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PROJECT
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Work Package:	**3. Joint Regional Analysis, Strategy and Framework**
Activity:	**3.6.3 Joint strategy and action plan for increasing energy efficiency through behavioural change**
Activity Leader:	**National Agency of Natural Resources**
Deliverable:	**3.6.3**

Version:	**Draft 1.0**	**Date:**	**28-10-2022**
Type:	**Report**		
Availability:	**Confidential**		
Responsible Partner:	**National Agency of Natural Resources**		
Editor:	**Roalb Studio Shpk**		

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DISCLAIMER:

The common challenge of PRO-ENERGY is to improve energy efficiency of public buildings (municipal/provincial/regional buildings, schools, universities, health centers, hospitals, museums, sports facilities etc.). This is a common problem faced by the territories participating in the project characterized by old facilities, outdated/degraded building façades, materials & equipment (insulation, electrical appliances, cooling/heating systems etc.), low energy consciousness & awareness, lack of skilled civil servants, etc. leading to high-energy consumption & CO2 emissions.

IDENTIFICATION SHEET

Project Ref. No.	***BMP1/2.2/2052/2019***
Project Acronym	***Pro-Energy***
Project Full Title	***Promoting Energy Efficiency in Public Buildings of the Balkan Mediterranean Territory***

Security (distribution level)	**Confidential**
Date of delivery	**24/04/2022**
Deliverable number	**3.6.3**
Type	**Report**
Status & version	**Draft 1.0**
Number of pages	
ACTIVITY contributing to the deliverable	**3.3 Joint Regional Analysis, Strategy and Framework**
Responsible partner	**National Agency of Natural Resources**
Editor	**Roalb Studio Shpk** 

INTRODUCTION

The common challenge of PRO-ENERGY is to improve energy efficiency of public buildings (municipal/provincial/regional buildings, schools, universities, health centres, hospitals, museums, sports facilities etc.). This is a common problem faced by the territories participating in the project characterized by old facilities, outdated/degradated building façades, materials & equipment (insulation, electrical appliances, cooling/heating systems etc.), low energy consciousness & awareness, lack of skilled civil servants, etc. all leading to high energy consumption & CO2 emissions. Combined with the fact that participating territories are energy import dependent it is more than evident that there is room for improvements in energy consumption & more efficient use of energy. More importantly, the exemplary role of the public sector should be promoted by increasing energy savings in public buildings. PRO-ENERGY aims to address these issues by developing & implementing a Joint Strategy & Action Plan, increasing competences of buildings' owners & operators, developing& applying technologies& tools to reduce energy consumption in public buildings,& promoting generated good practices& results to local/regional/national entities in the Balkan-Med region. The project addresses the policy & institutional level (Joint Strategy& Action Plan),human resources level (Capacity Building of Energy Managers)& the managerial systems level (ICT Platform & CBA Modeller & Energy Performance Contracting-EPC). The novel energy saving technologies promoted by PRO-ENERGY refer to Behaviour-based Energy Efficiency. Behavioural efficiency programs introduce cost-effective ways to reduce energy consumption, as literature & practice suggests. The overall objective is to promote Energy Efficiency in public buildings in the Balkan Med area & to create a practical framework of modelling & implementing energy investment interventions through specific ICT monitoring & control systems,& through EPC. The innovativeness of PRO-ENERGY lies on the EPC use, a proven in EU projects, practical& effective "creative financing" tool enabling funding of energy upgrades& on the fact that most energy efficiency measures involve technological interventions but equally have to rely on people adjusting their energy consumption behaviour. To do so, consumers should be provided with meaningful, clearly communicated&continual feedback. PRO-ENERGY focuses on non-domestic consumers (employees/visitors etc. of public buildings), because in this segment initiatives are normally delivered at the organisational level & there is no direct link to personal wealth of the individual users. Motivation for those users to engage in energy efficiency behaviours is therefore very different from domestic users& must rely on corporate & social responsibility objectives & societal norms' reinforcement. Behaviour change measures at work may inspire consumers to act differently at home increasing thus multiplier effects.

Based on the above, Work Package 3 (WP 3) "Joint Regional Analysis, Strategy and Framework" aims at sustainability of project results is also self-evident since PRO-ENERGY involves activities that directly impact & reduce energy consumption in public buildings leading to the coverage of an apparent need of project partners & stakeholders to keep applying & trying to extend the applicability of these activities.

More specifically, Activity WP3 Del. 3.6.3 "Joint strategy and action plan for increasing energy efficiency through behavioural change.**" aims to:**

1. Joint Strategy & Action Plan contributing to developing effective energy efficiency policies & measures & to defining pilot actions for the reduction of energy spending in public buildings.

2. Joint Cost-Benefit Analysis Modeller (open to all) supporting decision-making for retrofits, renovations etc. which lead to increased energy efficiency.
3. Energy Performance Contracts through open-tendering procedures to finance energy upgrades from cost reductions & contribute in this way to increased energy savings & increased energy efficiency.
4. Framework for energy-related interventions in public buildings which includes the implementation of Energy Audits in selected public buildings enabling through smart sensor systems the recording of energy consumption & the measurement of the impact of behavioural change measures.

SUSTAINABLE ENERGY ACTION PLAN OF THE GJIROKASTRA (SEAP)

List of abbreviations

AKBN - National Agency of Natural Resources
AKE - National Agency of Energy
DCM - Decision of Council of Ministers
EBRD - European Bank for Reconstruction and Development
EE - Energy efficiency
EEC - Albania - EU Energy Efficiency Centre
ERE - Energy Regulatory Authority
EUROSTAT - European Statistics Office
GTZ - German Technical Cooperation
IEA - International Energy Agency
IFC - International Finance Corporation
INSTAT - Albanian Institute of Statistics
KESH - Albanian Power Corporation
KfW - Kreditanstalt fuer Wideraufbau
LPG - Liquefied Petroleum Gas
METE - Ministry of Economy, Trade and Energy
MEI - Ministry of Energy and Industry
MoEFWA - Ministry of Environment, Forestry and Water Administration
MPW - Ministry of Public Works
MoT - Ministry of Transport
NEEAP - National Energy Efficiency Action Plan
NSE - National Strategy of Energy
OSSH - Distribution System Operator
OST - Transmission System Operator
RES - Renewable Energy Sources
USAID - U.S. International Development Agency
WB - World Bank
toe - Tons oil equivalent
ktoe - Kilo tons oil equivalent
GWh - Gigawatt hours
MWh - Megawatt hours
MW - Megawatt
kWh - kilo watt hours
kW - kilo watt
UNECE - United Nations Economic Commission for Europe

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CHAPTER 1: ACTUAL SITUATION RELATED WITH ENERGY CONSUMPTION IN GJIROKASTRA MUNICIPALITY

Introduction

The main objective of the PRO-ENERGY project is the incorporation of a green component in tourism in the trans-boundary area of Greece – Albania, and the creation of a "new green Greece – Albania touristic path". For this purpose attraction points (acting as nodes of the path) will be created through demonstrative application of environmental friendly technologies. Specific targets include:

- Demonstrative implementation of mature and targeted projects,
- Improvement of tourism infrastructure which leads to growth, new jobs creation and the development of new innovative markets,
- Multidimensional contribution to the European and national targets of Greece and Albania (2020) as well as the preparation of strategic intra-Municipalityal development plans for green tourism in view of the new programme period (2020 – 2030),
- Investigation of mature ready to implement projects of green tourism,
- Attraction of private sector investments in the field of tourism.

The Specific objective of the project is to promote sustainable energy, through an integrated approach to the efficient use of energy and its production from renewable sources.

The eligible territories of the cross-border Programme "Greece – Albania" present high potential for the implementation of energy and environment-friendly technologies in open spaces, facilities and buildings of architectural heritage characterized by high touristic traffic, a fact that can lead to greater and faster touristic growth. The potential for Energy Efficiency, especially for open spaces, buildings and facilities, is considerable particularly because of the related high energy consumption and CO_2 emissions. Moreover, tourism is one of the main pillars of development of the eligible areas and its strengthening is a strategic choice for both Greece and Albania towards 2020.

All activities will be undertaken with a strong participatory approach and this plan will be executed in three main phases focus on:

a– Target Communities identification

On the base of an agreed set of common criteria, we will select one or more target communities in which a comprehensive energy sustainability planning process will be subsequently implemented. For each of these target communities, the direct involvement of the local boards in the project activities and the formal commitment of the competent public authorities to adhere to PRO-ENERGY objectives and actively support its activities will be requested (e.g. municipal or Municipalityal/county government deliberations).

b – Capacity building for target communities

Activities for territorial promotion, information and training specifically addressing the chosen target communities and aiming to supply citizens and local businesses with assistance in a) developing skills and competencies in the energy sector; b) reinforcing institutional and administrative ability, specifically relating to the programming and management of European and national energy funds; c) constructing organizational structures able to guarantee efficient management systems and the participation of the relevant parties in the sphere of sustainable energy.

The targets of this task are the local communities identified in the preceding point a; however, depending on the specific administrative, political and socio-economic situations of each pilot areas.

c – Energy assessment of Target Communities
Assessment of the total energy balance including all domestic, productive, construction and economic sectors, and the specification of possible strategies for the fulfilment of medium-long-term requirements for energy-saving activities and the use of renewable energy. The studies will address both energy needs and consumption models and the local availability of energy resources and/or energy efficiency improvement potential.

d. "Integrated Plans for Energy Sustainability" represents the 'heart' of the project and focuses on the development, in three Demonstrative Zones selected, of a complex programming and planning operation of which the final results are "Integrated Energy Sustainability Plans". These plans will define for each target community the strategy of choice for a transition towards a more sustainable use/production of energy and will identify an integrated set of actions to be implemented over time.

The Sustainability Plans will be defined through an articulated and gradual process which aims to actively involve the local stakeholders and the citizens in the decisional process. In order these Demonstrative Zones to be significant and the results produced easily transferable/adaptable to different situations, the selection of the target communities in which to implement the "Integrated Energy Sustainability Plans" will be made according to a shared set of criteria that take into account all the relevant technological, geographical and socio-economical factors, thus maximizing their replicability and diffusion potential.

Based on the above mentioned analysis the final conclusion is: the maximum final RES Target for Albania shall be at 37.96% rounded to 38%. This percentage will serve as the National RES Target for the year 2020. Also, it is important to be mentioned that all future calculations for fulfilment of the RES Target are based the value of 38%.

Gjirokastra is a town and a municipality in southern Albania. Lying in the historical region of Epirus, it is the capital of Gjirokastër County. Its old town is a World Heritage Site described as "a rare example of a well-preserved Ottoman town, built by farmers of large estate." Gjirokastër is situated in a valley between the Gjerë mountains and the Drino, at 300 metres above sea level. The city is overlooked by Gjirokastër Fortress, where the Gjirokastër National Folklore Festival is held every five years. Gjirokastër is the birthplace of former Albanian communist leader Enver Hoxha and notable writer Ismail Kadare. It hosts the Eqrem Çabej University. Gjirokastra.

Figure 1: Map of Albania and position of GjirokastraGjirokastra District

The south east borders mainly of Gjirokastra and Permeti district are political borders with Greece, whereas all the other border is an administrative one and it goes in the west and southwest with the district of Saranda and Delvina, in the northwest with that of Ballshi, in the North with Berat and in the northeast and east with the districts of Skrapari and Kolonja. Some of the region consists of the following municipalities and communes:

Gjirokastra District:

Antigone	Zagorie
Cepo	Kurvelesh
Gjirokaster	Qesarat
Lazarat	Frasher
Lunxheri	Petran
Tepelene	Dropull i Siperm
Picar	Dropull i Poshtem
Carcove	Libohove

1.3 Gjirokastra Municipality Tourism Sector and its Relation with Energy Efficiency in Service Sector

The present municipality was formed at the 2015 local government reform by the merger of the former municipalities of Antigonë, Cepo, Gjirokastër, Lazarat, Lunxhëri, Odrie and Picar, that became municipal units. The seat of the municipality is the town Gjirokastër The total population is 25,301 (2011 census), in a total area of 469.25 square kilometres (181.18 sq mi).The population of the former municipality at the 2011 census was 19,836. Gjirokastra. Following photos are presenting the main building of the Gjirokastra municipality.

Figure 2: Gjirokastra

The climate is warm and temperate in Gjirokastra. There is more rainfall in the winter than in the summer in Gjirokastra. The climate here is classified as Csa by the Köppen-Geiger system. The temperature here averages 14.3 °C. The average annual rainfall is 1593 mm. Gjirokastra The hottest month is July while January is the coldest. The difference in precipitation between the driest month and the wettest month is 266 mm. During the year, the average temperatures vary by 17.9 °C. Gjirokastra There exists good reserves of SHPPs, Wind Potential as well as Solar Energy. More details about them will be given in the following sections.

The households/public buildings energy sector is one of the most important energy consuming sub sectors in Gjirokastra District. Its importance is highlighted by the fact that it consumes large quantities of electricity and fuel-wood, which has contributed to the country's current severe energy crisis. Up to year 2000, the supply and demand for cooking and heating fuels (mainly wood) was more or less in balance.

After 2000, there was a large reduction of fuel-wood supplied by the forestry enterprises to urban area of this region. As a result there was an over cutting of trees (much of which is illegal) and overloading the electricity distribution system. Electricity is supplied to the region by a 110 kV transmission line that is far away from the power plants. This thing has brought in a very low level of voltage in electricity supplied, which is down 150 V in household/public buildings sectors. The growing use of electrical appliances, fuel-wood shortages and other related issues, such as access and prices, are worrying and can cause further future problems. Due to lack of coherent data, the uncertainties about the actual level of fuel-wood own harvesting in the rural areas is growing. This uncertainty severely influences any judgments, not only in relation to the level and structure of the households/public buildings energy consumption but also in relation to the level and structure of the total energy supply for this region.

The energy consumption of the household/public buildings sector is divided into four parts describe as much basic energy uses with widely differing characteristics: space heating, water heating, cooking, lighting and electrical appliances. Right now, the population in Gjirokastra Clearly more information is needed in order to determine which actions are appropriate to be taken in order to improve the efficiency, to increase the use of local energy sources from a technical and from an economic point of view, in the use of energy by households/public buildings sectors in Gjirokastra Area. The starting point is that electricity consumption has exploded when the level of non-technical losses really picked-up. But what is behind this development is rather unknown.

The building conditions and the trends in the households/public buildings consumption of the energy and water play an important role in estimating the chances of accomplishing these ambitious objectives. The issue of water is mentioned in close connection with the issue of energy because the promotion of local energy sources, such as the use of small-scale heat-only-boilers (which may be used upon a range of different fuels), District Heating Systems and Combined Heat and Power (especially for the consumers which were supplied by CHP) linked with water based central heating systems inevitably is dependent on a reliable and efficient water supply system. But even more important is the fact that due to the prevailing low conditions of the buildings and installations, the associated losses are huge.

For calculating the energy demand in the Service Sector has divided it in two branches: Public Service and Private Service. The Public Service Sector has a traditional experience in the heat demand, having mainly old technology, installations and organization, with some cases of new schemes introduction. The database for the quantity of energy demanded for each service and the contribution of each energy commodity is based on different surveys prepared by National Agency for Energy and World Bank studies. It should be underlined that space heating, domestic hot water and lighting are generally carried out with a very poor quality, due to old energy infrastructure in public service institutions and lack of budget.

Private Service Sector is a new experience aiming at a rapid introduction of modern technology and instalments, but improvements are needed regarding the efficient utilization. Private Service Sector has inherited some traditional repair / service and small shops / restaurants that had neither possibility nor demand for space heating and air conditioning. Meanwhile, in many services, the private sector has experienced modern and qualitative developments. This service group includes business categories such as hotels, restaurants, banks, tourist agencies, consulting and insurance offices, etc., as well as many parallel services with the public service such as education, culture, health, etc., aiming the maximal comfort. Main attention is paid to the reduction of electricity. Different measures are foreseen to be taken on Gjirokastra District related with improvement of energy supply in general and EE in particular, such as the increase of electricity tariffs, implementation of energetic building code in dwellings, application of fiscal incentives for energy renewable resources and other efficient resources, awareness campaigns, etc. These measures are:

- A strong penetration of diesel no. 2 and solar for space heating;
- A strong penetration of LPG for space heating and cooking;
- An improvement of thermal insulation in existing building stock and rigorous application of the Energetic Building Code for new buildings in service sector;
- An extension of solar panels use for preparation of hot water in public and commercial buildings;
- A gradual introduction of small scale combined heat and power plants (SSCHP diesel) and central heating schemes for large and small consumers (hospitals, boarding-schools, hotels, etc.), particularly through substitution of existing conventional systems;
- An efficiency increase through “second hand” measures, such as increase of fluorescent lighting, use of intelligent electronic techniques, use of modern electric appliances with improved cos Φ for different consumers of the service sector.

Whilst the Gjirokastra Region has a very long history, distinctive traditions and an exceptional environment, tourism in most of the region is emerging as an economic sector. Figures for tourist arrivals have not been collected or compiled but according to local stakeholders, there has been a significant increase of visitors in recent years. The region has an excellent mix of soft and hard cultural assets as well as outstanding natural assets. These are described in greater detail in the following section as are the markets that are currently visiting the Gjirokastra Region. The next few paragraphs provide an impression of the richness of the Gjirokastra Region but do not attempt to present the totality of the tourism products that exist. Gjirokastra has special conditions for tourism since it is a World Heritage site; elected in 2005 for its rare type of Ottoman stone houses which the old bazaar/old town is dominated by. The management of a World Heritage site is both a national and a global concern involving many stakeholders exhibiting different desires and requests. World heritage management and tourism destination aspirations are only two of many other issues facing the city of Gjirokastra and the nation of Albania. Like many other post-communist countries Albania is struggling between a fast economic development and the restraints of preserving heritage: 4 modernization vs. tradition. In Gjirokastra this is evident through the city’s division in a new and old town – each fighting for attention and resources. The region has a wide range of products based on its history, culture and traditions, its villages and its lakes and mountains. These constitute a major tourism asset and are located throughout the region. Several villages are located near Gjirokastra City including Antigone, Cepo, Dropull i Siperm and Dropull i Poshtem. Some of the best alternatives which Gjirokastra offers to tourists are:

Streets: The old main street climbs the hilly terrain towards the old bazaar, where the paved roadways and stepped sidewalks are lined with coffee houses and restaurants.

Gjirokastra Castle: One of the biggest castles in Albania, which represents magnificent and well preserved constructions in the country. Its origins go back to the 4th century AD and it was greatly extended by Ali Pasha in order to protect the growing town. Raises high on the top of a hill, it provides the possibility for visitors to cast a glance on the most interesting landscape of the city and the nearby area and Drinos valley. The Festival of the Folkloric Arts from all parts of Albania use to be organized continually there.

National Museum of Armaments: (housed inside the castle) where various arms from the neolithic period until the Second World War are displayed.

Ethnographic Museum: In the home that was the birthplace of Enver Hoxha. The house has four floors, all of which are open to the public. The rooms are arranged as they would have actually been used and are decorated with numerous household items, folk costumes and cultural artefacts typical of a wealthy Gjirokastra family of merchants or Ottoman administrators living in the 19th Century.

Zekate house: The best surviving example of an Ottoman tower house in Gjirokastra.

Saint Sotire Church

Mosque in the Old Bazaar

Museums: A number of museums exist in Gjirokastra: the ethnographic museum, the Skenduli house and the castle. Our gathered picture of these activities is that there is no clear definition of responsibilities or management (the municipality is in charge on paper). The entrance fee of 200LEK/ visitor (approximately 1,5 Euro) is the guide's salary, there are no other money for running the museums. This lack of funds results in physical degradation, and no promotion, marketing or printed information in Albanian/ English and so forth. When asking the guide at the Skenduli house about the information, he said "Who shall pay for printing this brochure – me?" The deteriorating physical buildings give a sense of abandonment. In the ethnographic museum the hole in the roof is managed by buckets. There is also a communication problem with the guides not speaking English. The museums could otherwise be a great experience with their interesting and unique interiors and functions, now they are however lost in translation and poor display.

Hotels: There are seven hotels inside the old bazaar of various shapes and prizes. One of them is especially using the traditional patterns and materials as a profile. We stayed one night in another hotel to try out the service level. There was no information about check- out times, breakfast or wife password et.c. and the employee could not speak English which caused confusion regarding many things. According to Denisa Basha (Gjirokastra Tourism Service Office) this is the case at almost all the hotels. She is currently working on hotel evaluation to create "stars" based on quality standards. We interviewed the hotel owner of two hotels to ask questions on sustainability approach. In their words sustainability is done by preserving the local culture by offering traditional music performances traditional cooking, dancing and exhibitions. When asked why not install solar panels they were deemed "not possible because the shade from the castle" (Respondent E, 2014i) "it would look bad because it is not the traditional architecture (Respondent D). Using eco labels, having a strategy for ecological footprints, water supply and waste was not done. "We only do what other hotels are doing and no one is using eco products" (Respondent E).


Cafes and Restaurant: The food quality is in general very good due to the fact that the country just recently started with pesticides and those have not yet accumulated in the soil, but the presentation is very bad in terms of aesthetic values. The coffee served is Turkish, cappuccino and espresso, no regular coffee exists. The interior of the cafés and restaurant is not in any particular design or style, plastic chairs with nice traditional carpets and table. Smoking is accepted indoors. The service quality is identified as an improvement area in general. GF has thus initiated a project where they will teach girls how to work in the tourism sector: service, reception skills, cleaning etc, it will be a 30 day course. The language skills create communication barriers and thus everyday misunderstandings between guests and hosts.

Activities: There are not many activities offered in Gjirokastra. “There is no entrepreneurship tradition in Albania, everyone just copies their neighbors business” (local business owner, 2014) Sightseeing in the old bazaar is the main one according to the visitor surveys. The old bazaar is easily distinguished from the new town with its cobbled streets but there is no gated “welcome” sign, there is no entering a world heritage feeling. There are also numerous ways to enter the old town but there is only one map, close to the hotel Cajupi and bus park. Inside the heritage there are signs pointing to places of interests but they only state the name and there is no interpretative signpost or sign or information on the buildings themselves. “There have always been talks but not much has been done. The municipality did put up some signs that you can see around the town but they only have titles on them, no information and they are ugly too” (Respondent D, 2014). If one would be interested in hiking or nature activities there are no informative signs about the surrounding mountains but there are some old trails to be found however they have not been prepared for tourists yet.

Infrastructure: In the city of Gjirokastra there are two different types of infrastructure divided between the “old town” and the “new town”. The old town which is the UNESCO world heritage site, consists of steep narrow cobbled streets where big busses and trucks can´t maneuver. The new town which is downhill from the old town is more modern with roundabouts and traffic police who oversee the flow of traffic. At the end of the main road in the new town there are daily departures of minivans that depart every hour between 8 o´clock till 12 o´clock. These minivans work as the main public transport to and out of the city and there are direct minivans to Saranda which take about 1,5 hours. There are alternative routes for getting to different destinations as Tirana for example and depending on what busses are available one can take either a minivan from Gjirokastra or the buss. They later transfer the passengers to whatever destination one is heading for. In other words there is a perfectly synchronized system and the drivers are extremely helpful according to our experiences.




Tourism is starting to become established in the area, especially in the last year and there are a number of small hotels and guesthouses to accommodate visitors. There have been features on TV about the area which have resulted in increased number of tourist arrivals. It boasts 10 kms of coastline, partly rocky and partly sandy that is still undeveloped. There is an Italian project underway to prepare the beaches for tourism. The area was declared a tourist zone in 1994 stating that and no new buildings can be constructed within 200 metres of the lake shore. There has been interest in developing tourist facilities from investors from as far as the United States.

1.4 Determination of the Overall Energy Usage of Different Categories of Public Buildings

The public buildings in service sector of Gjirokastra Municipality include these activities:

- Public health buildings;
- Education institutions buildings and culture buildings;
- Different search institutions buildings;
- Military buildings;
- Central and local administrative institutions buildings;
- Justice buildings, etc.

Other categories consume very low quantities compared with hospitals and schools. The energy consumption by fuel is as follows: coal 1.2%, oil by products 64.4%, electricity 22.7%, fuel wood 11.7%. The energy consumption by sectors is shown in the **Figure 3**.

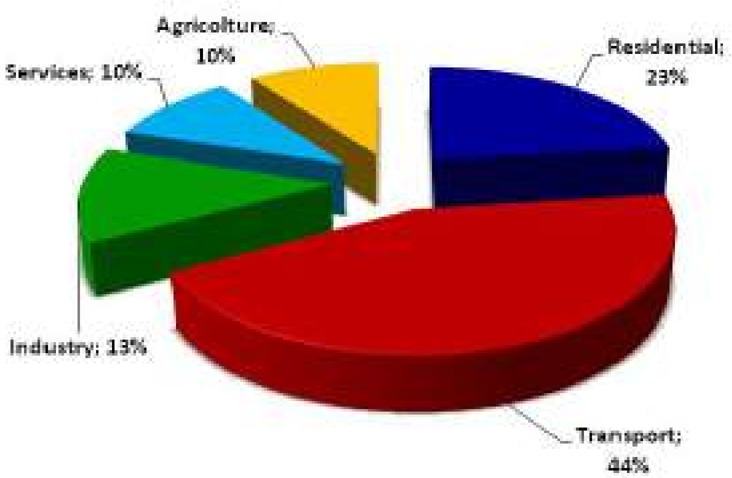


Figure 3: Energy Consumption Breakdown by Sector

The largest consumer of energy in industry is food and beverage with 19.9%, the building materials sector with 18.6%, followed by chemicals with 15.4 %, and extraction industry with 12.5%. The structure of energy consumption by fuels, in Industry Sector, is as follows: solid fuels 1.7%, biomass 11.7%, oil products 64.4% and electricity 22.2%.

CHAPTER 2: NEEAP AND ITS IMPORTANCE IN THE IMPLEMENTATION IN RESIDENTIAL, PUBLIC AND PRIVATE BUILDINGS OF GJIROKASTRA MUNICIPALITY

Republic of Albania is a signatory party to the Energy Community Treaty (ECT). Similarly, it is a member of the Task Force on Energy Efficiency, established within ECT, in February 2008. In its efforts to approximate national legislation with EU legislation on energy efficiency, and in conformity with the requirements set forth by EC Directive 2006/32, the Government of Albania adopted Administrative Instruction No.2008/15 on Promotion of Utilization of Efficient Energy by Final Consumers and Energy Services. In applying the objectives set forth by ECT, MEI (METE) was obliged to prepare this National Action Plan on Energy Efficiency, titled Albanian National Energy Efficiency Action Plan (NEEAP).

NEEAP is a long-term document, prepared and implemented at the national level, covering the period between of 2009-2018. Albanian National Energy Efficiency Action Plan was prepared by using as a base a sample of National Action Plan on Energy Efficiency provided in detail in the approved National Strategy of Energy (prepared and approved on 2003 and updated on 2008). NEEAP contains indicative targets for energy saving in long-term, medium term and intermediate term (2009 – 2011) perspectives. Albania National Energy Efficiency Action Plan (NEEAP) represents the first long-term energy efficiency plan, covering the period between of 2009-2018. It also entails the EE Interim Plan 2009-2011.

The summarized target levels within each sector are provided in the table below. The distribution of this intermediate energy saving target, by sector is presented in
Table 1.

Table 1: Energy Saving Target by Sector

Sector	**%**
Residential	22
Services	19
Industry	25
Transport	31
Agriculture	3
Total Saving Potential	100%

Source: Albanian National Energy Efficiency Action Plan, MEI (METE)/ AKBN

CHAPTER 3: ACTUAL STATUS OF THE EXISTING AND NEW BUILDINGS STOCK OF GJIROKASTRA MUNICIPALITY

3.1 Actual Status of the Buildings Stock of Gjirokastra Municipality from Thermodynamic Point of View

Energy consumption in Residential Sector in Gjirokastra Municipality is divided in six major energy related services: space heating, air conditioning, domestic hot water, cooking, lighting, and electric appliances. Residential Sector occupies the second place in the consumption of total energy resources in this Municipality. As a consequence, it is important to know the consumption of electricity, fuel woods, LPG and kerosene for each of these six residential energy services and their energy efficiency potential.

The Public Service Sector in Gjirokastra Municipality has a traditional experience in the heat demand, based mainly on the old technology, installations and organization, but in some cases new schemes have been introduced. It should be underlined that space heating, domestic hot water and lighting for all sub-sectors is generally realized with a very low quality, due to old energy infrastructure in the public service institutions and lack of budget. In the Public Service Buildings are included: kindergartens (nursery schools), elementary schools, medium schools, universities, dormitories, small curative centers in communes, policlinics, hospitals, elder houses, orphanages, administrative buildings of communes, administrative buildings of municipalities, administrative buildings of district, bibliotheca, cinema and theatre, military buildings and police buildings.

Private Building Service Sector in Gjirokastra Municipality is a new experience aiming at a rapid introduction of modern technology, but improvements are needed regarding the efficient utilization. Private Service Sector has inherited some traditional repair-service and small shops/restaurants that have neither possibility nor demand for space heating and air conditioning. Meanwhile, in many services, the private sector has experienced modern and qualitative developments. This service group includes business categories such as hotels, restaurants, banks, tourist agencies, consulting and insurance offices, etc. as well as many parallel services with the public service such as education, culture, health, etc, aiming the maximal comfort.

3.2 Public and Private Buildings Stock Categories of Gjirokastra Municipality

Geographical location of private and public building is divided on the basis of the geographical division most applicable/practical for Albanian conditions and for the market analysis under consideration. Having this division into consideration consultants, based in the statistics of INSTAT and yearly reports of different publications, was found the share of them in each zone, as it is shown in the **Table 2**. One of the most important parameir for calculation of hot water energy demand is capacity of client/student/people in those building. Their capacity is based in the data gathered from INSTAT, different studies, ministries publication and yearly reports. Based in those data was found the share of them in each zone, as it is shown in the **Table 2**.

Table 2: All Service and Commercial Stock of Number of People Capacity (in Gjirokastra Municipality for the Year 2013)

Stock of Buildings	Gjirokastra Municipality
Newly build hotels	1838
Existing hotels in tourist sector	5903
Commercial building (business centres, shops, restaurants)	67653
Recreation facilities (swimming pools, sports centres)	698
Hospitals, residential homes (for the elderly) and nursing homes	2545
Schools, universities, dormitories, daily cares and kindergartens	8905
All Other Public Buildings	2349
Total	89892

3.4 Actual Energy Saving Law in New Buildings and Council of Ministers Decision Regarding Energy Building Code

Government approved the Decree No. 584, dated 02.11.2000 “On Energy Savings and Conservation in Buildings”, which provides for that in all buildings constructed for dwellings as well as other public and private buildings should be installed central heating systems using whatever kind of fuel except electricity. The decree envisages that the Councils of Territorial Adjustment of Municipalities will approve the construction permissions only after the project contains installation of central heating systems.

In the same line with the above decree is the Law No. 8937, date 12.09.2002 “On Heat Conservation in Buildings”. The aim of this law was to establish the necessary legal basis for setting up the rules and making mandatory actions for conservation of heat in buildings of whatever purpose they are built. According to this law, all buildings to be constructed after this law enters in force, shall observe the normative volumetrically coefficient of thermal losses (Gv), as well as provide for a thermal installation for central or district heating. Based on this law, with the proposal of the Ministry of Industry and Energy and the NAE, in 19 January 2003, the Council of Ministers approved the Technical Norms of Heat Conservation in Buildings, which are mandatory for all new construction in all sectors (e.g. residential, public and private buildings).

Article 5 of Law No. 8937, date 12.09.2002, "For Energy Saving in Dwellings and Public Buildings" is titled "Norms, regulations, design and constructions conditions, for heat generation and energy saving in dwellings and public buildings". This document serves on energy needs assessment for residential, social and individual buildings and defined request for thermal insulation of buildings. A criterion used for assessing insulation needs, which is provided in this Law, is the "transmission volume loss coefficient." The transmission volume loss coefficient Gvt represents the thermal energy lost in transmission (through doors, windows, floors, ceilings, walls, etc.) per cubic meir, per degree Celsius of temperature difference from indoor and outdoor temperatures for a composite building section (e.g. for a room or an apartment unit). The transmission volume loss coefficient values in dwellings and buildings Gvt must not exceed the normative values Gvtn, which are recommended in function of climate zone and dwelling characteristics; so:

$$Gvt < Gvtn$$

For the Republic of Albania Territory, the recommended prescriptive coefficient values of transmission volume loss coefficient Gvtn are presented in **Table 3** shown below:

Table 3: Transmission Volume Loss Coefficient Gvtn in W/m^3 ºC

S/V	ZONE BY DEGREE-DAYS					
	A		B		C	
	Degree-Day 900 – 1,500		Degree-Day 1,501 – 2,500		Degree-Day 2,501 – 3,000	
0.2	0.394	0.380	0.380	0.356	0.356	0.344
0.3	0.461	0.437	0.437	0.398	0.398	0.379
0.4	0.529	0.496	0.496	0.441	0.441	0.414
0.5	0.596	0.554	0.554	0.484	0.484	0.449
0.6	0.663	0.612	0.612	0.527	0.527	0.485
0.7	0.731	0.671	0.671	0.570	0.570	0.520
0.8	0.798	0.728	0.728	0.613	0.613	0.555
0.9	0.865	0.787	0.787	0.656	0.656	0.590
1	0.932	0.845	0.845	0.698	0.698	0.626

Source: Albanian Energy Building Code (January 2003)

CHAPTER 4: BASELINE AND ENERGY EFFICIENCY SCENARIO (WITHOUT EE AND WITH EE) FOR GJIROKASTRA MUNICIPALITY BUILDINGS STOCK

4.1 Energy Demand Forecast for Residential Buildings Stock by Services

The energy consumption of the residential sector is divided into six parts describe as much basic energy uses with widely differing characteristics: space heating, space cooling, water heating, cooking, lighting and electrical appliances. For carrying out the calculations of energy demand, for baseline scenario, and forecast the demand for each energy service related to particular characteristics of residential buildings stock, in the following session is describe the respective methodology.

4.1.1 Space Heating

For the estimation of the "real" energy demand for space heating, a model was prepared. This model calculates the "real" thermal losses, the required heating components (boiler, burner, heating panel, etc.)

Based on the above mentioned method and the household building stock have been calculated space heating energy demand for baseline scenario up to 2025. In **Figures 4** and **5** are shown the values for both scenarios in GWh.

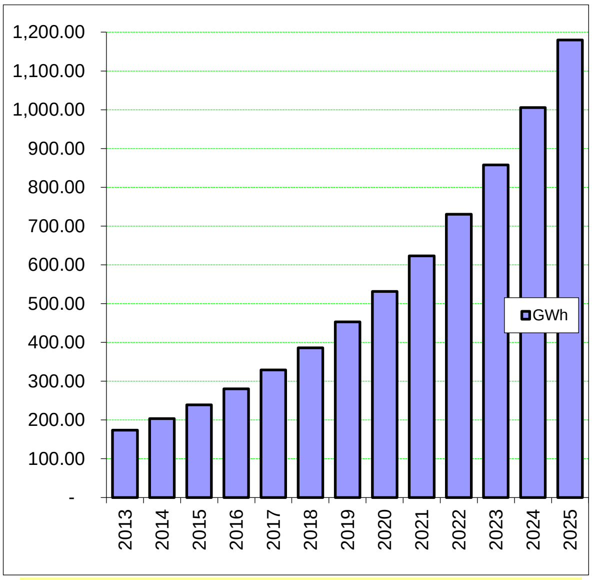


Figure 4: Space Heating Energy Demand of Gjirokastra Municipality according to Baseline Scenario (GWh)

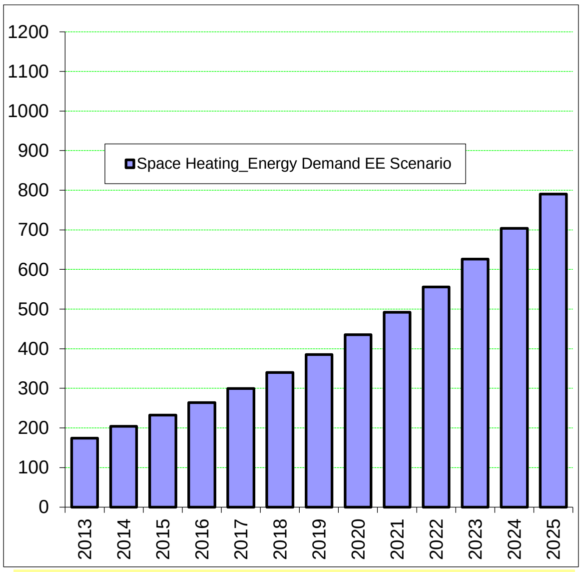


Figure 5: Space Heating Energy Demand of Gjirokastra Municipality according to Energy Efficiency Scenario (GWh)

At the following session will be described EE measures forecasted to be introduced to meet efficiently space heating services.

4.1.1.1 Refurbishment measures in existing residential buildings

Basic formula for calculating unitary energy savings by implementing this measure used in the prepared model is as following:

$$UFES = \frac{SHD_{init}}{\eta_{init}} - \frac{SHD_{new}}{\eta_{new}} \qquad [kWh/m^2 \; of \; useful \; floor \; area \cdot year] \quad \textbf{(1)}$$

Where:

SHD_{init} = Specific heating demand before the implementation of the refurbishment measure [kWh/m^2*year];

SHD_{new} = Specific heating demand after the implementation of the refurbishment measure [kWh/m^2*year];

η_{init}, η_{new} = Energy efficiency of the heating system before (init) and after (new) the refurbishment measure (seasonal).

The total energy savings achieved by the measure are calculated by summing up the savings of each refurbished buildings calculated by summing up the savings of each insulated building (**Figure 6,7**).

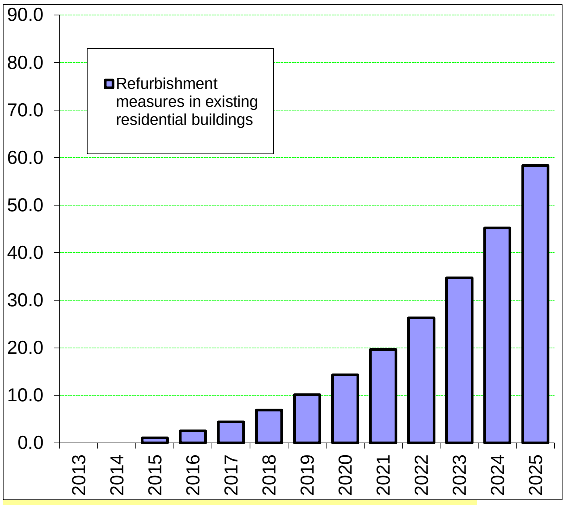


Figure 6: Space Heating Energy Savings by introducing Refurbishment Measures in existing Residential Buildings (GWh)

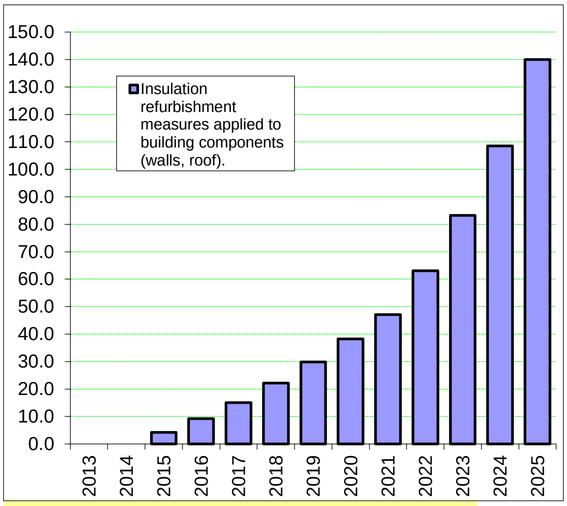


Figure 7: Space Heating Energy Savings by introducing Insulation Refurbishment Measures applied to Building Components (walls, roof) (GWh)

4.1.1.2 Refurbishment measures in existing residential buildings

Let analyse in detail all elements of above mentioned formula for Gjirokastra Municipality conditions and for residential building stock. Specific heating demand before the implementation of the refurbishment measure (SHD_{init}-[kWh/m^2*year]) has been determine for Albanian condition take into consideration Gjirokastra Municipality HDD and type of buildings explain before based on well known thermodynamic methods of defining heating losses. These values for each category of buildings are presented in the **Table 4**.

Table 4: Specific Heating Demand before the implementation of the Refurbishment Measure (SHDinit-[kWh/m²*year])

Building	Gjirokastra Municipality
Villa I	237.05
Villa II	251.27
Multi store prefabricated	291.57
Multi store solid bricks	215.72
Multi store bricks with holes	208.60
Weight Average for each Zone	236.39

Second important parameirs in the above mentioned formula are energy efficiency of the heating system before (init) and after (new) the refurbishment measure (seasonal) (η_{init} , η_{new}) and they are presented in the **Table 5**.

Table 5: Energy Efficiency of the Heating System before (init) and after (new) the Refurbishment Measure (η_{init} , η_{new})

Average Household Heating Boiler Efficiencies in Gjirokastra Municipality Market			
Energy efficiency	η_{init}	η_{new}	
Energy commodity	Baseline-Strategy of Energy	EE Class B	EE Class A
Electricity	90.00%	92.00%	94.00%
Wood	48%	80%	88%
LPG	68%	85%	94%
Coal	60%	80%	88%
Diesel	65%	83%	92%
Solar Energy	52%	58%	70%
Heating produced	85%	90%	94%
Natural Gas	70%	88%	95%
Heating Oil	64%	82%	90%
Kerosene	65%	84%	93%

Last parameter used in the above mentioned formula is: SHDnew - Specific heating demand after the implementation of the refurbishment measure [kWh/m²*year] and its values have been calculated from consultants for three cases:

1. Specific heating demand after the implementation of thermal insulation of outside walls;
2. Specific heating demand after the implementation of thermal insulation of roof/terrace;
3. Specific heating demand after the implementation of double/triple glass windows.

Those specific values for each type of buildings are presented in respective **Tables 6**, **7** and **8**.

Table 6: Specific Heating Demand after the implementation of Thermal Insulation of Outside Walls (SHDnew-[kWh/m²*year])

Building	Gjirokastra Municipality
Villa I	192.5
Villa II	204.0
Multi store prefabricated	236.8
Multi store solid bricks	175.2

Multi store bricks with holes	169.4
Weight Average for each Zone	192.0

Table 7: Specific Heating Demand after the implementation of Thermal Insulation of Roof/Terrace (SHDnew-[kWh/m²*year])

Building	**Gjirokastra Municipality**
Villa I	216.2
Villa II	229.2
Multi store prefabricated	265.9
Multi store solid bricks	196.7
Multi store bricks with holes	190.2
Weight Average for each Zone	215.6

Table 8: Specific Heating Demand after the implementation of Double/Triple Glass Windows (SHDnew-[kWh/m²*year])

Building	**Gjirokastra Municipality**
Villa I	216.2
Villa II	229.2
Multi store prefabricated	265.9
Multi store solid bricks	196.7
Multi store bricks with holes	190.2
Weight Average for each Zone	215.6

Based on the above mentioned figures and respective Formula (1) calculations have been carried out and in the **Table 9** are presented UFES (kWh/m² year) with introducing in the same time two measures: thermal insulation of walls and new efficient wood space heating boiler. In the same way will be calculated the UFES for all other possible combinations, as it is shown in the **Figure 13**.

Table 9: UFES with introducing in the same time Two Measures: Thermal Insulation of Walls and New Efficient Wood Space Heating Boilers -[kWh/m²*year])

Building	Gjirokastra Municipality
Villa I	275.11
Villa II	291.61
Multi store prefabricated	338.38
Multi store solid bricks	250.34
Multi store bricks with holes	242.09
Weight Average for each Zone	274.34

4.1.1.3 Insulation refurbishment measures applied to building components (walls, roof)

Basic **Formula (2)** for calculating unitary energy savings by implementing this measure used in the prepared model is as following:

$$UFES = \frac{(Uvalue_{init} - Uvalue_{new}) \cdot HDD \cdot 24 \cdot a \cdot b \cdot c}{1000} \quad [kWh/m^2 \; of \; renovated \; facade/envilope \cdot year] \quad \textbf{(2)}$$

<u>Where:</u>

$Uvalue_{init}$ and $Uvalue_{new}$ = U-value before (init) and after the refurbishment (new) W/m^2*K, use the values for thermal transmittance of the insulation materials.

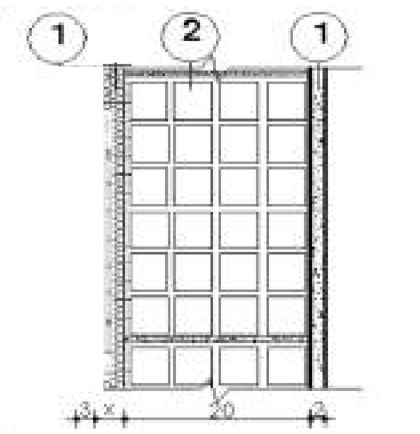
a = correction factor depending on the climatic zone of the building, with a=1, if no national correction value is available like in the case of Gjirokastra.
b = Correction factor depending on the heating system efficiency and energy source. This correction factor is the average efficiency of the stock of heating systems. With b= 0,95 for direct electric heating and 0,6 for fossil fuel boilers, if no national correction value is available like in the case of Gjirokastra.
c = Intermittency coefficient depending on not continuous operation of the heating system. With c= 0,5.
HDD = Heating degree-days [K*day/year].

The total annual energy savings in kWh per building and per year are calculated by multiplying the measured unitary annual energy savings per m² by the total insulated area (m^2) of the refurbished building shell (walls, roofs or windows). The total energy savings achieved by the measure are existing residential buildings.

4.1.1.4 Insulation refurbishment measures applied to residential building components (walls)

This section will shows calculations of unitary energy savings by implementing insulation refurbishment measures applied to building components (walls) into a residential building with the actual outside wall structure presented in the **Tables 10** (before) and **Table 11** (after) thermal insulation.

Table 10: Outside Wall composed from Hollow Brick Walls with data presented below

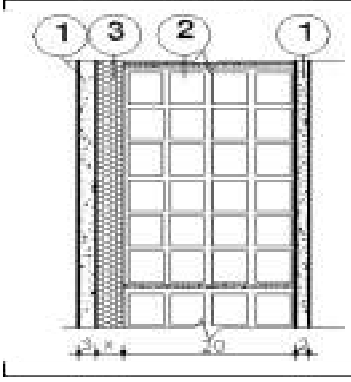


Hollow Brick Wall	No. Elem.	Layers Code	Description of Layer	δ cm	λ W/m°K	ρ kg/m³	R m²°K/W	k W/m²°K	c kJ/m°K
			Outdoor Air				0.043		
	1	5.3	External Plastering	3.00	0.900	1800	0.033	30.000	0.91
	2	3.11.7	Hollow Brick	20.00	0.520	1800	0.385	2.600	0.88
	1	5.3	Internal Plastering	2.00	0.900	1800	0.022	45.000	0.91
			Indoor Air				0.120		
			Universal				1.145	1.225	

Table 11: Outside Wall composed from Hollow Brick Walls and

Outside Thermal Insulation with data presented below

Hollow Brick Wall With Outside Thermal Insulation



No. Elem.	Layers Code	Description of Layer	δ cm	λ W/m°K	ρ kg/m³	R m²°K/W	k W/m²°K	c kJ/m°K
		Outdoor Air				0.043		
1	5.3	External Plastering	3.00	0.900	1800	0.033	[illegible]	0.91
2	3.11.7	Hollow Brick	20.00	0.520	1800	0.385	[illegible]	0.88
3	6.4	Polystyrene	2.00	0.037	25	0.541	[illegible]	1.34
1	5.3	Internal Plastering	2.00	0.900	1800	0.022	[illegible]	0.91
		Indoor Air				0.120		
		Universal				1.145	0.874	
3	6.4		4.00	0.037	25			
		Universal				1.685	[illegible]	
3	6.4		6.00	0.037	25			
		Universal				2.226	0.449	
3	6.4		8.00	0.037	25			
		Universal				2.766	0.361	

Based on the above mentioned figures and respective **Formula (1)** calculations have been carried out and in the **Table 12** are presented UFES (kWh/m2 year) with introducing of EE measure like thermal insulation of outside walls.

Table 12: UFES with introducing of EE Measures: Thermal Insulation of Outside Walls [kWh/m²*year])

Building	**Gjirokastra Municipality**
Villa I (with outside wall before and after EE measure	**10.35**

4.1.1.5 Substitution of existing windows in the residential buildings with double/triple glass windows

Basic formula for calculating unitary energy savings by implementing double/triple glass windows measure used in the prepared model is as following:

$$UFES = \frac{(Uvalue_{init} - Uvalue_{new}) \cdot HDD \cdot 24 \cdot a \cdot b \cdot c}{1000} \quad [kWh/m^2 \; of \; renovated \; facade/envilope \cdot year]$$

<u>Where:</u>

$Uvalue_{init}$ and $Uvalue_{new}$ = U-value before (init – old windows) and after the refurbishment (new windows) W/m²*K.

a, b, c same coefficients like above.

The formula provides for the evaluation of the annual energy savings resulting from substitution of the existing old windows with efficient windows with double and triple glass windows. The unitary annual energy savings (in kWh/m²*year) are based on the difference between the U-values before and after the implementation of the refurbishment measure.

This section will shows calculations of unitary energy savings by implementing double/triple glass windows measure to building into a residential building with the actual windows with one glass presented in the **Figures 13** and **14**.

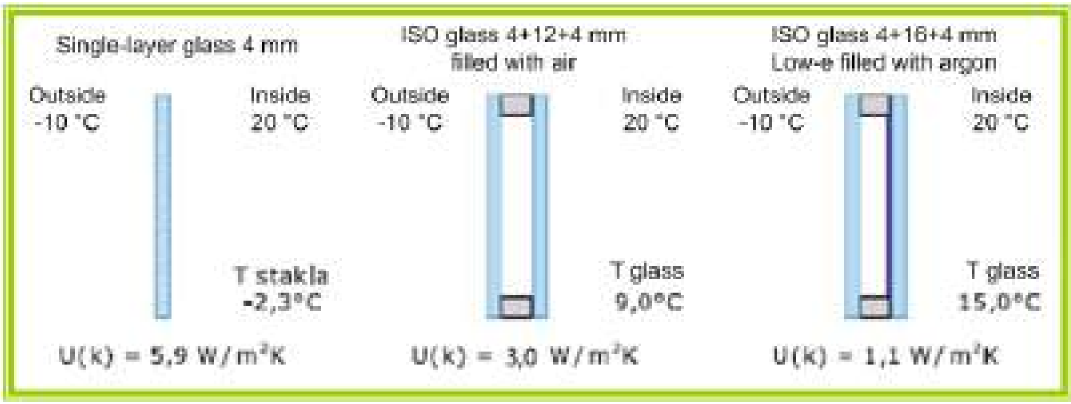


Figure 13: Main data for Windows with One and Double Glasses

Based on the above mentioned figures and respective formula (1) calculations have been carried out and in the **Table 15** are presented UFES (kWh/m^2 year) with introducing of EE measure like thermal insulation of outside walls (**Figure 8,9**).

Plastic frame - U=1.45 W/m^2 K

Aluminum frame - U=2.1 W/m^2 K

Figure 14: Main data for Windows with One and Double Glasses with Plastic and Aluminum Frame mostly used in Gjirokastra Municipality

Table 15: UFES with introducing of EE Measures: Thermal Insulation of the Outside Walls [kWh/m^2*year])

Building	**Gjirokastra Municipality**
Villa I (with plastic frame windows - U=1.45 W/m^2 K versus single glass windows)	**131.24**
Villa I (with Aluminum frame windows - U=2.1 W/m^2 K versus single glass windows)	**112.07**

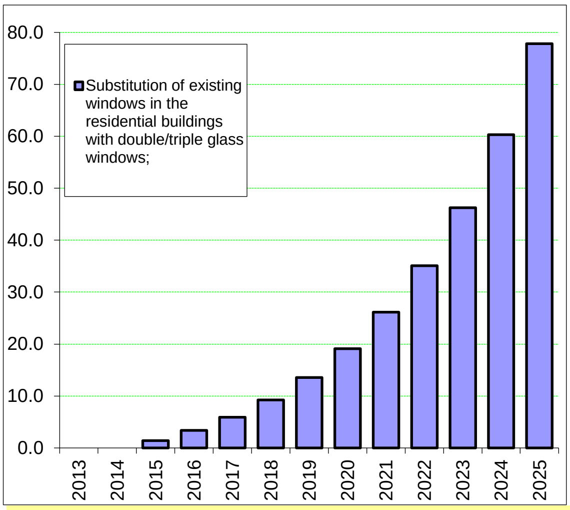


Figure 8: Space Heating Energy Savings by introducing substitution of Existing Windows in the Residential Buildings with Double/Triple Glass Windows (GWh)

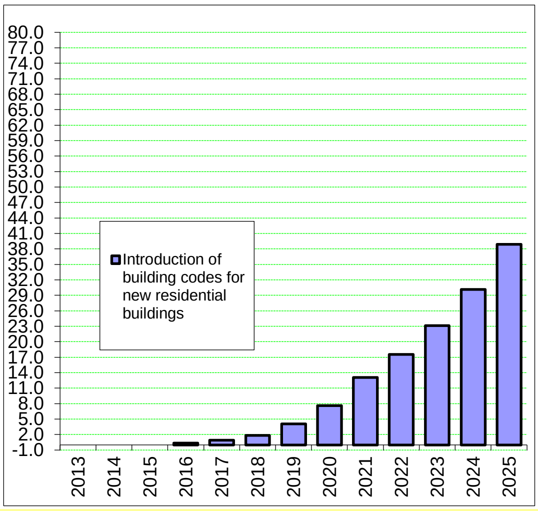


Figure 9: Space Heating Energy Savings by introducing of Building Codes for New Residential Buildings (GWh)

4.1.1.6 Introduction of building codes for new residential buildings

Rapid growth of electricity consumption in all economic sectors, especially in the residential and service sectors, made necessary the introduction of measures for electricity savings and promotion of use of other alternative energy sources, especially for heating and cooling purposes in building stock of all countries. For this reason was approved the Decree No. 584, dated 2.11.2000 “On Energy Savings and Conservation in Buildings”, which provides energy efficiency norms in all buildings constructed for dwellings as well as other public and private buildings (excluding industrial buildings) should be installed central heating systems using whatever kind of fuel except electricity. The Decree envisages that the Councils of Territorial Adjustment of each Municipality/Commune will approve the construction permissions only after the project contains detail engineering design of the installation of central heating systems (**Figure 9**).

The crucial point of the Energy Building Code is that volumetric heat transmission loss coefficient values in dwellings and buildings Gvt must not exceed the normative values Gvtn, which are recommended in function of climate zone and the dwelling characteristics; so:

$$Gvt \leq Gvtn$$

For the Gjirokastra Municipality, the recommended coefficient values of volumetric heat transmission loss coefficient Gvtn are as they are shown in the following **Table 16**:

Table 16: Volumetric Heat Transmission Loss Coefficient Gvtn in W/m3 ºC

S/V	Zone by degree-days					
	A		B		C	
	Degree days		Degree days		Degree days	
	600 – 1 300		1 301 – 2 300		2 301 – 3 000	
0,2	0,394	0,380	0,380	0,356	0,356	0,344
0,3	0,461	0,437	0,437	0,398	0,398	0,379
0,4	0,529	0,496	0,496	0,441	0,441	0,414
0,5	0,596	0,554	0,554	0,484	0,484	0,449
0,6	0,663	0,612	0,612	0,527	0,527	0,485
0,7	0,731	0,671	0,671	0,570	0,570	0,520
0,8	0,798	0,728	0,728	0,613	0,613	0,555
0,9	0,865	0,787	0,787	0,656	0,656	0,590
1	0,932	0,845	0,845	0,698	0,698	0,626

Interpolation of transmission volume loss coefficient Gvtr (according to CMD)

	Zone by degree-days								
	A			B			C		
	Degree days			Degree days			Degree days		
S/V	600	1 000	1 300	1 301	1 800	2 300	2 301	2 700	3 000
0,2	0,304	0,386	0,380	0,380	0,368	0,350	0,350	0,349	0,344
0,3	0,461	0,447	0,437	0,437	0,418	0,398	0,398	0,387	0,379
0,4	0,529	0,510	0,496	0,496	0,469	0,441	0,441	0,426	0,414
0,5	0,596	0,572	0,554	0,554	0,519	0,484	0,484	0,464	0,449
0,6	0,663	0,634	0,612	0,612	0,570	0,527	0,527	0,503	0,485
0,7	0,731	0,697	0,671	0,671	0,621	0,570	0,570	0,541	0,520
0,8	0,798	0,758	0,728	0,728	0,671	0,613	0,613	0,580	0,555
0,9	0,865	0,820	0,787	0,787	0,722	0,656	0,656	0,618	0,590
1	0,832	0,882	0,845	0,845	0,772	0,698	0,698	0,657	0,626

Interpolation of transmission volume loss coefficient Gvtr (for easy utilisation)

Basic formula for calculating unitary energy savings by implementing this measure (introduction of implementation of New Energy Building Code (to be prepared according the above mention Draft EE Law) used in the model prepared is as following:

$$UFES = \frac{SHD_{ini\,code}}{\eta_{init\,code}} - \frac{SHD_{new\,code}}{\eta_{new\,code}} \qquad [kWh/m^2 \cdot year] \qquad (5)$$

Where:

$SHD_{inicode}$ = Specific heating demand of building according to the initial building code in place [kWh/m²*year] and since there has been no one building code in Albania up to now this number will be equal with the specific number of baseline scenario for each building category.

$SHD_{newcode}$ = Specific heating demand of building according to the new building code which has been approved recently from the Ministry of Environment and Spatial Planning and is duty to be implemented [kWh/m²*year].

$\eta_{inicode}$, $\eta_{newcode}$ =Energy efficiency of the heating system in building according to the existing average situation (since there was not a building code in Albania (inicode)) and the new (newcode) building code.

The **Formula (5)** provides for the evaluation of annual energy savings derived from the introduction of a new building code with stricter requirements in relation to the building's heat demand.

Let's analyse in detail all elements of above mentioned formula for Gjirokastra Municipality's conditions and for residential building stock. Specific heating demand for actual building code ($SHD_{inicode}$-[kWh/m²*year]) are transform from standard values of volumetric heat losses coefficient of **Table 4** and **Table 22** into superficial heat losses coefficient for Gjirokastra Municipality and each category of buildings and they are presented in the **Table 16**.

Table 16: Specific Heating Demand before the implementation of the Refurbishment Measure SHDinit-[kWh/m²*year])

Building	Gjirokastra Municipality
Villa I	163.20
Villa II	172.99
Multi store prefabricated	200.74
Multi store solid bricks	148.51
Multi store bricks with holes	143.62
Weight Average for each Zone	162.74

As it was explain above New Draft Law on EE is requiring to amend the existing Energy Building Code and to prepare new norms. So, with this is related the last parameir used in the above mentioned formula $SHD_{newcode}$ and these values for different zones and different building are not yet analysis from any Albanian Energy Institution. Consultants have calculated approximately $SHD_{newcode}$, based on the cost benefit analysis as it is strongly suggested in EU Directive on Energy Performance of Buildings, in order to process with the calculation of **Formula 5**. Those specific values for each type of buildings are presented in **Table 17**.

Table 17: Specific Heating Demand after the implementation of the New Energy Building Code (SHDnewcode-[kWh/m²*year])

Building	Gjirokastra Municipality
Villa I	120.40
Villa II	172.99
Multi store prefabricated	200.70
Multi store solid bricks	148.51
Multi store bricks with holes	143.61
Weight Average for each Zone	143.91

Based on the above mentioned figures and respective Formula (5) calculations have been carried out and in the **Table 18** are presented UFES (kWh/m^2 year) with introducing in the same time two measures: New Energy Building Code and new efficient wood space heating boiler.

Table 18: UFES with introducing in the same time Two Measures: New Energy Building Code and New Efficient Wood Space Heating Boiler -[kWh/m²*year])

Building	Gjirokastra Municipality
Villa I	200.91
Villa II	163.82
Multi store prefabricated	190.09
Multi store solid bricks	140.64
Multi store bricks with holes	136.00
Weight Average for each Zone	175.45

4.1.1.7 Replacement of heating supply equipment in residential buildings

Basic formula for calculating unitary energy savings by implementing this measure used in the model prepared is as following:

$$UFES = \left(\frac{1}{\eta_{init}} - \frac{1}{\eta_{new}} \right) \cdot SHD \cdot A \qquad [kWh / unit \cdot year] \qquad (6)$$

Where:

η_{init} = Energy efficiency of the old heating supply equipment before the replacement (seasonal)

η_{new} = Energy efficiency of the new heating supply equipment (seasonal)

SHD = Specific heating demand [kWh/m^2*yr]

A = Average area of the space heated by the heating supply equipments (household, office etc.) [m^2]

The formula above provides for the evaluation of annual energy savings derived from the replacement or new installation of heating supply equipment in residential and tertiary buildings. The unitary annual energy savings are calculated on the basis of the change in efficiency of the heating system after its replacement, multiplied by the specific heat demand and the heated useful floor area (in kWh/unit*year) per building.

The total annual energy savings in kWh per building and per year has been calculated by summing up the unitary annual energy savings achieved by each unit of replaced heating supply equipment. The total energy savings achieved by the measure are calculated by summing up the savings achieved in each building.

4.1.1.8 Refurbishment measures in existing residential buildings

Let's analyse in detail all elements of above mentioned formula for Gjirokastra Municipality's conditions and for residential building stock. Specific heating demand before the implementation of the refurbishment measure (SHD_{init}-[kWh/m^2*year]) has been determine for Gjirokastra Municipality's condition take into consideration Gjirokastra Municipality HDD and type of buildings explain before based on well known thermodynamic methods of defining heating losses. These values for each zone of Gjirokastra Municipality and each category of buildings are presented in the **Table 19**. Second important parameters in the above mentioned formula are energy efficiency of the heating system before (init) and after (new) the refurbishment measure (seasonal) (η_{init}, η_{new}) and they are presented in the **Table 6**.

Based on the above mentioned figures and respective **Formula (6)** calculations have been carried out and in the table 19 are presented UFES (kWh/apartment year) with replacement of heating supply equipment (from old wood to LPG) in residential buildings. In the same way will be calculated the UFES for all other possible combinations (**Figures 10** and **11**).

Table 19: UFES with Replacement of Heating Supply Equipment (from Old Wood to LPG) in Residential Buildings -[kWh/apartment*year])

Building	Gjirokastra Municipality
Villa I	4589.92
Villa II	4865.31
Multi store prefabricated	5645.60
Multi store solid bricks	4176.83
Multi store bricks with holes	4039.13
Weight Average for each Zone	4551.97

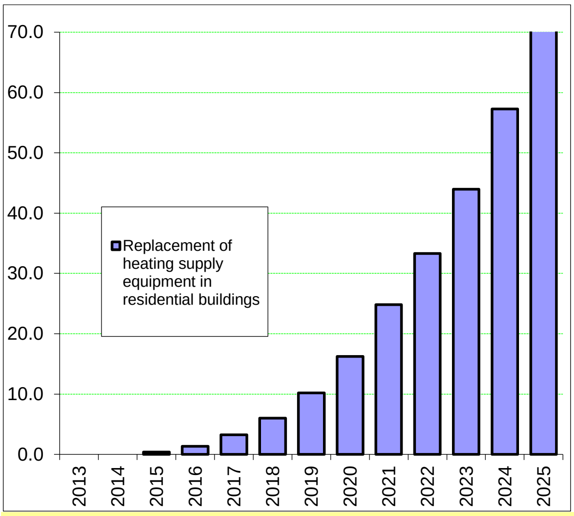


Figure 10: Space Heating Energy Savings by introducing Refurbishment Measures in existing Residential Buildings (GWh)

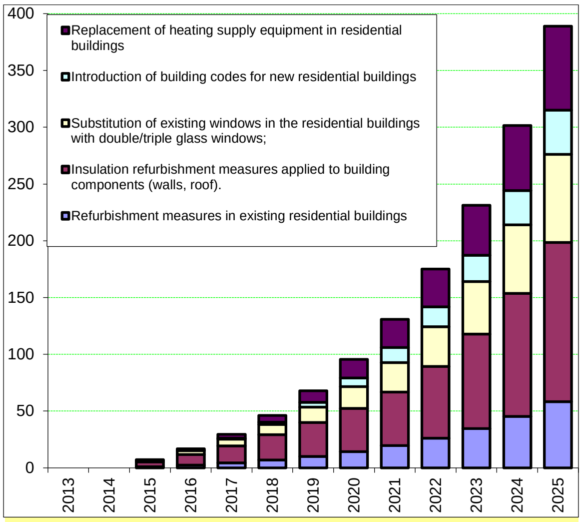


Figure 11: Space Heating Energy Savings by introducing Five Measures (GWh)

4.1.2 Water Heating

Analyzing in details the energy consumption for sanitary domestic hot water, model assumes that person at the household will take one -at least- shower every day. The hot water temperature is taken 40°C, hot water quantity for each person is taken 40 liters, hot water for personal hygiene is taken 10 liters, and for dish washing is assumed 10 liters.

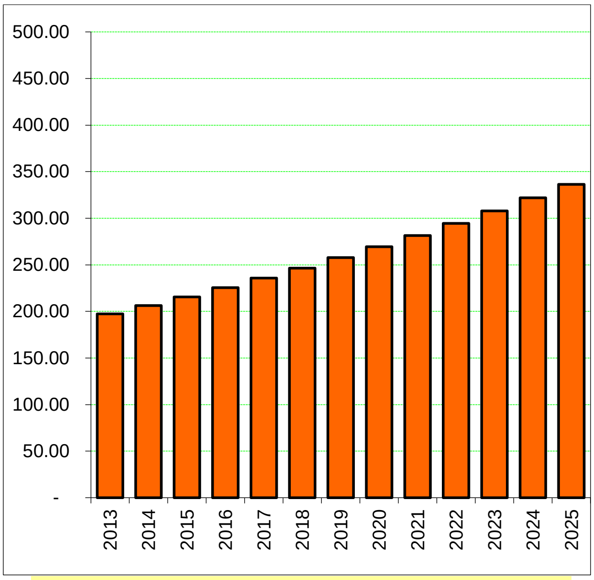


Figure 12: Water Heating Energy Demand according to Baseline Scenario (GWh)

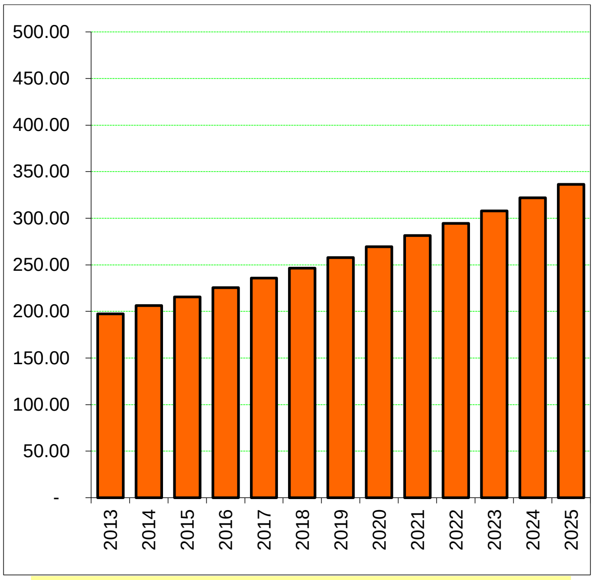


Figure 13: Water Heating Energy Demand according to Energy Efficiency Scenario (GWh)

Based on the average temperature of cold water for each month and on the number of persons for households are calculated the hot water needs for showers, personal hygiene, and dish washing. Also it is taken into consideration the washing of the clothes, sheets, and etc. Based on the above mentioned method and the household building stock have been calculated hot water heating energy demand for baseline scenario up to 2025. The values for both scenarios are shown in GWh in **Figures 12** and **13**.

4.1.2.1 Replacement of water heating in residential buildings

Basic formula for calculating unitary energy savings by implementing this measure used in the model prepared is as following:

$$UFES = \left(\frac{1}{\eta_{init}} - \frac{1}{\eta_{new}} \right) \cdot SWD \qquad [kWh / households \cdot year]$$

$$SWD = \frac{C_{hot\_water\_daily} \cdot 365 \cdot n_{persons/hholds} \cdot (t_{hot\_water} - t_{cold\_water}) \cdot c_{water} \cdot c_f}{1000} \qquad (7, 8)$$

$$[kWh / households \cdot year]$$

<u>Where:</u>

η_{init}, η_{new} = Energy efficiency of the old and the new water heating equipment. In the **Table 6** are shown the efficiencies of different categories of hot water boilers.

SWD =Specific hot water demand [kWh/household*year] has been calculated using the above mentioned formula and on the following figures:

365d = 365 days

$C_{hot\_water\_daily}$ = Volume of hot water for one person, for personal hygiene during a day equal to 50 liters/day (40 for showers, 4 for dish washing and 6 for personal hygiene)

$n_{persons/hhds}$ = Average number of persons in one household equal to 4

t_{hot_water} = The temperature of hot water for shower and personal hygiene equal to 40°C

t_{cold_water} = Cold water temperature (usually 15°C)

c_{water}= Specific heat of water =1kcal/kg*°C

c_f = Conversion factor 0,001163 kWh/kcal with 1 litre of water = 1 kg

$N_{oshowers}$ → Frequency of showers per person per day equal to 1

$C_{heat\ cap}$ → Heat capacity of water equal to 4.186 kJ/kg °C

T_{inlet} →Introduce data of Cold Water Temperature for each Prefecture of Albania including Gjirokastra Municipality presented in **Table 20**.

The formula above provides for the evaluation of annual energy savings derived from the replacement or new installation of water heating equipment in existing residential buildings. The unitary annual energy savings (in kWh/building*year) are calculated on the basis of the difference in the energy efficiency between before and after the replacement of the water heater, multiplied by the specific hot water demand is shown in the **Table 21**. The total annual energy savings [kWh/year] are calculated by summing up the unitary annual energy savings by the number of replaced water heater units.

Table 20: Cold Water Temperature for each Prefecture of Albania

Prefectures of Albania: Average Cold Water Temperature [°C]												
Month	1	2	3	4	5	6	7	8	9	10	11	12
	Berati	Dibra	Durresi	Elbasani	Fieri	Gjirokastra	Korca	Kukesi	Lezha	Shkodra	Tirana	Vlora
Jan	11.3	8.0	11.8	10.8	11.9	10.5	7.6	8.8	11.3	11.0	11.2	12.0
Feb	10.3	7.3	10.8	9.8	10.8	9.6	6.9	8.0	10.3	10.0	10.1	10.9
Mar	11.6	8.4	11.5	10.8	11.9	10.5	7.6	8.8	11.3	11.0	11.3	12.0
Apr	13.3	9.4	13.9	12.8	14.0	12.4	9.0	10.9	13.8	12.9	13.2	14.2
May	15.4	10.9	16.0	14.7	16.2	14.3	10.7	11.9	15.4	14.9	15.4	16.3
Jun	17.4	12.3	18.2	16.6	18.3	16.2	11.7	13.5	17.4	16.8	17.5	18.5
Jul	19.4	13.7	20.3	18.6	20.4	18.1	13.0	15.1	19.4	18.8	19.2	20.6
Aug	21.5	15.2	22.4	20.5	22.5	20.0	14.4	16.6	21.9	20.8	21.1	22.8
Sep	19.4	13.7	20.3	18.6	20.4	18.1	13.0	15.1	19.6	18.8	19.2	20.6
Oct	17.4	12.3	18.2	16.6	18.3	16.2	11.7	13.5	17.4	16.8	17.6	18.5
Nov	15.4	10.9	16.0	14.7	16.2	14.3	10.7	11.9	15.4	14.9	15.4	16.3
Dec	13.3	9.4	13.9	12.8	14.0	12.4	9.0	10.3	13.8	12.9	13.0	14.2
AVG	**15.5**	**11.0**	**16.1**	**14.8**	**16.2**	**14.4**	**10.4**	**12.0**	**15.6**	**15.0**	**15.4**	**16.4**

Table 21: UFES with Replacement of Hot Water Heating Supply Equipment (from Inefficient Electrical Boiler to Efficient Boiler class A) in Residential Buildings - [kWh/apartment*year])

Building	Gjirokastra Municipality
One household	150

4.1.2.2 Solar water heating in residential buildings

Now, that we know the energy demand of one household we can analyze the energy supply from SWH system, we can define the energy need from back-up system, as a difference between the energy demand and the energy supply. On this base we can define the annual energy supply from the SWH system and the annual energy need from the back-up system. As SWH system for the calculation is used the most spread one (produced also in Gjirokastra Municipality) with an average efficiency of 60%.

Optimization of the solar collector area is carried out based on the optimum value of the NPV financial indicator versus solar collector area. NPV indicator is calculated based on the first investment (which consider total investment of solar water heating system including installation cost, running cost (labor cost, O&M cost, back-up energy cost) and profits which are coming from substituting electricity or diesel/LPG/fuel oil (in the case without project hot water is going to be secure from electrical boiler or fuel oil boiler (**Figure 14**). Based in this analysis the optimal area of SWH system is going to be 3.5 m^2.

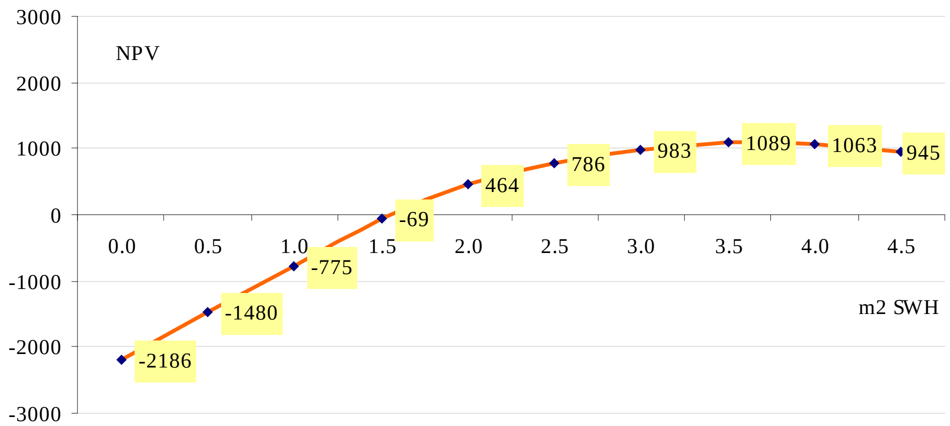


Figure 14: NPV versus Solar Collector Area for Household Consumer (Euro)

Basic formula for calculating unitary energy savings by implementing this measure used in the model prepared is as following:

$$UFES = \left(\frac{USAVE}{\eta_{stock\_average\_heating\_system}} \right) \qquad [kWh/m^2 \cdot year] \qquad (9)$$

USAVE = Average yearly savings per m^2 of solar collector, representing the average heat production per m^2 of solar collector [kWh/m^2]. For the above mentioned case this value is 2247 kWh/(3.5 m^2) year and for 1 m^2 solar system equal to 622 kWh/(1 m^2) year (for average conditions of Gjirokastra Municipality).

$\eta_{\text{systemheating average stock}}$ = Efficiency of the average stock water heating systems. Let's analyze this parameter in the following. Actually water heating is secure almost 81% from electricity, 8% LPG and 7% from fuel wood and 4% from solar energy. Under such conditions efficiency of the average stock water heating systems will be 75.16%.

The formula above provides for the evaluation of annual energy savings derived from the installation of solar collector for water heating in existing or new residential buildings (**Table 22**). The unitary annual energy savings are calculated on the basis of the average annual energy savings per m^2 of solar collector, considering the average efficiency of the water heating systems stock in the reference year, for either new or existing buildings (in kWh/m^2*year). The total annual energy savings [kWh/year] are calculated by multiplying the unitary annual energy savings by the total installed area in m^2 of solar collectors.

Table 22: UFES Solar Water Heating in Residential Buildings [kWh/m^2*year])

Building	Gjirokastra Municipality
One m^2	465

4.1.3 Cooking

The household building consumes Electricity, fuel wood, LPG to meet cooking energy demands during the whole year. Based in the above mentioned analyses the following assumption has been used to calculate cooking energy demand on the main parameter: Energy Intensity for cooking: 16-20 kWh/(month persons). Based on the model prepared for the calculation for energy demand it was calculated, taking into consideration an average efficiency of different stoves and without taking any measure for energy efficiency. Based on the above mentioned method and the household building stock have been calculated cooking energy demand for baseline scenario up to 2025. The values for both scenarios are shown in GWh in **Figures 15** and **16**.

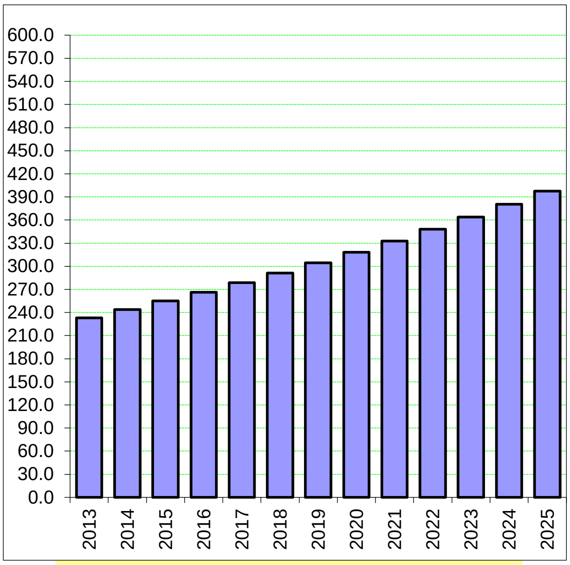


Figure 15: Cooking Energy Demand according to Baseline Scenario (GWh)

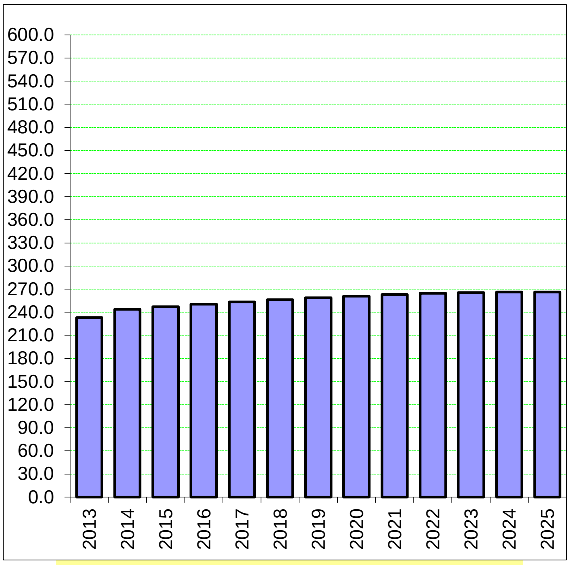


Figure 16: Cooking Energy Demand according to Energy Efficiency Scenario (GWh)

4.1.3.1 Replacement of household cooking stoves in residential buildings

Basic formula for calculating unitary energy savings by implementing this measure used in the model prepared is as following:

$$UFES = AEC_{reference\,year\,stock\,averag} - AEC_{reference\,market\,promoted\,energy\,class} \quad [kWh/stove \cdot year] \quad (10)$$

Where:

$AEC_{\text{reference year stock cooking stoves average}}$ = Annual energy consumption of the stock in the reference year (2006-7-8) [kWh/unit*year]. This parameter has been calculated on the average for the year (2006-7-8) and it is [kWh/unit*year], based on the calculation carried from consultants and presented on baseline scenario, on section 4.1.3. Total yearly value is 1,246 kWh/unit*year with an average efficiency of stock of cooking stoves of 81.22%.

Above mentioned methodology suggest that in formula 10, $AEC_{\text{reference market promoted cooking stoves energyclass}}$ = Annual energy consumption of the appliances promoted by the measures and programmes under the EUROPEAN UNION (2008-9, for early action) [kWh/unit*year]. As it was known, it is much better to use Gjirokastra value, because they represent much better consumer behavior compare with orientation value. Consultant have calculated Gjirokastra values based on the new technologies on the efficiency of $\eta_{\text{systemheating average stock}}$.

Efficiency of the average stock of stoves systems for cooking preparation on Gjirokastra Municipality households has been based on database of consultants. Actually cooking is secure almost 61% from electricity, 21% LPG and 18% from fuel wood. Under such conditions efficiency of the average stock stoves systems for cooking will be 93.47%.

The formula above provides for the evaluation of annual energy savings derived from the replacement of existing household cooking stoves appliances with new more energy efficient ones. The unitary annual energy savings for household cooking stoves are calculated based on the difference between the annual energy consumption of the reference year stock average and the annual energy consumption of the appliances promoted by the measures and programmes.

$$UFES = \frac{1246}{81.22\%} - \frac{1246}{93.47\%} = 200.33\ [kWh / stove \cdot year] \qquad (11)$$

The total annual energy savings in kWh per cooking stove appliance type and per year are calculated by multiplying the unitary annual energy savings by the number of energy efficient appliances units sold.

4.1.4 Lighting

The required lighting for the building can be realized according to international or national standards and in the case of this model are used the European standards. For a certain lighting intensity, the required power depends on the lighting equipment efficiency (types of lamps, incandescent or efficient etc.), the way the lighting system has been designed and its maintenance. The lighting hours are related to the space occupation, the day lighting, and the way of controlling the lighting equipment.

The natural lighting gives an important contribution for lighting to an internal area and can provide sufficient lighting for a defined period during the day, avoiding the use of the artificial lighting. The aspects of natural lighting depend, firstly, on the form and the orientation of the building and its windows. The main influencing factors that should be taken into account for evaluating the efficiency of energy used for lighting are: natural lighting, types of lamps, commanding and controlling, illuminator type, and maintenance. In the household buildings, the calculations related to the electricity consumption for lighting are based upon the number of lamps, the average lamp power and the average time of their operation, during the summer and winter periods. Based on the above mentioned method and the household building stock have been calculated lighting energy demand for baseline scenario up to 2025. The values for both scenarios are shown in GWh in **Figures 17** and **18**.

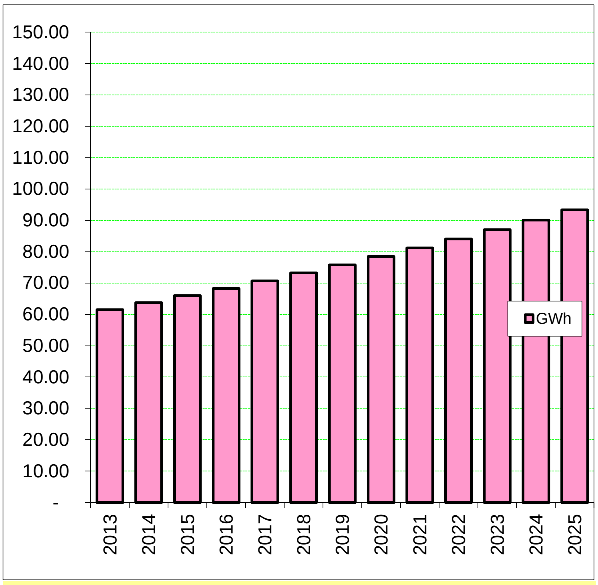


Figure 17: Lighting Energy Demand according to Baseline Scenario (GWh)

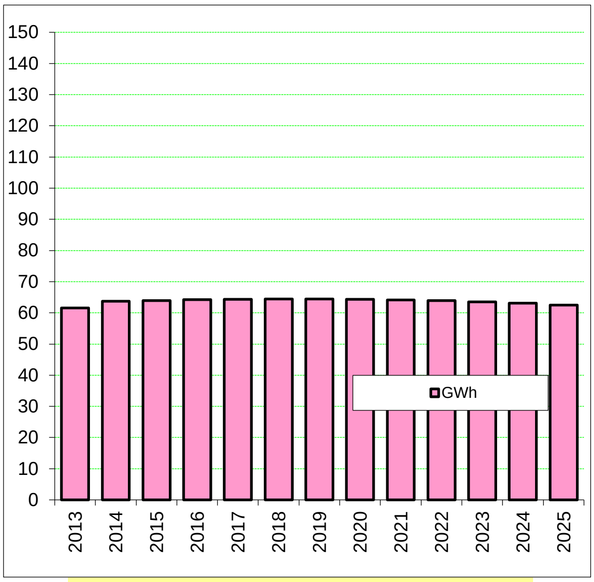


Figure 18: Lighting Energy Demand according to Energy Efficiency Scenario (GWh)

4.1.4.1 Replacement or new installation of lamps in residential buildings

Basic formula for calculating unitary energy savings by implementing this measure used in the model prepared is as following:

$$UFES = \left(\frac{P_{STOCK\_AVERAGE} - P_{BEST\_MARKET\_PROMOTED}}{1000} \right) \cdot F_{rep} \cdot n_h \quad [kWh/unit \cdot year] \quad (12)$$

<u>Where:</u>

$P_{STOCK\_AVERAGE}$ = Power average of the existing lighting bulbs in households [W]. Total number bulbs will be 8 for each household and their average capacity is 75 W, or 8*75=0.6 kW.

$P_{BEST\_MARKET\_PROMOTED}$ = Power of the market promoted efficient bulb [W]. The best offer bulbs for time being in Gjirokastra are 18 W each and total one is 8*18=0.144 kW.

n_h = Number of operating hours for the first zone as average is 3.5 hours, for the second one is 4 hours and for the third zone is 5.0 hours.

F_{rep} = Correction factor taking into consideration that a proportion of bulbs sold will not immediately replace existing bulbs; F_{rep}• 1

The formula above provides for the evaluation of annual energy savings derived from the replacement of lamps with new more energy efficient ones or installation of new lamps. The unitary annual energy savings (in kWh/unit*year) for lamp replacement are calculated by the difference between the lamp stock average power consumption in the reference year ('before' situation) and the power of the efficient lamps promoted by the measures and programmes ('after' situation = year of promotion) (**Table 23**). In case of additional lamps the market average power consumption in the reference year shall be used for the before situation.

Table 23: UFES for Lamps replacement of Household Buildings [kWh/m^2*year])

Building	Gjirokastra Municipality
One household	733.22

The total annual energy savings in [kWh/year] are calculated by multiplying unitary annual energy savings by the number of efficient light bulbs sold or installed under the measures and programmes for residential use.

4.1.5 Electrical Appliances

The electric appliances include: radio, TV, videos, washing machines, refrigerators, tape recorder, computers and water pumps. Based in the above mentioned analyses the following assumption has been used to calculate electrical appliance energy demand on the main parameter: Energy Intensity for Electrical Appliances: 10-15 kWh/m^2. Based on the above mentioned method and the household building stock have been calculated electrical appliances energy demand for baseline scenario up to 2025. The values for both scenarios are shown in GWh in **Figures 19** and **20**.

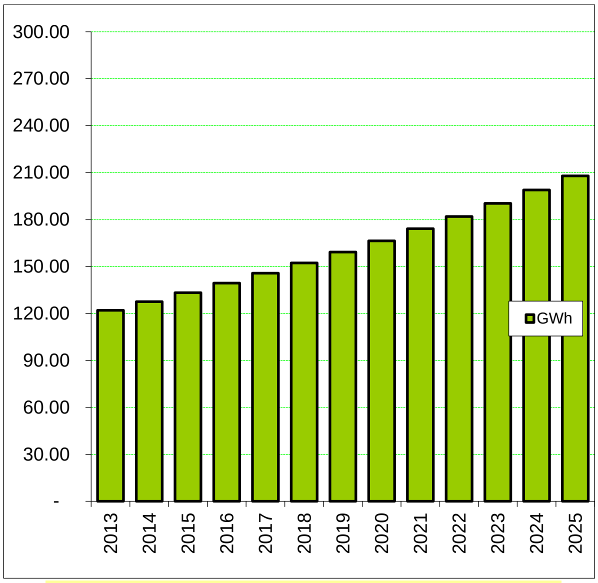


Figure 19: Electrical Appliances Energy Demand according to Baseline Scenario (GWh)

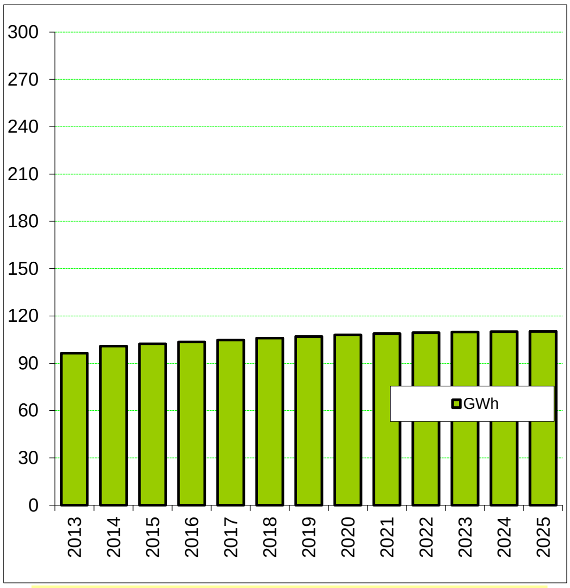


Figure 20: Electrical Appliances Energy Demand according to Energy Efficiency Scenario (GWh)

4.1.5.1 Replacement or new electrical appliances (refrigerators & freezers appliances, washing machines, dishwashers, televisions, etc.) in residential buildings

Basic formula for calculating unitary energy savings by implementing this measure used in the model prepared is as following:

$$UFES = AEC_{reference\ year\ stock\ averag} - AEC_{reference\ market\ promoted\ energy\ class} \quad [kWh / unit \cdot year] \quad (13)$$

Where:

AEC $_{reference\ year\ stock\ average}$ = Annual energy consumption of the stock in the reference year [kWh/unit*year]

AEC $_{reference\ market\ promoted\ energyclass}$ = Annual energy consumption of the appliances promoted by the measures and programmes under the EUROPEAN UNION [kWh/unit*year]

AEC $_{reference\ year\ stock\ refregerators\ average}$ = Annual energy consumption of the stock in the reference year (2006-7-8) [kWh/unit*year]. This parameter has been calculated on the average for the year (2006-7-8) and it is 950 [kWh/unit*year], based on the calculation carried from consultants and presented on baseline scenario, on section 4.1.6. Value for washing machine is 777 [kWh/unit*year].

Above mentioned methodology suggest that in formula 10, $AEC_{\text{reference market promoted cooking stoves energyclass}}$ = Annual energy consumption of the appliances promoted by the measures and programmes under the EUROPEAN UNION (2008-9, for early action) [kWh/unit*year]. As it was known, it is much better to use Gjirokastra value, because they represent much better consumer behavior compare with orientation value. Consultants have calculated Gjirokastra values based on the new technologies (with A labels') on the efficiency of refrigerators and washing machine respectively 750.5 [kWh/unit*year] and 421.2 [kWh/unit*year].

The formula above provides for the evaluation of annual energy savings derived from the replacement of existing refrigerator/washing machine appliances with new more energy efficient ones. The unitary annual energy savings are calculated based on the difference between the annual energy consumption of the reference year stock average and the annual energy consumption of the appliances promoted by the measures and programmes.

$$UFES_{refrigerator} = 950 - 750.5 = 199.5\ [kWh / refrigerator \cdot year]$$

$$UFES_{washing\ machine} = 777 - 421.2 = 355.8\ [kWh / washing\ maschine \cdot year]$$

The total annual energy savings in kWh per appliance type and per year are calculated by multiplying the unitary annual energy savings by the number of energy efficient appliances units sold.

4.1.6 Air Conditioning

Energy demand for cooling purposes was calculated upon the Gv and the cooling degree-days for Gjirokastra Municipality. Cooling degree-days are taken approximately based on the average outside air temperature for summer season. Based in the above mentioned analyses the following paraMEIrs have been used for modelling to calculate cooling heating energy demand (**Figures 21** and **22**):

- Number of Cooling Days;
- Volumetric Heat Losses Coefficient;
- Cooling hours;
- Cooling space/volume.

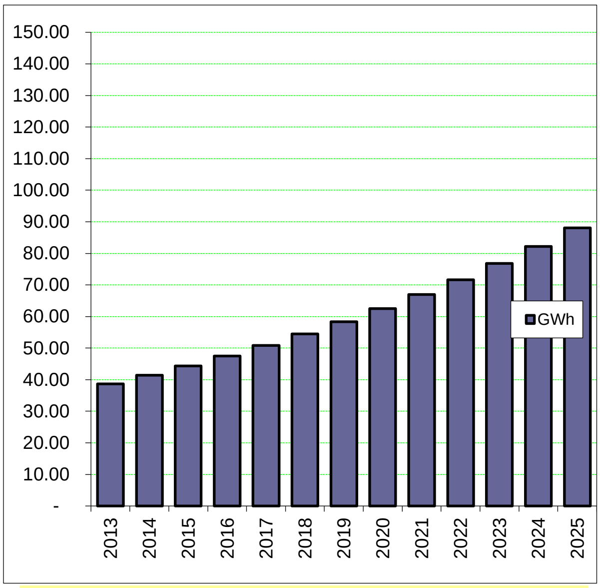


Figure 21: Air Conditioning Energy Demand according to Baseline Scenario (GWh)

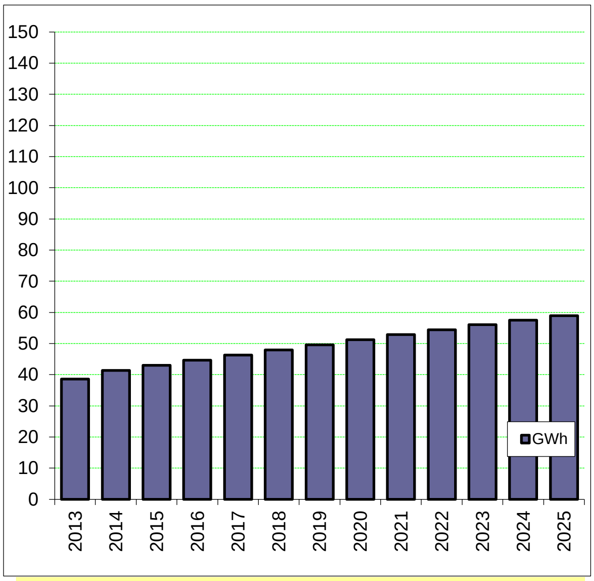


Figure 22: Air Conditioning Energy Demand according to Energy Efficiency Scenario (GWh)

4.1.6.1 Installation or replacement of air conditioning split system (<12kW) in residential buildings

Basic **Formula (14)** for calculating unitary energy savings by implementing this measure used in the model prepared is as following:

$$UFES = \left(\frac{1}{EER_{average}} - \frac{1}{EER_{best\_perf\_on\_market}} \right) \cdot P_{fn} \cdot n_h \qquad [kWh/unit \cdot year] \; (14)$$

with:

$n_h = n_{sh} \cdot f_u$

<u>Where:</u>

EER = Energy efficiency ratio of the equipment: (supplied cooling power) / (electric power of the equipment) average.

EER = Seasonal energy efficiency ratio of the reference equipment; Based on some survey carry out with different AC supplier average value for this parameter is 3.2 for Gjirokastra Municipality’s households.

$n_{market\ onperf}$ EER_{best} = Seasonal energy efficiency ratio of the high-efficiency substituting equipment. Based on some survey carry out with different AC supplier the best that market offer for AC equipment for this parameter is 4.6.

P_{fn} = Nominal cooling power of the equipment [kW]. By taking into consideration one split unit for a room with 20 m^2 or 60 m^3 its capacity will be 3.75 kW

n_h = Annual operation hours at full power = 4 months *30days*6 hours/day=720 hours

n_{sh} = Annual switch-on hours – equal with 1 for Gjirokastra condition.

u_f = Part-load factor (suggested default value: 51% based on some simple calculation carry out from consultants)

By substituting the above mentioned values, UFES will be:

$$UFES = \left(\frac{1}{3.2} - \frac{1}{4.6}\right) \cdot 3.75 \cdot 720 \cdot 1 \cdot 0.51 = 109.13[kWh / unit \cdot year]$$

The formula above provides for the evaluation of annual energy savings derived from the installation or the replacement of air conditioning split systems in residential and tertiary buildings. The unitary annual energy savings are calculated on the basis of the improvement of the energy efficiency ratio (EER) of the air conditioning equipment, normalized by nominal cooling power of the equipment and the annual operation hours (in kWh/unit*year). The total annual energy savings achieved by the measure [kWh/year] are calculated by summing up the unitary annual energy savings of all replaced or newly installed air-conditioning units.

4.1.7 All Energy Services

Based on the above mentioned method and the household building stock have been calculated all energy services demand for baseline scenario up to 2025. The values for both scenarios are shown in GWh in **Figures 23** and **24**. After calculation of energy demand for all end-users, it is possible to calculate also the whole energy demand for household sector. **Figures 25** to **26** are presenting energy demand forecasts for each energy service for both scenarios. (Figure 27,28,29,30 dhe 31)

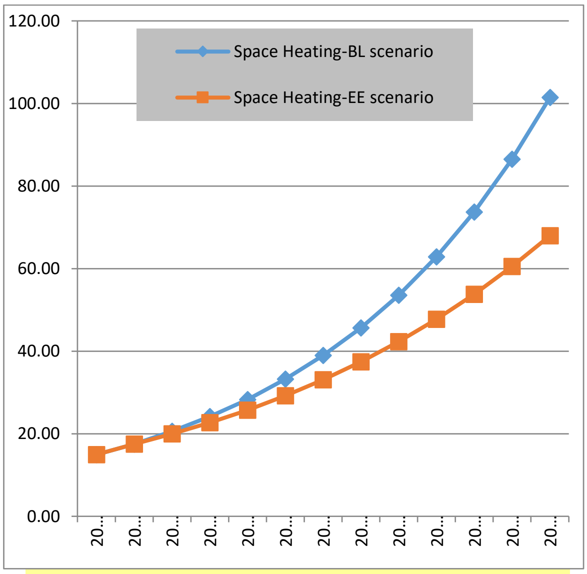


Figure 23: Space Heating Energy Demand according to Baseline and EE Scenarios (GWh)

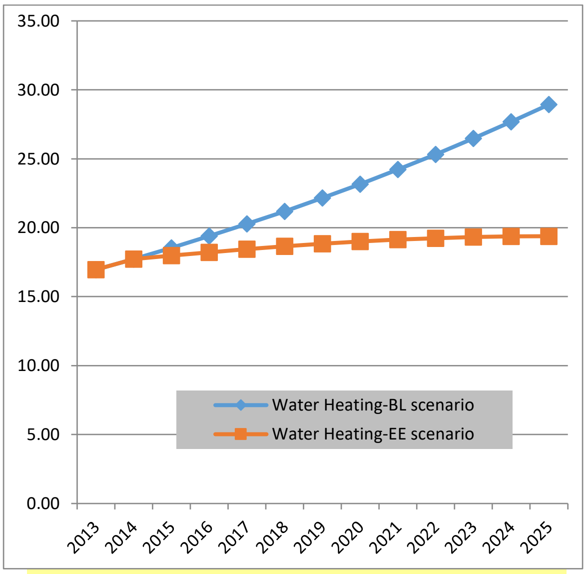


Figure 24: Water Heating Energy Demand according to Baseline and EE Scenarios (GWh)

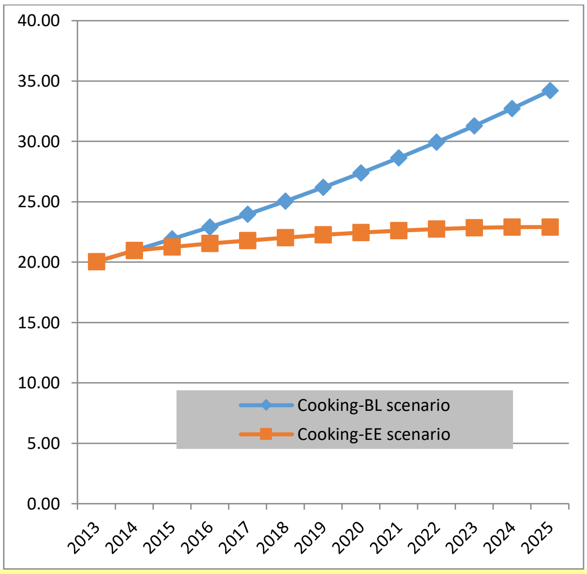


Figure 25: Cooking Energy Demand according to Baseline and EE Scenarios (GWh)

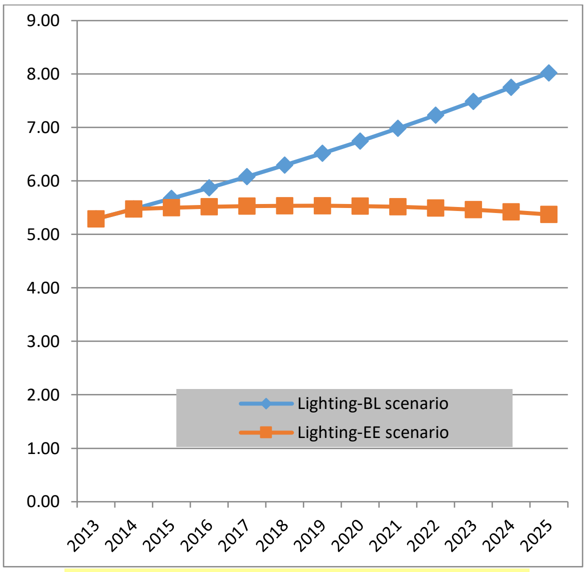


Figure 26: Lighting Energy Demand according to Baseline and EE Scenarios (GWh)

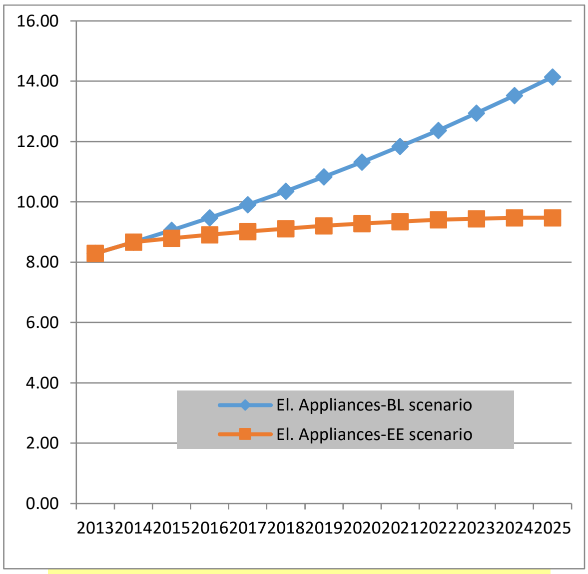


Figure 27: Appliances Energy Demand according to Baseline and EE Scenarios (GWh)

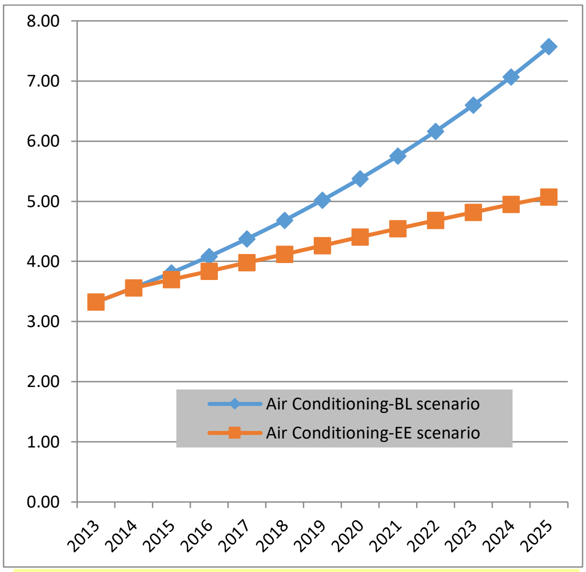


Figure 28: AC Energy Demand according to Baseline and EE Scenarios (GWh)

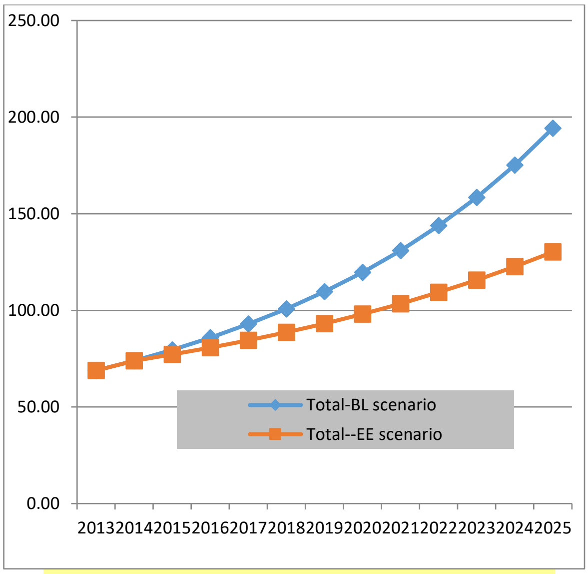


Figure 29: All Energy Services Demand according to Baseline and EE Scenarios (GWh)

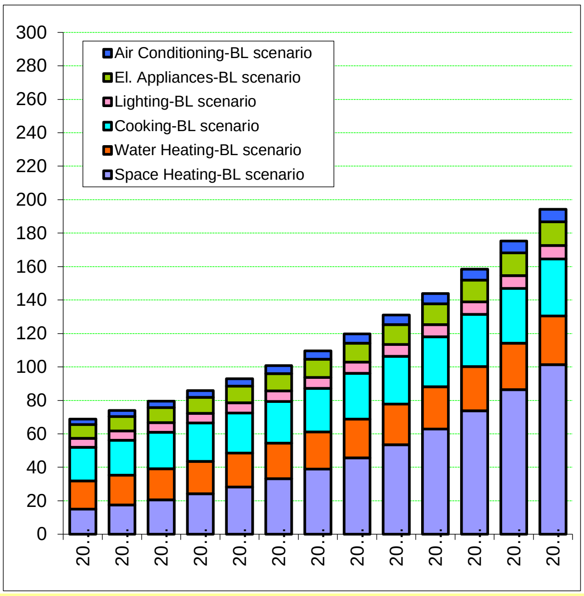


Figure 30: Energy Demand for all end-users of Household Sector according to Baseline Scenario

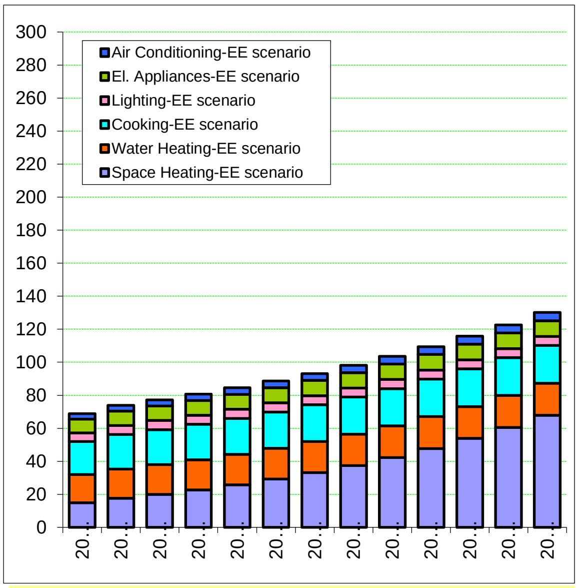


Figure 31: Energy Demand for all end-users of Household Sector according to Energy Efficiency Scenario

4.2 Energy Demand Forecast for Public and Private Service Buildings Stock by Energy Services

The energy consumption of the Public and Private Service Buildings Stock is divided into six parts describe as much basic energy uses with widely differing characteristics: space heating, space cooling, water heating, cooking, lighting and electrical appliances. For carrying out calculations of energy for this group of buildings the model has been prepared taking into consideration some characteristics of public buildings stock, as following in the below sections.

4.2.1 Space Heating

Methodology used for define baseline scenario is almost the same like in the household's buildings stock with some particularities which are considered on the preliminary calculations:

- Building volumes
- Thermal losses
- The transmission volume loss coefficient Climate data: Based on average outside temperature are defined the heating degree days for each Municipality of Gjirokastra.
  .

Based on the above mentioned method and the Public and Private Service Building Stock (PPSBS) have been calculated space heating energy demand for baseline scenario up to 2025. The values for both scenarios are shown in GWh in **Figures 32** and **33**.

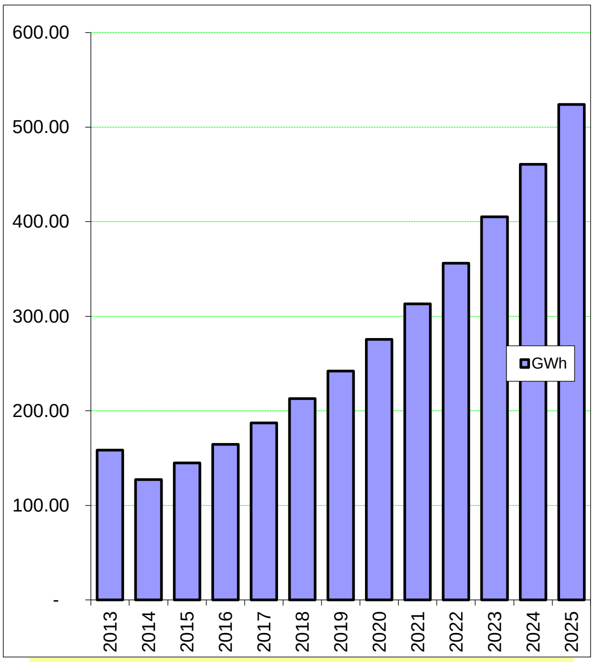


Figure 32: Space Heating Energy Demand according to Baseline Scenario (GWh)

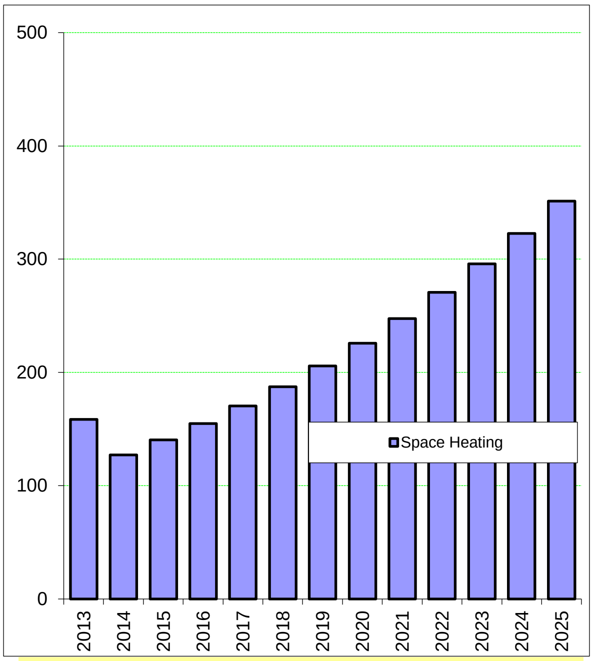


Figure 33: Space Heating Energy Efficiency Demand according to Baseline Scenario (GWh)

4.2.1.1 Refurbishment measures in existing Public and Private Service Buildings

Let's analyse in detail all elements of above mentioned formula for Gjirokastra Municipality's conditions and for public and commercial building stock. Specific heating demand before the implementation of the refurbishment measure (SHD_{init}-[kWh/m^2*year]) has been determine for Gjirokastra Municipality's conditions for this category of buildings. These values for each category of buildings are presented in the **Table 24**.

Table 24: Specific Heating Demand before the implementation of the Refurbishment Measure (SHDinit-[kWh/m^2*year])

Building	Gjirokastra Municipality
Recreation facilities (swimming pools, sports centres)	257.79
Newly build hotels	271.36
Existing hotels in tourist sector	287.64
Hospitals, residential homes (for the elderly) and nursing homes	333.77
Commercial building (business centres, shops, restaurants)	246.94
Schools, universities, dormitories, daily cares and kindergartens	106.22
All Other Public Buildings	238.80
Weight Average for each Zone	208.83

Second important parameters in the above mentioned formula are energy efficiency of the heating system before (init) and after (new) the refurbishment measure (seasonal) (η_{init}, η_{new}) and they are presented in the **Table 25**.

Table 25: Energy Efficiency of the Heating System before (init) and after (new) the Refurbishment Measure (η_{init}, η_{new})

Average Household Heating Boiler Efficiencies in Gjirokastra Market			
Energy efficiency	η_{init}	η_{new}	
Energy commodity	Baseline-Strategy of Energy	EE Class B	EE Class A

Electricity	90.00%	92.00%	94.00%
Wood	48%	80%	88%
LPG	68%	85%	94%
Coal	60%	80%	88%
Diesel	65%	83%	92%
Solar Energy	52%	58%	70%
Heating produced	85%	90%	94%
Natural Gas	70%	88%	95%
Heating Oil	64%	82%	90%
Kerosene	65%	84%	93%

Last parameter used in the above mentioned formula is: SHDnew - Specific heating demand after the implementation of the refurbishment measure [kWh/m2*year] and its values have been calculated from consultants for three cases:

1. Specific heating demand after the implementation of thermal insulation of outside walls;
2. Specific heating demand after the implementation of thermal insulation of roof/terrace;
3. Specific heating demand after the implementation of double/triple glass windows.

Those specific values for Gjirokastra Municipality and each type of buildings are presented in respective **Tables 26, 27** and **28**.

Table 26: Specific Heating Demand after the implementation of Thermal Insulation of Outside Walls for Public and Private Buildings (SHDnew-[kWh/m^2*year])

Building	**Gjirokastra Municipality**
Recreation facilities (swimming pools, sports centres)	209.34
Newly build hotels	220.36
Existing hotels in tourist sector	233.58
Hospitals, residential homes (for the elderly) and nursing homes	271.04
Commercial building (business centres, shops, restaurants)	200.53
Schools, universities, dormitories, daily cares and kindergartens	86.25
All Other Public Buildings	193.92
Weight Average	169.59

Table 27: Specific Heating Demand after the implementation of Thermal Insulation of Roof/Terrace for Public and Private Buildings (SHDnew-[kWh/m^2*year])

Building	**Gjirokastra Municipality**
Recreation facilities (swimming pools, sports centres)	235.10
Newly build hotels	247.48
Existing hotels in tourist sector	262.32
Hospitals, residential homes (for the elderly) and nursing homes	304.40
Commercial building (business centres, shops, restaurants)	225.20
Schools, universities, dormitories, daily cares and kindergartens	96.87
All Other Public Buildings	217.78
Weight Average	190.46

Table 28: Specific Heating Demand after the implementation of Double/Triple Glass

Windows for Public and Private Buildings (SHDnew-[kWh/m²*year])

Building	Gjirokastra Municipality
Recreation facilities (swimming pools, sports centres)	233.30
Newly build hotels	245.58
Existing hotels in tourist sector	260.31
Hospitals, residential homes (for the elderly) and nursing homes	302.06
Commercial building (business centres, shops, restaurants)	223.48
Schools, universities, dormitories, daily cares and kindergartens	96.12
All Other Public Buildings	216.11
Weight Average for each Zone	188.36

Based on the above mentioned figures and respective **Formula (1)** calculations have been carried out and in the **Table 29** are presented UFES (kWh/m² year) with introducing in the same time two measures: thermal insulation of walls and new efficient wood space heating boiler. In the same way will be calculated the UFES for all other possible combinations.

Table 29: UFES with introducing in the same time Two Measures: Thermal Insulation of Walls and introducing a New Efficient Diesel Space Heating Boiler versus Old Coal Boiler for Public and Private Buildings [kWh/m²*year])

Building	Gjirokastra Municipality
Recreation facilities (swimming pools, sports centres)	158.64
Newly build hotels	167.00
Existing hotels in tourist sector	177.01
Hospitals, residential homes (for the elderly) and nursing homes	205.40
Commercial building (business centers, shops, restaurants)	151.96
Schools, universities, dormitories, daily cares and kindergartens	65.36
All Other Public Buildings	146.96
Weight Average for each Zone	128.08

4.2.1.2 Insulation refurbishment measures applied to Public and Private Service Building components (roof)

This section will shows calculations of unitary energy savings by implementing insulation refurbishment measures applied to building components (terrace) into a public and private service building with the actual terrace structure and the thermal insulated one. Based on the above mentioned figures and respective **Formula (1)** calculations have been carried out and in the **Table 30** are presented UFES (kWh/m² year) with introducing of EE measure like thermal insulation of terrace.

Table 30: UFES with introducing of EE Measures: Thermal Insulation of Terrace for Public Building (hospitals) [kWh/m²*year])

Building	Gjirokastra Municipality
Hospitals, residential homes (for the elderly) and nursing homes	4.53

4.2.1.3 Refurbishment measures in existing Public and Private Service Buildings

Let's analyse in detail all elements of above mentioned formula for Gjirokastra Municipality's conditions and for public and commercial building stock (average area of the building in service sector 188 m^2). Specific heating demand before the implementation of the refurbishment measure (SHD_{init}-[kWh/m^2*year]) has been determine for Gjirokastra Municipality's condition take into consideration Gjirokastra Municipality HDD and type of buildings explain before based on well known thermodynamic methods of defining heating losses for these categories of buildings. These values for each zone of Gjirokastra Municipality and each category of buildings are presented in the **Table 31**.

Second important parameters in the above mentioned formula are energy efficiency of the heating system before (init) and after (new) for boilers serving into the service sector the refurbishment measure (seasonal) (η_{init}, η_{new}) and they are presented in the above respective tables.

Based on the above mentioned figures and respective **Formula (6)** calculations have been carried out and in the **Table 31** are presented UFES (kWh/m^2 year) with introducing in the same time two measures: thermal insulation of walls and new efficient wood space heating boiler. In the same way will be calculated the UFES for all other possible combinations.

Table 31: UFES with Replacement of Heating Supply Equipment (from Old Coal to Heating Oil) in Public and Private Buildings -[kWh/average area*year])

Building	Gjirokastra Municipality
Recreation facilities (swimming pools, sports centres)	14219.61
Newly build hotels	14968.01
Existing hotels in tourist sector	15866.09
Hospitals, residential homes (for the elderly) and nursing homes	18410.65
Commercial building (business centers, shops, restaurants)	13620.89
Schools, universities, dormitories, daily cares and kindergartens	5858.84
All Other Public Buildings	13171.84
Weight Average for each Zone	11519.33

4.2.2 Water Heating

Analyzing in details the energy consumption for sanitary hot water, model assumes that person at the Public and Private Service Buildings Stock will take shower depended from the activity of the building. The hot water temperature is taken 40°C, hot water quantity for each person is taken 20-40 liters/day, hot water for personal hygiene is taken 5-10 liters, and for dish washing is assumed 2-10 liters. Based on the average temperature of cold water for each month and on the number of persons for Public and Private Service Buildings Stock are calculated the hot water needs for showers, personal hygiene, and dish washing. Also it is taken into consideration the washing of the clothes, sheets, and etc. Based on the above mentioned method and Public and Private Service Building Stock (PPSBS) have been calculated hot water heating energy demand for baseline scenario up to 2025. The values for both scenarios are shown in GWh in **Figures 36** and **37**.

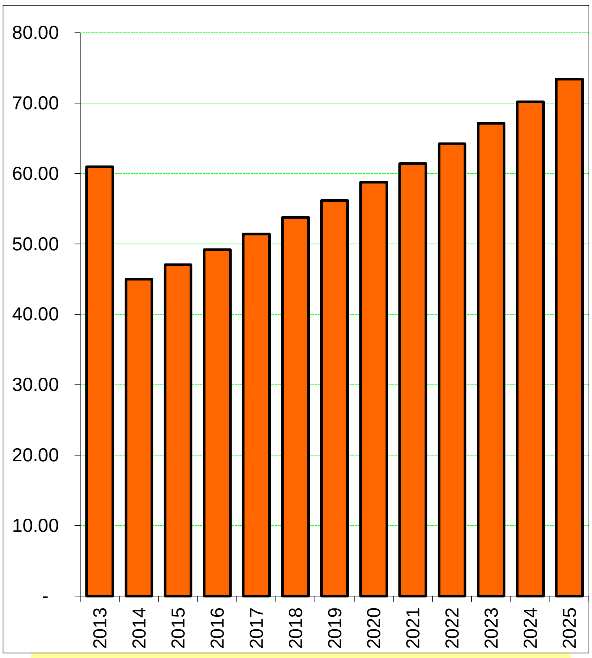


Figure 36: Water Heating Energy Demand according to Baseline Scenario (GWh)

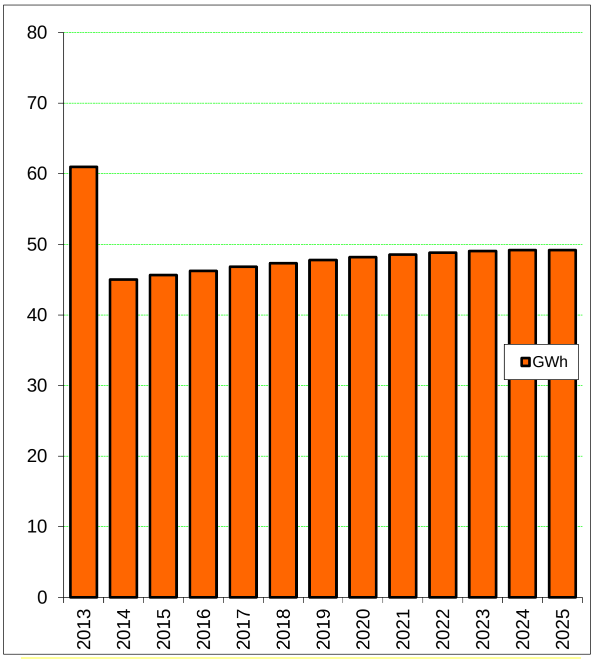


Figure 37: Water Heating Energy Efficiency Demand according to Baseline Scenario (GWh)

4.2.2.1 Replacement of water heating in Public and Private Service Buildings Stock

Basic formula for calculating unitary energy saving by implementing this measure used in the model prepared is as the same one used under the analysis of residential sector. The formula above provides for the evaluation of annual energy savings derived from the replacement or new installation of water heating equipment in existing residential buildings. The total annual energy savings [kWh/year] are calculated by summing up the unitary annual energy savings by the number of replaced water heater units.

4.2.2.2 Replacement of water heating with Solar Water Heating Systems in Public and Private Buildings

Let's analyse for public building and private ones one medium size hotel. Analyzing in details the energy consumption for sanitary domestic hot water, it is assumes that each client of the hotel will take one -at least- shower every day. The hot water temperature requested for shower is taken 40°C, hot water quantity for each client of the hotel is taken 40 liters/day, hot water for personal hygiene is taken 10 liters, and for dish washing is assumed 11 liters/day. Based on the average temperature of cold water shown in the **Table 20** for each month and on the number of clients of the hotel (120 clients + staff = persons – maximum load) are calculated the hot water needs for showers, personal hygiene, and dish washing. **Table 32** shows number of clients/occupancy factor during the year.

Table 32: Occupancy of the Hotel

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Person	35	45	55	65	85	100	120	120	100	85	65	55

In summary, based in the above mentioned analyses the following assumptions have been used to calculate domestic hot water energy demand:

- The hot water temperature is taken 40°C;
- Number of showers for the client – 1 per day and each client of the hotel;

- Hot water quantity for each client is taken 40 liters/day;
- Hot water for other personal hygiene is taken 10 liters/day;
- Dish washing is assumed 11 liters/day.

Based on the above mentioned calculation value of SWD = 49,609 [kWh/hotel*year] (Gjirokastra Municipality), and this variation is depended from cold water temperature. unitary annual energy savings (in kWh/hotel*year) are calculated on the basis of the difference in the energy efficiency between before and after the replacement of the water heater, multiplied by the specific hot water demand is shown in the **Table 33**. The total annual energy savings [kWh/year] are calculated by summing up the unitary annual energy savings by the number of replaced water heater units.

Table 33: UFES with Replacement of Hot Water Heating Supply Equipment (from Inefficient Electrical Boiler to Efficient Boiler class A) in Buildings -[kWh/hotel*year])

Building	Gjirokastra Municipality
One hotel	2,554

Now, that we know the energy demand of one hotel we can analyse the energy supply from SWH system, we can define the energy need from back-up system, as a difference between the energy demand and the energy supply. On this base we can define the annual energy supply from the SWH system and the annual energy need from the back-up system for the respective hotel at each zone. Optimization of the solar collector area for the hotel is carried out based on the optimum value of the NPV financial indicator versus solar collector area. Based in this analyze the optimal area is 27 m^2 as it is shown in the **Figure 38**.

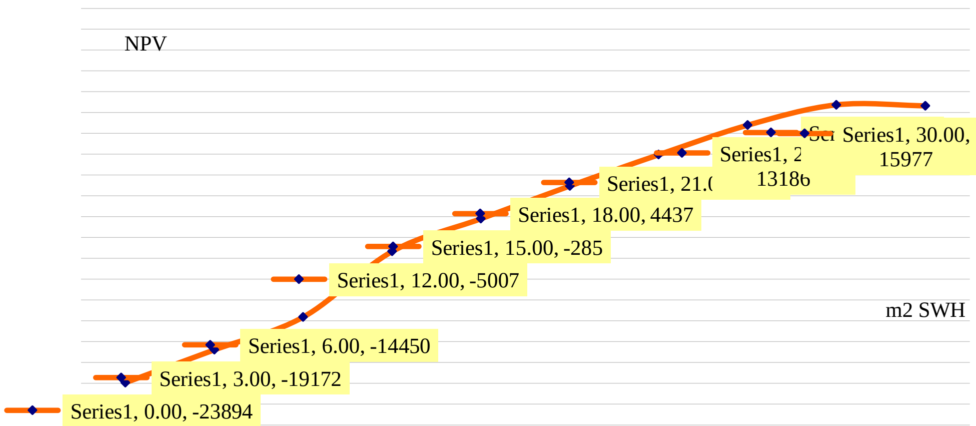


Figure 38: NPV versus Solar Collector Area (Euro) for a Hotel Building

4.2.3 Cooking

Based on the above mentioned method and the Public and Private Service Building Stock (PPSBS) have been calculated cooking energy demand for baseline scenario up to 2025. The values for both scenarios are shown in GWh in **Figures 39** and **40**.

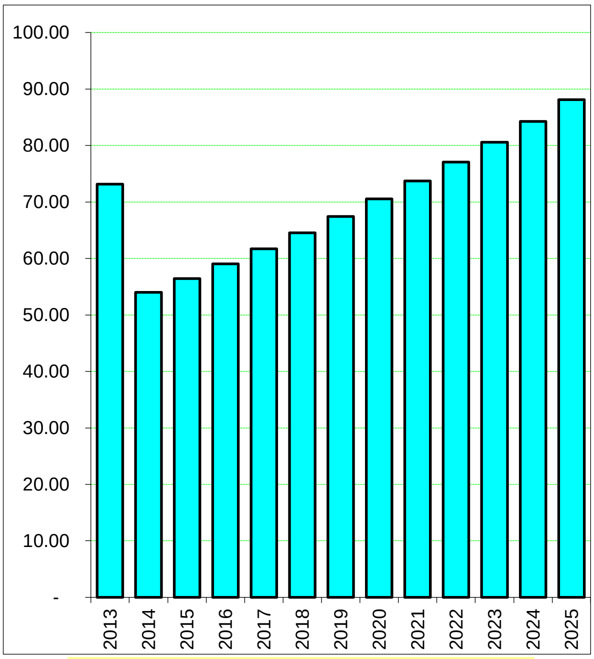


Figure 39: Cooking Energy Demand according to Baseline Scenario (GWh)

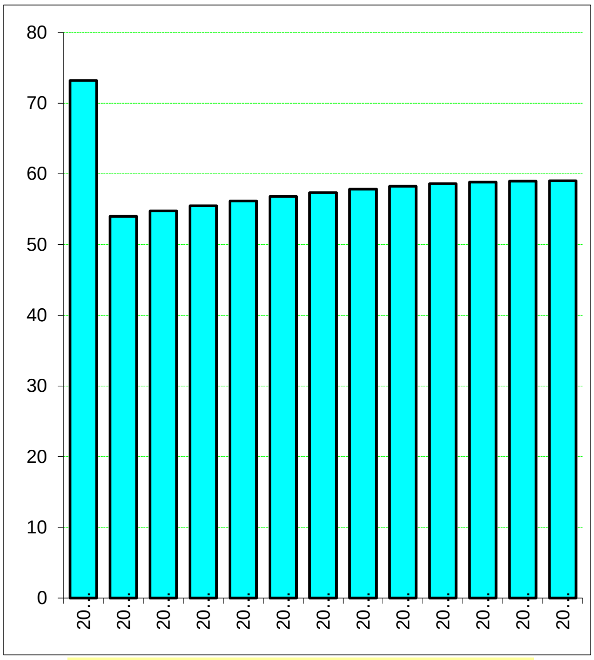


Figure 40: Cooking Energy Demand according to Energy Efficiency Scenario (GWh)

4.2.4 Lighting

Based on the above mentioned method and the Public and Private Service Building Stock (PPSBS) have been calculated lighting energy demand for baseline scenario up to 2025. The values for both scenarios are shown in GWh in **Figures 41** and **42**.

Figure 41: Lighting Energy Demand according to Baseline Scenario (GWh)

Figure 42: Lighting Energy Demand according to Energy Efficiency Scenario (GWh)

4.2.4.1 Replacement or new installation of lamps in Service (commercial and public) Buildings

The baseline ('before' situation) is the stock average of the lighting systems (lamps, ballasts, no. of luminaries) in the reference year (2007 or 1995). The formula gives the unitary annual energy savings (in kWh/unit*year) per building floor/building/group of buildings where the lighting systems were refurbished. For new installation the baseline is the market average in the reference year (**Table 34**). Regarding public and private building the parameters are as following for an average building with 188 m^2 area.

Table 34: UFES for Lamps replacement of Buildings [kWh/m^2*year])

Building	Gjirokastra Municipality
One average service building	711.50

The total annual energy savings in [kWh/year] are calculated by multiplying unitary annual energy savings by the number of efficient light bulbs sold or installed under the measures and programmes for public building and commercial ones.

4.2.5 Electrical Appliances

The electric appliances include: medical equipments, hotel equipments, restaurant equipments, radio, TV, videos, washing machines, refrigerators, tape recorder, computers and water pumps. Based in the above mentioned analyses the following assumption has been used to calculate electrical appliance energy demand: Energy Intensity for Electrical Appliances: 12-25 kWh/m^2 without taking into consideration EE measures. Based on the above mentioned method and the Public and Private Service Building Stock (PPSBS) have been calculated electrical appliances energy demand for baseline scenario up to 2025. The values for both scenarios are shown in GWh in **Figures 43** and **44**.

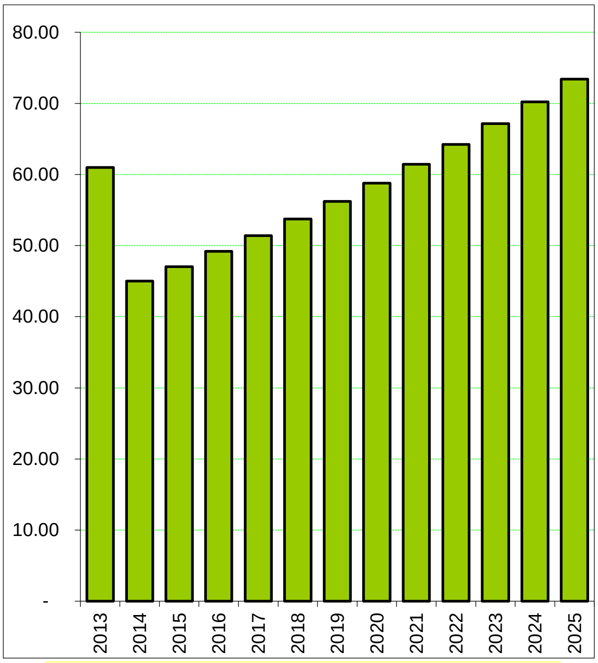


Figure 43: Electrical Appliances Energy Demand according to Baseline Scenario (GWh)

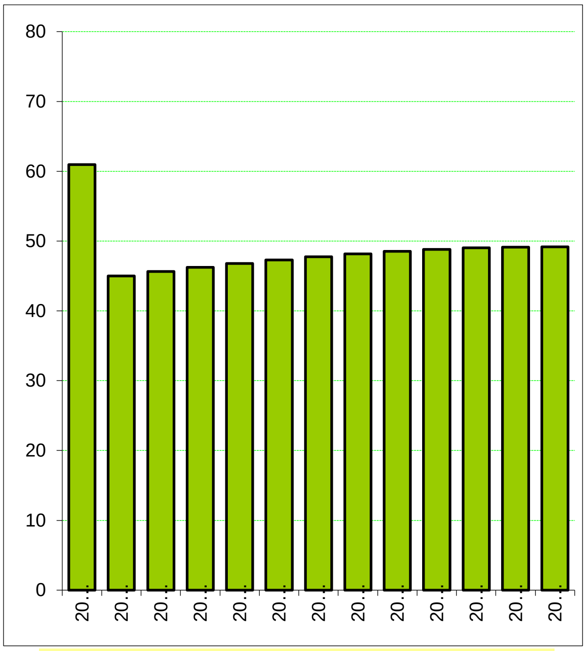


Figure 44: Electrical Appliances Energy Demand according to EE Scenario (GWh)

4.2.6 Air Conditioning

Energy demand for cooling purposes on the Public and Private Service Buildings Stock will be calculated upon the Gv and the cooling degree-days for Gjirokastra Municipality.

Cooling degree-days are taken approximately based on the average outside air temperature for summer season. Based in the above mentioned analyses the following assumption has been used to calculate cooling energy demand: 0-35 kWh/m^2/year without taking into consideration EE measures (zero belongs the public buildings which do not practice air conditioning like schools in their premises and 35-belongs to the hotels). Based on the above mentioned method and the Public and Private Service Building Stock (PPSBS) have been calculated air conditioning energy demand for baseline scenario up to 2025. The values for both scenarios are shown in GWh in **Figures 45** and **46**.

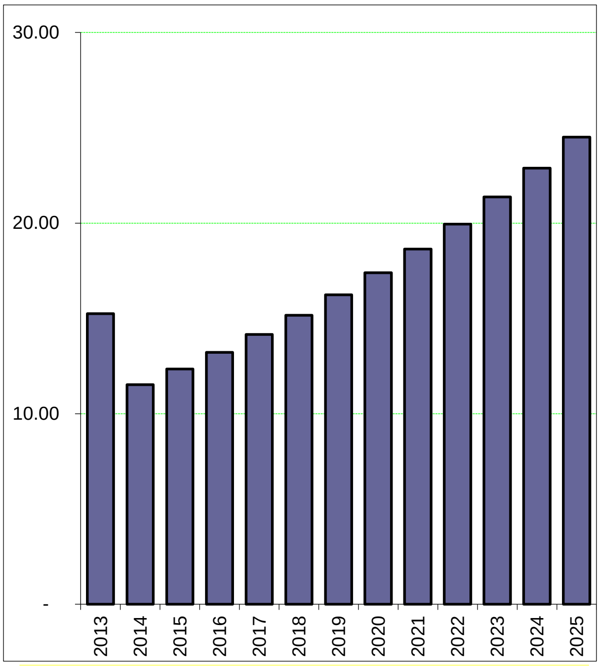


Figure 45: Air Conditioning Energy Demand according to Baseline Scenario (ktoe)

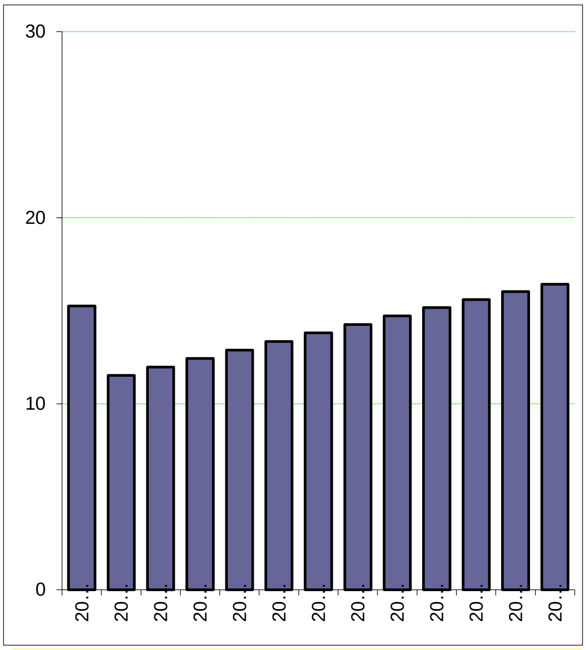


Figure 46: Air Conditioning Energy Demand according to EE Scenario (GWh)

4.2.7 Final Comparison of Baseline and EE Scenarios for each Energy Service

Figures 47 to **53** are presenting energy demand forecasts for each energy service for both scenarios.

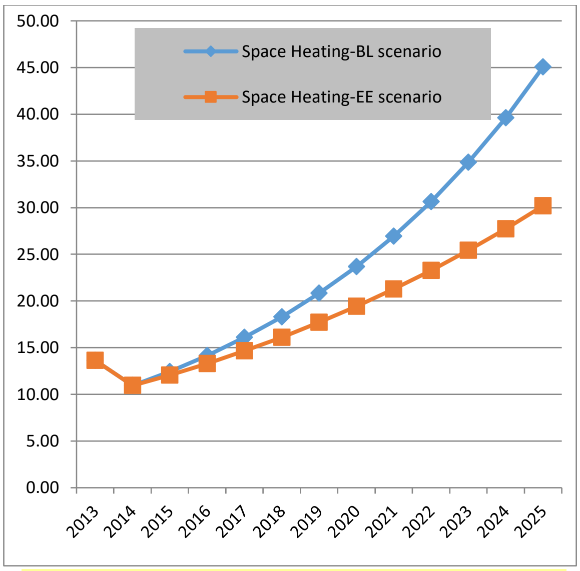


Figure 47: Space Heating Energy Demand according to Baseline and EE Scenarios

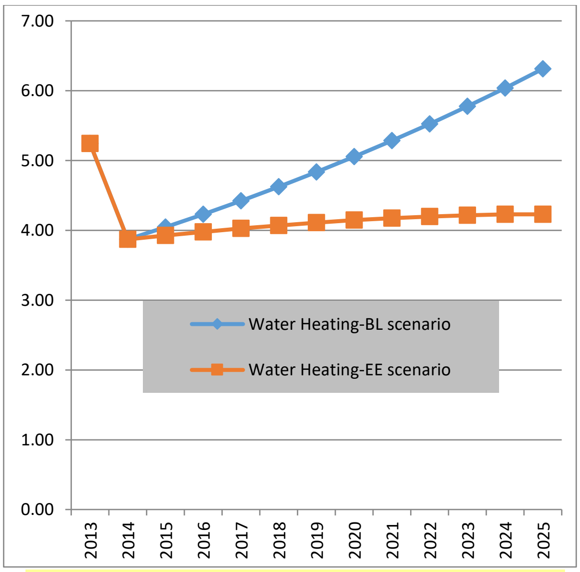


Figure 48: Water Heating Energy Demand according to Baseline and EE Scenarios

(GWh)

(GWh)

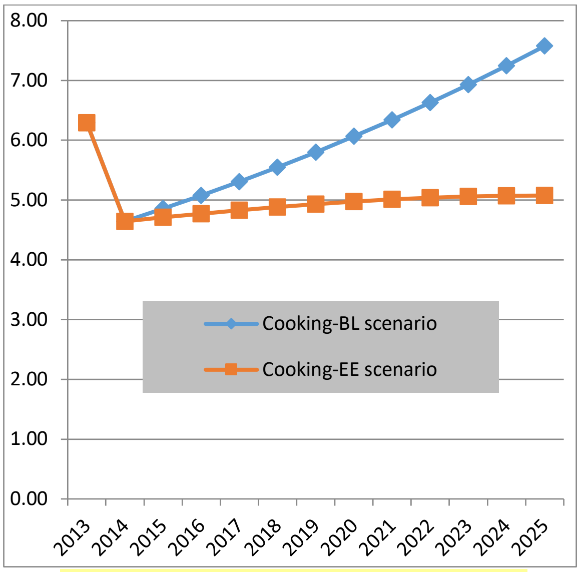


Figure 49: Cooking Energy Demand according to Baseline and EE Scenarios (GWh)

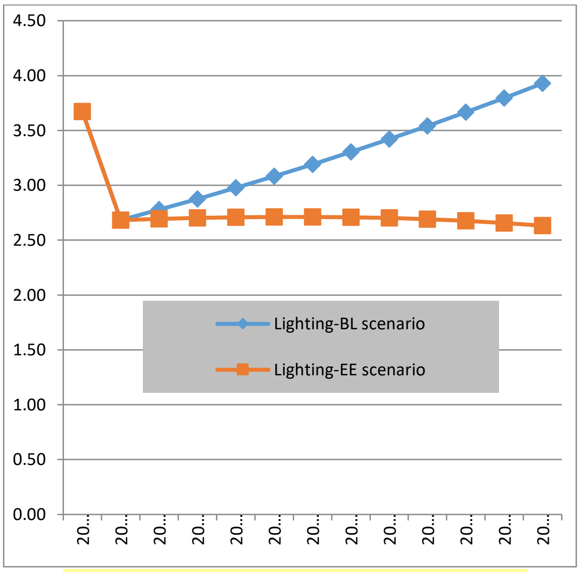


Figure 50: Lighting Energy Demand according to Baseline and EE Scenarios (GWh)

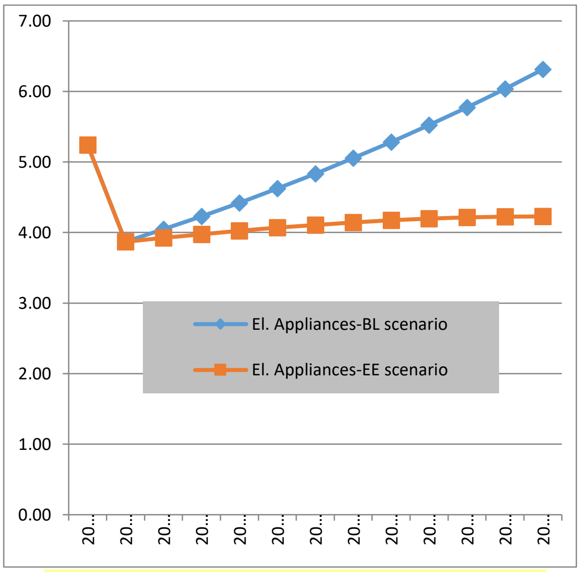


Figure 51: Appliances Energy Demand according to Baseline and EE Scenarios (GWh)

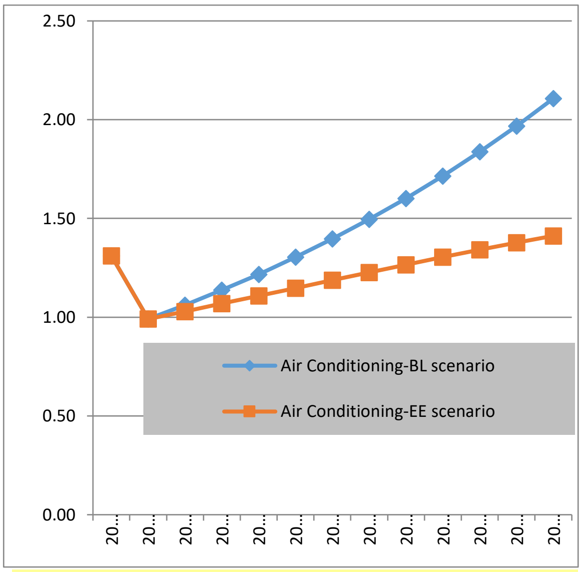


Figure 52: AC Energy Demand according to Baseline and EE Scenarios (GWh)

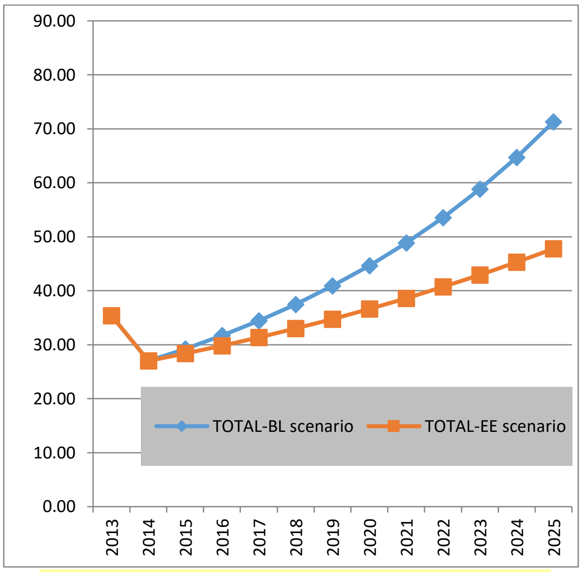


Figure 53: All Energy Services Demand according to Baseline and EE Scenarios (GWh)

After calculation of energy demand for all end-users, it is possible to calculate also the whole energy demand for household sector, for both scenarios, which are shown in ktoe in **Figures 54** and **55**.

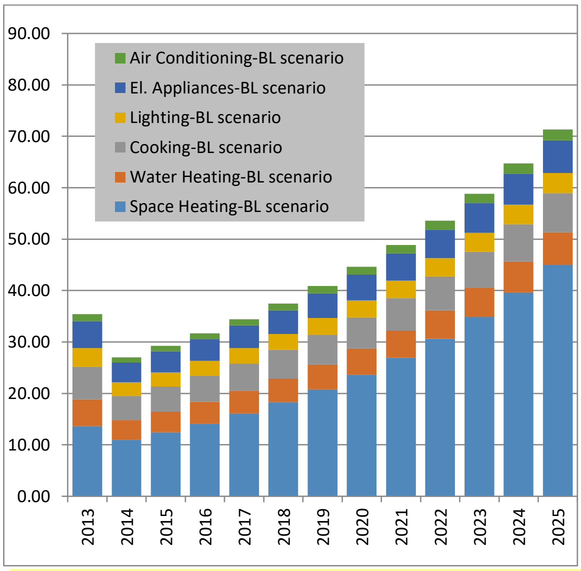


Figure 54: Energy Demand for all End-users of Service Sector according to Baseline Scenario (ktoe)

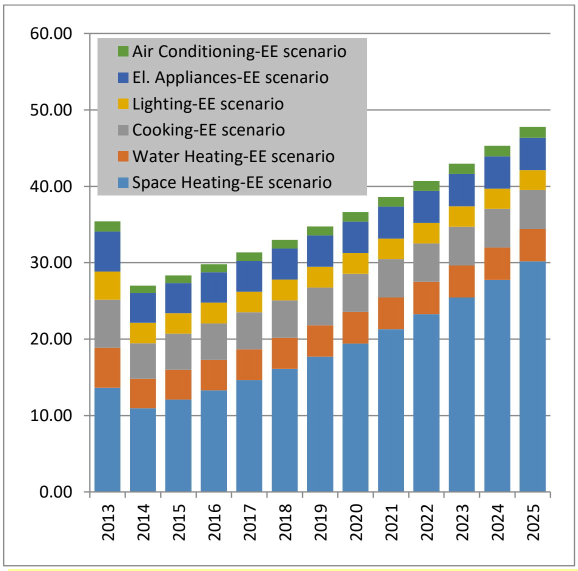


Figure 55: Energy Demand for all End-users of Service Sector according to EE Scenario (ktoe)

Final analysis of baseline scenario shows that space heating is occupying the biggest share of energy consumption in the Public and Private Service Building Stock (PPSBS) and it will be increase from 33.4% (2013) to 34.0% (2025); the second one is lighting and it will be decrease from 15.6% (2013) to 11% (2025); the third one is cooking and it will be increase from 14.2% (2008) to 16.7% (2025); fourth one is electrical appliances and it will be decrease from 13.5% (2013) to 10% (2025); fifth one will be water heating and it will be increase from 11.4% (2013) to 13.2% (2025) and the last one is air conditioning and it will be face a higher increase from

11.9% (2013) to 15.1% (2025).

4.3 Summary of the Energy Demand Forecast for Residential and Public and Private Service Buildings Stock by Energy Services

Energy demand for both sectors, residential and service sectors, has been sum up and it is presented in the **Figures 56** and **57** for all services and for both scenarios.

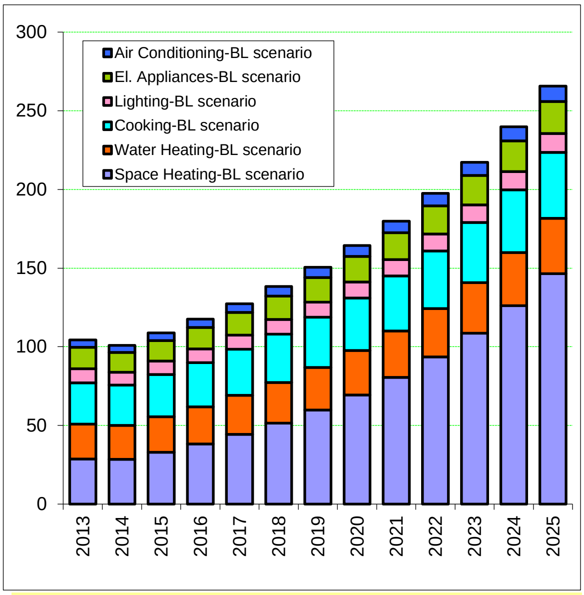


Figure 56: Energy Demand for all End-users of Residential and Service Sector according to Baseline Scenario (ktoe)

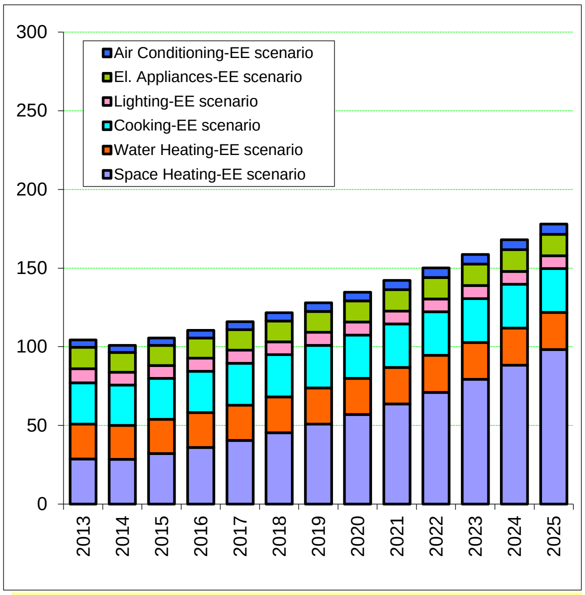


Figure 57: Energy Demand for all End-users of Residential and Service Sector according to EE Scenario (ktoe)

Energy demand for both sectors, residential and service sectors, has been sum up and it is presented in the **Figures 58** and **59** for all energy commodities and for both scenarios.

Energy demand for both scenarios and both residential and service sectors has been sum up and it is presented in the **Figure 60**. In the same graphs are presented also the energy savings for Gjirokastra Municipality and it could be reached to 33%. In addition, in the **Figure 61** it is shown the calculation of energy savings for all commodities and for both sectors.

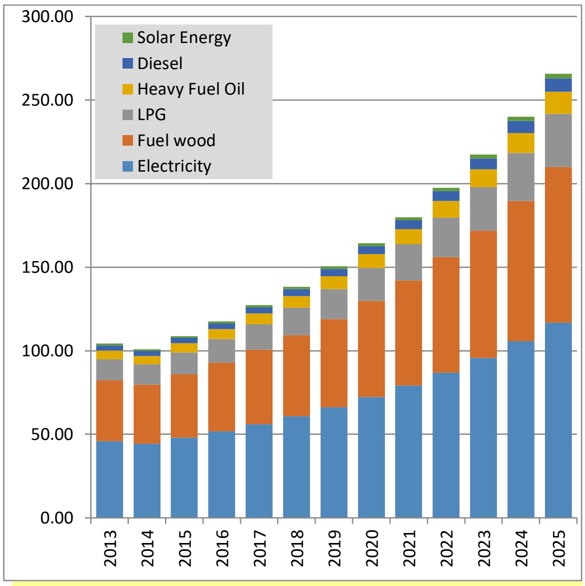


Figure 58: Energy Demand for all End-users of Residential and Service Sector according to Baseline Scenario (ktoe)

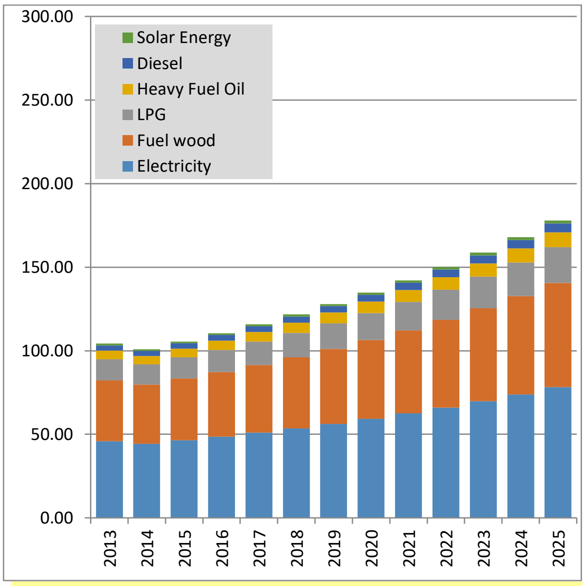


Figure 59: Energy Demand for all End-users of Residential and Service Sector according to EE Scenario (ktoe)

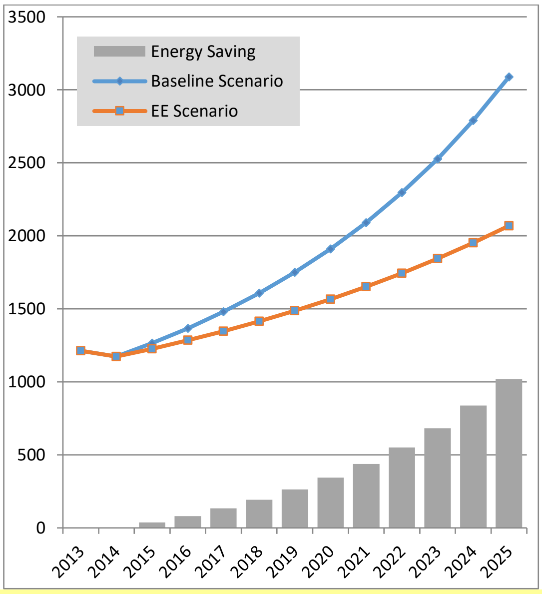


Figure 60: Energy Demand for all End-users of Residential and Service Sector according to Baseline Scenario (GWh)

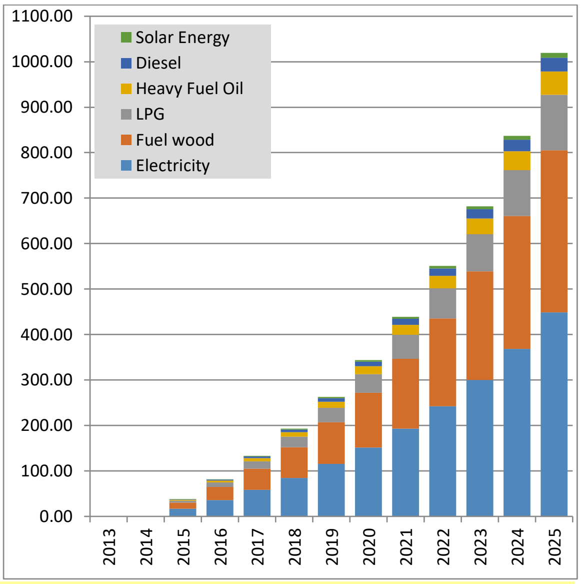


Figure 61: Energy Saving for all End-users of Residential and Service Sector according to EE Scenario (GWh)

The energy savings for Gjirokastra Municipality could be reached to 1,020 GWh. This value is equal to 10% of total energy consumption of Albania for all commodities and for both sectors. Analysing the energy demand (presented at the Figures 59 and 60 for all energy commodities and for both scenarios) will give the possibility to optimise energy supply based primarily on Renewable Energy Sources penetration into the energy balance of Gjirokastra Municipality. This issue will be analysed in details at Chapter 5.

CHAPTER 5: RES ACTION PLAN FOR GJIROKASTRA MUNICIPALITY

5.1 SHPPs Potential for Gjirokastra Municipality

As of December 31, 2014, the Albanian Government, based on the Concession Law (approved on December 2006), has issued up to about 120 concession contracts (110 already have been approved and 10 are in the final stage of discussion) for building different categories of hydropower plants (HPPs). In order to have a clear picture between small, medium and large HPPs, the total list of HPPs has been sorted in three following categories:

- One or Cascade of SHPPs with total capacity lower than 15 MW: Based on the definition of the Council of Ministers Decree (CMD), they are considered as SHPP.
- Cascade of SHPPs with total capacity of the cascade higher than 15 MW: Based on the definition of CMD and since each plant is of lower capacity than 15, MW they are considered as SHPP.
- Medium & Large HPPs and Cascade of HPPs with capacity of each plant higher than 15 MW: Based on the definition of CMD and since each plant is of higher capacity than 15 MW, they are not considered SHPP.

The **Figure 65** presents the number of concession contracts for each of the above mentioned groups. Analysis shows that the biggest number of concession is related to the first and second groups with a total of 112 concessionaire contracts included in small hydropower plant category.

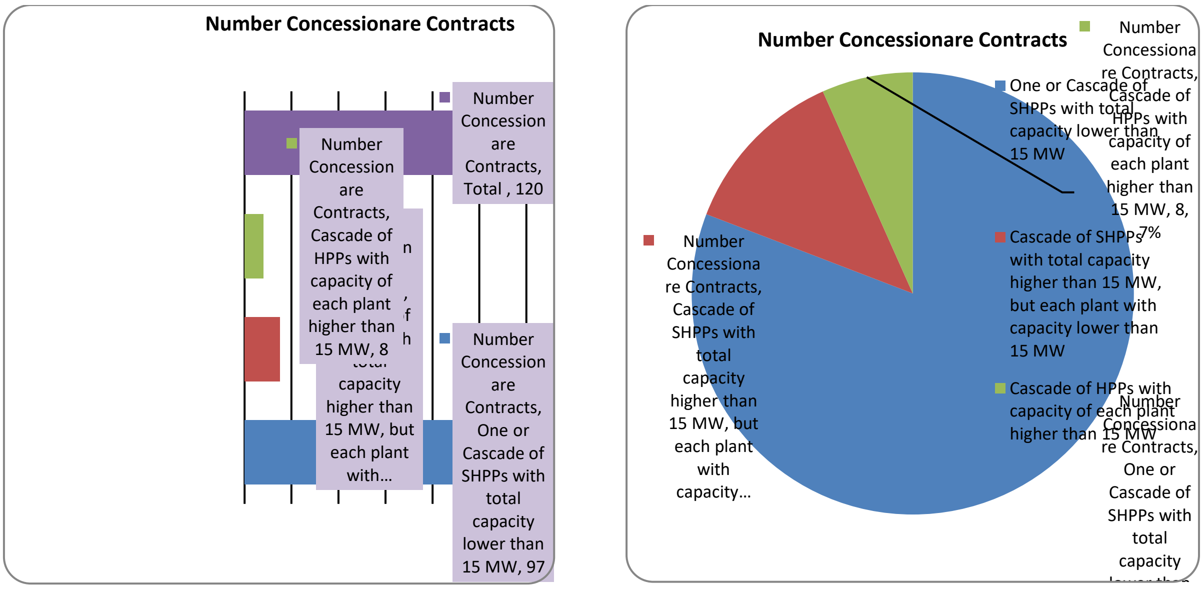


Figure 65: Number of HPP Concession Contracts in Albania

Table 35 presents the projected total installed power generating capacity for each of the above mentioned HPP groups for Gjirokastra Municipality.

Table 35: Total installed Power Generating Capacity for each of SHPPs for Gjirokastra Municipality

Nr	Name of SHPPs	Company which have express interests	Investment Value	Installed Capacity	Average Elec. Generation
			ALL	kW	kWh/year
1	Dishnice	Agro Zagma sh.p.k	160	800,000	164,769
2	Picar 1	Perivoli sh.p.k	200	1,200,000	272,737
3	Qyteze	Muso shpk	250	1,340,000	213,077
4	Lubonje	Alb Agron sh.p.k	300	1,300,000	300,000
5	Nishova 1 Nishova 2	Nishova sh.p.k	550	3,144,390	689,879
6	Çarshove	Korsel shpk	1,200	6,300,000	642,308
7	Sotire 1 Sotire 2	Shushica sh.p.k	2,100	8,578,428	1,111,958
8	Bistrica 3 Bistrica 4	Bistrica 3	2,905	23,652,000	5,818,462
9	Suha 2	Albaenergjiaplus	3,400	7,300,000	2,769,231

5.2 Biomass Energy Potential for Gjirokastra Municipality

Useful biomass for energy purposes can be classified in four major categories:

- Woods or wood residues from various wood processing industries;
- Vegetation residues (stems, seeds etc.) after completion of their production cycle, which are not used in other production sectors;
- Energetic plants (woods) cultivated to be burned as biomass, and;
- Animal residues (bones, skins, dung), which are not used in other economic sectors.

Data on forest resources are based on inventories done every 10 years from the National Environmental Agency subordinated to the Ministry of Environment, Forestry and Water Administration. Forests are classified in these major categories:

- High forests which represent 47-50 % of the total wood resources,
- Copses which are 29-30 % of total resources, and
- Bushes, which are 24-25 % of total wood resources.

Forests cover a large part of Albania's territory with proven reserves of fuel wood estimated at 125 to 250 Mcm (or 6 Mtoe)[1]. Additional, other vegetal sources could be considered: biomass from agriculture, urban and rural wastes and special plants produced for energy purposes. This potential is shown in the following **Table 36**.

Table 36: Available Technical Energy Potential of all Biomass Categories for whole Albania (ktoe/year)

[1] Austrian Energy Agency, IEA (Yearly Publication - 2010)

Biomass categories	Theoretical potential (ktoe)	Participation in the state energy balance (%)	Technical energy potential -– heat (ktoe)	Participation in country's heat energy balance (%)	Technical energy potential - electricity (ktoe)	Theoretical Potential of possible participation in the state electricity balance (%)	Economically liable potential for the next decade (ktoe)
Forests	263.6	1.07%	234.4	0.95%	70.3	1.07%	315.1
Biomass Of Agricultural Production	1521.1	6.17%	979.8	3.97%	293.9	4.45%	1316.8
Urban Waste	1576.4	6.39%	1276	5.18%	382.8	5.80%	1446.6
Waste From Orchards	168.1	0.68%	142.9	0.58%	42.9	0.65%	207.5
Waste From Livestock	585.25	2.37%	521.6	2.12%	156.50	2.37%	701.5
Energy Plants	62.34	0.25%	57.1	0.232%	17.13	0.260%	76.72
TOTAL	**4176**	**16.9%**	**3212**	**13.0%**	**963.6**	**14.6%**	**4064.2**

Table 37 presents the biomass energy potential for Gjirokastra Municipality.

Table 37: Available Technical Energy Potential of all Biomass Categories for Gjirokastra Municipality (ktoe/year)

Biomass categories	***Theoretical potential***	***Technical energy potential***	***Technical energy potential - electricity***
Forest Residues & Wood Processing Waste	10.38	7.34	0.48
Fuel Wood	7.42	7.42	0.00
Agricultural Residues	31.36	10.92	0.00
Waste From Livestock	9.36	2.35	0.83
Energy Crops	43.36	43.36	4.21
Total	101.89	71.40	5.52

5.3 Solar Potential for Gjirokastra Municipality

The study "Sun in Action"[2] showed that e huge potential exists for solar water heating systems, not only for the EU Municipality, but practically all around the world, including the countries of the IEA cooperation. Some major studies about the market development and the potential for

[2] Solar Thermal Markets in Europe Trends and Market Statistics 2009 (published on June 2010)

solar energy systems have recently been carried out. All of those studies came to a common conclusion: The market is huge and, taken as a whole, is steadily growing, although the market growth differs widely from country to country. In those studies it has been shown that the solar collector potential for the residential and district heating sectors can easily be expressed as a figure:

0.5 – 1 m^2 solar collectors per inhabitant

The lower figure represents the warmer climates and the higher figure the climates of Northern and Central Europe. Furthermore, the studies show that this specific number can move towards 1 m^2 solar collector per inhabitant for countries with warmer climates.

There are great conditions for solar water heating in Albania. The annual solar radiation is high and can theoretically provide Albania with the low temperature heat necessary during a period of at least (7-8) months. Solar radiation regime and sun hours during the year for Albania are shown in the **Figures 66** and **67**.

Figures 66: Solar Radiation (kWh/m^2 year=kWh/m^2 vit)

Figures 67: Sunshine Hours (hours/year) in Albania

The commercially available solar collector systems in Albania rely on an electrical back-up, especially during November-March period. Also, it is important to be mentioned that hot water energy demand of a family of 4 persons is approximately 2,500 kWh/year. The need for additional energy could be reduced by installing more efficient solar collectors but as a consequence this will increase the surplus of solar energy supply from April to September.

The **Figures 68** and **69** show the total energy demand for DHW and energy supplied from solar collector as well as the energy need from back-up systems, in yearly period, versus solar collector efficiency for the Gjirokastra Municipality (with the lowest solar radiation) and for Saranda (with highest solar radiation).

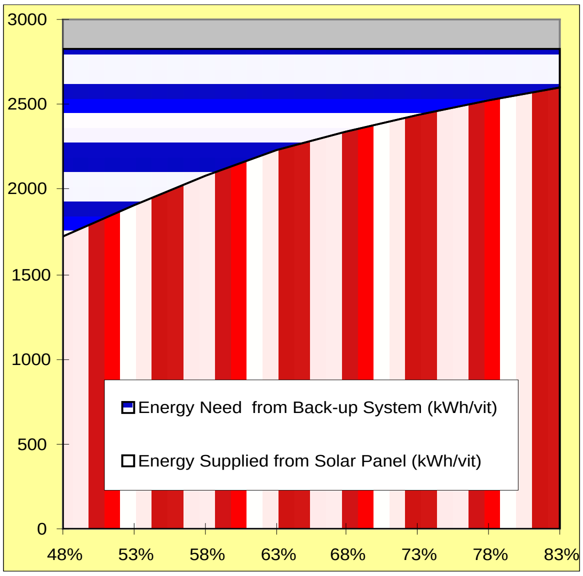


Figure 68: Total Energy Demand, Energy Supplied from Solar Collector and Energy Need from Back-up System versus Solar Collector Efficiency for Gjirokastra Municipality (kWh/year)

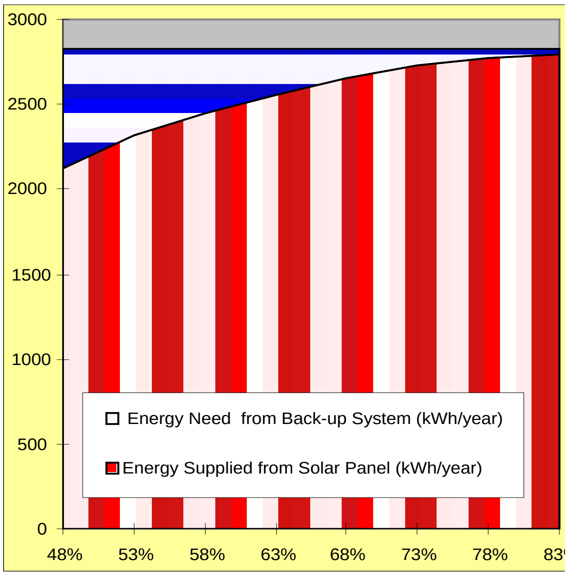


Figure 69: Total Energy Demand, Energy Supplied from Solar Collector and Energy Need from Back-up System versus Solar Collector Efficiency for Saranda (kWh/year)

As it is shown on these figures, based on the average efficiency of solar water heating systems installed in Albania (as 55%) the SWHS covers for Gjirokastra Municipality 68% of energy demand for hot water preparation, meanwhile it covers for Saranda 86% of energy demand for hot water preparation.

MEI (METE), for the whole period 2009-2014, is assisted from GEF/UNDP Program "Global Solar Water Heating Market Transformation and Strengthening Initiative: Albania Country Program " and since two years a lot of tasks have been carried out especially monitoring the solar systems installed up to now in Albania and evaluation of future markets for households, public and private services building as well as for some industrial sub-sectors.

Data of thermal solar energy penetration for each country, presented in the **Figure 70**, are based on the most updated Solar Energy Market Study produced by ESTIF for Europe for 2010 (http://www.solarthermalworld.org). Under this study are presented the last development of each country for the period 2000-2010.
Data for Albania are based on a detailed work carried out by the UNDP Climate Change Programme together with producers, installers and retail companies working in Albania. Austria leads among all countries with the installation per capita of solar system and cumulative SWH area is approximately 540.2 m²/1000 inhabitants (Status: as of end 2010). Albania has done a great progress on the penetration of solar energy systems and cumulative SWH area is 23.5 m²/1,000 inhabitants (as shown in the **Figure 70**) for the year 2010.

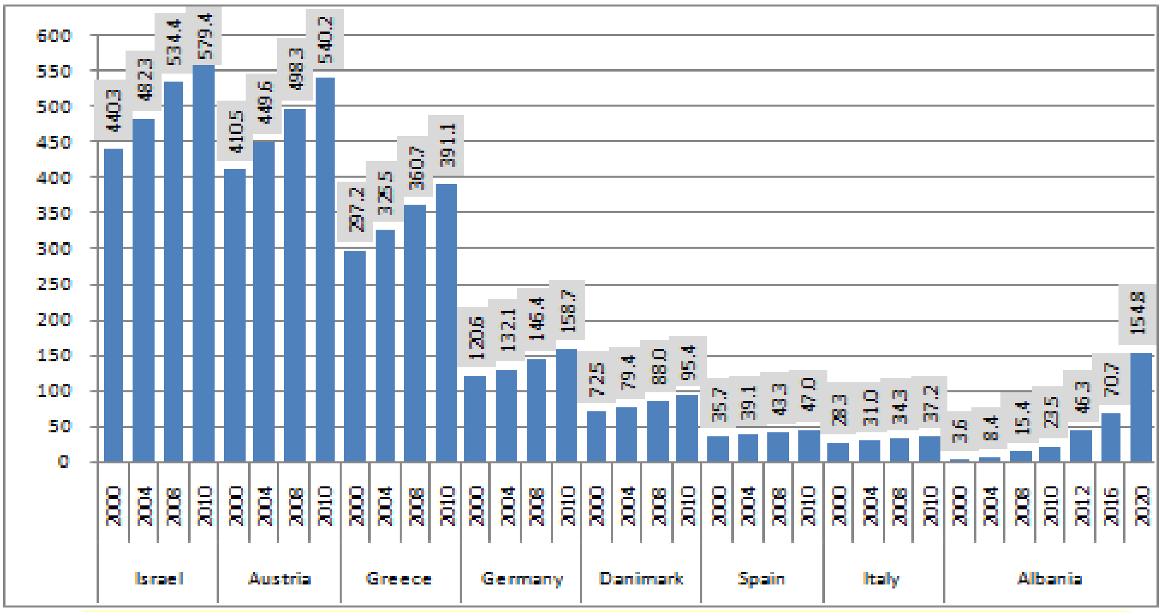


Figure 70: Solar Water Heaters penetration in Different Countries (m^2/1,000 inhabitants)

The use of solar energy through thermal collectors has had a constant growth in Albania during the last years. In the **Figure 71** is shown the updated market development of solar water heaters in household, service sector as well as in total for Albania until 2010.

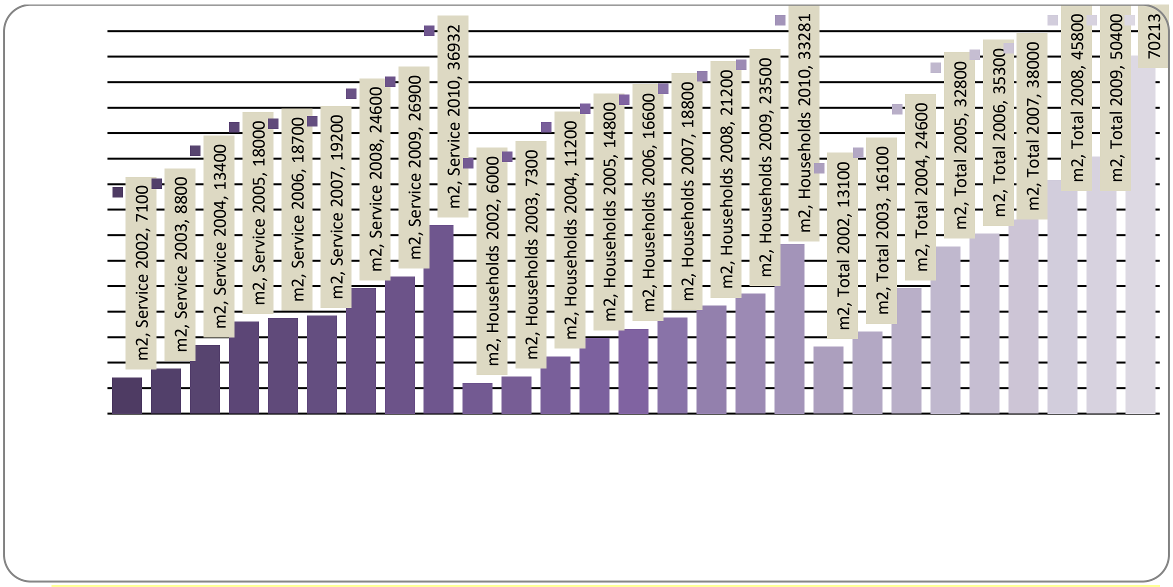


Figure 71: Accumulative SWH Systems installed in Household and Service Sectors (m^2)

In the **Figure 72** is shown the contribution in terms of energy (GWh) from the solar water heating systems in household and service sectors as well as in the total for Albania until 2010.

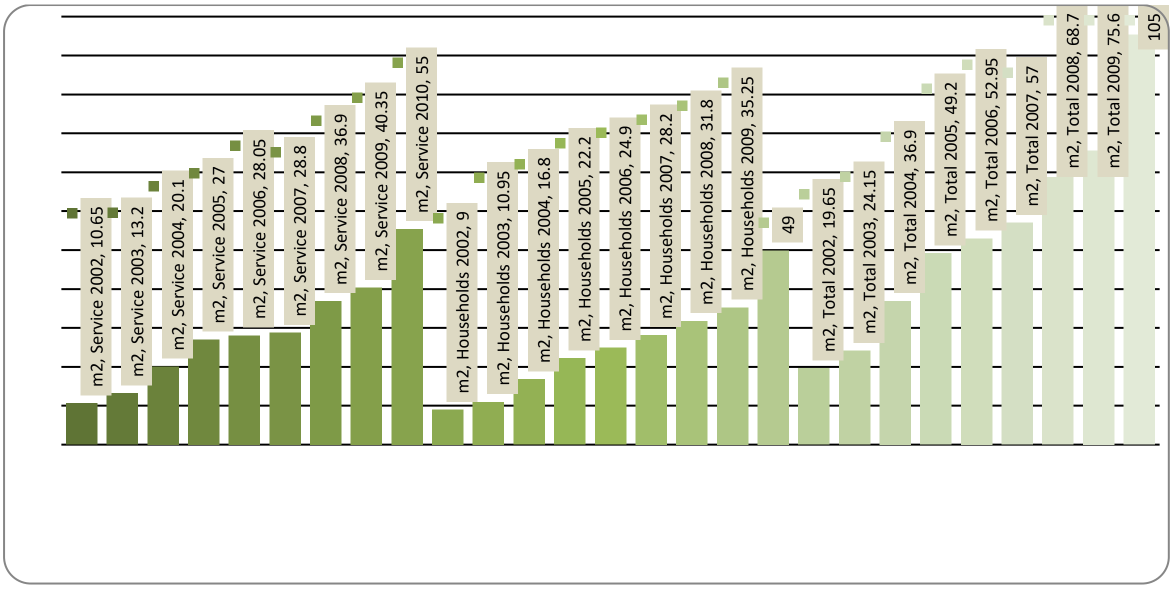


Figure 72: Contribution of SWHS installed in Household and Service Sector (GWh)

In the **Figure 73** is presented the SWHS market for household sector, and the total m^2 of SWHS expected to be installed by 2025 will be about 169,000 m^2. Share of SWHS for urban and rural households will be respectively 77.11% and 22.89%. Meanwhile the share of SWHS for the climatic zone I (all districts with values lower than 1,300 Heating Degree Days), the climatic zone II (all districts with Heating Degree Days values into the interval 1,300-2,300), the climatic zone III (all districts with values higher than 2,300 Heating Degree Days) will be respectively 58%, 35% and 7%.

In the **Figure 74** is presented the SWHS market for public and private service building sector, and the total m^2 of SWHS expected to be installed by 2025 will be about 380,000 m^2.

Also, calculations have been carried out as well as for the industry sector and grand total forecasted SWHS area for three sectors is presented in the **Figure 75**.

Energy is consumed in the different industrial subsectors in three main services:

i) For securing heat energy with temperature lower than 60 ^{o}C;
ii) For securing heat energy with temperature higher than 60 ^{o}C; and
iii) For securing motive power energy (which is almost in the form of electricity most of the cases).

It is known that SWHSs can secure only heat energy with temperature lower than 60 ^{o}C. Under such conditions, the most important sub-industrial sectors on which SWHSs might contribute are the followings:

- Food/Beverage/Tobacco;
- Textile/Leather/Shoes;
- Wood/Paper/Printing, and
- Others.

Potential of SWHS for four sub-industrial sectors analyzed and for the whole industrial sector is presented the **Figure 76**. Final analysis shows that potential market of SWHS in industrial sectors by 2016, 2020 and 2025 will be respectively 26,796 m^2, 91,407 m^2 and 131,475 m^2.

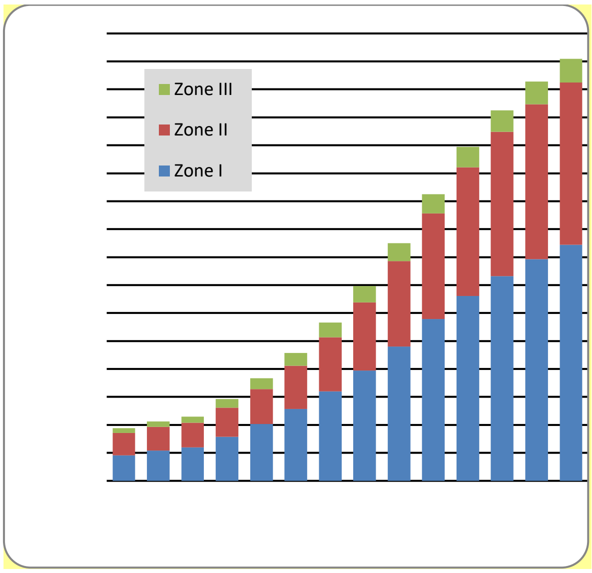


Figure 73: SWHS Potential for Residential / Household Sector (m^2) for Each Climatic Zone

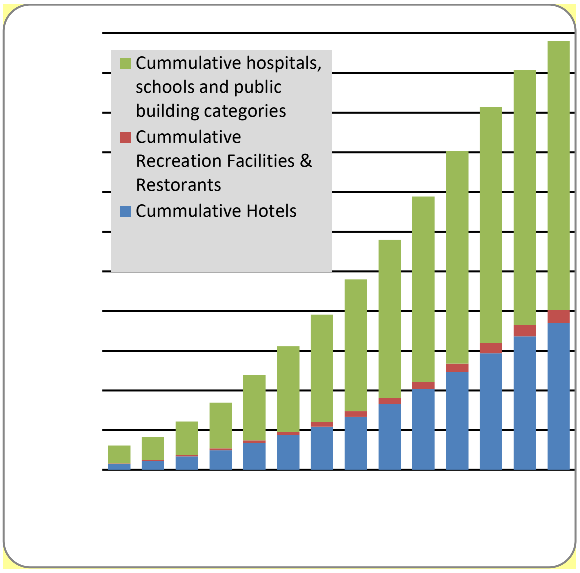


Figure 74: SWHS Potential for Public and Private Service Building Sector (m^2)

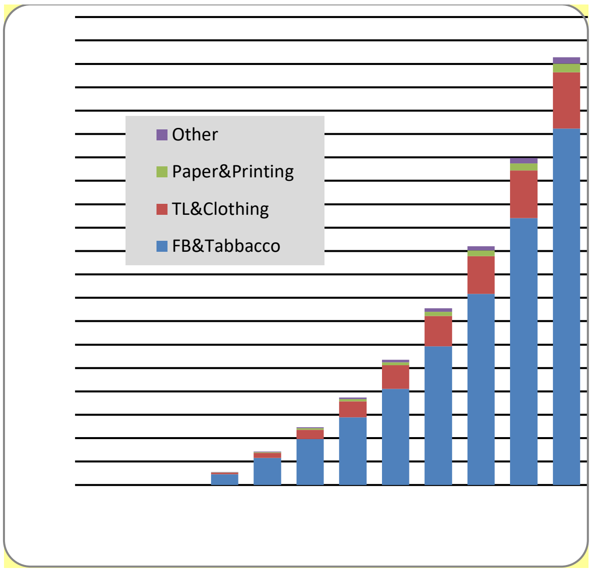


Figure 75: SWHS Potential for Sub-industrial Sector (m^2)

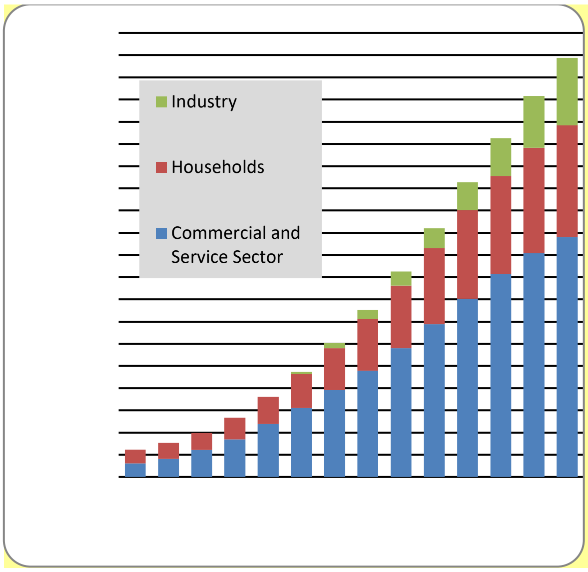


Figure 76: SWHS Potential for all Sectors (m^2)

Solar contribution required for covering part of RES supply by 2020 is estimated to be about 475,000 m^2, meanwhile total potential for all sectors will be almost 570,000 m^2.

Table 38: Solar Radiation including Gjirokastra Municipality

District	***Jan.***	***Feb.***	***Mar.***	***Apr.***	***May***	***Jun.***	***Jul.***	***Aug.***	***Sep.***	***Oct.***	***Nov.***	***Dec.***
Gjirokastra	10696	12627	15208	16488	18739	20955	22567	21598	20533	15466	13255	12607

Shkodra	**10,857**	**12,316**	**14,119**	**15,771**	**17,425**	**19,253**	**20,836**	**20,069**	**18,855**	**14,450**	**12,977**	**12,235**
Durres	**13,205**	**13,523**	**14,347**	**17,604**	**18,637**	**20,228**	**22,277**	**23,199**	**20,305**	**17,750**	**15,347**	**14,677**
Tirana	**12,066**	**13,292**	**14,243**	**16,007**	**18,555**	**20,538**	**21,598**	**21,896**	**19,854**	**16,564**	**13,604**	**13,250**
Vlora	**14,239**	**13,894**	**13,733**	**17,726**	**19,207**	**21,376**	**22,926**	**24,093**	**23,217**	**19,791**	**17,799**	**15,347**
Saranda	**12,868**	**15,445**	**16,633**	**18,511**	**20,405**	**22,758**	**23,443**	**24,101**	**23,237**	**17,390**	**16,857**	**14,820**

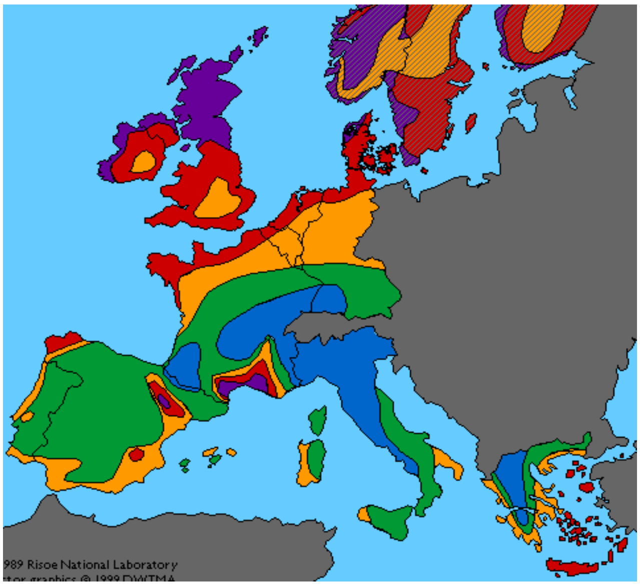
Table 39: Optimal Angle including Gjirokastra Municipality

Zone	***Gjirokastra***	***Shkodra***	***Tirana***	***Durres***	***Vlora***	***Saranda***
Optimal Annual Angle	***37.49***	***38.57***	***37.87***	***38.33***	***37.72***	***36.23***
Optimal Seasonal Angle (summer)	***28.34***	***29.53***	***28.98***	***29.24***	***28.78***	***27.4***
Optimal Seasonal Angle (winter)	***75.67***	***57.72***	***57.29***	***57.67***	***57.22***	***55.52***

5.4 Potential of Wind Energy for Gjirokastra Municipality

Wind energy is used for water pumping, windmills and last decades the attention is concentrated on the power generation. Aggregates operating with wind energy have an installed capacity from few [kW] to 2 [MW], and are being used successfully in isolated areas. Wind energy is a considerable potential as energy source, uniformly widespread in every corner of the earth. Windmills can be installed quickly and they need a small area of land. In most of the countries, instalment of windmills have a common concern, that of not having continuous measurement of the wind speed and long-lasting along several years.

For this reason, various companies that are willing to invest in this sector find it difficult to take a decision whether it is feasible to invest in a certain area without those necessary data. Data received from the different Albanian meteorological stations are approximate and not very reliable ones since they are collected not for wind energy measurement purposes (**Figure 77, 78**).



	Open Terrene		On coast line	
	m/s	W/m²	m/s	W/m²
	>7.5	>500	> 8.5	> 700
	6.5-7.5	300-500	7.0-8.5	400-700
	5.5-6.5	200-300	6.0-7.0	250-400

Figure 77: Average Speed of Wind (m/s)

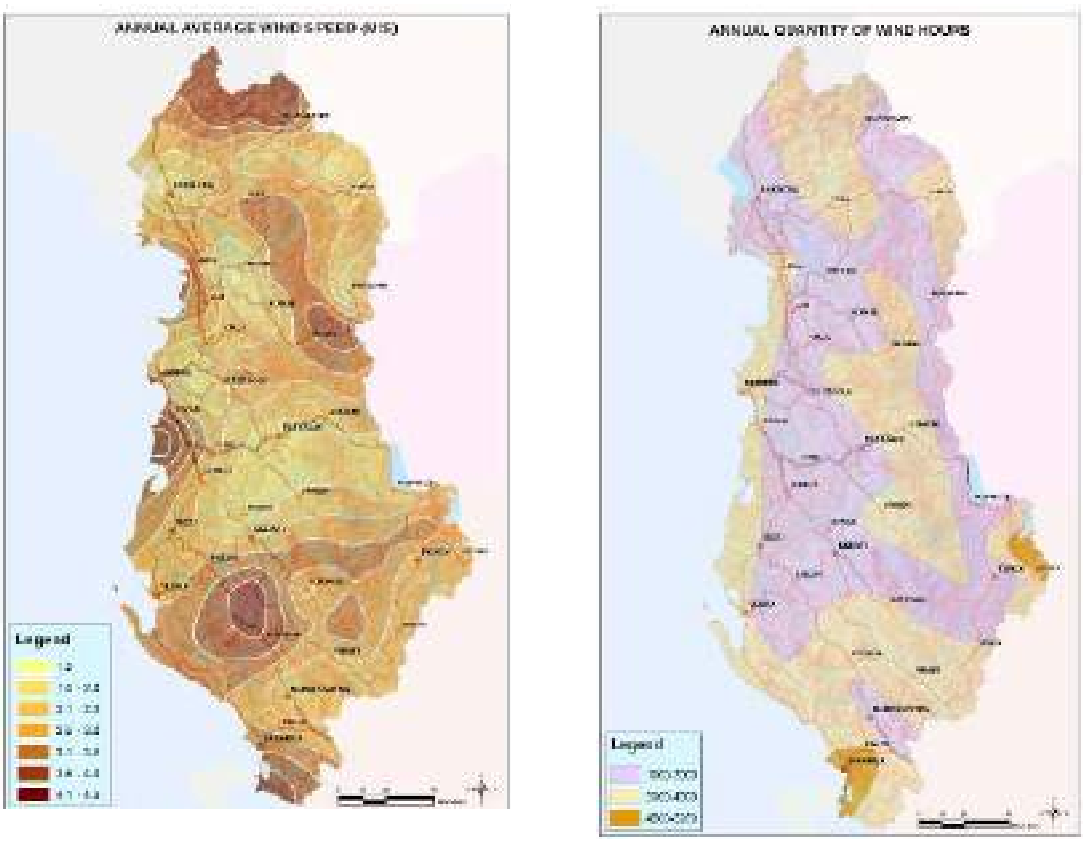


Figure 78: Zoning According to Annual Time of Wind with a Wind Speed Iso-lines

There are major plans for developing wind energy in Albania in the next few years with significant investments in a proposed 1,300 MW new generation capacity from wind power

5.5 Particular RES Priorities and the Innovative Best Practices

Because of the significance of hydropower to the electricity supply sector in Albania, this section focus primarily on issues and developments in regard to small hydropower plant (SHPPs) developments. However, many of the issues are relevant to other RE power plant types. Highlights of these developments are summarized below.

- **Increasing the reliability of payment for electricity deliveries to the national grid;**
- **Adopting a long-term Power Purchase Agreement (PPA):** The adoption of a standardized PPA regulating the terms, under which the power is purchased, reduced a major risk in financing SHPPs. The necessity of such a document was the key-message at the International Stake-holder, regulating the following major issues:
    a) PPA's validity: 15 years;
    b) Obligation of KESH -WPS to buy at any time the entire output of the plant at a tariff announced annually by ERE and determined according to the respective feed-in tariff methodology;
    c) Compensation clause for non-acceptance of power by KESH.

To improve this situation, Albania has to initiate a series of reforms to increase the sector's performance and develop alternative energy sources. An Electricity Market Model (EMM) was approved in March of 2008, which is characterized by bilateral contracts of electricity between and among market participants. Based on this market model design, the Regulator developed and approved the Market Rules and technical and commercial codes that facilitated power purchase agreements between small power producers and independent power producers and a variety of regulated and unregulated electricity suppliers.

Small Power Producers and Independent Power Producers may sell electricity on all markets, including to the Wholesale Public Supplier, with regulated prices or to Eligible Suppliers or Traders or DSO, at commercially agreed terms and if no agreement can be reached, on terms approved by the regulator. Also they may sell electricity directly to Eligible Customers if they obtain licenses to be Qualified Suppliers. Beginning from 2015, all non-household customers have been granted the right to become eligible consumers and choose their own suppliers.

In spite of these changes, Albania needs a more liberalized electricity market, better incentives for energy efficiency, and more clear rules to boost RE development. The adoption of these laws is crucial for sustainable energy reform. The intention is good, but unfortunately the time span to initiate and promote these laws was too long, decision was delayed, and a number of opportunities were lost because investors were reluctant to spend their money in a country where the legal framework is not yet attractive.

1) Adoption of challenging but realistic targets and trajectories till 2020 for renewable energy share in country's energy mix is essential to show GoA's commitment to deploy RE. Without it no action plan can be defined and appropriate policies developed. Also, the foreign investors in this domain will not be confident to come and implement RE projects in the country.

2) Without a clear, sustainable, and sure regulatory framework, the country cannot attract foreign investment in all domains but especially in the RE one. Concerning renewables, the primary need is for clear tariffs methodologies, a fair and streamlined licensing process, disputes settlement, and reliable green electricity billing. Any other delay of solving issues will cost country especially in this time of European financial crisis when the competition for investment is harsher. Albania will need donors' coordination in providing technical assistance to help GoA to solve this stringent necessity.

3) Some of the RE development related difficulties are common with the existing issues of the land ownership system. Improve land rights system is important for RE project because. Especially, wind, PV, and hydro projects require that the system of recording and assigning land rights, including accurate land ownership records, be improved to enable clear title to public and private land.

CHAPTER 6: POLICY AND PROGRAMMATIC MEASURES FOR EE FOR BUILDINGS STOCK

Albania has taken good steps in order to implement in its National Energy Policy the requirements of EU Directives relating to the common rules for the creation and development of the internal energy market and the promotion of the production and consumption of energy from renewable energy sources. RES Directive on the promotion of electricity produced from renewable energy sources in the internal electricity market has been transposed into the Albanian Draft RES Law and in the approved Biofuels Law. Actually, the Albanian energy institutions are working to prepare the respective secondary legislations / regulations. After analyzing the possible incentive mechanisms and reviewing the good practices put in place in other Member States, a feed-in tariff system has been adopted (since January 18, 2007) especially for existing and new SHPPs, which provides greater certainty to investors and, has started to deliver much faster results (up to now are issued about 112 concessionaire contracts for construction of small, medium and large HPPs).

The feed-in tariff system creates the conditions for the promotion of electricity produced from renewable sources, while tariff rates take into account the type of technology and efficiency of generating equipment. The Albanian Draft RES Law also provides for other incentives such as:

- Obligatory connection to the network of the transmission or distribution companies;
- Payment only of the direct costs of connection to the electricity transmission or distribution networks;
- Long-term power purchase agreements (15 years with respect to electricity produced from hydropower plants of up to 15 MW installed capacity and the amount of electricity produced);
- Obligatory off-take of the electricity produced from SHPPs.

The Albanian Biofuels Law has also introduced incentives for the use of biofuels in the transport sector such as:

- Compulsory blending of biofuels with mineral oil derivatives;
- Reduced rate of excise duty for biofuel blends of a specified percentage;
- Zero rate of excise duty for pure biofuels.

As a result of these measures, interest in renewable energy sources has grown considerably and new plants have started to be constructed - first of all, small hydropower plants as the best-known and available technology and followed by solar water heating systems. Meanwhile, several investors have started to request authorizations for wind farms and installation of wind turbines as well as.

On the other hand, in the new Draft RES Law a chapter on promotion of Solar Water Heating Systems is introduced. This chapter establishes a number of measures and incentives including:

- Mandatory installation of SWH systems in buildings and the inclusion of such an obligation in the certification of the energy performance of buildings;
- Minimum technical and efficiency requirements for SWH;
- Certification of SWH and installers by an accredited body;
- Exemption from custom duties and VAT of imported or domestically produced or assembled SWH systems.

These measures will provide a boost to the development of the SWH market that is already in its initial steps in Albania.

The measures for promoting the use of RES have been summarized in the following **Table 43**.

Table 43: Overview of all Policies and Measures

Name and reference of the measure	Type of measure[3]	Expected result[4]	Targeted group and or activity***[5]	Existing or planned	Start and end dates of the measure
1. Feed-in tariffs for electricity produced from renewable sources for Albania in general and Gjirokastra Municipality in particular (FiT)	Financial	Energy generated (ktoe)	Investors	Existing	With respect to new projects, the measure will continue beyond 2025
2. Obligatory and priority connection of producers of electricity from renewable sources to the grid for Albania in general and Gjirokastra Municipality in particular	Regulatory	Energy generated (ktoe)	Investors	Existing	
3. Payment only of the direct costs of connection to the grid for Albania in general and Gjirokastra Municipality in particular	Regulatory	Installed capacity (MW/year)	Investors	Existing	No specific time limit
4. Long-term power purchase agreements with regard to electricity produced from SHPPs for Gjirokastra Municipality in particular	Regulatory	Energy generated (ktoe)	Investors	Existing	10 years
5. Obligatory purchase of electricity produced for HPPs of lower 15 MW installed capacity for Gjirokastra Municipality in particular	Regulatory	Energy generated (ktoe)	Investors	Existing	10 years
6. Penalty payments in the event of curtailment of production due to the network operator's fault (take or pay clauses) for Albania in general and Gjirokastra Municipality in particular	Financial	Energy generated (ktoe)	Investors	New	10 years
7. Compensation mechanism for the costs of the Public Supplier and Public Retailers of purchasing electricity from SHPPs at preferential prices for Gjirokastra Municipality in particular	Regulatory	Energy generated (ktoe)	Networks, investors, users	Existing	10 years

[3] Indicating if the measure is (predominantly) regulatory, financial or soft (i.e. information campaign)

[4] The expected result behavioral change, installed capacity (MW; t/year), energy generated (ktoe)

[5] The targeted persons: investors, end users, public administration, planners, architects, installers, etc or what is the targeted activity / sector: biofuel production, energetic use of animal manure

8. Licensing procedures for producers of electricity from renewable sources up to 15 MW installed capacity for Gjirokastra Municipality in particular	Regulatory	Energy generated (ktoe)	Producers	Existing	No specific time limit
9. Guarantees of origin for all non-priority RES (all RES expect SHPPs) for Gjirokastra Municipality in particular	Regulatory	Energy generated (ktoe)	Investors	New	No specific time limit
10. Obligations for persons placing on the market petroleum-derived liquid fuels for transport purposes to offer fuels for diesel and petrol engines blended with biofuels in the percentage terms laid down in the existing Biofuel Law for Albania in general and Gjirokastra Municipality in particular	Financial	Biofuel production and use (ktoe)	Investors, traders and public administration	Existing	In force from 2009
11. Zero rate of excise duty for pure biodiesel and reduced rate of excise duty for biofuel blends of a specified percentage for Albania in general and Gjirokastra Municipality in particular	Financial	Biofuel production and use (ktoe)	Investors, traders and public administration	New	January 2015
12. The authority responsible for supervising the quality of pure biofuels for Albania in general and Gjirokastra Municipality in particular	Administrative	Use of biofuels for transport	Distributors and end users	New	January 2015
13. Testing equipment for pure biofuels provided to the Institute for Metrology for technical surveillance for Albania in general and Gjirokastra Municipality in particular	Administrative	Use of biofuels for transport	Distributors, end users and public	New	January 2016
14. Energy Efficiency and Renewable Energy Credit Line (‘EERECL’). This will be fixed after the approval of Energy Efficiency Fund	Financial	Energy Savings and generated (ktoe)	Investors and (industrial) end users	New	January 2016
15. Energy Efficiency Facility of the European Reconstruction and Development Bank and as well as European Investment Bank for Albania in general and Gjirokastra Municipality in particular	Financial	Energy Savings and generated from RES	Investors	Existing EBRD direct or through banks Existing KfW direct or through banks	January 2015-2025
16. Adoption of policies and measures for	Administrative	Energy generated	Newly built or	New	January 2016

increasing the use of solar energy in buildings to install solar water heating system for Albania in general and Gjirokastra Municipality in particular		from SWHS	existing ones, public or private buildings		
17. Installation of solar water heating systems by taking into account in the certificate for energy performance of the building issued according to the provisions of the Law on energy efficiency for Albania in general and Gjirokastra Municipality in particular	Administrative	Energy generated from SWHS	Newly built or existing ones, public or private buildings	New	January 2017
18. All domestic and imported solar water heating systems shall meet minimum technical requirements for Albania in general and Gjirokastra Municipality in particular	Administrative	Energy generated from SWHS	Newly built or existing ones, public or private buildings	New	January 2015
19. Any person producing or importing solar thermal systems shall be exempted from the customs duties and VAT for those solar water heaters for Albania in general and Gjirokastra Municipality in particular.	Financial	Energy generated from SWHS	Newly built or existing ones, public or private buildings	New	January 2015

CHAPTER 7: MAIN SERVICES OF GJIROKASTRA MUNICIPALITY SUPPORTING TOURISM

The **purpose of the assessment** is to shape an urban energy action plan for a time horizon of 15 years by analyzing the energy performance of municipal service sectors, prioritize areas of intervention, development of a catalogue of energy efficiency investment measures and a sound implementation strategy. This analysis presents the key findings of the application of the ENERGY SAVING model. The recommendations are based on a rapid assessment of all sectors of municipal energy spending, its challenges and needs.

The **rationale for investments** in municipal urban infrastructure is to improve (I) living and working conditions as well as the (II) sustainable utilization of resources towards a clean and livable Municipality. Investment in energy efficiency (EE) retrofit of municipal facilities (such as in public buildings, street lighting or transport) enable to achieve levels of service and comfort standards which are set by governmental regulations and establish a comfortable, healthy and safe environment for the urban population. In parallel, energy and fuel savings as well as the reduction of energy bills and public spending for energy along with an extension of the facility lifetime contribute to urban sustainable development by reducing vulnerability and increasing resilience to stress. EE investments allow a long-term reduction of budget spending needed to supply the facility with energy by achieving standard performance parameters (such as indoor temperature and illumination). These savings constitute returns and can be utilized to refinance the investment. Under the current low energy tariffs many EE measures have a long payback periods, hence the Municipality is encouraged to start with those investments that generate the highest returns. ….

The **Municipality government has to undertake** a wide variety of **interventions** to address barriers that currently hinder uptake of energy efficiency improvements in the municipal sector and in order to achieve (i) Scaling up municipal EE investment; (ii) Promoting sustainable EE financing and (iii) Strengthening EE delivery capacity.

Implementation of the EE program and investment measures is to **build institutional capacities**. Those are necessary to manage the program and to effectively implement municipal energy management raise awareness among energy consumers. Institutional capacities are essential as it determines the success of implementing the investment measures. It is recommended to establish or strengthen a dedicated administrative unit within Municipality Administration as **Energy Efficiency Department** with the tasks of the EE Program and project implementation.

7.1 Public Building in the Gjirokastra Municipality

Operators of facilities/ utilities:	City public buildings can be divided into two types of budget funding: central government, regional and municipal buildings. Ownership of the government, regional facilities is belonging to the respective Ministry which is obliged to pay salaries for teachers, medical staff, police and other central governmental ministries.

<table>
<tr><td></td><td>
The city administration is obliged with the operation of the buildings within the city boundaries which includes the payment of energy bills. Those building operation costs are included in the overall municipal budget.
Electricity consumption of municipal buildings is metered at monthly basis and reported to the city administration. There is no evaluation of energy consumption.
- Municipal Agency of Social Welfare is responsible for the operation of kindergartens, schools, dormitories and policlinics
- Occupation in schools
- 6 kindergartens in Gjirokastra city, total use by 600 kids + 5 kindergartens in villages, total 300 kids
- Total number of pupils 1-9 grade, 3,000
- Space heat supply: mainly by electricity and wood stoves, diesel fuel oil is exemption for 1 kindergarten and high school
- Municipality has budget limits for building heating: only limited amount of wood or diesel is purchased by municipality and delivered to the building, there are power consumption limits communicated with the directors of the facility, but no monitoring of consumption
- No data are available on the area of the buildings its use and its energy consumption
- City hall: 100 years old building, 3 floors, total approx. 1,500 m² area, leaking roof
Currently under retrofit financed by funds of EU IPA, including windows, envelop repair, heating system, etc., Design in the frame of PRO-ENERGY project in 2013
➔ Pls also see: overview of public buildings document
- 2 tables with power consumption for schools/ kindergartens/ other → Rainer's desk
a) 19 schools/ kiga villages; August 2016, 35,5 MWh
b) 25 buildings in G.: 68 MWh
➔ No areas, no info on wood or diesel consumption, August is off season! → no use of such data possible
<u>Recommended EE measures</u>
- Concentration on 10 public buildings in the historic center:
- Asim Zeneli school, High school, Kotto Hager school, music&art school, ethnographic museum, library Balkaneana, etc.
list from Min of Culture, Institute for monuments:
- Measures in schools:
o Retrofit of building envelop: roof, windows, walls, doors
o Appropriate heating systems: efficient wood (or pellet) stoves
o EE lighting, retrofit of electric wiring
- Measures in Kindergartens:
o As for schools including efficient wood (or pellet) stoves plus solar DHW collector with tank and piping
- Museum: complete retrofit
</td></tr>
</table>

7.2 Street Lighting

Operators of facilities/ utilities:	Operation and maintenance of municipalities' outdoor lighting is carried out by municipal public lighting company.
Level of Municipality administration control or influence:	ımination of monuments and historic buildings: - Illumination of castle is subject to Ministry of Culture, including investments and energy bills - No intervention by municipality - In 2012 MoC invested in retrofit of 7 castles - 52 buildings in G. need decorative illumination, category I of list http://www.imk.gov.al/site/?page_id=77 - http://www.imk.gov.al/wp-content/uploads/monumente/lista%20e%20monumentewve/GJIR.pdf

	- Proposal: selection of 10 buildings of Cat I belonging to municipality (no state, no private houses), e.g. Kotto Hager,, Gjirokastra Museum, Ethnographic museum, Asim Zeneli school

7.3 Municipal solid waste services

Operators of facilities/ utilities:	Within the Gjirokastra Municipality the Department of Transport, Civil Emergencies and Services is responsible for cleaning and waste collection and disposal. For city cleaning and waste collection and disposal is the municipal subsidiary company is contracted.
Level of Municipality Administration control or influence:	The city administration has full control over the waste service and finances the expenses of the municipal subsidiary company through the fee revenues, which are billed by the municipality. Specific sector information: - Waste collection is realized in the complete area of Municipality of Gjirokastra - 5 hot spots of waste collection, 100% cleaned - CA provides 300 waste bins at 1 m³ throughout municipal area + 50 in villages Vehicles for collection: 3 modern (2006) +ü 3 small old - There are many illegal waste dumps, estimated < 20%; sporadic waste dumping - Waste revenues 2,5 M ALL, while costs amount to 30 M ALL - Waste collection service costs are not covered by revenues from waste fees; municipality substitutes to balance - Billing of waste service is done per household or legal entity together with the waste supply bill; during last year collection rate was increased to 90% - Plan to establish regional landfill 16 km away from G. together with additional 5 municipalities, total investment costs 5-7 M EUR, capacity 30 yrs, currently technical specification, tender in 2017, planned operation in 2018/19 Recommendations for intervention: - Containers + vehicle replacement - Idea for underground containers in old town

7.4 Potable Water supply

Operators of facilities/ utilities:	Water supply and waste water services are provided by Joint Stock Company “Water supply-sewage Gjirokastra” servicing all customer groups in the city of and 10 villages in the municipal area.
Level of Municipality administration control or influence:	The municipal administration as a key shareholder has control over " Water supply-sewage Gjirokastra” and maintains influence on operation, performance and financing.
Condition of main equipment and EE potential:	<u>Specific sector information:</u> - 3 water sources of which 2 with reservoirs and gravity flow - 1 well with pumping station - Current water supply average 1 h/day - 100% of HH and businesses are connected to water distribution system - Old waster distribution system is from 1940, huge water losses and waste of water - Total 70% losses, of which up to 50% distribution network losses and 20% wasted as customer side which have no meter (pay only flat rate) - Water fee collection rate id 95% - Distribution capacity peak 95.000 m³ (June 2016), Municipality energy spent 0.738 M ALL/months - Energy spend in off-peak season: 19.000 ALL for pumping - KfW project: 5 M EUR invest - feasibility study of 2014 available for water network fixing available in Albanian (Rainer)

	- Intention to supply (from now 60% to future 100%): reservoir → storage in town → distribution network, from now 1 h/d to 24 h/d supply - Stage I: to be completed by 31.12.2016: Construction of 1.500 m^3 reservoir north of G. + 750 m^3 South of G. - Distribution system fixing, - experience: 5 km network fixing lead to 30% reduction of water consumption - Only 1 village included - Next stages with KfW agreed: 2017-2020, remaining part of water distribution network, metering, WW collectors + sewer + (no WWTP!) - Water subscribers: currently 8.500 households, 1.500 businesses, 80 public customers - Due to water shortages almost all customers have their individual water tank (top roof or next to buildings) with water pup (~ 1.5 kW, to keep pressure, working 6-7 h/day), total pumping energy per HH of 4000 kWh/yr * 8.000 HH!

7.6 Waste water services

- Old city widely without WW collectors, 10.000 inhabitants
- 90% of city G. has WW collector
- WW not treated, goes directly to river Drino
- WWTP is planned at 6km from city, currently no investor foreseen for the time being

<u>Identified needs and sub-projects:</u>

- Extension of WW collection, from now 90% to 100% (partly KfW)
- WWTP

<u>Recommendations for intervention:</u>

- Waste Water Treatment Plant

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7.7 Municipal public transport

The mobility of inhabitants in the Municipality of Gjirokastra is undertaken by different means of transport (pedestrian, public transport, individual motorized transport). It is assumed that each inhabitant travels on average 5.9 km per day (according to average statistic value Albania). Gjirokaster welcomes annually about 80.000 tourists with increasing tendency of 10-20% per year. It is assumed that tourists travel 35 km during their stay.

- 7 mini-bus lines in the city + to villages, 12 mini-busses + 1 large bus
- 1 private company, licensed for 5 years
- Also serves village of Lazarat (4.000 inhab.) with 9 busses.

CHAPTER 8: FINANCING ISSUES FOR UTILIZATION OF RES AND IMPLEMENTATION OF EE MEASURES IN THE GJIROKASTRA MUNICIPALITY

8.1 Necessary Financial Means for Utilization of RES and Implementation of EE Measures in the Gjirokastra Municipality

Finally, based on the first investment for each measure for each category of building has been possible to carry out the last calculation related to investment needed to cover all each measures for the residential sector of Gjirokastra Municipality. These investments are presented at figure 79, 80, 81, 82)

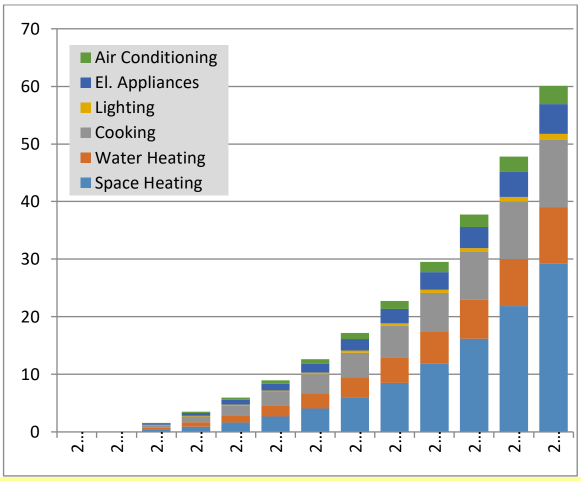

Figure 79.: Investment needed (Million Euro) for household building stock of Gjirokastra Municipality

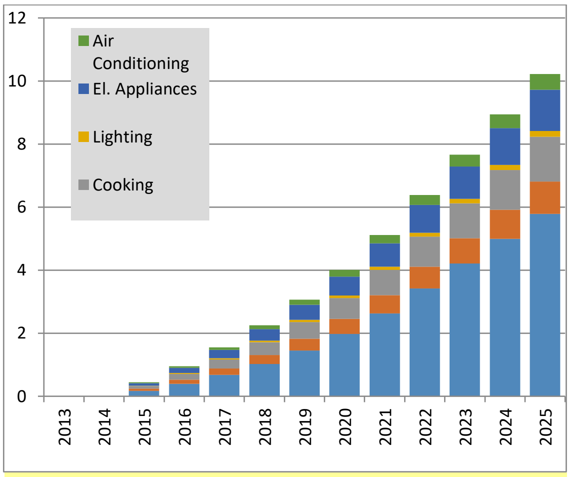

Figure 80.: Investment needed (Million Euro) for public building stock of Gjirokastra Municipality

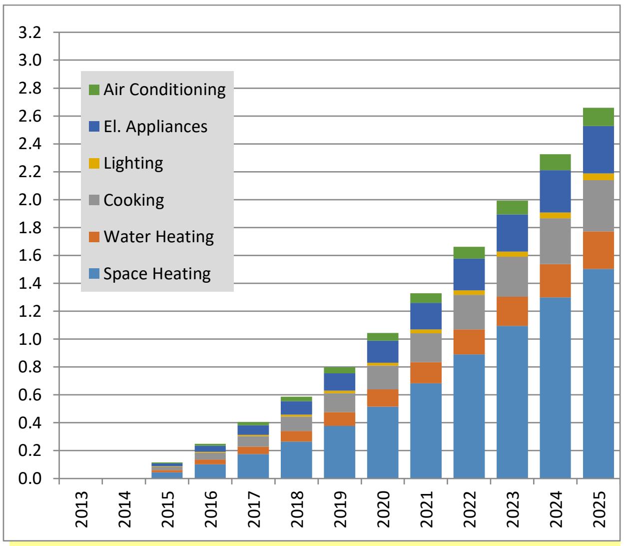

Figure 81.: Investment needed (Million Euro) for private building stock of Gjirokastra Municipality

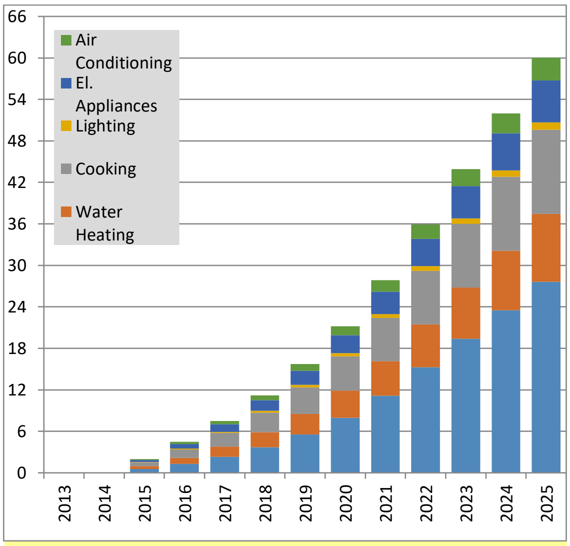

Figure 82.: Investment needed (Million Euro) for EE residential, public and private building stock of Gjirokastra Municipality

Despite their relatively low savings potential, launching the EE implementation programme in the central and municipality public building sectors would give a strong message that the local government is prepared to lead by example and it would provide a showcase for encouraging other EE initiatives in Gjirokastra. This in turn would help to foster a market for EE goods and services and create better access to public and donor funds. On the supply side (that is, in the provision of goods and services that improve EE, such as the installation of efficient heating and cooling systems, solar hot water systems, efficient light bulbs, etc), a successful implementation programme will create real opportunities for construction, heating and air conditioning companies and they will be incentivized to improve their skills and knowledge in order to win future business. After completing a number of EE implementation projects successfully, the experience of other countries suggests that some of these companies will evolve and transform into ESCOs. Secondary legislation to support the ESCO contracting framework would need to be prepared, as required by the Draft Law on Energy Efficiency, to provide an enabling environment for the uptake of ESCO business.

8.2 The Financial Possibilities and Creation of Good Predisposition for Investments in the Gjirokastra Municipality

Each of the Fund models presented above can potentially stimulate EE investments. However, these models have different impacts in terms of their ability to mobilize new investment, make efficient use of the Fund’s capital and ensure the sustainability of the Fund’s operation. Some advantages and drawbacks of Fund models are listed below:

Table 1. Advantages and drawbacks of Energy Efficiency Fund models

Fund model	**Advantage**	**Drawback**
Loan Guarantee	• Provide funding for EE investments that are not financially viable under current loan conditions • Reduced risk of non-repayment helps projects to receive better loan conditions from the commercial banks	• If failure to repay loans by borrowers is higher than expected, the Fund’s resources could be used more rapidly than planned and its ability to support new loans diminished

Fund model	Advantage	Drawback
	• High guarantee to loan ratio and mobilization of high external investments for the projects • Possible support to development of EPC/ESCO industry • Guarantee can be used again for new loans, once current loans are repaid	• Certain borrowers may not meet the loan standards of the Fund and hence not qualify for financing • If the Fund charges a fee for its guarantee, these costs might be passed on to the borrower, thereby increasing total loan costs
Interest Rate / Investment deduction payment	• Reduced cost of borrowing will increase the feasibility of projects • The Fund benefits from the commercial banks' client portfolio and expertise • Limited or no exposure of the Fund to borrower credit risk	• Interest rate / investment deductions will reduce the Fund's capital until it is depleted • If investment deduction is applied, the Fund resources will be spent faster, leaving no resources for other projects • Does not address essential risks the banks may perceive in making loans • Very limited benefit for small investments
Direct Loans	• Fund provides loans at more favourable and flexible terms than those offered by the commercial banks • Fund is the last alternative for some projects that cannot get financing from commercial banks • Fund may give loans to projects being implemented on an EPC/ESCO basis, supporting developing of this new business model • Once loans are repaid, funds can be used to finance new projects (i.e. act as a revolving fund)	• Significant costs associated with staff training and Fund operation (since the Fund acts as a bank) • Potential legal obstacles for establishing and running such a fund • Fund bears all credit risks • If the Fund's capital is fully distributed then no resources will be available to make new loans for other projects until the first repayments have been collected

However, if the annual income of the Fund is secured by energy and environmental taxes, then the sustainability of the Fund's operations can be achieved.

Based on the advantages and drawbacks of EE Funds presented above, the following recommendations are suggested;

- Begin by providing loan guarantees, so that by reducing the risk exposure of the Fund, higher external investments can be attracted;
- Utilize interest rate payment reductions, because the benefits for smaller investments are low. This is also the least sustainable EE Fund model and it is not preferred to be selected at least in short to medium period;
- Utilize investment deductions with caution, particularly if the annual income of the Fund is not secured since this option spends the Fund's resources the fastest;
- Build up a capability to offer direct loans over the medium-term, cooperating where possible with similar existing state institutions such as a Guarantee Fund, a Development Fund or a Development Bank.

Establishing an Energy Efficiency Fund requires several decisions to be made and actions to be taken. The following activities are recommended for this process:

- Establish relationships with IFIs and available EU financing instruments and determine how IPA instruments and IFIs can contribute to establishing a Albania EE Fund or a joint EE Fund;
- Develop detailed market assessments to understand the investment potential of the market by sector and by different target groups;
- Draft eligibility and evaluation criteria for investments to be supported by the Fund for pre-screening of potential projects and to ensure that the development of selected projects helps the Fund achieve its priorities;
- Determine the Fund models to be used for different investment projects, according to the type of projects, the level of investment and the type of client;
- Prepare promotion of the Fund among target groups to bring together all potential partner organizations (commercial banks, project developers, clients-investors) that may wish to cooperate with or capitalize the Fund in future;
- Evaluate cooperation alternatives with external financiers and identify how the Fund, partner institutions and clients can benefit from such cooperation.
-

The general opinion about energy levies among Western Balkan (including Albania) countries is negative. The view is that energy levies will, together with permanent increase in energy carrier prices, lead to diminished living standards, increase the utility companies' operating costs and lower energy service affordability. Higher energy prices should increase the motivation for energy efficiency investments, while at the same time reducing the ability of energy consumers to invest in energy efficiency. Thus, energy consumers will become more motivated and willing to invest in energy efficiency, but their ability to invest will be reduced. Therefore a lack of up-front finance for investment in energy efficiency measures will not allow for improving energy efficiency but will simply lead to reduced affordability of energy services. Energy market reforms envisaged by the ECT are associated with minimizing adverse social effects which include, among others, the impact of increasing energy prices on vulnerable and low income population groups. Improvements in the quality of energy infrastructure services to provide better accessibility, provide a more reliable quality of supply and increase energy efficiency are possible only if energy carrier prices become cost-reflective. In practice, this means higher prices and increased payment discipline (better billing and collection). But while cost-reflective prices will bring benefits, at the same time they will make energy services less affordable, not only for households below the poverty line but also for households above it. Whilst policy-makers are aware of the social consequences of infrastructure reform, they often use affordability as an argument against tariff reform rather than as a means through which the social impact of tariff adjustments can be mitigated. Thus, the main issue is how to bring tariffs to cost reflective levels, improve and secure a self-sustainable quality of energy services and protect vulnerable groups. A suitable approach must combine: (i) tariff reform with associated measures to mitigate its social consequences, (ii) a targeted assistance programme, and (iii) an end-user energy efficiency programme.
A good example may be VAT reduction (or deduction) for EE equipment that is not produced in Albania. Exemption from custom duties would probably not provide a sufficient incentive and custom duties on such equipment imported from EU will diminish in the next few years, most likely prior to the end of the period covered by the NEEAPs (diminishing customs taxes will be subject to agreement on Albania' EU stabilization and integration). However, VAT reductions over a specified short period of time could stimulate the wider use of such

equipment.
A comprehensive study on VAT and income tax reduction is strongly recommended for households and private (commercial and industrial) sectors in Albania. In households, such a sector study could cover windows and thermal insulation, solar water heaters and efficient biomass boilers. Until such studies are completed no fiscal measures may be recommended, since they could adversely impact the annual state budget revenue and income.

8.3 Financial and Technical Barriers which have to be Overcome

Updated Energy Strategy review will be based on the Albania Government Program and a number of Government decisions, the document of the medium term energy sector policies, and a variety of relevant studies and analysis conducted in the recent years. Actual **Energy Strategy of Albania aims as the main objective at achieving effective management of existing energy resources and protection of the environment.** It focuses on enhancing the security of energy supply according to European standards, as well as on the diversification of energy resources. **This strategy aims also at stimulating rational utilization of energy, promoting energy efficiency, promoting development of renewable energy sources** and introduction of new technologies that do not cause irreparable damage to the environment, thus respecting the application of internationally accepted environmental standards. The Energy Efficiency and Demand Side Management measures are critical for reducing the high rate of annual demand growth, which is due mainly to use of electricity for heating purpose. MEI assisted from AKBN has prepared as well as the Draft Energy Efficiency Law and this one will give even greater importance for increasing energy efficiency in all sectors of the Albanian economy.

The main barriers and the ways to mitigate them for introducing energy efficiency in Albania building stock are as following:

a. Non-payment of energy by consumers - **Government of Albania in the last three month has improved rate of collections very fast and will help in direction increasing the implementation of EE measures in building stock**.
b. Lack of information and awareness from consumer's side - This is a potential barrier in every end-use sector. **Being under such conditions MEI/AKBN supported by Donors has started an EE awareness campaign for promotion of EE and this will help a lot mitigating this barrier**.
c. Lack of incentives to take actions leading to energy efficiency - One very important barrier in the public sector is that the rules do not allow a hospital, school or other unit to benefit directly from energy savings.
d. Lack of capital - There is frequently a shortage of capital and there are often alternative uses for capital that are more cost-effective. Loans can be difficult to obtain and when obtained, high interest rates have to be paid. KfW will finance about 25 Million Euro as soft loans for EE in Public Buildings
e. Lack of professional skills and knowledge - The architects, engineers, importers and installers may not have the necessary technical skills or knowledge to take full advantage of the opportunities for saving energy using modern methods. **MEI/AKBN supported by GIZ has prepared the first training course for the first group of Energy Auditors**.
f. Lack of legal and regulatory base - There is, at present, a lack of a suitable legal and regulatory base for the promotion of energy efficiency and renewable energy applications or to allocate the responsibilities and competencies for improving the situation.