of firewood consumption recommendations for future</li> </ul>	Minister of Energy	LEDS Committee	March 2017	
	Biomass	<ul style="list-style-type: none"> <li>• Efficient wood burning technologies</li> <li>• Develop forest management practices</li> <li>• Public awareness</li> <li>• Modify existing wood stoves to achieve higher efficiency</li> </ul>	Minister of Environment	Ministry of Environment and Natural Resources Protection / LEDS Committee	May 2015	

**Table 8. Institutional development**

Area	Topic	Actions	Responsible Person	Supporting Entity	Deadline	Comments
Ministry of Energy	Reorganization of MoE	<ul style="list-style-type: none"> <li>• Develop an action plan</li> <li>• Develop new organizational structure, job descriptions, department functions</li> </ul>	MoE	HIPP	June 2015	
Reorganization of GSE/TSO	<ul style="list-style-type: none"> <li>• Unbundling options: choose from 4 models/structures of TSO</li> <li>• HICD</li> <li>• Development of</li> </ul>	<ul style="list-style-type: none"> <li>• Develop an action plan</li> <li>• Develop various training programs on related issues</li> </ul>	GSE	HIPP, MoE	September 2015	

	asset management program <ul style="list-style-type: none"> <li>• Increase capacity in load forecasting/planning</li> </ul>					
Reorganization of MO	<ul style="list-style-type: none"> <li>• Development of new organizational structure</li> <li>• Develop clear vision and mission</li> <li>• HICD</li> </ul>	<ul style="list-style-type: none"> <li>• Establishment of new “market development” department</li> <li>• Establishment of new IT department with additional tasks</li> <li>• Reorganization of settlement department</li> <li>• Develop responsibilities for departments and job descriptions for the staff</li> </ul>	MO	HIPP, MoE	August 2015	

**Table 9. Public Service Obligations**

Area	Topic	Actions	Responsible Person	Supporting Entity	Deadline	Comments
Customer Protection	Compliance with Energy <i>acquis</i>	<ul style="list-style-type: none"> <li>• Analyze existing social programs;</li> <li>• Develop new social programs in compliance with EU Energy <i>acquis</i></li> </ul>	MoE	Ministry of Labor, Health and Social Affairs of Georgia; LEDS Committee	February 2017	

**Table 10. Environmental Protection**

Area	Topic	Actions	Responsible Person	Supporting Entity	Deadline	Comments
Resources	Biomass	<ul style="list-style-type: none"> <li>• Poplar tree plantations</li> </ul>	Minister of Environment	Ministry of Environment and Natural Resources Protection; LEDS Committee	June 2016	
	Biofuels	<ul style="list-style-type: none"> <li>• Encourage establishment of green cities</li> </ul>	Municipalities of signatory cities of the Covenant of Mayors	Ministry of Environment and Natural Resources Protection City Halls of signatory cities of the Covenant of Mayors LEDS Committee	May 2016	

**Table 11. Technology and Innovation**

Area	Topic	Actions	Responsible Person	Supporting Entity	Deadline	Comments
Education	Support educational institutions	<ul style="list-style-type: none"> <li>• Provide support to educational institutions and universities for research and development</li> </ul>	Minister of Education Minister of Economy / Chairman of the	Ministry of Education Ministry of Economy / Innovation and	September 2015	

		<ul style="list-style-type: none"> <li>• Encourage technology and innovation in the energy sector</li> </ul>	Innovation and Technology Agency	Technology Agency		
Innovation & Technology	Suggestions for use of innovation and technology:	<ul style="list-style-type: none"> <li>• Smart grid solutions for integrating the renewables and increasing efficiency;</li> <li>• Use of hydropower reservoirs as energy storage and integrating large scale wind and solar power;</li> <li>• Exploration and development of unconventional resources;</li> <li>• Use of low grade coal and developing the full cycle of utilization, including the coal bed methane;</li> <li>• Innovative Energy management solutions in industry and buildings for higher efficiency of energy use;</li> <li>• Integrated resource management - for example fresh water management for energy production, agricultural (irrigation) and consumption use.</li> </ul>	Minister of Economy / Chairman of the Innovation and Technology Agency	Ministry of Economy / Innovation and Technology Agency		

## 22.0 ANNEX II: INPUT IN FIGURES

**FIGURE 1: Georgia's total primary energy supply between 2010 and 2013**

Fuel source (ktoe)	2010	2011	2012	2013
Oil	936.6	907.9	915.7	966.4
Coal	199.6	253.6	299.8	267.86
Hydropower	806.1	678.59	620.89	711.18
Gas	1,009	1,604	1,772	1,721
Biomass	525	525	525	525

**FIGURE 11: Electricity generation production vs. consumption (in GWh)**

Year	Consumption Growth (1%) incl Loss	Consumption Growth (3%) incl Loss	Consumption Growth (5%) incl Loss	Generation
2010	8,681	8,681	8,681	10,058
2011	9,498	9,498	9,498	10,105
2012	9,647	9,647	9,647	9,698
2013	9,965	9,965	9,965	10,059
2014	10,065	10,264	10,463	9,841
2015	10,165	10,572	10,986	9,978
2016	10,267	10,889	11,536	12,361
2017	10,370	11,216	12,113	12,729
2018	10,473	11,552	12,718	13,037
2019	10,578	11,899	13,354	13,150
2020	10,684	12,256	14,022	14,007

New HPPs	Start of operation	Annual generation in 2020 (MWh)	Installed capacity (MW)
Bakhvi 3 HPP	2014	35.0	9.8
Larsi HPP	2014	101.0	19.0
Akhmeta HPP	2014	50.2	9.5
Aragvi HPP	2014	50.0	8.0
Paravani HPP	2014	425.0	85.0
Nabeghlavi HPP	2014	13.0	1.9
Kazbegi HPP	2014	31.9	5.0
Debeda HPP	2015	10.6	2.5
Pshavela HPP	2015	8.6	1.9
Dariali HPP	2016	502.2	108.0
Mtkvari HPP	2017	200.0	43.0
Lukhuni 2 HPP	2016	73.6	12.0
Kintrishi HPP	2016	30.0	5.0
Arakali HPP	2016	63.0	9.0
Abuli HPP	2016	129.0	22.0
Okropilauri HPP	2016	9.4	1.8
Goginauri HPP	2016	9.3	1.8

Gori WPP	2016	92.3	20.0
Kirnati HPP	2017	133.6	51.0
Khelvachauri 1 HPP	2017	128.1	47.0
Shuakhevi HPP	2017	455.0	175.0
Khobi 2 HPP	2017	260.0	55.0
Samkuristskali 2 HPP	2018	117.3	22.6
Mestiatchala 2 HPP	2018	84.1	20.0
Matchakhela 1 HPP	2019	138.0	24.0
Matchakhela 2 HPP	2019	99.7	19.0
Khobi 1 HPP	2020	320.0	60.0
Tsageri HPP	2020	724.0	151.0

**FIGURE 12: Electricity generation vs. consumption in the winter (in GWh)**

Year	Winter Generation (expected)	Consumption Growth (1%) incl loss	Consumption Growth (5%) incl loss	Consumption Growth (3%) incl loss
2010	5,040	4,711	4,711	4,711
2011	5,000	5,198	5,198	5,198
2012	4,793	5,232	5,232	5,232
2013	5,042	5,314	5,314	5,314
2014	5,118	5,367	5,579	5,473
2015	5,292	5,420	5,858	5,637
2016	6,570	5,475	6,151	5,806
2017	6,938	5,529	6,459	5,980
2018	7,246	5,585	6,782	6,160
2019	7,359	5,640	7,121	6,345
2020	7,735	5,697	7,477	6,535

**FIGURE 13: Growth of consumption of electricity during winter and summer periods**

Year	Winter (GWh)	Summer (GWh)
2007	4,460	3,350
2008	4,454	3,611
2009	4,252	3,378
2010	4,573	3,855
2011	5,046	4,175
2012	5,080	4,287
2013	5,159	4,516
2014	5,285	4,747
2015	5,415	4,989
2016	5,547	5,244
2017	5,683	5,512
2018	5,822	5,794
2019	5,965	6,090
2020	6,111	6,401

**FIGURE 15: Available Peak Capacity vs. Required Peak Capacity (in MW)**

Year	Required Capacity (1%)	Required Capacity (3%)	Required Capacity (5%)	AVAILABLE PEAK CAPACITY (based on generation)
2010	1,782	1,782	1,782	2,626
2011	1,849	1,849	1,849	2,858
2012	1,848	1,848	1,848	2,848
2013	1,991	1,991	1,991	2,894
2014	2,011	2,051	2,091	2,868
2015	2,031	2,112	2,195	2,893
2016	2,051	2,176	2,305	3,175
2017	2,072	2,241	2,420	3,264
2018	2,093	2,308	2,541	3,299
2019	2,113	2,377	2,668	3,320
2020	2,135	2,449	2,802	3,383

**FIGURE 19: Daily peak gas consumption vs. technical and contractual limitations**

In mcm	2010	2011	2012	2013	2014
Power Generation	2.43	4.4	4.7	4.8	3.6
Residential	4.14	3.2	3.3	4.32	4.6
Commercial	2.43	2.4	2	2.88	3.6
Total daily consumption	9	10	10	12	11.8
Technical & Contractual Limitation	12.5	12.5	12.5	12.5	12.5



## **23.0 ANNEX III: MARKAL – ENERGY BALANCE SCENARIOS**

## 24.0 REFERENCES:

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