


# ALBANIA'S TECHNOLOGY NEEDS ASSESSMENT

***(Final Draft)***

MoE

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**ACRONYMS**

| | |
|---|---|
| ARMO | Albania Refinery Marketing of Oil Company |
| CEE | Central East Europe |
| CEEC | Central and Eastern European Countries |
| CHP | Combined Heat and Power |
| CoP | Conference of Parties |
| CSP | Continuous Seismic Profilers |
| CZMP | Coastal Zone Management Plan |
| DGFP | General Directorate of Forests and Pastures |
| DH | District Heating |
| DHW | Domestic Hot Water |
| DSU | Data Storage Unit |
| E.S | Echo-Sounder |
| EEC | Energy Efficiency Center |
| ERE | Energy Regulatory Body |
| EU | European Union |
| FAO | Food and Agriculture Organization |
| FNC | First National Communication |
| GDP | Gross Domestic Production |
| GEF | Global Environment Facility |
| GHG | Greenhouse Gas |
| GIS | Geographical Information System |
| HOB | Heat only Boilers |
| HPP | Hydro Power Plant |
| IHM | Institute of Hydro Meteorology |
| IPCC | Intergovernmental Panel on Climate Change |
| KESH | Albania's Electro-Energy Corporation |
| LEAP | Long -range Energy Alternatives Planning |
| LPG | Liquefied Petroleum Gas |
| LUCF | Land Use Change and Forestry |
| MAP | Mediterranean Action Plan |
| MDGs | Millennium Development Goals |
| MoE | Ministry of Environment |
| MSW | Municipal Solid Waste |
| NAE | National Agency of Energy |
| NEAP | National Environmental Action Plan |
| NGOs | Non-Governmental Organizations |
| NHM | National Hydrological Network |
| NSSED | National Strategy for Socio-Economic Development |
| PV | Photo Voltaic |
| R&D | Research and Development |
| REA | Regional Environmental Agency |
| SAA | Stabilization and Association Agreement |
| SERVECOM | Service of Oil Companies |
| SMEs | Small and Medium Enterprises |
| SSCHP | Small Scale Combined Heat and Power |
| TNA | Technology Needs Assessment |
| TPP | Thermo Power Plant |
| UCTE | Union of Central Transmission of Electricity |
| UNDP | United Nations Development Program |
| WWT | Waste Water Treatment |

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## INTRODUCTION

### *i. Albania's Development Context*

The last decade has been one of the great political, economic and social transformations in Albania. During the first decade of the transition, at a time when many other former communist countries, for various reasons, resisted implementing reforms at all, Albania was considered to be a courageous and ambitious country willing to carry out radical reforms. It attained considerable success in many important indicators but in contrast to other former-communist countries, the first five years of the transition culminated in the internal crisis of 1997 due to pyramid schemes, which severely damaged the achievements, which has been accomplished at early stages of transition. This crisis was reflected in the drastic fall of the production as a result of the massive shutdown of inefficient state-owned companies and the collapse of the agricultural production. This can be clearly seen in the negative growth of the GDP up to the year 1993 and in the high levels of the inflation. (see Table 1).

The implementation of an ambitious reform program coupled with a liberalization of prices and markets, privatization, establishment of a commercial banking system, and the drafting of new legislation brought forth swift and notable results in macro-economic stability, which was viewed quite positively by international institution. During the period 1993-1996, in particular, there was an impressive growth in the private sector, which led to a substantial rise in GDP of about 13% and in fall of inflation to 6%. The private sector, almost non-existent up to the year 1990, turned into the main contributor to the GDP with about 75% in 1996. (see Table 1).

Despite of economic reforms, Albania still remains one of the poorest countries in Europe with an estimated 46% of the population living on $2 per day. Poverty is even more prevalent in rural areas where four out of five people are poor. Many families lack access to basic services including water, sanitation and electricity. In remote mountainous areas there is a sense of isolation and abandonment.

***Table 1:*** *The main macro-economic indicators for Albania: 1991-2001*

| Indicators | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GDP growth at constant price (%) | -27.7 | -7.2 | 9.6 | 8.3 | 13.3 | 9.1 | -7.0 | 8.0 | 7.3 | 7.8 | 6.5 |
| Inflation (%) | 104.1 | 236.6 | 30.9 | 15.8 | 6.0 | 17.4 | 42.1 | 8.7 | -1.03 | 4.2 | 3.5 |
| Exchange rate USD / Lek | 25.0 | 98.7 | 100.9 | 95.0 | 94.5 | 103.7 | 149.8 | 150.6 | 137.7 | 143.7 | 144.0 |
| FDI (Million USD) | 8.0 | 32.0 | 45.0 | 65.0 | 89.0 | 97.0 | 42.0 | 45.0 | 51.0 | 92.0 | 220.0 |
| Unemployment rate (%) | 8.3 | 27.9 | 29.0 | 19.6 | 16.9 | 12.4 | 14.9 | 17.7 | 18.0 | 16.9 | 14.6 |
| Total GDP in current prices (Lek) | 16,404 | 50,697 | 125,334 | 184,393 | 229,793 | 280,998 | 314,716 | 460,631 | 506,205 | 536,202 | 576,533 |
| Contribution of the private sector (%) | 5.0 | 10.0 | 40.0 | 50.0 | 60.0 | 75.0 | 75.0 | 75.0 | 75.0 | 75.0 | 75.0 |

Source: INSTAT

After 1990, the big changes of the economy affected also the change of the GDP structure. Because of the massive damages and the drastic reduction of the production levels in general and especially in other branches of the economy like industry, transport, services etc it results; that starting from the year 1992 to 1996 agriculture stands for about 54% of the GDP (calculated according to the method of production calculation – *see Table 2).*

***Table 2:*** *The structure of GDP 1992 - 2001*

| Sector share (%) | Years | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **1992** | **1993** | **1994** | **1995** | **1996** | **1997** | **1998** | **1999** | **2000** | **2001** |
| Industry | 32.1 | 16.9 | 13.9 | 12.5 | 11.7 | 15.5 | 13.8 | 11.4 | 11.4 | 11.7 |
| Agriculture | 42.5 | 54.2 | 54.6 | 54.6 | 54.6 | 30.8 | 31.2 | 30.7 | 28.5 | 28.1 |
| Construction | 6.6 | 7.6 | 9.1 | 9.6 | 11.4 | 4.6 | 4.3 | 4.1 | 4.9 | 6.1 |
| Transport | 3.3 | 3.0 | 3.1 | 3.4 | 3.5 | 6.5 | 7.6 | 10.3 | 11.0 | 9.9 |
| Commerce, hotels & rest | | | | | | 24.3 | 20.8 | 21.2 | 23.2 | 21.3 |
| Services | 15.6 | 18.3 | 19.4 | 19.8 | 19.9 | 21.1 | 25.9 | 27.9 | 25.9 | 26.7 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

Source: INSTAT

In 2001, the Albania's Government, in collaboration with the World Bank prepared its Strategy on Growth and Poverty Reduction, known as the National Strategy for Socio-Economic Development (NSSED), which is the country's first comprehensive economic development strategy. This strategy, developed through a broad participatory process that included local government, civil society, private sector and donors, aims to address poverty reduction through the sustainable development and a broad set of reforms and activities. It is also seen as one of the mechanisms to achieve Millennium Development Goals (MDGs) as long-term targets for development, as agreed globally, in particular through United Nations Development Program UNDP. In addition, in the context of the adoption of MDGs, efforts are made to review and adapt the NSSED targets to comply with the MDGs required trends.

Albania is also in the process of negotiating a Stabilization and Association Agreement (SAA) with the European Union (EU), which will set the conditions for the country's eventual accession to the EU. The process of integration in the EU is at focus of all discussions in Albania, in particular since 1997. The Government considers the signing of the SAA to be as a political priority, representing the confirmation of the progress made in Albania and an indication of Government achievements, which will strengthen and accelerate reforms in all fields and thereby brings the country progressively closer to EU. The policies that need to be adopted and actions to be taken under the SAA are fully in line with the NSSED. The NSSED and SAA are the main focus of national development and donor support.

**ii. Environmental context**

According to the Constitution, every citizen in Albania is entitled to "an ecologically healthy environment for present and future generations" as well as "access to information on the state of the environment". The Constitution also requires the "rational exploitation of forests, waters and pastures based on the principle of sustainable development".

The Law on Environmental Protection (1993, amended in 1998 and 2002) forms the basis for environmental management in Albania. The law addresses the prevention and reduction of pollution, sustainable management of natural resources, monitoring and how to define pollution levels. It provides binding provisions for environmental impact assessment and the implementation of the polluter pays principle.
A series of sectoral laws contain provisions for environmental protection, for example the law on water reserves, law on mining, and laws on regulatory entity of waste waters, hunting, forestry, soil, urban planning etc. These laws are accompanied by a considerable number of normative acts. The legislative framework is already quite comprehensive.

Several important laws are adopted by the Parliament such as Law on Environmental Administration of Solid Wastes; Law on Environmental Treatment of Used Waters; Law on Environmental Impact Assessment; Law on Protected Areas; Law on Protection of Marine Environment from Pollution; Law on Air Protection. There are also several Decisions recently adopted by the Government of Albania such as Decision on: Environmental Monitoring; Environmental Standards; Procedures Related to the Designation of Protected Areas; Administration of Protected Areas; Designation of Nature Monuments. However, the challenge is not so much in the legislation, which seems to be in place, but in its implementation and enforcement.

The National Environmental Action Plan (NEAP) is the basic document presenting the Government's policy and general programmes in the environmental sector. The NEAP was first prepared with assistance from PHARE and the World Bank in 1994. It was revised in 2001 (covering the period 2002 – 2005) through an extensive consultative process involving a large number of stakeholders organised into thematic work groups. The main issues identified through the NEAP are: (i) Development of policies and programmes; (ii) Improvement of the legal framework; (iii) Institutional strengthening and capacity building; (iv) Public awareness raising.

Priority investments are to focus on watershed management, forestry, flood control, solid waste management, water supply, sewage systems and urban management. However, the revised NEAP does not set out priorities. Moreover, although each proposed activity in the NEAP is costed; most funds have only been requested and not secured. An inter-ministerial committee, chaired by the Prime Minister, has been set up to enable implementation of the revised NEAP.

Other main policy documents that address environmental concerns directly or indirectly include NSSED which is complemented by many sectorial strategies such as: National Water Strategy (2004); National Strategy for Development of non - Food Industry Sector (2004); National Energy Strategy (2003); National Strategy for the Development of Agriculture and Food (2003); National Biodiversity Strategy and Action Plan (2000); National Waste Management Plan (1996).

In institutional terms, the Ministry of Environment (MoE) is the highest governmental body responsible for environmental protection, in the Republic of Albania. MoE was created in September 2001 from the National Environmental Agency, which had been established in 1998, based on the Committee for Environmental Protection in the Ministry of Health and Environment. The Law on Environmental Protection states that the Ministry is responsible for the implementation of global environmental agreements in Albania. Specifically, the Council of Minister's decree on "Environmental monitoring" mandates the MoE to monitor all environmental issues, including the fulfillment of obligations and coordination of activities relating to the global environment and to international environmental agreements. Within this overall framework, the Ministry collects necessary data from different research institutes and line ministries.

The Environmental Inspectorate established at central level and Regional Environmental Agencies (REA), established at prefecture level, control and ensure the implementation of the environmental legal framework; supervise and apply preliminary environmental licensing, and; collect and process the data on the environmental situation at municipal and prefecture level. Other inspectorates such as the Sanitation Inspectorate, the Forest Police and the Construction Police play an important role.

In line with the Law on Local Government, municipalities (district level urban areas) are assigned the following environmental responsibilities: the management of water supplies, closed industrial sites, waste and urban green areas. However, the municipalities face enormous challenges as the economy grows and associated environmental issues such as solid

waste and air pollution increase. In response, many municipalities have prepared Local Environment Action Plans and Local Action Plans for Environment and Health.

Many sectoral ministries have established environmental units, although the roles and responsibilities of these units have not been fully clarified. The mechanisms for communication and collaboration between the units and MoE have also to be clarified. At the national level, a number of high level inter-ministerial structures with a permanent or temporary mandate, decision-making or advising, exist. The majority of scientific and research institutions contribute to environmental monitoring based on government decisions and through financial support from the government. MoE also sub-contracts these institutes to collect information and perform other Convention-related tasks. MoE recently established the Institute for Environment.

***iii. UNFCCC context on technology transfer.***

The UNFCCC represents a global accord, which joins all Parties under a global effort to address climate change issue. The overall objective of the UNFCCC, as indicated in the Article 2 is to achieve, in accordance with relevant provisions of the Convention, stabilization of GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

Achieving the ultimate objective of the UNFCCC will require technological innovation and the rapid and widespread transfer and implementation of technologies, including know-how for mitigation of GHG emissions, reducing the vulnerability and adaptation to climate change.

***Box 1*:**

*The beginning of the industrial revolution is usually used as the time frame from which increases in the emissions and accumulation in the atmosphere of the GHG are measured. The introduction of large numbers of new technologies. It is thus not surprising that a frequently expressed view in the world-wide deliberations on global climate change has been: 'if the introduction of the technologies created the problem, other new technologies will help us in solving it. In most cases, the adequate technologies already exist, but not necessarily in the locations where they could best be used to mitigate increases in the emissions of GHG or adapt to their impacts on environment.*

*Sustainable Development globally will require radical technological and related changes in both developed and developing countries. Economic development is most rapid in developing countries, but it will not be sustainable if these countries simply follow the historic pollution trends of industrialized countries. Rapid development with modern knowledge offers many opportunities to avoid bad past experiences and move more rapidly towards better technologies, techniques, and associated institutions. But to achieve this developing countries will require assistance with developing human capacity (knowledge, techniques, and management skills) developing appropriate institutions and networks and with acquiring and adapting specific hardware. Technology transfer must therefore operate on a broad front covering these "software' and "hardware" challenges, and ideally within a framework of helping to find new sustainable paths for economies as a whole. A key element is choice. Hence the development of societal and organizational structures that enables well informed choices of technologies, which promote climate stability, adaptation, to the effects of climate change, and sustainable development is essential. To a large extend, the state of environment today is the result of technological choices of yesterday. Similarly, the sate of environment in the 21st century will be determined largely by technologies we choose today.*

***Methodological and Technological issues in Technology Transfer; IPCC***

Article 4.5 of the UNFCCC states that developed countries "shall take all practicable steps to promote, facilitate, and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly developing country Parties, to enable them to implement the provisions of the Convention." In this context, technology

transfer is designed to assist developing countries with responding to climate change through the diffusion and use of appropriate climate change mitigation and adaptation technologies. As part of the technology transfer process, a framework for technology transfer was developed and adopted by all Parties at the second part of the Sixth Session of the Conference of Parties (COP) to the UNFCCC in July 2001, in Bonn, Germany.

By decision 4/CP.4 the COP urges non-Annex 1 Parties to submit their prioritized technology needs, especially those relating to key technologies to address climate change. Decision 2/CP.4 directed the Global Environment Facility (GEF) to provide funding to developing countries to assist with this process of technology needs assessment (TNA). The GEF has responded to this request by providing assistance through Additional Financing for Capacity Building in Priority Areas (Phase II top ups).

**iv. What is the Technology Needs Assessment**

The UNFCCC identifies TNA as one of the five key elements of a framework to enhance technology transfer [1]. The elements of the technology transfer are as following:

- Technology needs and needs assessment
- Technology information
- Enabling environments
- Capacity building
- Mechanisms for technology transfer

This framework to facilitate and enhance technology transfer activities under the UNFCCC is based in large part on examination of the experience gained through existing technology transfer initiatives between developing countries and donor organizations. According to the Intergovernmental Panel on Climate Change (IPCC), "*technology transfer*" means a set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change amongst different stakeholders such as governments, private sector entities, financial institutions, NGOs and research /education institutions.

TNA as a component of the technology transfer process is a mean by which assessment of development and climate response needs and opportunities are brought together and integrated. TNA is a complex process, it is not a stand alone activity; rather it is a continuation of the work most countries have already carried out or identified/recommended in their National Communications and through other activities to enhance technology transfer. TNA entails the identification and evaluation of technical means for achieving specified ends. From a climate change and developmental perspective, TNA would identify technologies, practices and reforms that might be implemented in different sectors of a country to reduce GHG emissions and vulnerability to climate change and to contribute to development goals.

**v. Technology Needs Assessment exercise in Albania**

The TNA exercise in Albania is mainly guided by "UNDP/GEF Handbook on Methodologies for Technology Needs Assessment'– final Draft, January 2003; the IPCC "Special Report on Methodological and Technological Issues in Technology Transfer" January 2000; "The First National Communication (FNC) of Albania to the United Nations Framework Convention on Climate Change" July 2002 and other countries experiences. They have shown that the technology needs assessment process should be tailored to fit country specific circumstances. Albania's TNA process considers both abatement and adaptation. It has passed through the consequence of the following steps:

- Undertake preliminary overview of options and resources

[1] This framework is agreed in decision FCCC/CP/2001/13/Add.1, adopted at COP 7.

- Identify criteria for assessment
- Select key technologies
- Identify barriers and policy needs
- Define and select actions
- Prepare a synthesis report on TNA

Specifically each activity /step of the TNA process involves the following considerations:

1. *Undertake preliminary overview of options and resources*

This step is designed as a data gathering exercise, as it needs to provide a baseline situation of all technology options in all relevant sectors. It is designed as a *sector-by-sector* approach. Sectors under consideration are those affected by both processes – GHG emissions abatement and adaptation to climate change.

The range of sectors under consideration for the TNA for abatement of GHG emissions includes (i) *Energy and Transport*; (ii) *Land use change and forestry*; (iii) *Agriculture*; (iv) *Waste management and Industrial Processes*. The TNA for adaptation is focused on the *coastal zone*, as it was selected as the most vulnerable area of the country, according to the findings from the Albania's FNC. The range of sectors under consideration for the TNA for coastal adaptation includes: (i) *Water resources ;*(ii) *Agriculture;* (iii) *Forestry; (iv) Health; (v) Tourism and settlements*.

The preliminary overview is focused on the following steps:

- An overview of the each sector profile;
- Policy and legislation framework for the relevant sectors;
- The existing work carried out under the Albania's FNC (such as abatement, vulnerability assessment and adaptation studies); and
- Take the stock (inventory) of the technologies currently in use.

*2. Identify criteria for assessment*

The aim of this step was to create a common, objective framework for identifying the highest priority technologies. Identifying the highest priority technologies requires a view of the contribution that new technologies in different sectors might make to social, environmental and development goals. As a result of an expert judgment and key-stakeholder consultation process, taking into account other countries experiences and Albania's development priorities, it was agreed that the criteria for selecting technologies for TNA will depend upon the following factors:

- Contribution to the achievement of most of the MDGs (see Box 2);
- Social acceptability and Suitability for Albania's conditions
- Market potential
- Contribution to climate change mitigation/adaptation

Each of the above factors entails specifically the following sub-factors:

- *Contribution to the achievement of most of the MDGs*
  - Job & wealth creation for the poor - **JW** *(MDG #1)*
  - Food security - **FS** *(MDG#1)*
  - Health improvements - **HI** *(MDG #4,5,6)*
  - Capacity building (human, institutional, physical, environmental) - **CB**
  - Ensure environmental sustainability - **EES** *(MDG # 7)*
  - Economic and industrial efficiency improvement - **EI**
  - Gender equality and empower woman - **GE** *(MDG#3)*

- *Social acceptability and suitability for country conditions* **SA&S**
- *Market potential*
  - Capital and operating costs relative to alternatives - **COC**
  - Commercial availability - **CA**
  - Reliability and potential scale of utilization - **RPS**
- *Contribution to Climate Change*
  - GHG emissions reduction potential **GR**
  - Adaptation potential **AP**

***Box 2:***

*The Millennium Development Goals are a set 8 major goals, 18 targets and 48 indicators. They are an ambitious agenda for reducing poverty and improving the lives of citizens worldwide. The MDGs were agreed upon by world leaders (including the President of Albania) at the Millennium Summit in September 2000. There are 8 MDGs to be achieved by 2015 as following:*

1. *Eradicate extreme poverty and hunger*
2. *Achieve universal primary education*
3. *Promote gender equality and empower woman*
4. *Reduce child mortality*
5. *Improve maternal health*
6. *Combat HIV/AIDS, malaria and other diseases*
7. *Ensure environmental sustainability*
8. *Develop a global partnership for development*

*The UN Secretary General, Kofi Annan has asked UNDP to act as a "scorekeeper" to track progress towards achieving the goals, and to spread awareness of the MDGs across the world and integrate them in the work of the UN system and the member states of the United Nations. In response to the Secretary General's request and the commitment made by Albania at the Millennium Summit, the UN Country Team in Albania launched the "Albania's Response to the MDGs". The report represented the first attempts to establish indicators to allow citizens and their elected representatives to track Albania's progress towards achieving the MDGs. The report also highlighted areas of concern so that Albania's decision makers and the public could begin to take action to place Albania on the road of the EU. For more information please visit the website http://www.undp.org/mdg/*

Determining the weight and importance of each of these factors and sub-factors was another part of the criteria selection process. This exercise was also affected by social, environmental and economic circumstances and based upon the expert judgment. Despite of likely the same set assessment criteria, the TNA teams, respectively TNA for abatement and TNA for coastal adaptation have been working independently on the assessment process. Having the difference between abatement and adaptation, the weight, scores and importance of the factors and sub-factors selected for assessment has been different. Specifically, for the TNA for abatement, the experts decided the maximum weight for the assessment factors to be 1 and the maximum score for sub-factors to be 100. While for TNA for adaptation an equal weight and score is used respectively for factors and sub-factors. The technology ranking/scoring matrix used is as follows:

***Table3:*** *Technology ranking matrix*

| TECHNOLOGY | CRITERIA / FACTORS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ***Development benefits*** | | | | | | | **SA&S** | ***Market potential*** | | | ***Contribution to CC*** | |
| | ***JW*** | *FS* | *HI* | *CB* | ***EES*** | *EI* | *GE* | | *COC* | *CA* | *RPS* | ***GR*** | *AP* |
| T 1 | | | | | | | | | | | | | |
| T 2 | | | | | | | | | | | | | |
| … | | | | | | | | | | | | | |
| … | | | | | | | | | | | | | |
| T n | | | | | | | | | | | | | |

The above weighing exercise entails a technique of multi-criteria analysis, which, in the case of energy and transport sector is combined with the cost-benefit assessment as well. Scoring of technologies under the set of above weighted factors and sub-factors was another step, which led to the ranking process, which in turn provides the key technologies.

3. *Select key technologies*

Using the compiled information on alternative technologies for the priority sectors and sub-sectors, both TNA teams have proceed with selection of key technologies. Based on the ranking of the alternative technologies the top 4 to 5 technologies are considered as key ones for each sector under assessment.

4. *Identify barriers and policy needs*

The prioritization of technologies and sectors in the preceding step has offered the opportunity for more focused, in-depth analysis of the prioritized technology needs. This analysis has been consisting on the identification of barriers and policy needs for the ranked technologies per each sector prioritized. The main categories of barriers identified in Albania are as following:

- *Policy:*
  - Regulations and standards that preclude new technologies;
  - Institutional and legal obstacles;
  - Distorting market interventions such as subsidies for polluting industries;
  - Regulated markets that create disincentives for new technologies;
  - Planning system issues.
- *Social and cultural issues.*
- *Market structure*
  - Monopoly powers that reduce incentives to innovate and erect barriers to new entrants;
  - Split incentives;
  - Access to capital;
  - Information barriers;
  - Externalization of pollution costs;
  - Level of Poverty in the country.

5. *Define and select actions*

The selected key technology needs remain as the core of the TNA report which is not a stand –alone document that once prepared will be placed somewhere in a shelf. The TNA would be a living document. It must be coupled with a concrete plan of implementation. Once the key technologies are selected, the barriers are assessed along with the stakeholders the TNA teams have proposed concrete actions in the form of the project ideas. A package of project ideas for the key technologies is designed. These project ideas address key issues, which are critical to the technology, needs such as capacity building, addressing barriers, direct interventions etc.

**vi. Structure of the report**

The TNA report provides an assessment of national needs for both types of technologies - greenhouse gas abatement technologies and adaptation technologies. The TNA report starts with an Introduction, including the UNFCCC context, explanation on what is the TNA and the structure of the report. It has been designed into two chapters structured as follows:

*Chapter 1*: TNA for Abatement of GHG Emissions - this chapter gives an assessment for country needs on less GHG emission technologies, for each sector that contributes to the greenhouse gas emission.

*Chapter 2:* TNA for Coastal Adaptation - this chapter gives an assessment for country needs on adaptation technologies focused on the Albania's coastal zone.

Each chapter contains Annexes, outlining evaluation matrixes for each sector, project ideas for the selected technologies and references. A list of acronyms is also provided.

# CHAPTER I

## TECHNOLOGY NEEDS ASSESSMENT FOR ABATEMENT OF GREENHOUSE GAS EMISSIONS

### Introduction

Albania's TNA for abatement of GHG emissions aims at prioritizing of the less GHG emissions technologies. This assessment of technology needs has been made through a sector-by-sector approach, starting with the energy sector which, according to the Albania's FNC has the most significant contribution to the overall GHG emissions inventory. The assessment covers also other sectors such as Land Use Change & Forestry; Agriculture; Waste Management and Industrial Processes.

According to the IPCC guidelines for estimation of GHG emissions mobile sources (transport) are considered under the energy category. For that reason, the GHG abatement analysis already performed in the frame of the Albania's FNC has considered the transport under the energy category. For the same reason, the TNA for energy sector considers also the transport sector under its focus. In addition, the category of energy industries is considered under energy one.

For each sector under assessment, the analysis has passed through the following steps:

- A preliminary overview of options and resources [2]
- Identification of assessment criteria
- Selection of key technologies
- Identification of barriers and policy needs
- Definition and selection of actions

[2] this step covers (i) an overview of the each sector profile;(ii) policy and legislation framework for the sector under assessment; (iii) existing work carried out under the Albania's FNC and (iv) take the stock of technologies currently in use.

# I. ENERGY SECTOR

## I.1 Overview of options and resources

### I.1.1 Sector profile

The energy sector used to be one of the most important sectors for the Albanian economy. Albania is endowed with a wide variety of energy resources ranging from oil and gas, coal and other fossil fuels, to hydropower, natural forest biomass and other renewable energy sources. The role of coal and natural gas has gradually decreased since the beginning of 90's while the oil sector remains stable due to imported oil products. The electricity sector is the most important energy sub-sector. Over 90% of electricity generation comes from hydro energy sources. The energy sector contributes to approx. 10% of the GDP and employs approximately 17000 employees.

#### I.1.1.1 Energy consumption

From the peak of 2.26 million tons of oil equivalent (Mtoe) in 1990 the primary energy supply dropped by more than 50% or to 1.22 Mtoe in 1992. Since then, the primary energy supply has remained relatively constant around the level of 1.84 Mtoe in the year 2001. The most drastic effects are, however, the structural changes that have taken place as regards the shares of energy sources on the supply side and the final energy consumption by industry sectors and fuels.

Up to 1985 Albania had a very energy intensive economy, where energy use per economic output was slightly higher than the average for the Central East European (CEE) countries and almost 5 times higher than the average level of the EU countries. The per capita energy consumption in Albania was, however, approximately only 1/3 of the level indicated by the EU average and the average of the CEE countries. During the following 10 years until 1994, Albania's situation changed radically (and there was a continuation in same direction during the period of 1995-2000). The energy intensity was reduced by some 50 % but the per capita energy consumption was reduced even more, to only 1/3 of the 1985-level.

Figure I.1 shows the consumption of the energy resources in all economic sectors during the period 1990-2001, whereas Figure I.2 shows the level of consumption by each energy commodity.

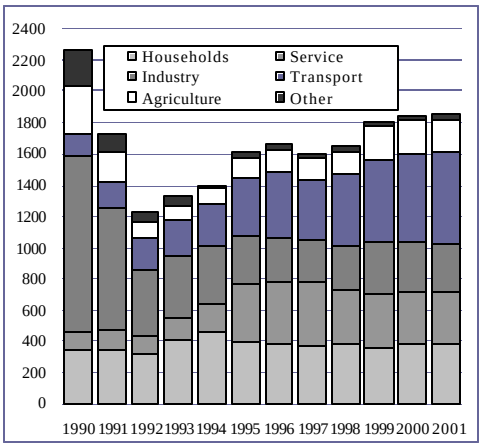



***Figure I.1:*** *Contribution of each sector in energy consumption (ktoe)*

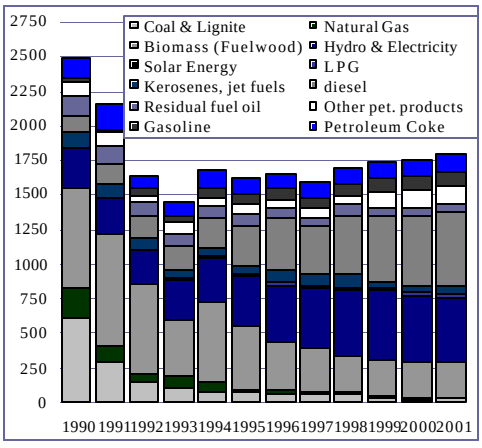



***Figure I.2:*** *Contribution of energy commodities in energy consumption (ktoe)*[3]

[3] Source: Figures I.1 and I.2 are based on the National Energy Balances prepared by the NAE.

In 1990, the industry consumed 50% of the total sources, declining to 35% in 1992 and 17% in 2001. Transport was the sector that experienced a continuous increase of the energy sources consumption. In 1990 the transport sector consumed 6% of the total energy, reaching the value of 44% in 2001. Another sector that experienced changes was the residential sector, with a consumption of 14.6% of the total in 1990 reaching a level of 21% in 2001. Service sector also experienced high rates of increase of energy consumption passing from 5.4% in 1990 to 16.5% in 2001. Figure I.2 shows that coal, natural gas, electricity, diesel and heavy fuel oil were energy sources that used to play the major role in 1990. One decade later, the situation was quite different with fuel woods, electricity and diesel playing the major role.

Figure I.3 indicates the consumption of electricity according to the economic sectors. During the period 1985-1990 the industry was the largest consumer, followed by service and residential sector and other sectors in a smaller extension. After 1992 the situation changed: as many industrial enterprises were closed down and the electricity consumption declined to a minimum, starting to recuperate in the following years due to the reactivation of old enterprises and opening of new ones. This situation remained unchanged till 1999, and then the consumption declined again during 2000-2002 due to the fact that the electric system was unable to supply many small producers rather than the decline of the industrial sector. This fact forced a number of enterprises to install back-up electricity generators. Electricity consumption in the residential sector has continuously increased during the period 1985-1999. Consumption in the service sector increased during the period 1985-1999 but after that started to decline due to the lack of supply rather than the lack of development.

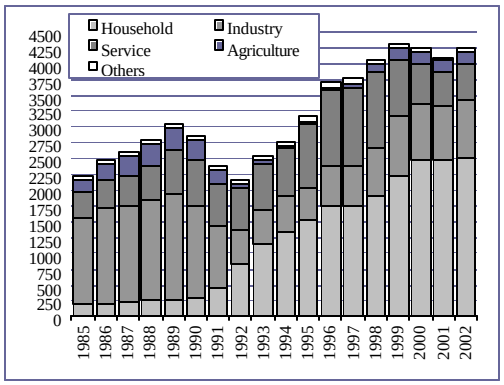



***Figure I.3:*** *Electricity consumption according to economic sectors (GWh)*

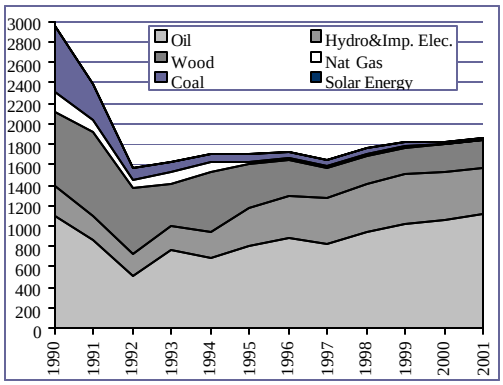



***Figure I.4:*** *Supply with primary energy resources (ktoe)*[4]

Some of main identified problems, point out through historic development analysis and possible tendencies for Albanian energy sector are:

- Increase of the electricity consumption by households during the transition period has led to high levels of technical and non-technical losses and reduction of security of supply;
- Lack of electricity price liberalization has led to its massive use for different services in the household and service sectors (space heating and cooking);
- Lack and relatively high prices of other alternative energy sources forced the consumers to focus more on the electricity use;
- Very low efficiency energy use;
- Growth rate in the consumption of diesel and gasoline especially in transports is much higher than what can be accommodated by the supply of domestic oil by-products affecting so the increase of import;

[4] Source: Figures I.3 and I.4 are based on the National Energy Balances prepared by KESH and the NAE.

- Production of oil and gas has declined rapidly due to the lack of funds, necessary technical discipline the natural decline of exploitable sources and efforts to increase oil capacity. This can be compared with the relatively smaller decline, from 80 to 38.5%, in the Ballsh refinery capacity utilization. The Ballsh refinery, which was built in 1978, is the only complex refinery with equipment, which is able to produce a reproduction in the existing and new sources through production sharing agreements have not yet been successful;
- Generation of electricity is dominated by the hydropower output while the thermal based generation has remained stable around 100 GWh per year. During the period 2000-2002 there was a sensitive decline of the electricity production due to drought seasons;
- Supply structure of primary energy sources is becoming less and less diversified due to the increasing role of oil, hydro and fuel woods energy supplies compared to coal and natural gas.

The last year's situation indicates that the electricity balance is very tight and Albania's Electro-energy Corporation (KESH) has become a net importer of considerable electricity quantities.

### I.1.1.2 Energy resources

Albania is largely self sufficient in energy resources and in most years (up to 1989) has been a net exporter of electricity and refinery oil by products. Albania is rich with energy resources: oil, gas, coal, wood, peat, and hydro-energy etc, which contribute in different ways to meet energy demands in the country.

#### I.1.1.2.1 Oil

Albania had an early development in the oil industry, since 1918 with the contribution of British and Italian companies. Many efforts are also made afterwards, by Albanian specialists in collaboration with foreign companies to explore and exploit new sources of oil and gas. In the figure I.5 is shown crude oil production from Albanian oil fields (sandstone and limestone fields) for the period 1987-2001. As it is clearly shown on the chart, Albanian oil production nowadays is reduced at maximum due to many reasons.

The oil sources, which are distributed in the western and southwestern part of Albania, are mainly in two structures: sandstone and limestone. Currently these sources have considerable reserves but their full potential extraction needs advanced secondary methods. The sandstone sources have geological reserves of 313.4 million tons, recoverable reserves of 38.8 million tons and a cumulative production of 18.8 million tons. As far as the limestone sources are concerned, they have geological reserves of 345 million tons, recoverable reserves of 30.8 million tons and a cumulative production of 23.8 million tons.

Estimated recoverable reserves are based on projected oil production using currently applied technology, which implies a low recovery factor of 12%. The situation of the oil reserves in early 1995 is the initial overall reserves are 63 million tons, cumulative production is 46 million tons and recoverable reserves are 17 million tons. In the exploitation of Albanian oil resources, the extraction coefficient varies from 25% in limestone to 12% in sandstone sources. These figures reveal an abnormal exploitation of the sources and as a result considerable quantities of oil remain in the strata. The characteristics of Albanian oil are: a high gravity of the order of 10-17 API and sulphur content of over 4%. In total, Albania has become highly dependent of imported oil products due to a declining of oil production in combination with a sharply growing demand for gasoline, diesel and heavy fuel oil.

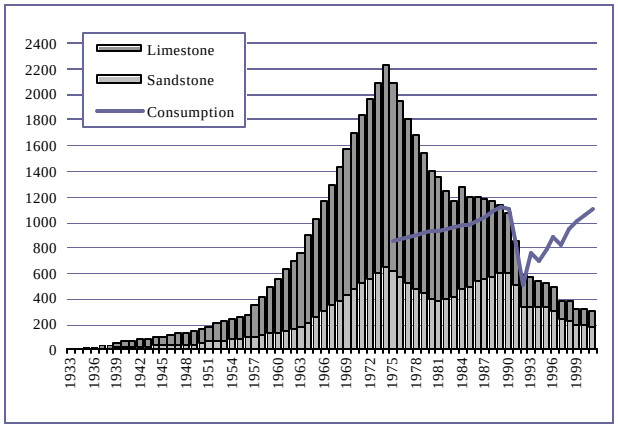



***Figure I.5:*** *Crude oil production and consumption for the period 1987-2001 (1000 tons).*

The oil refining industry in Albania has four refineries, located respectively in Cerrik, Kucove, Fier and Ballsh. Three refineries (Cerrik, Kucove and Fier) were built in the 1960's and they are simple ones with distillation processes (topping and small vacuum distillation) as well as washing process of the light products and have been used for refining of part of crude oil produced in Albania, fulfilling the needs of Albanian market until 1978.

Operational loads on the Cerrik, Fier and Kucova refineries has declined very significantly with the fall in domestic oil production since 1974, particularly after the larger and more sophisticated refinery in Ballsh came on line. The Cerrik and Kucova refineries were progressively suspended from operation after 1990, while Fier continues to function at about 20-30% of fnge of finished products. However, although it was built in 1978 the technology of this refinery was relatively outdated (Chinese plant since the first half of the 1960's) which, means that from the start of operation the refinery performance was not at the average level of worldwide refineries. A relatively modern lubricating oil production section based on Rumanian technology was added in 1988. Most of units are somewhat outdated and modern analytical equipment necessary for good quality control are lacking. Ballsh refinery separated crude oil according to the following table I.1. Nowadays, very little is done for technological improvements or for modernization of processes, to mentioned only replacing of Chinese catalysts with European ones.

***Table I.1****: Ballsh refinery separated crude oil products*

| Nr. | Oil by products | Share of production |
|---|---|---|
| 1 | Gasoline | 10.8% |
| 2 | Gas oil | 28.0% |
| 3 | Kerosene | 6.6% |
| 4 | BTX | 4.3% |
| 5 | Solvent | 0.7% |
| 6 | L.P.G. | 0.6% |
| 7 | Coke | 15.6% |
| 8 | Lube residue | 11.4% |
| 9 | Fuel oil | 14.3% |
| 10 | Sulfur | 1.5% |
| 11 | Lube Oils | 2.0% |
| 12 | Fuel gas &losses | 7.2% |

### I.1.1.2.2 Natural gas

The commercial production and consumption of natural gas in Albania began in 1963 and gradually seven gas fields were brought on stream: Divjake, Frakull, Ballaj Kryevidh, Durres, Povelce, Panaja, Delvina where about 500 wells were drilled. Until the end of 1995 about 3.04 billion $m^3$ of natural gas were extracted from these fields. In addition, about 8.5 billion $m^3$ of associated gas were extracted from the oil wells resulting in a total of 11.5 billion $m^3$ of gas extracted in Albania. In oil equivalent terms, associated gas accounts for a little over 5% of the total ultimate resources of oil and gas: some 3% in the case of sandstone deposits and 12% of limestone deposits. In most fields, however, associated gas represents less than 4% of total oil and gas resources.

A much higher rate of exploitation of the limestone deposits is due to the dominance of these fields in oil production in the 1960s and 1970s. The extraction of gas has been considerably faster than for oil in both types of deposits, however. Over 30% of the last resources in limestone deposits and 10% in sandstone deposits have been exploited to date. Associated gas extraction has averaged 3 to 4% that of oil extraction in both limestone and sandstone reservoirs.

In the figure I.6 is shown graphically natural gas production from Albanian gas and oil fields for the period 1981-2001.

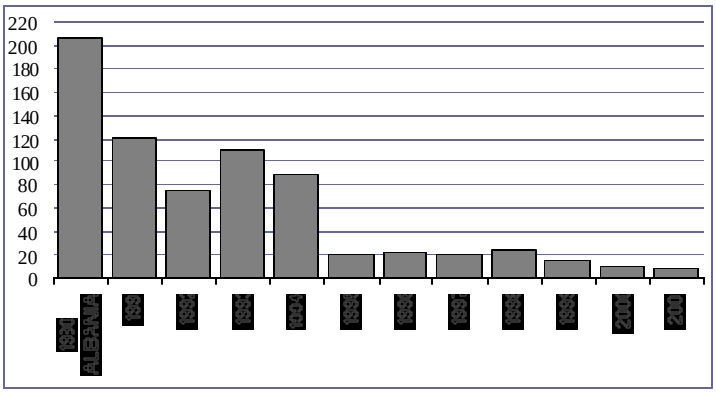



***Figure I.6:*** *Natural gas production for the period 1981-2001 (Million $m^3$ N).*

Currently these fields are in the final phase of their life cycle. The number of producing wells has fallen (to about 30) and the flow rates are minimal (from 300 to 1,500 $Nm^3$/day). Of the existing fields, the condensate gas field of Delvina has the best growth potential. The results of the new wells drilled near the existing fields by the national oil company, namely Albpetrol, in recent years have had poor results in discovering new gas reserves and have not economically justified the investments undertaken.

The decline of associated gas production after 1992 is linked to the outdating of extraction technology, equipment, and the maintenance of wells and the decline of work discipline in all gas and oil sectors. The investments in the existing oil deposits have been small and the funds were mostly used in wrong direction.

The integration of Albania with the international gas network is an element of the energy policy because Albania is the only European country not connected to the network. The studies indicate that Albania does not have a big gas market for consumers. However, consumers like Thermal Power Plant (TPP), chemical and petrochemical industry, metallurgy, food and beverage industry, building materials industry, etc, can use imported natural gas.

According to the National Strategy of Energy the potential role of the imported natural gas as fuel for electricity generation and for industrial use has been analyzed and compared to other alternatives, mainly to the fuel oil use. According to the active scenario, the potential market for natural gas will be developed very slowly with 250 million $m^3N$ in 2006 and 560 million $m^3N$ in 2010. According to the passive scenario, the potential market will be developed rapidly, with 490 million $m^3N$ in 2006 and 1160 million $m^3N$ in 2010.

**I.1.1.2.3 Coal**

Coal is one of largest energy sources of Albania and it is spread in four main basins. The forecasted coal reserves are around 226.49 Mtoe. In general, our coal basins have coal with low net calorific value and thin mineral layer that causes a higher cost for energy unit compared to imported coal. These problems led by closing down of many coal mines in Tirane-Durres, Pogradec and Korca basins except Bezhani mine, which is almost an open one. The Bezhani mine reserves are around of 2.77 Mtoe and it is the only mine in Korca basin with an efficient coal extraction cost. Proven reserves are approximately 14.7 Mtoe.

During 1990s, domestically produced coal has been the "big loser" since the economic turmoil caused many industrial consumers to shut down and thus reduced energy demand significantly. Supply and use of coal has dropped from around 2 million tons of coal or 19% of the primary energy supply in 1990 to 27,500 TOE or 4% of the primary supply in 1995. In the year 2001 it accounts for only 1.1% of total energy sources. Coal is one of the biggest energetic reserves in Albania. The reserves discovered so far are at relatively high altitude and located in four main deposits. The domestic geological reserves are calculated to 712 Million ton or 178 Mtoe and the commercial reserves are 280 Million ton or 70 Mtoe. In general the mining depth is small and varies from the only open - pit mine (Korca - Erseka Coal Basin-Bezhan Mine) to 400 meters (Memaliaj Coal Basin). Historically, coal has been produced according to the figure I.7.

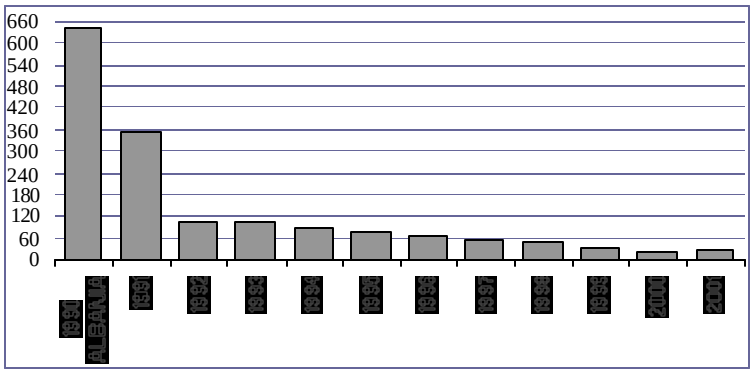



***Figure I.7:*** *Coal production in Albania (kTOE)*

On the other hand, Albanian coal is very poor in quality, e.g. the sulphur content is up to 4%. The ash content and moisture are also high, leading to low calorific values and high emission of $SO_2$ as well as particles. In the table I.2 are reported some characteristics of main coalmines in Albania.

| *Table I.2: Coal content for each mine in Albania* | | | | |
|---|---|---|---|---|
| **Mine** | **Net calorific value (kcal/kg)** | **Moisture content (%)** | **Ash content (%)** | **Sulphur content (%)** |
| Krrabe | 4254 | 7 | 30 | 4.0 |
| Mushqeta | 2676 | 9 | 53 | 3.2 |
| Valias | 1746 | 16 | 58 | 3.0 |
| Alarup | 3196 | 36 | 20 | 0.9 |
| Memaliaj | 3058 | 12 | 38 | 3.8 |
| Verdove | 2054 | 7 | 64 | 3.9 |

Two enrichment plants of Chinese design have been operating for many years at Valias and Memaliaj. These accept coal fraction above 6 mm in size and had a combined capacity of about 950 thousand ton/year of raw coal. Coal recovery in these plants varies between 40-65% and the treated coal frequently has a lower heating value of 3500 kcal/kg compared to a design specification of over 5000 kcal/kg. A third enrichment plant, with a capacity of 500 thousand ton/year has begun operation at Maliq in 1992, in the Southeastern region (close to Korca). However, these coal enrichment capabilities have stopped working since 1996 due to lack of coal production, lack of spare parts and due to the fact that cost of coal production and enrichment in Albania is too high compared with imported coal. Average costs for the various phase from mining to final distribution indicate that the principal cost component is due to mining though this varies widely from the mine to mine. Coal extraction had contributed on average about 50% enrichment had just over 30% and transport less than 20%.

Pulverised coal waste and fractions smaller than 6 mm, obtained as products from the washing plants, amounted to between 440 and 490 thousand ton/year, prior to the drop in coal production. These have been largely fed into bracketing plants. The remaining 30% or so of the coal used to be burned as such. Different types of coal were frequently mixed together in order to decrease slag formation. Historically, coal use has been concentrated in district heating (including central heating) and power generation usually located close to the mines, especially in Elbasan, Tirana, Maliq, Cerrik, Korca and Vlora. Regarding coal-fired TPP's, the following plants were built: TPP Korçe 6 MW, TPP Elbasan 6 MW, second phase of TPP Fier 60 MW and TPP Ballsh 24 MW, all of them used to produce heat and power.

In 1989 distribution of coal to end users was as follows: central and district heating plant, combined heat and power plants about 48%, households for heating and cooking about 20%, export about 16%, heat for industrial process about 10%, coal used in industrial furnace about 10% and other consumers 4%. The situation has changed drastically on the year 2001, where firstly coal from 2.18 million tons has been reduced up to 94000 ton and secondly it is consumed almost entirely in building materials industry.

### I.1.1.2.4 Hydro energy

Albania has a major hydropower potential of which only 35% is being exploited so far. Hydropower capacity installed up to 2002 is 1,446 MW. Average output from hydropower is 4,162 GWh. Profitability of hydropower exploitation is conditioned by the geological and topographic conditions for construction of dams and particularly by topographic conditions in view of avoiding as much as possible the land flooding. Their construction requires large on big capital investment per unit.

The total hydropower reserves are estimated around 3,000 MW and the potential of annual generation may reach 10 TWh. According to the actual system, are considered preferable new plants in the south part of Albania (Vjosa and Devoll), which will make possible and will create more profitability on the geographic balance of supply and demand. Based on the studies of Institute of Hydrotechnics Studies and Designing is made possible the implementation

of the fully exploitation schemes of Drin, Devoll and Vjosa rivers. The new probable Hydro Power Plants (HPPs) to be constructed in the future are those on *Drini river* (i) Bushati HPP [84 MW]; (ii) Peshkopi (Skavica 1) [130 MW]; (iii) (Skavica 2) [350 MW]; *on Vjosa river* (i) Kaludha HPP [75 MW]; Dragot-Tepelena HPP [130 MW] and Kalivaci HPP (100 MW); *on Devoll river*: (i) Bratila HPP (115 MW) and (ii) Banja HPP (80 MW).

Exploitation of hydro energy through small HPP schemes is of interest, too. Until 1988, in Albania were built 83 small HPPs, which capacity varies from 5 to 1200 kW, with a total capacity of 14 MW. These HPPs are mostly of *derivation* type and exploit the water springs and streams closed to these areas and the average life of these HPPs is 25 years. Based on the different realized hydro-energetic studies of small HPPs they are of the range from 100-120 MW.

### I.1.1.2.5 Biomass

Estimations of agriculture residues are based on average ratio between residues and output for unit for each of main agriculture crops. These ratios differ from one zone to another, and are indirectly related to the agriculture output and other conditions. According to some residues in Albania in the year 1980 have been around 800 [toe/year], while in 2001 were around 130 [toe/year].

***Box I.1:***

*Biomass can be classified in four major categories: (i) woods or wood residues from various wood processing industries; (ii) vegetation residues (stems, seeds etc.) after completion of their production cycle, which are not used in other economic sectors; (iii) energetic plants (woods) cultivated to be burned as biomass, and (iv) animal residues (bones, skins, manure), which are not used in other economic sectors.*

Data on forest resources are based on inventories made every 10 years from the General Directorate of Forests and Pastures subordinated to the Ministry of Agriculture and Food. Approximated total forecasted resources reach some 125 million $m^3$ (14.3 toe). 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. From three aforementioned categories, only 10% of high forests and 50% of copses and 100% of bushes are used as fuel wood. From these data, proven resources of fuel wood are respectively 5.87, 18.25 and 30 million $m^3$. An approximated value of total proven reserves of fuel wood is considered to be about 6 Mtoe.

### I.1.1.2.6 Solar energy

Albania has a considerable potential for the exploitation of the solar energy due to the high number of sunshine hours and high values of solar radiation (see tables I.3 and I.4). Studies of expected climate changes for Albania indicate that in the future these figures are expected to be higher, generating higher potential of solar energy exploitation.

Solar energy potential is not studied and used in the overall Albania's potential territory so far. There are carried out only some area studies and very few implementation projects mainly funded by donors.

***Table I.3:*** *Daily average solar radiation in ($kJ/m^2$)*

| County | Jan | Feb | March | April | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Peshkopia*** | 9813 | 11584 | 13952 | 15127 | 17192 | 19225 | 20704 | 19815 | 18838 | 14189 | 12161 | 11566 |
| ***Shkodra*** | 10857 | 12316 | 14119 | 15771 | 17425 | 19253 | 20836 | 20069 | 18855 | 14450 | 12977 | 12235 |
| ***Durres*** | 13205 | 13523 | 14347 | 17604 | 18637 | 20228 | 22277 | 23199 | 20305 | 17750 | 15347 | 14677 |
| ***Tirana*** | 12066 | 13292 | 14243 | 16007 | 18555 | 20538 | 21598 | 21896 | 19854 | 16564 | 13604 | 13250 |
| ***Vlora*** | 14239 | 13894 | 13733 | 17726 | 19207 | 21376 | 22926 | 24093 | 23217 | 19791 | 17799 | 15347 |
| ***Saranda*** | 12868 | 15445 | 16633 | 18511 | 20405 | 22758 | 23443 | 24101 | 23237 | 17390 | 16857 | 14820 |

| *Table I.4.: Sunshine hours according to measuring stations* | | | | | |
|---|---|---|---|---|---|
| **Meteorological Station** | **Hours with sun (h/year)** | | | | |
| | 1951-1960 | 1961-1970 | 1971-1980 | 1981-1990 | **Average, 1951-1990** |
| **Vlore** | 2 734 | 2 718 | 2 765 | 2 524 | **2 685** |
| **Durres** | 2 666 | 2 684 | 2 717 | 2 310 | **2 595** |
| **Kucove** | 2 532 | 2 674 | 2 648 | 2 441 | **2 574** |
| **Shkoder** | 2 533 | 2 489 | 2 370 | 2 232 | **2 406** |

National Agency of Energy (NAE) and Albania EU Energy Efficiency Centre (EEC) have carried out a number of studies for installing solar panels in both residential and service sector.

Based on these studies, the EEC has managed providing small grants from various donors like EU, OSCE or GEF and has installed about 15 solar panel systems.

Albanian citizens have started installing solar panels systems for hot water supply promoted repeatedly by the EEC through various awareness campaigns.

If the solar panel systems in Albania would be developed similarly with that of Albania's neighbour countries like Greece, the production potential of hot water supply should be equal to the energy amount of 1000 $GWh_{th}$ (or 125 $MW_{th}$ of installed capacity), which is almost equal to the capacity of a new TPP to be constructed in Vlora. This is an indicator of high potential values for solar energy in the country.

There is also a tendency for production of the solar panels in the country. First attempts are already identified.

***Box I.2:***

*Solar energy is clean and inexhaustible. It reduces the dependence on fossil fuels and does not pollute environment. Consequently, the economic advantages of solar heating systems can only be appreciated by means of a global cost approach and reduction of green houses gases. Active exploitation of solar energy is achieved in systems that absorb this kind of energy through flat collectors. Hot water can be used for space heating, when its temperature is high, but it is used largely for Domestic Hot Water (DHW) needs. Nowadays, this technology has resulted as the most viable for exploitation of solar energy. There exists also the possibility of transforming solar energy directly into electrical energy without going through intermediate stages, using photovoltaic systems, but the cost of one energy unit produced by them is around 27-32 US cents/kWh. Some of the advantages of exploiting solar energy are: (i) it is a huge energy source; (ii) it is free of charge; (iii) its exploitation provides a high flexibility. The exploitation of solar energy has some disadvantages, too. Initial investment required for exploitation of solar energy for all applicable technologies is very high. This can be explained with the fact that economic benefits of its exploitation depend on the availability of solar energy (which is not continuous), the solar radiation which is variable during the day as well as the large surfaces needed to collect this type of energy. Major limit of renewable energies (solar energy inclusive) is that they are not continuous; therefore all their production systems require energy accumulation. The energy can be accumulated in thermal or electrical accumulator.*

**I.1.1.2.7 Wind energy**

According to the research work performed by Institute of Hydrometeorology, some regions were identified in Albania as most suitable for development of wind energy – these are the regions characterized by wind speeds exceeding 3-4 m/s. In addition to opportunities for installation of large wind facilities, there is considerable potential for small wind power facilities in the remote zones; for example, in remote areas characterized by the high costs of delivery of fuels for electricity and heat supply. Pre-feasibility studies, have shown the highest wind speed zones and too much more longer period are those on the seashore lowland. This implies to give priority to the construction of 20 windmills nearby 20 pumping stations that are situated along the Adriatic cost safeguarding the land from floods. If this will be applied, than it is expected to get by year 2020 additional electricity of 400 GWh/year in the energy balance.

Developing wind energy is one of the supported and sustainable options for long-term energy sector development program in Albania. Its development, though, requires strong governmental and international financing support. According to the newly adopted energy strategy, feasibility study should be done for selection of the best sites of installation of wind power farms with total capacity of 100-150 MW in the future.

Total investment required is about 100-150 million USD. It is expected that the scale effect will reduce the cost of this energy, and in perspective move it closer to those of the traditional sources. Under the rough assumption of using the existing grid share, the potential of wind power plants would be up to 10% of total capacity, without new investments in transmission and distribution except of connection costs which made up to 200-250 MW of wind power plant that may be introduced in Albania. With an average load factor of 20%, the assumed wind power installed would lead to the electricity production of 300-400 GWh/year.

***Box I.3:***

*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 4 [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 developing countries, installations of windmills have a common concern that of not having continuous measurement of the wind speed and its duration among time series for several years. For this reason, various companies that are willing to invest in this sector are faced with these constraint, which makes them difficult to take a decision whether it is feasible to invest in a certain area without these necessary data.*

Data received from the meteorological stations, as given in the in table I.5, are approximate and not very reliable due to the obsolete measurement equipment. They are available as approximates only for some regions of our country, as indicated in the following table:

***Table I.5*** *Average speed of wind (m/s)*

| **Month** | **Durres** | **Kryrvidh** | **Tepelene** | **Sarande** |
|---|---|---|---|---|
| January | 4.10 | 5.00 | 5.80 | 4.90 |
| February | 4.50 | 5.10 | 5.70 | 4.90 |
| March | 4.20 | 4.60 | 4.90 | 4.80 |
| April | 4.10 | 4.50 | 4.30 | 4.60 |
| May | 3.60 | 3.70 | 3.60 | 4.30 |
| June | 3.40 | 4.10 | 3.40 | 4.50 |
| July | 3.30 | 4.30 | 3.50 | 4.60 |
| August | 3.20 | 4.00 | 3.50 | 4.40 |
| September | 3.30 | 4.30 | 4.10 | 4.10 |
| October | 3.50 | 4.70 | 5.30 | 4.50 |
| November | 4.10 | 4.90 | 4.70 | 4.70 |
| December | 4.40 | 5.10 | 5.60 | 5.00 |
| **Mesatare** | **3.80** | **4.52** | **4.53** | **4.60** |
| **Density** $W/m^2$ | 75 150 | 100 230 | 100 230 | 110 250 |

The EU objectives for next 20 years are to secure 20% of the electricity supply from wind power plants. In Albania conditions, it is estimated that by 2020, only 4% of the electricity generated can come from wind energy sources (some 400 GWh/year). This implies to give priority to the construction of 20 windmills nearby 20 pumping stations that are situated along the Adriatic cost safeguarding the land from floods. Based on some studies carried out by the NAE, in the costal lowland nearby pumping stations, it is identified an electricity demand of around 30 GWh/year or 0.7% of the actual domestic power generation). In these zones

average speed of wind, throughout the year, is around 4-6 m/s (10 m height), and the average annual energy density of 150 W/m$^2$. Predicting that a concession project with total investments of US $150 million crediting limits, for construction of 20 windmills within a period of 20 years[5] it is expected to get an additional electricity amount of 400 GWh/year in the Albania's energy balance by 2015.

**I.1.1.2.8 Solid wastes**

Albania has considerable potentials of using the solid wastes as energy sources.

Rough estimates are made to identify the potential of solid wastes as energy source.

The forecasted energy resources from solid urban wastes in our country by 2010 will be around 9.517 toe.

The potential of municipal solid wastes as fuel is given primarily through their ingredients, calorific value, moisture content and quantity of non-combustible material.

***Box I.4:***

*Solid wastes may be used for energy production, but it should be emphasized that their cost is much higher than other traditional fuels. There are four well-known ways of solid waste treatment with a goal of energy production: (i) direct combustion; (ii) production of combustible briquettes; (iii) production of gaseous or liquefied fuels and (iv) production of biogas from their bio-degradation. Since these schemes require big capital investment it is typical that they require collection of large quantity of solid wastes and their products have a large selling market. When the selling market is difficult to be found, these products may be combusted for producing steam (to generate electricity) or hot water.*

Solid wastes are composed from components by many elements given in table I.6 (the net calorific values are given for comparison purposes as well). Table I.7 gives the urban waste reserves for some main areas of the country.

The issue of municipal solid wastes is an important one either for developed countries or developing ones, their amount grows with welfare growth of the people. Conservation of raw material through restoring and recycling as much as possible of municipal solid wastes is of vital importance nowadays. In table I.6 are given the net calorific values of some typical components of solid wastes. These values are provided from the studies made in the frame of preparation of National Waste Management Plan.

***Table I.6:*** *Calorific value for some typical components of solid wastes.*

| Ingredients of solid wastes. | Net calorific Value [MJ/kg] |
|---|---|
| Paper | 14.6 |
| Plastic | 37 |
| Cautchouc | 34.7 |
| Old rags | 16.3 |
| Food wastes | 6.7 |
| Vegetable and animal wastes. | 18 |
| Wood wastes. | 19.5 |
| Coal | (20-35) |
| Oil | 44 |
| Natural gas | 52.4 |

[5] This means building nearby each pumping station a windmill of 9 MW capacity with wind turbines of installed capacity WT1500; WT1000; WT600

| *Table I.7: Energetic content of urban wastes in some areas of country.* | | |
|---|---|---|
| **Area** | **Energetic contents in year 2002 in Toe.** | **Energetic content in year 2010 in Toe.[6]** |
| Durres | 191 | 1071 |
| Elbasan | 155 | 861 |
| Fier. | 110 | 524 |
| Korce | 112 | 584 |
| Shkoder | 131 | 724 |
| Tirane | 399 | 2938 |
| Vlore | 130 | 704 |
| Albania | 1783 | 9517 |

### I.1.1.2.9 Geothermal energy

There are a variety of geothermal sources, which may be classified as: hydrothermal sources, hot drought and melted rocks. From these three groups, up to date, only hydrothermal sources have found practical utilization in Albania. Hydrothermal sources are divided in: sources which produce drought steam, sources producing saturated steam is produced from (temperatures of these two sources are higher than 150 $C^o$) and sources where hot water is produced, and is used in some countries for space heating. A new technique of using the geothermal energy, which is spreading out, is that of injection of cold water in deep abandoned wells of oil and natural gas where it gets warmed. Water is injected with a temperature of (7-8)$^oC$ and comes out on the surface with a temperature of (22-25)$^oC$. In our country there are still not fully discovered geothermal sources, producing steam. As geological studies show there is a little hope for these source and hydrothermal sources are of relatively low temperature. Data on these sources are given in the table I.8.

| *Table I.8: Geothermal resources in Albania* | | | | |
|---|---|---|---|---|
| **No.** | **Location of hydrothermal source** | **Temperature, $C^0$** | **Title of Well** | **Temperature of water on surface, $C^0$** |
| 1 | Karme-Sarande | 34 | Ishmi-1/b | 60 |
| 2 | Langarice-Permet | 26-31 | Kozan-8 | 54 |
| 3 | Sarandapori-Leskovik | 26-27 | Galigati-2 | 45 |
| 4 | Tervoll-Gramsh | 24 | Bubullima-5 | 48-50 |
| 5 | Llixha-Elbasan | 58 | Seman-1 | 35 |
| 6 | Kozan-Elbasan | 57 | Ardenica-12 | 32 |
| 7 | Shupal-Elbasan | 29-30 | | |
| 8 | Mamurras-Kruje | 21 | | |
| 9 | Peshkopi | 35-43 | | |

Most important geothermal resources in Albania are:

- Geothermal area of Kruja is the zone with the largest geothermal resources in Albania, with a size of 18 km length and 4.5 km width, containing reserves of a range of $5.9x10^8$-$5.1x10^9$ GJ;
- Geothermal area of Ardenica where the water springs have a temperature of 32-38 $^oC$ and a water flow is 15-18 l/s;
- Geothermal area of Peshkopia where there are some geothermal sources bcated next to each other. Water flow is about 14-17 l/s and the temperature is 43.5 $^oC$.

### I.1.1.3 Energy supply and production

Since 1990 there have been major structural changes regards the shares of energy sources on the supply side. Domestically produced coal and gas have been the "big losers" since the economic turmoil caused many industrial consumers to shut down. The main issues on the energy supply and production side are:

[6] The National Plan for Management of Solid Wastes makes the forecast for energetic content in year 2010.

- Albania has become a net importer of electricity and this will continue during a number of years until the domestic generating capacity is expanded;
- The production of oil and gas has declined rapidly, due to lack of necessary technical discipline to maintain fixed levels of the production and the natural decline of exploitable resources;
- The generation of electricity is dominated by the hydropower output, which has increased from 2,800 GWh in 1990 to 4000 - 4500 GWh in 1999-2000 (+8.6% per year on average) whereas the thermal based generation has remained stable around 200 GWh per year;
- The real harvesting rate for fuel wood is believed to be at a level equal to 300000 – 350000 toe but this level is not sustainable in the medium term without re-plantation.

**I.1.1.3.1 Albanian power sector situation**

Notwithstanding from financial barriers to import, the main problem, which Albanian power sector faces today is the limited technical capacity to produce and insufficient imports resulting in maximum possible electricity supply of 18-20 million kWh/day. As a consequence, the power system fulfils only 70-80% of the total demand during the peak winter period, causing electricity load shedding to customers. The most urgent problems that the Albanian power sector is facing today are the following:

- *Current generation capacity* is insufficient to meet the actual demand of 6.60 TWh/year for 2003;
- *Problem of the so-called "non-technical losses"*. Non-technical losses has been very high, but in 2000 and 2001, these kind of losses were reduced due to very strict measures taken by Ministry of Industry and Energy, Group of Donors in cooperation with KESH and ENEL;
- *High values of technical losses in the transmission-distribution network*. KESH, in close cooperation with Group of Donors and ENEL, have prepared an Action Plan, updated every year, in order to reduce the losses. Necessary investments for this objective are being funded by the financial package approved by Donors Group;
- *Power interconnection to neighbor countries*. Power interconnection to neighbor countries includes three high voltage lines. Due to the instability of the system, the effective capacity of lines is reduced to 400 MVA. The capacity was considerably increased in 2001 due to increase of transforming capacities in Elbasan substation and the commissioning of a 220 kV line (4 km) between Elbasan 1 and Elbasan 2 substations, in August 2002. This created for KESH the possibility to import large quantities of electricity and reduce the electricity load shedding, but due to the technical limits of Greek system interconnection lines, the importing capacity is considerably reduced, requiring an extension towards the north part of the country;
- *High values of electricity consumption for space heating.* A strong tendency towards the increase of electricity consumption for space heating is becoming highly evident more and more, although other possibilities to use alternative energy sources already exist. Electricity which is used for heating in households and services is the main reason why the power system is unable to guarantee a regular supply for other services besides space heating (such as lighting, electric appliances, different industrial operations and service sector);
- *Unrealistic electricity tariffs*. Many studies carried out by international and local institutions indicate that the long term marginal cost of electricity generation / transmission / distribution, taking into consideration the new plants / substations / lines that will be constructed to meet the increasing demand, is approximately 9.64 US cents/kWh (Electricity Tariff Evaluation Module prepared by the World Bank in January, 2003 and average tariff for 2003 is 6.24 US cent/kWh. The difference between marginal cost and average tariff still is subsidized by the Government and remains still a concern and it is foreseen to be such a barrier by the year 2007. KESH Action Plan of 2003-2005 approved by the Albanian Government and the Donors recommends tariffs gradually

increase in order to improve the financial situation of KESH. According to the Action plan the average tariff for 2003 are increased by 10% and for 2004 to be increased by 12.8%.

### I.1.2 Policy and legal framework

#### I.1.2.1 Policy framework

A National Strategy for Energy has been drafted and approved in June 2003 by the Government of Albania according to Decision of the Council of Ministers, No. 424 dated. 26.06.2003. The National Energy Strategy primarily *aims* at the restructuring the energy sector based on market economy principles and developing a modern energy policy. A detailed plan of action also adopted on 19 September 2003 by the Albanian Government follows this strategy.

The strategy for the development of energy sector is a document that analyses and recommends the future changes, by the year 2015 that must be undertaken in the Republic of Albania, in order to increase the security of the energy supply and the optimisation of the energy resources to meet the demand and achieve the sustainable development. It is the first national strategy, which address explicitly the environmental issues like greenhouse gas emissions and urban air emissions. Addressing the recommendations provided for the energy sector under the Albania's FNC is considered as a significant progress in mainstreaming the global environmental concerns into national sectoral planning and policy. This strategy is considered as an expression of the national demands which provides a sustainable development of the whole national economy and achieves in the meantime, the environmental protection during the whole cycle of the energy sources utilisation
The strategy for the development of energy sector is an essential part of the NSSED. The Energy Strategy considers the country obligations in the framework of the Regional Electricity Market in South East European countries, and international environmental conventions that Albania is a Party to, as well as the harmonization and converging of the energy sector development according to EU Directives for the association of Albania in the European family.

The energy strategy analyses in details many key issues herein broadly discussed: should we focus more on imports in order to meet the future energy demands (construction of interconnection lines) or on the domestic generation (using the TPP or building new HPP, thus depending on climatic conditions); what should be the necessary steps for energy saving in the household, service and industry sectors; should we still continue to use electricity for space heating in private and public buildings (thus creating a deficit) or should we introduce alternative fuels (especially LPG); should we just import oil by-products, import crude oil and rehabilitate Ballsh refinery to meet the future demands for oil by-products or build a new refinery; which is the best feasible position and capacity for hydrocarbons stocking; which is the best option for the penetration of natural gas in the Albanian energy sector and the necessary investments; etc.

The strategy for the development of the energy sector includes technical, financial, economic, legal, organizational, institutional and environmental aspects as well as the continuous training of the specialists in order to prepare the necessary framework for an easy integration of the Albanian system into the regional and European energy systems.

Specific objectives of the National Energy Strategy are:

- Increase of the security and reliability of the energy supply in general and electricity in particular, in national and regional levels;
- Establish of an efficient energy sector from the financial and technical aspects;

- Establish of an effective institutional and regulatory framework and restructuring of energy companies;
- Increase of the energy efficiency in generation/production and final use of energy sources aiming a minimal environmental pollution;
- Optimization of the supply system with energy sources based on the least cost planning principle with minimal environmental pollution;
- Considerably increase investments in the energy sector through capital enhancement by International Financial Institutions as well as private capital.

The strategy aims also at establishment of a competitive electricity market according to EU requirements for the electricity sector reforms (*Directive 2003/92 EU*) and Albania obligations under the Athens Memorandums, respectively (*November 15, 2002*) and (*December 17, 2003)* to support the energy sector integration into the Southeast Europe Regional Electricity Market and the interconnection with Union of Central Transmission of Electricity (UCTE) network.

Future energy scenarios are developed based on the well-known software namely Long - range Energy Alternatives Planning (LEAP). (See Box 5). In order to provide the necessary analysis and realistic recommendations for the energy strategy in the Albania's conditions, this general energy model was adapted. The software was developed to illustrate the different scenarios by 2015 and the consequences of energy policies and their effects. The scenarios describe two limits within which the Albanian energy system will likely be developed. The scenarios describe the medium and long-term possibilities of the Albanian energy sector development based on future technological and economic forecasts for neighbour countries with similar economic development levels and climatic conditions. Some of the main directions that illustrate the future energy trends in Albania are as following:

***Box I.5:***

*LEAP (Long -range Energy Alternatives Planning) is a scenario -based integrated energy - environment modeling system designed and disseminated by the Boston Centre of the Stockholm Environment Institute. Its methodology is based on a comprehensive accounting of how energy is consumed, converted and produced in a given region or economy under a range of alternative assumptions on population, economic development, technology, price and so on. With its flexible data structures, LEAP allows for analysis as rich in technological specification and end-use detail as the user chooses. At the heart of LEAP is the process of scenario analysis. Scenarios are self-consistent storylines of how an energy system might evolve over time in particular socio-economic setting and under a particular set of policy conditions. Using LEAP, scenarios can be built and then compared to assess their energy requirements, social costs and benefits and environmental impacts. For more information on LEAP visit the website:*
*http://www.seib.org/leap*

- The future energy system should be more consumer-oriented;
- The future power system should be very diversified as regards the use of all energy sources and technologies;
- The future energy system should be more decentralized;
- More attention should be focused on the efficient energy use;
- The technologies selected to meet the demands should be based on the least cost planning principle, supply reliability and environmental protection;
- The renewable energy resources (solar, wind, biomass and especially small HPPs should be stimulated for a maximal use of indigenous resources, based meantime on least cost planning and environmental protection principles.

Figures I.8 and I.9 show two scenarios for total energy demand in general and for the electricity. As per the electricity demand, according to the active scenario by the year 2015, the energy savings are expected to be around 22.48% of the total energy consumption. The contribution in these savings by 2015 shall come from transport sector with 27.28%, industry with 24.58%, agriculture with 24.67%, service with 17.86% and residential sector with 7.4% of the total savings, respectively.

Figure I.11 shows electricity savings according to different energy efficiency measures and analysis shows a level of electricity savings of 3,056 GWh in 2015, with the main contribution from reduction of technical losses followed by savings in service, residential and industry.

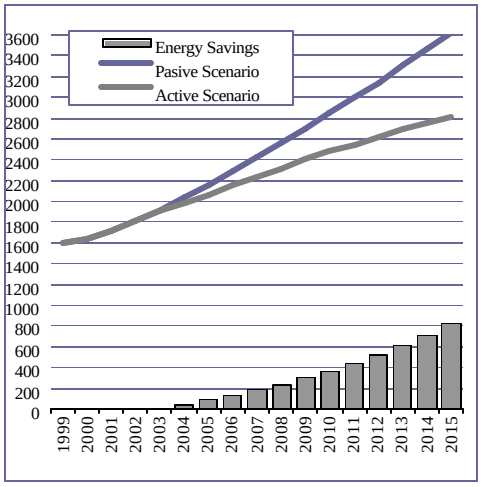



***Figure I.8:*** *Forecast of energy demand and energy saving (ktoe)*

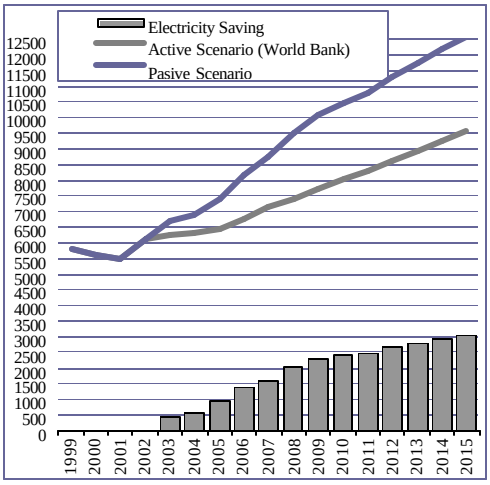



***Figure I.9:*** *Forecast of electricity demand and electricity saving (GWh)*

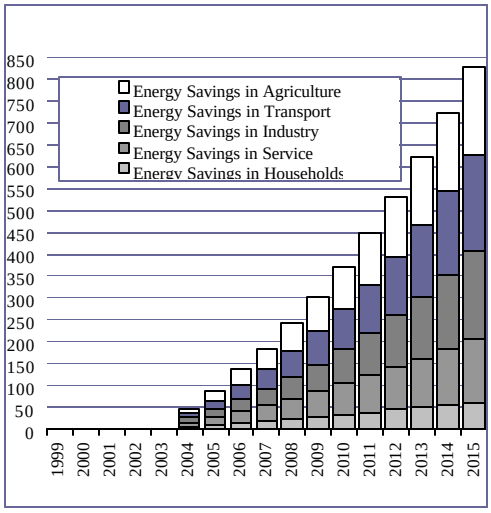



***Figure I.10:*** *Energy saving in each sector according to active scenario compared to passive scenario (ktoe)*

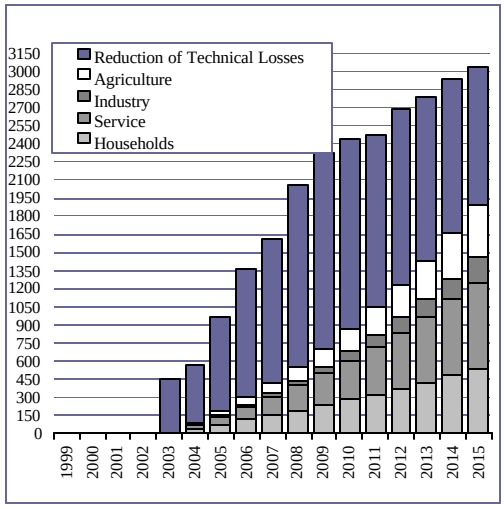



***Figure I.11:*** *Electricity saving in each sector according to active scenario compared to passive scenario (GWh)*

As per the $CO_2$ emissions released from the energy sector the analysis shows that according to the active scenario a reduction of 4 million ton of $CO_2$ will be achieved as a result of implementation of all energy efficiency measures and increased share of renewable energy sources utilization. Figure I.12 shows the reduction potential of $CO_2$ emissions released from energy sector. The analysis demonstrates that the development of energy sector according to the Passive Scenario will lead to a growth of the energy consumption per capita by 38.1% (an advantage), but in the same time it will increase significantly the energy intensity by 14.1% (a disadvantage) in year 2015.

The trend of both above indicators according to the Active Scenario is in the right direction because by 2015 the value of energy intensity is expected to be 20.01% lower than in 2005 (an advantage) and the value of energy consumption per capita is expected to be increased by 16.5% compared to the year 2005 (an advantage as well). Therefore, all actions should be undertaken to ensure that the Albanian energy system to be developed according to the Active Scenario. In other words, the Albanian economy will consume less energy to produce the same output unit becoming more competitive and gaining more markets, creating more jobs and providing a higher welfare. The trade deficit will be reduced as well enabling the use of financial means for different investments in the Albanian economy.

The analysis shows that both indicators ($CO_2$ emissions per capita and that per the produced GDP) will be increased for the Passive Scenario, demonstrating that this scenario is unacceptable from environmental point of view. By the year 2015, the emissions per capita are expected to increase by 84.8% while the $CO_2$/GDP indicator is expected to increase by 53.4% compared to the year 2005. As regards the Active Scenario, a development towards the right direction is expected, accompanied by a decrease of $CO_2$/GDP indicator by 19.3% and an increase of $CO_2$/capita indicator by 20.5% compared to year 2005. The increase of the second indicator is not a positive sign, but it should be highlighted that the emissions are expected to be decreased by 64.3% compared to the Passive Scenario.

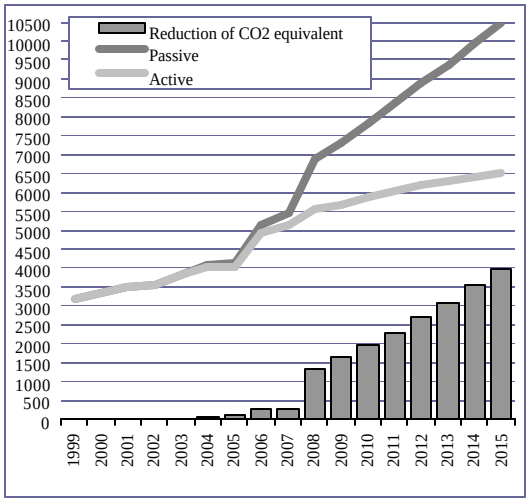



***Figure I.12:*** *$CO_2$ emission for each scenario and their reduction based on LEAP (1000 ton)*

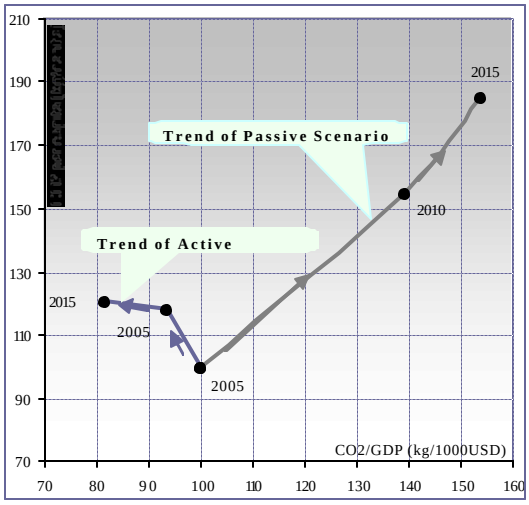



***Figure I.13:*** *Trend of emission intensity and emission per capita according to the Passive and Active Scenario*

As per the renewable energy, by 2015, according to the active scenario (Figure I.14) it is expected a higher ratio of renewable energy versus the total energy supply.

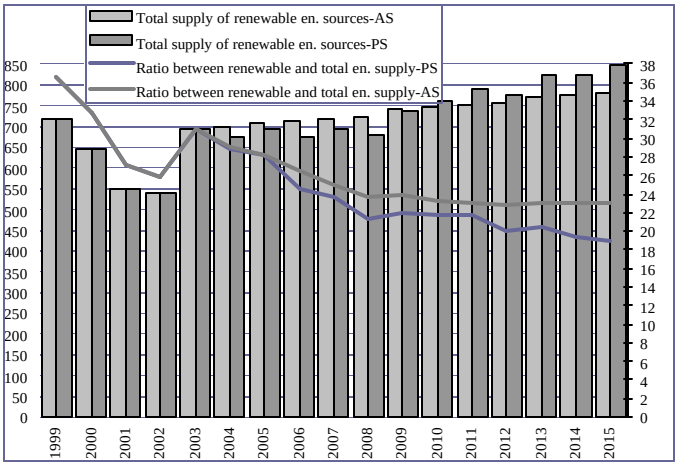



***Figure I.14.:*** *Renewable energy supply versus the total energy supply - active and passive scenario*

A set of measures to be undertaken which increase the energy efficiency in all consumption sectors are considered and analysed from the cost-benefit point of view as follows:

? Substitution of electricity for space heating and cooking with LPG and other alternatives;
? Thermal insulation of existing stock of public buildings based in a new building code;
? Promotion of solar energy use for hot water supply in households and services;
? Promotion of the central heating and district heating and CHP in services, industry and households;
? Promotion of the efficient lighting in households, services and industry;
? Substitution of coal, fuel wood, residual fuel oil with heavy fuel oil in boilers/furnaces;
? Increase of energy efficiency for existing stock of boilers/furnaces in industry and services;
? Improvement of power factor in industrial enterprises;
? Promotion of public transport;
? Increase of energy efficiency in agriculture sector in general and irrigation in particular;
? Rising public awareness for the efficient use of energy in services, households, industry transport and agriculture sector.

### I.1.2.2 Legal framework

#### I.1.2.2.1 Energy Legislation

A legislative framework on energy in Albania comprises a relatively large number of different pieces of legislation at present. However, it has to be emphasized that until today there is no existent umbrella law that covers the primary objectives of the Albanian energy policy and basic principles for the whole energy sector in long-term. On 26 May 2003, the Albanian Parliament adopted Law on Power Sector and has also expressed the willing to develop the Law on Energy Efficiency and Renewable Energy Sources. This draft law on Energy Efficiency and Renewable Energy Sources fills the gap in the legal framework for energy sector in Albania. Also the foreign investment legislation is expected to have an impact to the energy sector. A more detailed analysis of the current legislation is given as follows:

- *Law on Power Sector*: The Law on Power Sector, No. 9072 of May 2003, abolishes the above two laws and combine them in one. This law assures the conditions of electricity supply to the consumers, efficient functioning of electricity market and adjust better the

Power Sector to the condition of market economy. The overall aim of the Law on Power Sector is to enhance the economic effectiveness and the quality of services for power generation, transmission and distribution and provide a transparent and comprehensive legal framework for the mentioned activities.

- *Law on Electricity*: The Law on Electricity, No. 7962 of July 1995, specifies the conditions of the activity in the power sector and the rights and duties of all physical and legal persons involved in one of these activities. It also legislates the relationship between consumers and suppliers in terms of their basic duties and obligations. The Law provides for operational and technical management of power network as well as for connections to the grid and measurements of electricity.
- *Law on Regulation of Power Sector*: The Law on Regulation of Power Sector, No. 7970 of July 1995, assumes the establishment of Energy Regulatory Body (ERE) in the power sector and defines its duties. According to this law, ERE is responsible for tariff regulation and licensing in the power sector.
- *Law on Energy Conservation in Buildings*: This law, No. 8937 of September 2002, defines that designing and construction of buildings should meet the necessary technical parameters for conservation, saving and efficient use of energy. All buildings that will be constructed (after this law enters in to force), shall observe the normative volumetric coefficient of thermal losses (G v), which means that thermal losses should be limited, as well as provide for a thermal installation for central or district heating.
- *Governmental Decree for Energy Building Code*: The Energy Building Code was elaborated since 1998 from the NAE in collaboration with the Albania-EU EEC and the other institutions of the sector. The Governmental Decree, No. 38 of January 2003 approves it as "Norms, Rules and Conditions for Design & Construction, Production & Conservation of Heat in Buildings".
- *Governmental Decree for Strategy of Energy*: The Governmental Decree, No. 424 of June 2003, approves the National Strategy of Energy until 2015. According to this decree, the Ministry of Industry and Energy and the NAE are appointed to update this strategy every two years.
- *Law on Electrical Police*. Based on this law No.8637, of July 2000 a specialized executive body for controlling the enforcement of legislation and use of electricity, namely the Electrical Police was established. The purpose of such a structure is to monitor and punish the abuses in the power sector, particularly the abuses with electricity consumption are highlighted as a necessity.
- *Draft Law on Energy Efficiency and Renewable Energy Sources.* This Law has a special focus on promoting energy efficiency and energy conservation, creation of an energy efficiency fund, energy efficiency labeling, and promoting energy audits schemes. It has been elaborated since February 2004 and is under reviewing process by different Parliamentary Commissions. It will be considered by the Albania's Parliament through end of April 2004.

**I.1.2.2.2 Foreign investment legislation**

- *Law on Foreign Investment*: The Law covers any kind of foreign investment in Albania and specifies basic conditions for promotion and protection of foreign investments in Albania. The Law provides for non-discriminatory treatment, full protection and dispute settlement in accordance with international standards. According to Article 2 of the Law on Foreign Investment no foreign investments are made prior to authorization. In addition the foreign investor has the rights to employ foreign citizens and to transfer all assets that are related to foreign investments out of the territory of Albania. A limitation to foreign investors is only imposed with respect to land ownership rights. Generally the Albanian Law on Foreign Investment is a tool that creates highly favorable conditions for the promotion of foreign investment.
- *Law on Concession*: The Law defines the legal basis for domestic and private sector participation in the provision of public services and infrastructure through concessions

and other arrangements (leasing, management contract, service contract, and so forth). Among other sectors of economy, the law covers also the whole energy sector.

- *Law on Free Zones*: This Law assumes the creation of the free zones in which the investors are exempted from duties and taxes.

### I.1.3 Overview of the work done under the Albania's First National Communication

Albania's FNC is the first accomplishment of the Government of Albania as a Party to the UNFCCC developed under the UNDP-GEF project: *"Enabling Albania to prepare its FNC in Response to its Commitments to UNFCCC"*. It consists mainly of: (i) a country report of GHG emission inventory for 1994; (ii) a GHG abatement analysis by the year 2020; (iii) a climate vulnerability study and adaptation options.

According to its FNC, Albania is a relatively low net emitter of greenhouse gases [7,061.45 Gg], where energy sector shows a significant contribution [44%] mainly due to the fuel combustion category, followed then by agriculture [27.12%], and Land Use Change and Forestry (LUCF) [21.60%]; Waste [4.81%] and Industrial Processes [2.96%] (see Figure I.15).

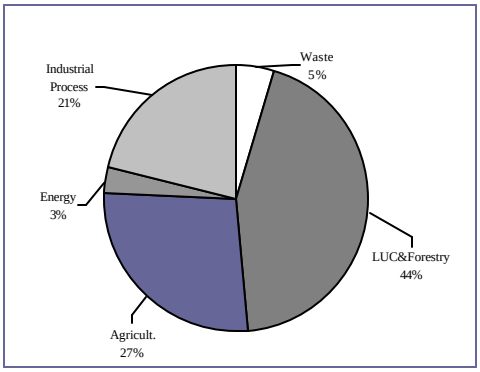



***Figure I.15:*** *$CO_2$ (eqv.) emissions from economic sectors [7061.45 Gg], 1994.*

Estimates from the Albania's FNC show that the $CO_2$ is the most significant contributor [66%] followed by $CH_4$ [30.49%] and $N_2O$ [4.19%]. The biggest share of $CO_2$ emissions due to fuel combustion activities comes from the energy sector [62.95%] which, itself contributes through industry sector (manufacturing industry and construction) [35%], followed by transport sector (road transportation) [27%], energy industries [20%] etc. The Albania's FNC highlights the contribution of each fuel type towards the $CO_2$ emissions coming from fuel combustion activities. Estimates show that the main contributor is oil [87.3%], followed by lignite [11%] and the last one natural gas [1.7%].

A relatively low level of $CO_2$ emissions per capita [1.97 ton/capita] is estimated. The main reason of that low level of emissions is explained due to the fact that more than 90 % of electricity is generated by hydro energy sources. Emissions per GDP show relatively high levels [3,758 ton/million USD] mainly due to the low level of productivity, out-of-date technologies and high level of consumption of electricity by residential sector.

Under the Albania's FNC, specifically under the GHG inventory preparation key source categories are estimated. Estimates are made based on IPCC Good Practice Guidance and Uncertainty Management in National GHG Inventories. The IPCC methodology prioritizes quantitatively the key sectors according to their significant contribution (up 95%) to the global warming potential. There are identified two significant key source categories which fall under the energy category, namely $CO_2$ emissions from fuel combustion in industry

[14.24 %,] and $CO_2$ emissions from mobile combustion [11.24 %]. Being key sources these two categories remain as object of improvement of the quality of estimates because of lack of activity data for years other 1994. Activity data for both categories are characterized from variability among '90s due to the changes in the development of transport and industry sector. Actually, after the year 1990 both of these sectors passed through a drastic change: road transport was characterized by a rapid development while industry was characterized by a collapse and shifted from heavy to light, construction industries. These changes were reflected to changes in fuel consumption structure and quantity by each sector. Activity data for each category were found for the base year (1994) only and in aggregation form for the sector as a whole but this did not reflect the real situation. The need for disaggregated data and time series was highlighted[7] by the national team of the GHG inventory because more accurate national GHG inventories means better national strategies to mitigate GHG emissions.

Based on the predictions[8] made through a baseline (business-as-usual) scenario for future emissions, it is expected that by the year 2020, the emissions total to be raised more than 5 times [37,653 Gg]. The abatement scenario of emissions foresees the introduction and implementation of different options mainly focused on energy saving and energy efficiency measures.

Referring to the GHG emissions baseline scenario, it is expected that most of $CO_2$ emissions will be released from the energy and transport activities, which in 2020 will account for 83% of the total. Concerning energy consumption side, the Abatement GHG Emissions Scenario assumes the gradual implementation of energy efficiency measures in the industry, household, and service and transport sectors. Concerning the energy supply side, the share of renewable sources in Albania that has contributed about 18-22% in primary energy balance, mainly due to the utilization of hydro sources is expected to be higher through the penetration of solar energy as well.

A set of 22 GHG abatement measures for energy and transport sector (see Box.6) is proposed in the frame of this study, which are then analysed in the terms of the cost and benefit. Even the rate of penetration is calculated. These measures are addressed in the National Climate Change Action Plan, which is a part of the revised NEAP is already adopted by the Government of Albania in 2002.

[7] Attempts are being made on that issue through a regional project initiated by UNDP-GEF National Communication Support Unit and funded by GEF, namely: "Building capacities to improve the quality of the GHG inventories (East Europe and CIS)"

[8] The methodology for scenario development is LEAP version 1995.

***Box I.6:***

*GHG Abatement Measures for Energy and Transport Sector*

1. *Introducing of thermal insulation of households which use fuel wood as energy source for meeting space heating demand;*
2. *Introducing of thermal insulation of households which use LPG as energy source for meeting space heating demand;*
3. *Improvement of power factor in industrial & service consumers;*
4. *Introducing of thermal insulation of households which use electricity to meet space heating demand;*
5. *Introducing of thermal insulation of households which use kerosene to meet space heating demand;*
6. *Introducing gas-taxies instead of gasoline taxies;*
7. *Introducing of efficient lighting (incandescent lamps instead of fluorescent ones) in households/service/industry;*
8. *Improvements of efficient boilers which use heavy fuel oil/diesel as fuel;*
9. *Improvements of efficient boilers which use coal as fuel;*
10. *Introducing thermal time switches in electric boilers (for DHW) in household sector;*
11. *Introducing prepayment meters in household sector;*
12. *Introducing wind turbines instead of diesel generators;*
13. *Introducing HPPs instead of heavy fuel oil power plants;*
14. *Introducing thermal insulation of households which use heat (from DH plants) as energy source for meeting space heating demand;*
15. *Introducing efficient electric motors in industry/service sectors;*
16. *Introducing efficient refrigerators in household/service sectors;*
17. *Introducing solar water heaters instead of electric boilers;*
18. *Introducing mini HPPs instead of diesel generators;*
19. *Introducing landfill gas plants with 70% recovery;*
20. *Introducing gas power plants instead of heavy fuel oil power plants;*
21. *Introducing PV electricity instead of diesel generators;*
22. *Introducing solar PV water pumps instead of diesel pumps.*

*Albania's First National Communication to the UNFCCC.*

Figure I.16 shows the GHG reduction potential of energy sub-sectors, expressed in million ton of $CO_2$ equivalent. Predictions show that abatement measures introduced in energy consumption industries are expected to have the most significant impact on the reduction of GHG emission from six economic sectors taken into consideration. The industry is then followed by household and energy transformation sector. This shows once more that introducing measures in demand side management gives more results in the abatement of GHG emissions than measures introduced in supply side (energy transformation sector).

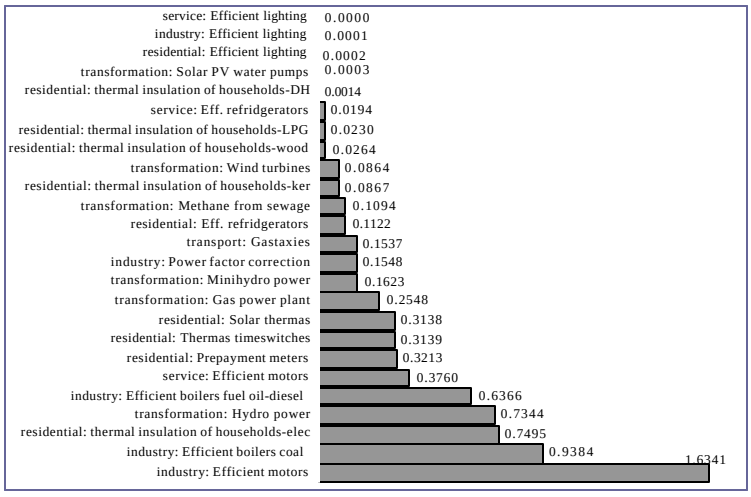



***Figure I.16:*** *All energy and transport measures ranked in decreasing order as per the reduction potential [Million tons of $CO_2$ eqv]*

The curve of marginal cost versus total $CO_2$ equivalent reduced can be seen in Figure I.17.

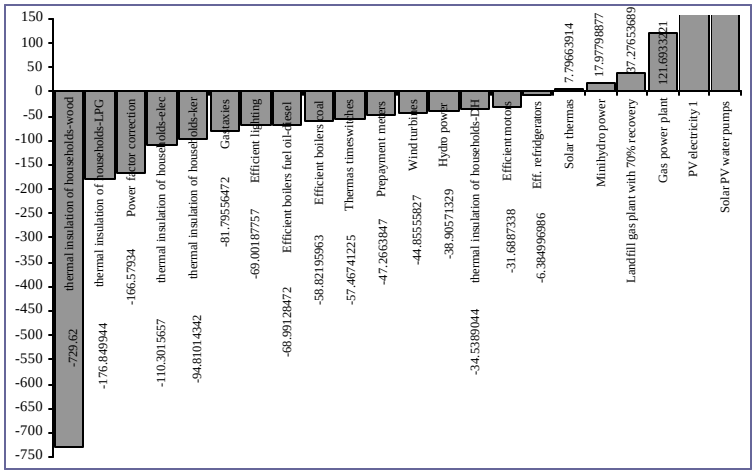



***Figure I.17:*** *Marginal abatement cost versus total $CO_2$ emissions to be reduced for all proposed measures [USD / $CO_2$ eqv]*

### I.1.4 Take the stock of technologies currently in use

The following section provides a stocktaking analysis of the technologies currently in use in Albania such as those of electricity generation (HPP, TPP, solar); power transmission, distribution network, energy consumption (households, services, transport), energy consumption industries.

#### I.1.4.1 Hydro power plants

The Albanian power system relies practically only on hydropower plants (over 90%) and therefore it is totally dependent on hydrological conditions, which means that it is vulnerable and unreliable. It is important to point out that the Drini River cascade production system can supply the installed yearly capacity only if the cascade accumulation basins are refilled fully six times per year. During the last two seasons, water inflow was the lowest ever recorded, so refilling of the basins has been far below the requirements. In a normal year, total power generation would be about 4,300 GWh (million kilowatt-hours). There is no new generating capacity, hydro or thermal, under construction, but there is a specific plan to construct a Combined Cycle Gas and Steam Turbine TPP with an installed capacity of 135 MW. Currently KESH has signed a loan agreement with the World Bank, the European Bank for Reconstruction and Development and European Investment Bank of total amount of 112.6 Million USD. Albania has a major hydropower potential of which only 35% so far are being exploited. The hydro capacity installed up to now is 1,446 MW. The average production from hydro is 4,300 GWh/year. Electricity generation and imports for Albania (GWh) for the period 1985-2000, are shown in Figure I.18.

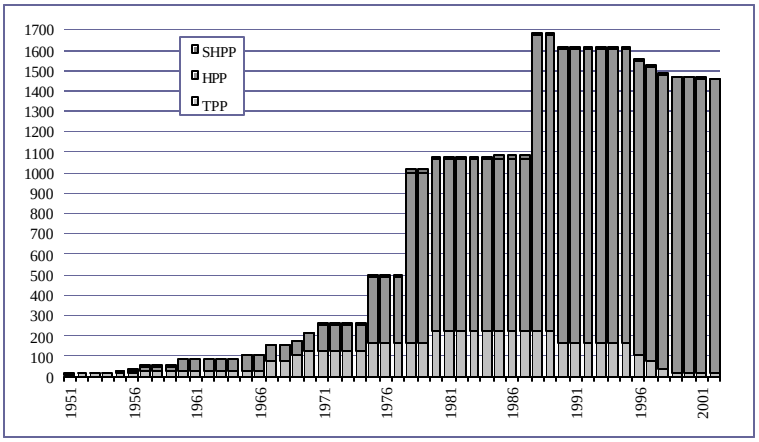



***Figure I.18:*** *Installed Generation Capacity for ALBANIA (MW).*

The three largest HPPs form a cascade with an installed capacity of 1350 MW on the Drin River in the north of the country: Fierza (4 x 125 MW) which acts as a head pond with a limited inter annual regulating effect, Komani (4 x 150 MW) and Vau i Dejes (5 x 50 MW). At the following are described three main HPPs of Albania.

- ***Fierzë HPP*** is located in the Drin River Valley, near the village of Fierzë and about 20 km from the town of Bajram Curri. The HPP was built in the period from 1971 to 1978. Fierzë dam is designed as a zoned rockfill embankment dam with a clay core. The maximum dam height above foundation is 152 m. The reservoir created by the dam serves as head pond for the Drin River cascade. With a total storage of 2.7 billion $m^3$, it is adequate for annual regulation. The powerhouse with its four 125 MW Francis units is located at the downstream toe of the dam. Its average annual energy output is 1,328 GWh.

The water intake system consists of 4 tunnels driven through the left abutment. For the discharge of floods, two spillway structures are provided, each consisting of an intake tower and an adjacent outlet tunnel with a length of about 800 m.

- ***Koman HPP*** is located in the Drin River Valley, between Fierzë and Vau i Dejës HPPs, and about 2 km from Koman village. The HPP was built in the period from 1980 to 1988. Koman dam is designed as a rockfill dam with concrete facing. The maximum dam height above foundation is 115 m. The powerhouse with its four 150 MW Francis units is located at the downstream toe of the dam. Ist average annual energy output is 1 500 GWh. The water intake system consists of 2 tunnels driven through the right abutment followed by 4 steel lining tunnels after the surge shaft. For the discharge of floods, two spillway structures are provided, each consisting of an intake tower and an adjacent outlet tunnel. Power factor is 29%.

- ***Vau i Dejës HPP*** is located in the lower part of the Drin River Valley, about 18 km from the city of Shkodër. This HPP was built in the period from 1967 to 1971. The HPP comprises three separate dams, Qyrsaq, Zadeja and Ragam. The powerhouse with five 50 MW Francis units is located at the downstream toe of the Qyrsaq dam. Its average annual energy output is 880 GWh. The water intake structure is incorporated into the gravity Qyrsaq dam body and 5 short outdoor pen-stocks connect it with the units. For the discharge of floods, two spillway structures are provided, one is located on the Qyrsaq dam and the other one is located on the Zadeja dam. Plant factor is 40%.

**Drin River** is the first largest river system in Albania. As it is known locations for two additional plants have been investigated for completion of the hydroelectric potential on the Drin River within Albania, i.e. Skavica upstream and Bushati downstream of the existing development.

**Vjosa River** is the second largest river system in Albania. Its upper catchments include areas in Greece's Northern Pindos Mountains with high precipitation. Until now, the hydroelectric potential has not yet been exploited. The Hydrogeotechnic Institute established the latest river development study. After having investigated numerous variants, the study defines 7 HPPs for the complete exploitation of the Vjosa River.

**Devoll River** with its maximum catchment area of around 3,500 $km^2$, located completely on Albanian territory, is the third largest Albanian River system. Its upper catchment is situated in the area around Korçë. Up to now the hydroelectric potential of the Devoll River has not yet been exploited.

Until the year 1988, in Albania are constructed 83 small HPP, with capacity from 5 to 1,200 kW; their total power capacity is 14 MW and in a normal year they can generate round 200 GWh of electricity. First of all, the aim of these HPP' construction has been the electricity supply in deep mountainous areas; nowadays all HPP are connected with Republic energetic system. These Small HPP are principally derivation types and they use sources and water running next to these areas. Most of HPP' machines and equipment are supplied from the following countries: Austria, Germany, China, Hungary, Italy, some parts are also produced in Albania. The turbines' types of are Frencis, Pelton, and Banki. The generators' type is Sincron with low voltage. Average age of these small hydropower plants is around 25 years old.

The development of a program on operation of existed small HPP is a part of energy policy of Albanian Government, while their privatization might put them again in efficiency. Taking into consideration their medium age (25 years old), running hours of operation machines, maintenance, qualification of workers, and the transit period that our country is passing as well, for the most of small HPP, to put them in use, considerable investments are needed. From the studies already performed only 19 small HPP could be economically refurbished at a total cost of USD 7.3 million in total.

### I.1.4.2 Thermal power plants

All the equipment of the thermal power plants is old, ageing and heavily corroded. The plants are almost at the end of their technical lifetime and cannot be reactivated. Out of eight TPPs installed in Albania, only the power plant in Fier is still partially in operation. The eight stations consist of the two larger plants in Fier and Ballsh and six smaller plants at Tirana, Cërrik, Vlorë, Kucovë, Korçë and Maliq. Details of these smaller plants which are at the end of their technical life-time and out of service since long time can be seen in table I.9 below.

| ***Table I.9:*** *Retired Thermal Power Plants in Albania.* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **No.** | **Name** | **Region/ Area** | **Commissioning** | **Shut-down** | **Capacity** | **Fuel Used** | **Fuel Supply** | **Remarks** |
| | | | Date | Date | Units / MW | | (truck, pipeline etc.) | |
| 1 | TPP Tirana | Tirana | 1951 | 1994 | 3 x 35 t/h | Coal | Truck and railway | |
| | | | | | 1 x 2,5 MW | | | |
| | | | | | 1 x 2,4 MW | | | |
| 2 | TPP Cërrik | Elbasan | 1956 | 1992 | 2 x 35 t/h | Coal | Truck and railway | |
| | | Cërrik | | | 2 x 3,5 MW | | | |
| | | | | | 1 x 1,5 MW | | | |
| 3 | TPP Vlorë | Vlorë | 1953 | 1991 | 3 x 12 t/h | Coal, | Truck | |
| | | | | | 2 x 1.5 MW | Gas | Pipeline | |
| 4 | TPP Kucori | Kuçovë | (1934; 1941) | | 1 x 12 t/h | HFO (Mazut) | Pipeline | Refinery not |
| | | | 1954 | 1993 | 1 x 18 t/h | Fuel oil | | in service |
| | | | 1960 | 1993 | 1 x 35 t/h | (S-cont. 6%) | | any more |
| | | | | | 1 x 3,6 MW | Gas | | since 1993 |
| | | | | | 1 x 2 MW | | | |
| 5 | TPP Korçë | Korçë | 1971 | 2000 | 2 x 35 t/h | Coal | Truck | Mainly |
| | | | | | 1 x 6 MW | | | for reactive |
| | | | | | | | | power |
| 6 | TPP Maliq | Maliq, | 1951 | 2000 | 1 x 35 t/h | Coal | Truck | Mines are |
| | | Korçë | 1960 | 2000 | 1 x 20 t/h | | | closed |
| | | | 1987 | 2000 | 3 x 12 t/h | | | |
| | | | | 2000 | 1 x 4 MW | | | |
| | | | | 2000 | 2 x 1,5 MW | | | |

The Ballsh power station was built in the period 1974-1976 and is located on the premises of the Ballsh Refinery ARMO. The station is (since 1996) the property of ARMO and consists of four boilers (4 x 120 t/h) and two turbines (2 x 12 MW). The plant provides only process steam for the nearby refinery and has already stopped working for electrical generation since 1996. According to the Lahmeyer Study dated June 1995, the Ballsh Power Station at that time was already in urgent need of rehabilitation. During the investigations in March 2002, it was confirmed that no major investment or maintenance was done by KESH since that time and, therefore, the condition of this plant must be considered unfit for rehabilitation.

The Fier Power Station was built in two stages. In the period from 1966 to 1969, the first stage was erected and commissioned. This equipment is of Chinese design and consists of six boilers and a common steam header from which the steam is supplied to the five condensing steam turbines. Three cooling towers and two chimneys are part of this first stage. The second stage, commissioned in 1980, is supplied by Czechoslovakian manufacturers and rated at 60 MW. This unit is designed as "block system" and consists of one drum type boiler, one condensing steam turbine, two natural draft cooling towers, and has its own chimney. The efficiency of this unit is assessed to be better than that of the Chinese part due to the higher steam parameters (temperature and pressure). The total installed generating capacity at Fier TPP was 159 MW. The following table gives information on:

| ***Table I.10**: Total Annual Electricity Generation of Fier TPP per Unit (MWh).* | | | | | | |
|---|---|---|---|---|---|---|
| **Boiler Type** | **1996** | **1997** | **1998** | **1999** | **2000** | **2001** |
| Chinese Boiler No. 1 | 22,800 | 40,694 | 49,721 | 14,058 | 24,300 | 26,072 |
| Chinese Boiler No. 2 | 4,856 | 0 | 23,940 | 67,232 | 0 | 57,349 |
| Chinese Boiler No. 3 | 44,131 | 30,354 | 0 | 0 | 0 | 18,280 |
| Chinese Boiler No. 4 | 0 | 32,143 | 7,850 | 30,092 | 37,800 | 0 |
| Chinese Boiler No. 5 | 0 | 0 | 0 | 0 | 24,100 | 0 |
| Chinese Boiler No. 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| Subtotal Chinese Boilers | 71,787 | 103,191 | 81,511 | 111,382 | 86,200 | 101,701 |
| Czechoslovak Boiler | 76,690 | 22,066 | 0 | 0 | 57000 | 35,055 |
| **Total** | **148,477** | **125,257** | **81,511** | **111,382** | **143,200** | **136,756** |

The net calorific value of the residual oil (with the Albanian nomination "Mazut" or Residual Fuel Oil ) used as primary fuel was kept constant over the years. According to information received from KESH, the average value is 38.5 MJ/kg. This value is slightly lower compared with the international average of 39.8 MJ/kg. The Fier Power Station equipment is of Chinese design and consists of six drum type front-fired boilers with natural circulation (2 x 75 t/h, 4 x 120 t/h, all 39 bar, 450°C) and five condensing steam turbines (2 x 12 MW, 3 x 25 MW). The two smaller turbines are equipped with extraction points to supply process steam to the nearby refinery and fertilizer plant (100 t/h at 10 bar/300°C, 80 t/h at 2,5 bar/180°C). However, the fertilizer plant has been closed down. The common supply steam header is equipped with a pressure reducing station, which can likewise supply steam to the refinery.

Fier is the largest TPP in Albania and the only one remaining in operation, however, only at an available capacity of 8 MW. The total operating hours of the boilers and steam turbines for the first stage varies from 100,000 to 170,000 hours, while those of the second stage are approximately 28,000 hours.

American Company Harza together with the NAE and KESH has carry out a feasibility study for rehabilitation of Czech unit according to international standards for air emissions.

### I.1.4.3 Solar energy

Despite of the high potential of solar energy exploitation there are few examples of utilization of this technology in Albania. The largest system currently operating in Albania consists of three sets of panels totally 48 [$m^2$] that are installed on the roof of Hospital No 5 in Tirana to provide hot water supply for personal hygiene.

Solar systems, designed for heating water, are made up of the following parts:

- the solar collector area;
- the hydraulic circuits and heat exchanger;
- the hot water storage tank;
- the back-up heating system.

The conventional "flat plate" solar collector consists of an absorber plate, with its hydraulic circuits, fixed behind a sheet of glass, in a watertight case. As these collectors are used throughout the year, an antifreeze fluid is generally required. Therefore, the solar installation needs to have two independent hydraulic circuits, linked by a heat exchanger:

- The "primary circuits" is the circuit flowing through the collectors using an anti-freeze heat transfer fluid;

- The “secondary circuit” is the domestic hot water circuits flowing through the heat exchanger to the hot water storage tank.

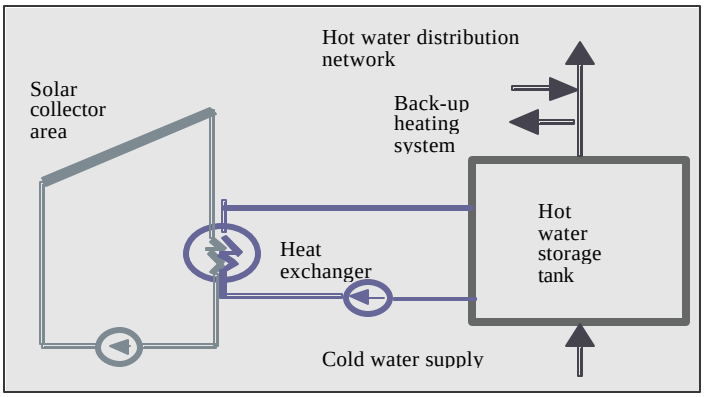



***Figure I.19:*** *Schematic layout diagram for collective SHW*

### I.1.4.4 Power transmission system

The Albanian Power System is experiencing serious operating problems due to insufficient development of its main-transmission and sub-transmission and lack of real rehabilitation and reinforcement of its facilities during the last fifteen years. This has significantly reduced operating reliability and quality of electricity supplied and has limited the exchange capability with neighboring countries. The major existing problems are:

- Overloading of some 220 kV transmission facilities, resulting in heavy losses, bad voltage profile and power outages;
- Low reliability and availability in the transmission system, because it is very rigid and cannot operate according to the n-1 criteria;
- Lack of possibilities to operate optimally and unbalanced reactive power requirements;
- Most of the equipment in 220/110 kV substations are very old and suffering from poor maintenance and lack of spare parts;
- Limitation in transmission network for exchange of electricity with neighboring countries;
- Outdated system control and very deficient communications facilities threatening system safety and security.

The 220 kV substations are mostly of a classical layout with double busbar for 220 kV and single busbar for l10 kV and 35 kV. Due to recent international financing, some modern SF6-gas insulated switchgear is installed in a few substations. The old equipment as switchgears, disconnectors, voltage and current transformers causes many of faults. The substations suffer by non effective measuring system as well. In general the 220 kV transmission lines are fully loaded under normal conditions, except two critical lines as Elbasan1-Elbasan2 and Vau Dejes-Komani, which are overloaded during normal conditions. During peak load the n-1 conditions are not satisfactory, because of overloading of many lines and transformers. In the same time the most of the installed transformers, in the substation, are working already at fully loaded even some of them overloaded.

Most of the equipment in 220 kV substations is of older manufacture. Many substations, as result, require substantial rehabilitation. However, spare parts are no available. Furthermore, there has not been adequate rehabilitation, reinforcement and development of the transmission facilities to meet current requirements. This situation has persisted for fifteen years resulting in serious reliability problems and uneconomical operations. Therefore, the needs for

rehabilitation and reinforcement of existing substations, construction of other new 220 kV lines and new substations 220/110 kV or 400/220 kV, are indispensable and very important for short term upgrading and long term development of main transmission network.

### I.1.4.5 Distribution networks, rehabilitation and upgrading program

#### I.1.4.5.1 Lines

The present power distribution facilities of Albanian Electric Power System serve over 715 000 industry, commercial, and residential customers thorough Albania. The current population of Albania is around 3 100 000 people. The average number of users per square kilometre is approximately a third of typical populated countries, and the number of inhabitants per square kilometre about half. These lower users and population densities require greater investment per customer. The primary cables and overhead feeders of distribution system are either 6 kV or 10 kV or 20 kV. The summary data of medium voltage network (6, 10, 20 kV) for 1999 year are given on the table I.11 below:

***Table I.11:*** *Characteristics of the medium voltage network*

| **Medium Voltage 6kVfeeder** | | **Medium Voltage 10kV feeder** | | **Medium Voltage 20kV feeder** | |
|---|---|---|---|---|---|
| Overhead lines km | Cable lines km | Overhead lines km | Cable lines km | Overhead lines km | Cable lines km |
| 2590 | 252 | 5453 | 154 | 0 | 112 |

The distribution facilities are supplied primarily from the 110 kV and 35 kV sub transmission system, which in turn, is supplied from the 220 kV and 110 kV systems. A small part of distribution system is supplied directly from transmission system 220 kV (transformation range 220I20 kV). This part of distribution network is construed after 1995.

#### I.1.4.5.2 Distribution

Present distribution facilities are in extremely poor conditions due to the long period of isolation as well as the poor economic conditions of the country itself. The distribution equipment obtained from the former Soviet Union up to the 1963 and from China as well starting from 1963 is for the most part 30 to 40 years old and to a large degree obsolete. Extreme overlade conditions resulted during severe winter 1992-1993 and in continuity up to nowadays when extensive use is made of electric heating that therefore had been restricted by the lack of electric heaters and other appliances. At the same time, there was wide spread tampering of metering and supply facilities that lead to an estimate at the end of 1999 year 53 percent bsses of total supply to the Distribution System, with about half of the losses being non technical. These conditions resulted in extensive damage to the distribution facilities, particularly in the main cite. Approximately 30% of the existing 110/10,35/10 and 110/6 35/6 kV transformers were destroyed, many substations were set on fire and a large number of low voltage (LV) cables were damaged. The technical losses of those facilities that remained in operation were and remain four - five times higher than normal due to extensive loading conditions.

### I.1.4.6 Energy technologies in household / service sectors

The energy consumption of the household/service sectors is divided into four parts described as basic energy uses with widely differing characteristics: *space heating, air conditioning, water heating, cooking lighting and electric appliances*. It is known that the domestic household/service sectors in Albania are one of the important energy consuming sectors. Their importance is highlighted by the fact that it consumes large quantities of electricity, fuel wood, LPG and kerosene, which have contributed to the country's last energy crisis. Up to 1990 the supply and demand for heating, cooking, domestic hot water and fuels balance

(mainly wood) were more or less in balance. After 1990s, there was a large reduction of fuel wood supplied by the state enterprises to the urban area. As a result there was an over cutting of trees (much of which is illegal), overloading the electricity distribution system and causing very big problems on the environment.

Due to the collapse of industries and the increasing energy consumption by households, in particular the demand for electricity, the household/service sectors now occupies a growing share of the energy consumption: More than 60% of the total energy demand and 62% of the electricity demand. Another pronounced trend is that a growing share of the each individual household's energy consumption is directed towards space heating, air conditioning (especially in service sectors) probably as much as 30-40% and at national level some 61% of the space heating demand is covered by electricity.

Five variables are particularly significant in evaluating the demand for space heating and air conditioning: household volume (which as it as known depends from area of living and the height of the houses), heating and cooling degree-days, thermal conductivity of walls, roofs (add here the ventilation losses through windows and doors) heating hours. From statistical values is shown in clear way that Albania is in the last position when we compare countries with indicator of square meters of leaving for capita. Houses currently being built on a self-basis rarely abide by the existing housing norms of height of ceilings and surface use and are considerably larger than the average figures indicated above. Of course a large house in volume and area will mean an increase of energy demand for space heating.

The thermal conductance of dwellings reflects the heat losses from the houses into the surrounding atmosphere and depends on a number of factors among which the most important are the surfaces (walls and roofs) in direct contact with the outside air, the construction materials, the size and characteristics of the windows and doors. Houses made with bricks and having walls of thickness typically to the majority of Albanian houses, have thermal conductance ranging between 0.872 [$W/m^3\ ^0K$] for large buildings or apartments and 2.151 [$W/m^3\ ^0K$] for detached single houses. The average values estimates for the early '90s are 1.51 [$W/m^3\ ^0K$] and 2.08 [$W/m^3\ ^0K$], respectively in urban and rural areas, with an average of 1.86 [$W/m^3\ ^0K$] over the whole housing stock. These values, however, do not make allowance for heat losses due to poor maintenance, holes in the walls, broken or inexistent windowpanes, etc.

This may seem quite high as an overall average, but large apartment buildings are probably the only way to accommodate the strong urban inflow, short of introducing barriers to internal migration or creating sprawling slums to the city outskirts. With these assumptions the thermal conductance decrease by almost 20% as an average over the whole housing stock to reach about 1.55 [$W/m^3\ ^0K$]. The decrease will come essentially due to introducing the new energetic code for new stock of buildings and the urban sector where increasingly large apartment buildings lead to an average conductance of only 1.22 [$W/m^3\ ^0K$] in 2010. On the other hand it is imperceptible in the rural sector where households continue to be largely single-family units with thermal conductivity's averaging a relatively high 2.09 [$W/m^3\ ^0K$].

Albanian families are using electric radiators in the most of the cases for ensuring space heating and DHW.

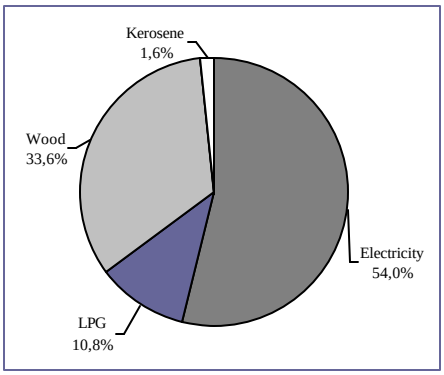



***Figure I.20*** *Appliances used for space heating in the household sector (in percentage)*

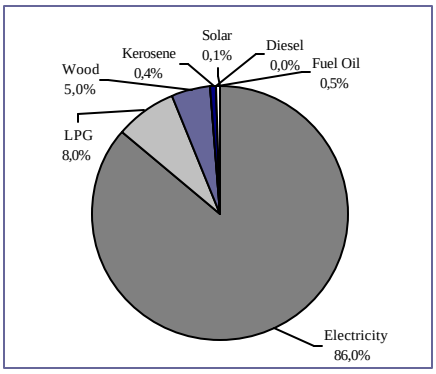



***Figure I.21*** *Appliances used for DHW in the household sector (in percentage)*

After 1990, there was a large reduction of kerosene and fuel wood supplied by the state enterprises to the urban area. As is shown in the following figure, Albanian families are using in the most of the cases electric stoves for cooking purposes.

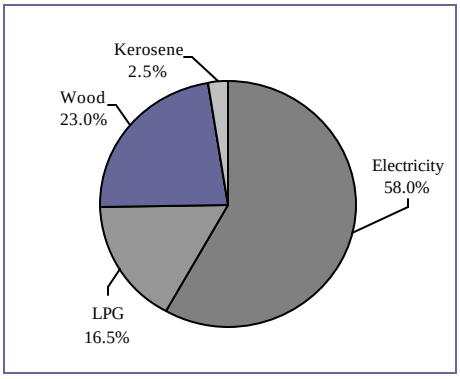



***Figure I.22*** *Appliances used for cooking in the household sector (in percentage)*

### I.1.4.7 Energy technologies in transport sector

Up to the end of 1980s, the transport sector has been relatively unimportant in the Albanian energy scene, accounting for less than 15% of total final energy consumption. With the collapse of the economy in 1991, consumption of gasoline and diesel for road and rail transport remained stagnant.

Beginning from 1992 the strong increase in the road vehicle stock has been accompanied by a surge in transport activity and a very visible increase in energy consumption associated by a deterioration of the urban air quality. Transport sector is divided into two sub-sectors: passenger transport and freight transport. At the following table are given the stock of vehicles in each category: cars, buses and mini buses, heavy-duty vehicles, motorcycles and road tractors.

| ***Table I.12**: Stock of the vehicles in each category* | | | | |
|---|---|---|---|---|
| | **1994** | **1996** | **1998** | **2000** |
| Cars | 53298 | 67278 | 90766 | 111345 |
| Buses and minibuses | 5471 | 7612 | 9227 | 12567 |
| Trucks (heavy-duty vehicles) | 25343 | 27774 | 34378 | 39600 |
| Motorcycles | 3345 | 5541 | 6542 | 5600 |
| Road tractors | 1110 | 2838 | 3035 | 3700 |
| **Total** | **88567** | **111043** | **143948** | **172812** |

Albania has around 10,000 km of roads. Of these 8,000 km, including all the major national roads, are under the responsibility of the Ministry of Transport while the remaining 2,000 km serve mainly to connect mining areas, forests and villages under other jurisdictions. Practically all roads, especially after damages of February-June 1997, are in very poor conditions and in emergence need for repair. If those repairs will take place, they will lead to a reduction in the rate of specific fuel consumption compared to current relatively high level, so no significant as to change the overall nature of the problem. Road passenger transport is divided into: cars and motorcycle, diesel cars and busses. In 1995, activity level for road passenger transport is 2,741passenger-km-capita. Shares for devices and energy intensities for road transport are given in the table below, based in the statistical records of the Ministry of Transport and the NAE.

Albania is one of the few countries where a policy of increasing railway transport has been applied consistently over the last several decades. The length of railway lines, which was just over 200 km in 1970, was more than tripled during the course of the '80s to reach 720 km in 1990. After 1990 passenger transport by rail way has dramatically dropped, because the state did not provide enough funds for the maintenance and trains are very slowly and old fashioned.

Albania's sea transport is provided through four principal ports, (Durres, Vlora, Saranda and Shengjin) of which Durres is the most important. Since the mid '80s a considerable effort has been made to create infrastructures for the use of inland waterways. Domestic transport by sea and by inland waterways accounts for only a small fraction of passenger and freight transport within Albania. Since 1990 sea passenger transport has exploded in the first place since the beginning of the emigration.

Besides Rinas, Albania has four other airports located in the tourist areas and 6 airfields. Air transport has been stagnant until the political changes opened the country to international traffic. Since 1990 to 1996 the air passenger transport increased rapidly, and it will continue to grow in the future due the refurbishment of Rinas airport, which began in 1996 and due to plans of commencing domestic air services. Shares of total end-use and energy intensity levels for 1994 are stated respectively in the following tables:

| ***Table I.13:** Shares of total end-use and energy intensity levels for passenger transport (1994)* | | | |
|---|---|---|---|
| **Year 1994** | **Fuel** | **SHARE % of total end-uses** | **INTENSITY GJ/ passenger-km** |
| Road | | | |
| - cars/MCs | GASOLINE | 10% | $10.20 * 10^{3}$ |
| - diesel cars | DIESEL | 20% | $2.840 * 10^{3}$ |
| - buses | DIESEL | 70% | $0.544 * 10^{-3}$ |
| Rail | DIESEL | 100% | $0.524 * 10^{-3}$ |
| Sea | DIESEL | 100% | $21.8 * 10^{3}$ |
| Air | Jet fuel | 100% | $4.360 * 10^{-3}$ |

| *Table I.14* *Shares of total end-use and energy intensity levels for freight transport(1994)* | | | |
|---|---|---|---|
| **YEAR 1994** | **FUEL** | **SHARE % of total end-uses** | **INTENSITY GJ/ ton-km** |
| Road | | | |
| All trucks | Diesel | Almost 100 | $2.64*10^{-3}$ |
| Rail | Diesel | 100 | $0.85*10^{-3}$ |
| Sea | Diesel | 100 | $0.54*10^{-3}$ |
| Air | Kerosene/Jet fuel | 100 | $135.87*10^{-3}$ |

### I.1.4.8 Energy consumption industries

The main sub-industrial sectors are listed as following:

- *Extraction* sub-sector, which includes mining of different minerals like cooper, iron, chromium, etc;
- *Food, beverage and tobacco* sub-sector**,** which includes food, beverage and tobacco industries;
- *Chemical and petrochemical industry***,** which includes plastic, fertilize, refineries, medicines and other industries;
- *Building materials* sub-sector**,** which include cements, limes, bricks, glasses and other non-metallic product industries;
- *Metallurgy* sub-sector**,** which includes steel, Ferro-chromium, pure cooper, nickel, and aluminum products industries;
- *Other industries where are* included: textile, leather, shoes, wood processing, paper, pulp, and printing, manufacturing of electric and electronic equipment and other processing industries.

Historically, Albania's energy intensity in industrial sub-sectors has been very high. This means that the macro economic output normally denounced by the GDP, especially from industry sector has been low compared with the overall energy consumption. The reasons are the same as for the other CEE countries which have been orientated towards energy intensive industries such as mining and metallurgy, and where energy prices have been prevailing low. In 1985, due to the existence of a very energy intensive industry in Albania, the energy use per economic output was slightly higher than the average for the CEE countries. This level again was almost 5 times bigger than the average level of the EU countries. During the following 10 years until 1994 Albania's situation changed radically. The energy intensity was reduced by some 50% but the per capita energy consumption was reduced even more, to only 1/3 of the 1985-level.

The very low productivity of the labour evidenced previously makes the energy consumption per employee considerably lower in all sectors and end uses. As an average over all industry, energy consumption per employee is less than 20% that for the state of the art technology. The ratio however varies very significantly with the sector, from as low as 7% for building materials and paper and pulp, to as high as 81% for metallurgy. These results evidence the effect of the high labor intensity of Albanian industry in reducing energy consumption, with labor quite clearly competing with energy, but only at a very low level of labor productivity.

With the opening of the Albanian economy towards free market economy, accompanied by industrial restructuring, technology, process and management changes, it may be expected that Albanian energy intensities in physical output terms will tend to approach the state of the art values. This will be relatively slow process, however, and it seems unlikely scale of the scenario. The scenario forecasts, which also attempt to incorporate changes in product slate within each sector, vary widely with the sector end use.

The strongest changes are assumed to take place in sectors, which are the most distant from current of the art, such as glass and ceramics, metallurgy, engineering and building materials, where relative changes in energy intensity are in the order of 50 to 100%. Changes are both positive and negative, reflecting the interplay of numerous factors among which the most important are the replacement of old and inefficient technology and production process and increasing mechanization. Considering manufacturing and mining as a whole, the ratio of Albanian to state-of-the-art energy intensities in physical terms decreased by about 18% for electricity and increased by about 22% for heat uses. Audits have shown very low figures of power factors (cos φ)[9] in the range of 0.55-0.7.

### I.2 Criteria for assessment

As indicated in the introduction section of this report, the identification of the priority technologies and actions has gone through a view of the contribution that new technologies in different sectors might make to social, environmental and development goals. There are four factors and respective sub-factors already determined as criteria of assessment (Box I.7).

***Box I.7:***

***Criteria for assessment***

*1.Contribution to the achievement of most of the MDGs*
- *Job & wealth creation for the poor - JW*
- *Food security - FS*
- *Health improvements - HI*
- *Capacity building (human, institutional, physical, environmental) - CB*
- *Ensure environmental sustainability - EES*
- *Economic and industrial efficiency improvement - EI*
- *Gender equality and empower woman - GE*

*2. Social acceptability and suitability for coun try conditions SA&S*

*3. Market potential*
- *Capital and operating costs relative to alternatives - COC*
- *Commercial availability - CA*
- *Reliability and potential scale of utilization - RPS*

*4.Contribution to Climate Change*
- *GHG emissions reduction potential - GR*
- *Adaptation potential – AP*

As indicated in the introduction section, 1 determines the maximum weight of factors and 100 determines the maximum score of sub-factors.

### I.3 Selection of key technologies

As indicated in section 1.3, namely overview of the work done under the Albania's FNC, a cost-benefit analysis of technology options/measures is performed for energy and transport sector.

The package of technologies / measures already analyzed for the energy and transport sector under the Albania's FNC have been screened and evaluated on the basis of above assessment criteria: (i) Development benefits; (ii) Social acceptability and suitability for country conditions; (iii) Market potential; (iv) Contribution to climate change.

A ranking process of the scored technologies has followed and a set of top 5 technologies has been selected as key ones for intervention. These top 5 technologies should be in our priorities. However, the Second National Communication will look at other technologies that

[9] cos φ is the ratio between the active power and total power in each end user.

are estimated as of lower score but easier, cheaper and faster to be implementing, such as #11, #12, #16, #19, #20 and # 22. The evaluation matrix of energy technologies is available in Annex I, Table 1. The final selection table is presented below:

***Table I.15**: Technology ranking matrix for the energy sector*

| No | Proposed technologies | Points |
|---|---|---|
| *1* | *Introducing thermal insulation of households/service (public buildings) which use fuel wood, LPG, electricity and kerosene as energy source for meeting space heating demand ;* | ***227.50*** |
| *2* | *Introducing combined heat and power plants in public buildings and private buildings (Hotels etc) in service/industry sector* | ***225.50*** |
| *3* | *Introducing solar water heaters instead of electric boilers in households/service sector;* | ***217.50*** |
| *4* | *Introducing public passenger transport with buses and trains instead of cars and mini buses;* | ***215.75*** |
| *5* | *Improvement of power factor in industrial & service consumers;* | *209.50* |
| 6 | Improvements of efficient boilers which use coal/oil coke/residual fuel oil/heavy fuel oil as fuel; | 206.25 |
| 7 | Introducing mini HPP instead of diesel generators; | 200.40 |
| 8 | Introducing central heating and district heating in public buildings and private buildings (hotels, etc) in service/industry sector | 198.50 |
| 9 | Introducing efficient electric motors in service/industry sectors; | 181.75 |
| 10 | Substitution of coal, residual fuel oil and oil coke fired boilers with heavy fuel oil fired boilers; | 157.50 |
| 11 | Introducing freight transport with heavy trucks and trains instead of small trucks and medium trucks; | 151.75 |
| 12 | Introducing LPG instead of electricity for space heating and cooking in households and service sectors; | 147.00 |
| 13 | Introducing HPP instead of heavy fuel oil power plants; | 142.25 |
| 14 | Introducing wind turbines instead of diesel generators; | 139.25 |
| 15 | Introducing gas power plants instead of heavy fuel oil power plants; | 136.00 |
| 16 | Introducing of efficient lighting (incandescent lamps instead of fluorescent ones) in households/service/industry; | 128.75 |
| 17 | Introducing efficient irrigation systems in Agriculture sector; | 121.00 |
| 18 | Introducing landfill gas plants with 70% recovery; | 113.50 |
| 19 | Introducing efficient refrigerators in household/service sectors; | 113.00 |
| 20 | Introducing prepayment meters in household sector; | 98.25 |
| 21 | Introducing PV electricity instead of diesel generators; | 96.00 |
| 22 | Introducing thermos time switches in electric boilers (for DHW) in household sector; | 71.00 |

From the above table it is evident that the most significant measures that really needs to be addressed and implemented in Albania are:

**Key measures in energy**

1. *Introducing thermal insulation of households/service (public buildings) which use fuel wood, LPG, electricity and kerosene as energy source for meeting space heating demand;*
2. *Introducing combined heat nd power plants in public buildings and private buildings (Hotels etc) in service/industry sector;*
3. *Introducing solar water heaters instead of electric boilers in households/service sector;*
4. *Introducing public passenger transport with buses and trains instead of cars and mini buses;*

## I.4 Identification of existing barriers and policy needs

A number of barriers that can hinder and remains as challenges for the technology transfer process in energy sector in Albania are identified. They are identified through a broad consultative process with key stakeholders. These barriers are of different categories such as: economic, organizational, legal, information, awareness, etc. Also policy needs in order to overcome these barriers are identified. In summary they are indicated in the following table:

***Table I.16:*** *Barrier assessment and policy needs*

| BARRIERS | POLICY NEEDS |
|---|---|
| *ECONOMIC* | |
| Limited financial resources | Support provided by the government in provision of grants, concessions, loans; |
| Lack of national currency conservation | Creation of an enabling environment for foreign investment; |
| Low paying capacity of enterprises & population;<br>Lack of domestic production of power engineering equipment | Improvement of the economic situation in the country;<br>Creation of an enabling environment for domestic production of power engineering equipment (solar panels); |
| Low energy price and state subsidies to energy consumption | Development of pricing policies reflecting the actual costs of energy supply; |
| *LEGAL / REGULATORY* | |
| Lack of standards and norms for energy consumption<br><br>Lack of a Law on energy saving and energy efficiency;<br>Lack of incentives for the utilization of renewable energy sources | Develop standards and norms for energy consumption and enhance efficiency of technologies<br>Adopt[10] a law on energy efficiency and energy saving |
| *INFORMATION /AWARENES* | |
| Lack of access to technological information | Establishment of an specialized information system for that purpose |
| Lack of information among investors on potential technology market;<br>Lack of information and awareness among governmental structures, private companies and public on the benefits of the energy efficiency and energy saving technologies. | Develop awareness raising campaign to keep different stakeholders informed on the potential technology market and the benefits of the energy efficiency and energy saving technologies. Organize TV and radio programs and advertising campaigns. |
| *HUMAN /INSTITUTIONAL RESOURCES* | |
| Lack of skilled professionals in energy conservation and efficiency techniques;<br>Lack of personnel for introduction and operation of environmentally sound technologies | Organize qualifications and trainings on energy conservation and energy efficiency techniques and good practices. |
| Lack of human and institutional capacities to implement the Kyoto Protocol Mechanisms such as Clean Development Mechanism | Ratification of Kyoto Protocol by the Government of Albania<br>Capacity development to respond to the implementation of the Kyoto Protocol Mechanisms. |

## I.5 Selection of actions

A package of policies and measures required for abatement of GHG emissions have already been proposed under National Climate Change Action Plan, developed under the Albania's FNC. As indicated there, sectorial measures and policies are addressed. This package of measures is highly taken into consideration during the phase of preparation of the National Energy Strategy and is fully reflected into the Action Plan[11] for implementation of this Strategy.

Actions needed in the framework of the technology needs, already identified for the energy sector in Albania are addressed in the form of project needs. Therefore a package of possible project proposals is designed by experts for each of key technologies for energy sector. Each project idea consists of the main objectives, expected outcomes, linkages to the development priorities, potential stakeholders, respective barriers, GHG reduction potential, and financial cost. Titles of project ideas proposed for energy sector are as following:

[10] This law has already been drafted by NAE and will be sent for adoption to the Parliament.

[11] According to the Decree # 184 Dated September 16, 2003 of the Council of Ministers, the National Action Plan for Implementation of the Energy Strategy is fully obligatory for all relevant and responsible institutions.

1. *Introducing thermal insulation of households/service (public buildings), which use fuel wood, LPG, electricity and kerosene as energy source for meeting space heating and air conditioning energy demand*

2. *Introducing DH and CHP systems in industry, service and households sectors to meet energy demand for heating and electricity in Albania*

3. *Introducing Solar Water Heating Systems in households/service (public buildings), which use electricity, LPG and fuel wood as energy source for meeting energy demand for space heating and air conditioning.*

4. *Increasing the share of public transport to the passenger transport in Albania*

Detailed project ideas can be found in Annex II.

## II. LAND USE CHANGE AND FORESTRY SECTOR

### II.1 Overview of options and resources

#### II.1.1 Sector profile

Albania's forests cover 1,030.230 ha, roughly 36% of the total land area whereas pastures cover 14%. Forests consist of high stem forests [45%] and coppice [54.3%]. The single forest species occupy 72.3 % and the mixed species forests [27.7%]. According to their functions forests are classified as production forests, which have a share of 86%, and protection forests [14 %]. In Albania, natural forests have a share of 91.2% and man made one or plantations cover 8.8% of the total.

At present, Albania's area distribution after land use is as follow:

***Table II.1:*** *Area distribution*

| Type of land | Share % |
|---|---|
| Arable land | 24 |
| Forest | 36 |
| Pasture and grassland | 16 |
| Other (water, stone, etc.) | 24 |

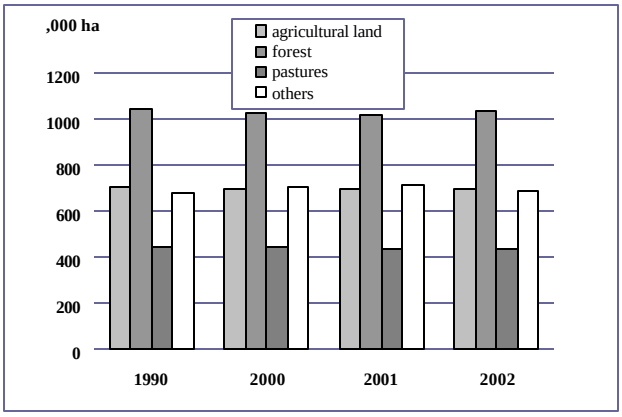
*Source: MoAF- statistics 2002*

About 83 % of forest area is semi-natural forests originating from natural regeneration, conserving the main species composition. There are also about 8.2 % or 84,841 ha of virgin/primeval forests, mainly localized on the northern part of Albania. The plantation or man-made forest area has been increasing until to early '90s and afterwards stopped because of investment reducing composing actually around 8.8 % of the area.

The total pasture area at the moment is estimated at 415,900 ha, with a pastoral capacity of 1,521 million heads. About 60 % of pastures have been transferred in use to communes, about 5.5% of total area is compensated to ex – owners, whilst other areas, mainly summer pastures are under the General Directorate of Forests and Pastures (DGFP) administration. Further needs for food are provided by forest areas through harvesting the green mass from certain types of trees.

There are no changes in the use of the agricultural area at the national level during the year 2002. The agricultural land fund has remained unchanged for the last ten years (699 thousand ha or 24% of the total area, 36 % forests, 15% pastures and 24% others). According to the data of the agricultural statistics, the area destined for agriculture has not changed in comparison to the year 1990, but in reality there is a considerable area not used for agriculture any longer; which has shifted the other areas. So, only 50% of this area is field and this land represents a real and stable fund for agricultural development. The other part, that is situated higher than 300 m from the sea level, is very fragmented, with stones, with very few potential capacities for irrigation, is salted, eroded and with little feeding possibilities. More than 30% of the land is situated on the hills side: these are mainly pastures converted in new lands during 1970-1985. Regarding the location of the lands for agricultural use, these lands are mainly extended on the sloppy areas and located in very high zones. More than 47% of the land is located higher than 600 m from the sea level and with some small exceptions like the Korca- Erseka valley, other areas are very poor and infertile.

The dynamics of the area destined for agricultural land, pastures, and forests in the period 1990- 2000 are given in Figure II.1 as follows:




*Source: MoAF- statistics 2002*

***Figure II.1:*** *The structure of the land (1990-2002)*

During the period 1990-2000, land categories have not changed much and the agricultural land stands for 24% of the total area, forests for 37%, pastures and meadows 15% and other lands 24%. The data show that an area of 10,000 ha has changed destination: it has merget from the category 'others' to 'forests'. Although it's a small area, this change speaks out significantly for the development of the communal forests.

Concerning the area of the agricultural land for each habitant, our country is the last ranked in the region (about 2,200 $m^2$/habitant). On the other hand, based on the fact that only 450,000 ha land can really be cultivated, which also corresponds with the de-facto cultivated area during the last decade, it can be concluded that one habitant is entitled to only 1,400 $m^2$,which renders Albania the most poor country in agricultural land. Moreover, even the fertile lands (especially in the west side of Albania) cannot be totally cultivated because of the high emigration in these zones, the lack of supporting governmental policies (eg. credits) etc.

The general situation of the Albania's forests and land use is given as following:

- Until 1990, the arable land has been increasing and after diminishing. Actually there are around 120,000 ha abandoned agricultural lands, which are refused even by farmers as inappropriate land to cultivate crops;

- Despite of reforestations, the share of forests has been decreasing in the past 50 years because of deforestation made in order to enlarge the share of arable land. A part of considerable loss in forest area came as result of inappropriate government decisions as part of an autocratic decision to strive for food self-sufficiency, which resulted in the clearance of about 260,000 ha to create " agricultural and". It was also impacted due to the change in definition on "forest". Afterwards, too much forest area is included in pastures;

- There has been in the past and continues to occur a gradual but pervasive degradation of the quality of the recourse base (loss in standing volume and overall productivity) over large areas of formerly productive forestlands. The current estimates show a total of standing volume of approximately 82.3 million $m^3$, a reduction of about 10% since 1950. Annual growth, despite relatively favorable growing conditions stands at about 1.34 $m^3$/ha/year, one of the lowest in all Europe;

- The pasture area has been decreasing until 1990 and after, increasing. The other area has been decreasing until 1990 by drainage of the inland water area and increasing by construction of the artificial lakes used for irrigation or electricity generation;

- The drying of a considerable inland water area has increased organic soils with considerable $CO_2$ reserves;

- The mountainous terrain, different geological straits and tips of soil, overlapping of central European to Mediterranean climate are the main factors to have too much biological diversity of the ecosystems. Actually there are about 3,250 plant species, from which about 330 species are shrubs and trees - the endangered species number is 130.

During the former regime the forest estate was organized into 26 districts – based Forest Enterprises, each of which was responsible for preparing management and utilization plans for the forest area under the jurisdiction. Staffing and capacities at that time were actually quite effective in preparing these plans. Towards the latter years of the former regime the central planning authorities, needing to ensure raw material for the installed wood processing industry capacity and meeting the fuel wood needs of an expanding population, often over – rode the exploitation limits and directed that amounts beyond annual allowance cut be harvested. This has sled to a gradual degradation of the forest resource base, particularly in the more accessible areas where there was also a fair amount of harvest by rural people to meet their own needs. In addition to forest enterprises, many districts had also forest harvesting and wood processing enterprises, which were used to deal with all activities, related to forest infrastructure, roads, harvesting and processing.

After Albania's shift to the market economy, while forestry administration began decentralization. The decentralization of forests and pastures management aims at accomplishing the transfer of state forests and pastures as well as their management competencies in use of local government units. The decentralization process of forests and pastures management aims at curbing further degradation and ensure overall development of forests and pastures through the participation of rural communities in their protection, improvement and sustainable management, and consequently in environmental protection, as well as increase in the communities and villages benefits from the management of these natural resources. At present the transfer process of forests and pastures in communes has been realized, and respective management plans have been worked out for 127 communes, with a total area of 322,400 ha forests and 58,240 ha of pastures.

Primary responsibility for the administration and development of the forestry and pasture rests with DGFP that is directly under the Ministry of Agriculture and Food. Under the DGFP it is established a Commission, which is in charge of giving licenses for participating in the timber auctions to private, people and companies.

### II.1.2 Policy and legal framework

#### II.1.2.1 Policy framework

A National Strategy and Action Plan for forestry and pastures has been designed in 2001. The main objective of this strategy would aim at improving management structures, as well as forest and pastures employment control. There are six policy goals of this strategy, which are as following:

- Maintenance of the integrity of the forests and pastures;
- Promotion of sustainable natural resource management;
- Promotions of the transition to a market-driven economy;

- Transferring the management responsibility for selected state forests and pastures to the local government;
- Improvement of the state management of production forests and the summer pasture resource base;
- Development of recreation and tourism opportunities in forest and protected areas.

This strategy implies a series of well-informed choices among the various options for reaching each goal among the various options for reaching the above goals.

Through the support of the World Bank Forestry Project, a process of transferring the Government administrated forests to the communes is launched. In collaboration with Food and Agriculture Organization (FAO) was carried out the re-profile of the DGFP.

In 1999 the former National Environmental Agency, which on 2001 has emerged to the MoE, has developed a Biodiversity Strategy and the Action Plan. This strategy was developed with GEF funding through the World Bank in cooperation the Institute of Biological Research and the Museum of Natural Sciences. The aim of this strategy is to help the protection and re-establishment of the natural balance of landscape and biodiversity, and protection of all forms of life as well as the natural and aesthetic values inside or outside Protected Areas, through promoting the sustainable use of those resources. The Biodiversity Strategy addresses the forest category, especially those under the protected areas.

From 1993-1996 a Coastal Zone Management Plan has been developed as a cooperation of Albania's Government, UNEP, World Bank and European Union. Many natural coastal habitats have been destroyed by excessive drainage and land reclamation for agriculture, currently abandoned for practical or political reasons. The biodiversity component of the Coastal Zone Management Plan deals with the conservation and protection of sites of ecological and aesthetic values, including forests.

**II.1.2.2 Legal framework**

The transformation of the forestry sector from the centrally planned and state implemented model has necessitated major changes in the legal and regulatory framework for the sector. The most important of these changes is, naturally, the forest law. A revised law "On Forestry and the Forestry Service Police", No. 7223, is adopted on 13.10.1992. The revisions set less emphasis on production from the forest and instead set special importance on market orientation, attention to environmental issues and on sustainable management of forests.

Another important aspect of the legal framework, as concerns forests and pastures is the Regulation No. 308 " Regarding the transfer of Commune Forests and Pastures for their Use and Administration", dated January 1996 and currently under consideration for revisions. This regulation provides the criteria for these transfers, discusses the nature of the relationship between the State and the Communes and their rights and responsibilities, and gives the terms of use of these areas once transferred to Communes. Communes intend this regulation as the primary mechanism for implementing the very innovative decision to handover forestlands for the use, control and management.

An inter-ministerial Task Force has been established and it has been very successful in reducing illegal cutting and traffic of wood. A Decree of Council of Ministers, No. 648 dated 13.12.2002 is adopted in order to better control forests use. It aims at temporarily prohibition of woodcutting in forests excluding the woods for heating.

A number of other areas of the legal framework are also pertinent to the understanding of the operational boundaries for the development of the forestry and pasture sector. They include local government, environmental protection, land legislation, tourism etc.

The legal framework relevant to the forestry and pastures is summarized in the Box II.1 as following:

***Box II.1:***

- *Law "On forestry and the forestry police service", No. 7223, dated 13.10.1992.*
- *Law "On environmental protection", No. 8934, dated 05.09.2002.*
- *Law "On the protected areas", No. 8906, dated 06.06.2002.*
- *Law "On pastures and meadows", No. 7917, dated 13.04.1995.*
- *Law "On fisheries and fish farming", No. 7908, dated 05.04.1994.*
- *Law "On hunting and wildlife protection", No. 7875, dated 23.11.1994.*
- *Law "On urban planning" No. 8405, dated 17.09.1998.*
- *Law "On the development of the tourism priority areas", No.7665, dated 21.01.1993.*
- *Law "On the compensation in value or in kind of agricultural land, pastures, meadows, forestland for the ex – owners", No. 7699, dated 21.04.1993.*
- *Law "On the protection of fruit trees and other orchard plants", No. 7929, dated 30.06.1994.*
- *Governmental Decree "On the approval of tourism priority areas" No.88, dated 01.03.199.3*
- *Governmental Decree "On the approval of coastal zone management plan", No. 364, dated 18.07.2002.*
- *Governmental Decree "On categories of protected areas", No.577, dated 06.02.1993.*
- *Governmental Decree "On the control of forests", No.648, dated 13.12.2002.*

### II.1.3 Overview of the work done under the Albania's First National Communication

Albania's forest area is composed mainly of the broad leaf species, which are more capable to serve as sinks of $CO_2$ emissions. The main source on biomass production and absorption of the $CO_2$ emissions for 1994 are commercial forests and deciduous broad leaf species.

Estimates from Albania's FNC, show that the LUCF category has a share of 21.60% against the net total of GHG emissions [7,061.45 Gg], calculated for 1994 as the base year.

Estimates also show that in 1994, forests do not serve as a sink but as a source of GHG emissions, due to the bad management. Based on these estimates, the total carbon uptake has shown a value of 615.36 carbons Kt. The total biomass consumption, annual carbon content and annual $CO_2$ emissions are found to be respectively 2,054.76 dm Kt, 1,027.38 Kt of carbon and –1,510.73 Gg of $CO_2$. The last negative value shows that there is more release of GHG emissions than absorption by forests (see Figure II.2). This happens due to wood cutting process in Albania, which is higher (over three times) than annual increment of forests. Despite of the high level of uncertainty concerning the activity data for this category, the biggest contribution comes from non-registered cuttings (illegal cuttings).

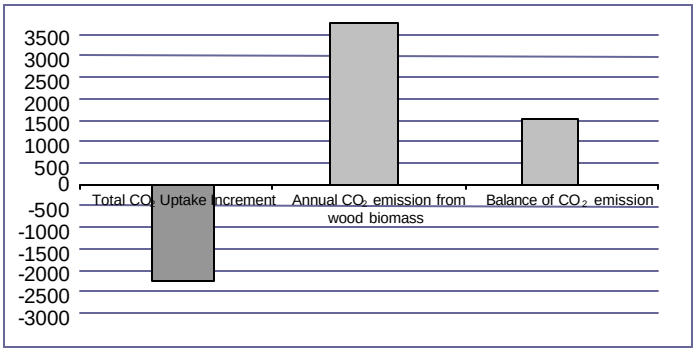



***Figure II.2:*** *$CO_2$ emissions and sinks from forestry, [Gg], 1994*

According to IPCC guidelines on GHG inventory preparation, the emissions from the fuel wood burned for meeting energy needs has to be reported under the LUCF category. Since in Albania the tree cutting rates are higher than yield intake they are reported under the Energy category as well increasing its share significantly. Furthermore, the $CO_2$ emissions from biomass burned for energy purposes are identified as a key source[12]. Estimates show that the share of this category represents 21.4%. This means that it needs to be taken into consideration during the policy design process for the LUCF sector because policies and measures to reduce emissions from this category have a significant impact to the overall GHG reduction. On the other hand, this category is identified as the most significant one in terms of contribution to the overall GHG inventory uncertainty level. This is explained due to the lack of data for illegal cuttings of trees in rural areas, which are not registered and reported elsewhere.

The baseline scenario [13] developed for the LUCF category under the Albania's FNC, for the baseline 1994-2020, shows that total $CO_2$ uptake is expected to change from 236.24 Gg in 1994 to 1,526 Gg in the year 2020. In 2020, the total emissions of released from burning of fuel-wood are expected to reach 2,940 Gg from 1,871 Gg in 1994.

Experts have proposed a set of 13 qualitative and quantitative measures. Only three of thirteen proposed measures are selected as key measures aiming at reducing GHG emissions in the LUCT category, starting from 2002 up to the year 2020. The selection is based on the criteria[14] set for the assessment of mitigation technologies in the frame of the Albania's FNC. Top three measures selected under the FNC of Albania for the LUCF category were as following:

*1. Integrate climate change concerns into forest development strategy and other related strategies*
Preparation of the forestry development strategy and action plan based at sustainable development principle, where implications by climate change are to be considered;

*2. Increasing the forest area by reforestation.*
The predicted reforestation area of about 15,000 ha with an average rate of reforestation about 775 ha/year would lead to a reduction of the rate of decreased forest area: from 1,024.616 ha in 2001 to 993,323 ha in 2020;

*3. Implementation of the forest improvement operations.*
Implementation of the coppice forest conversion using the same or fast-growing species to high stem forest in a forest area of about 100,000 ha with an average annual rate of 5,000 ha/year.

According to the abatement scenario, assuming the implementation of the above three measures the projections of GHG emissions from LUCF category, would be as following:

- The total $CO_2$ emissions, would change from [-2,732.72 Gg] in 2001 to an uptake of [2,886.84 Gg] in 2020;
- The total emissions of $CH_4$, would change from [0.15 Gg] in 2001 to [0.29 Gg] in 2020;

[12] Key sources represent the main sub categories that have significant contribution (up to 95%) to the overall GHG inventory.
[13] Baseline scenario of GHG emissions from LUCF category is estimated for years 2010 and 2020. The IPCC methodology is used for estimates.
[14] A qualitative assessment has been made for the LUCF category under the Albania's FNC. Criteria used under this phase were: (i) mitigation potential; (ii) economic impact; (iii) environmental (non-climate) impact; (iv) potential ease of implementation; (v) long term sustainability; (vi) consistency with national development goals; (vii) data availability for evaluation

- No emissions of $N_2O$ from LUCF. From [0.00 Gg.] in 2001 will remain the same [0.00 Gg] in 2020;
- The total emissions of NOx would change from [0.04 Gg]. in 2001 to [0.07 Gg] in 2020.

**II.1.4 Take the stock of technologies currently in use**

As previously indicated there exist a National Strategy and Management Plan for the Development of Forests and Land, object of revision every 10-15 years. There is also some experience, capacities already built and developed. There exist institutions that have proposed, prepared and implemented studies and research projects in different areas of forestry. Last years, in the framework of forestry development project in Albania supported by World Bank, have started the implementation of around twelve research projects and a monitoring program of the forest health situation.

Projects to regenerate the forests area by planting of more adapted species and the fast-growing species, aiming at developing mix forests, directly by seed and by sapling plantings are well-known practices in our country.

Thousands hectares of forests mainly oak forests by re-stumping operations are rehabilitated. Also, in order to increase their productivity, forests have been converted from coppice to high stem forests by consenescence way of the same native species or by planting the more fast-growing species.

There are experimented some fast-growing forest species and, some of them have resulted successful as: poplar hybrids, Monterey pine, Douglas fir, seaside pine, while some others are in their way of experimentation. For some of them, even the planting possibilities on the considerable area have been studied.

By plantings of Mediterranean pines (Aleppo pine-Pinus halepensis Mill, Seaside pine-Pinus pinaster and Stone pine-Pinus pinea L.) on the limestone geological formations and on sandy terns along the coastal area, and black pine (Pinus nigra Arn.) on the serpentine geological formations, are established too much man-made forests. The same could be said with poplars along the rivers on sandy terns. There are planted also some other broadleaf species as walnut (Juglans regia L.), chestnut (Castanea sativa L.), Sweetball (Laurus nobilis L.) etc. There are areas with fast growing forest tree species as Black-locust (Robinia pseudoacacia L.), while some small area is planted with Monterey pine (Pinus radiate D.Don.), etc.

Despite the good practices, in order to have the fodder for livestock husbandry during the cold season, farmers have always pruned oak tree and beech tree, during the autumn season, reducing too much the annual increment of forest in a forest area about 275.860 hectares

The current legal and regulatory framework prohibits interventions to the forests areas (no operations are eligible) without proposed and approved application projects. Also the law on forest protection by fire has enabled the establishment of the national service for forest protection by fire. However, there is an emergent need to improve such a service and strengthen their capacity building since the fires in the forests and in the pastures are foresighted to be increased and to be more intensive. On the other hand there is little awareness related to risks of forest and pasture fires which brings the desertification of the territories.

There is also still common in the rural area the practices of usage of wood for energy purposes (to meet the demand for space heating, cooking and hot water supply in the households). Therefore there is an urgent need to reduce wood consumption for energy by substitution of firewood with other non-fossil fuels.

### II.2 Identify criteria for assessment

The same assessment criteria as for energy sector are used for the selection of the key technologies: (i) Development benefits; (ii) Social acceptability and suitability for country conditions; (iii) Market potential and (iv) Contribution to climate cha nge.

As indicated to the introduction section and energy and transport section, 1 determines the maximum weight of factors and 100 determine the maximum score of sub-factors. See Annex I, Table 2.

### II.3 Selection of key technologies

A ranking process of the scored technologies has followed and a set of top 4 technologies has been selected. Four technologies are found as key ones for intervention for the LUCF category. The evaluation matrix of LUCF technologies is available in Annex I, Table 2. The final selection table is presented below:

| No | Proposed technologies | Points |
|---|---|---|
| *1* | Identification of firewood needs of farmers and their forest resources to meet them | **76.60** |
| *2* | Reforestation of an area of 100,000 ha, on refused agriculture lands, using more capable species to absorb the $CO_2$ and fast-growing species | **72.50** |
| *3* | Integrate climate change concerns into the National Strategy for forest development and to other related strategies | **71.80** |
| *4* | Monitoring of fire situation to assess the more threatened forest areas from climate change point of view and the desertification scale due to fires | **70.00** |
| 5 | Increase of the protected forest area | 67.30 |
| 6 | Conversion of the coppice forests to high stem forests by planting the fast-growing species or more capable species to sink $CO_2$ in an area of 20,000 hectares | 67.30 |
| 7 | Regeneration of a forest area of about 15,000 ha with more capable species to absorb $CO_2$ by planting the fast-growing species and more adapted species to the expected climate change and the sea level rise, harvesting therefore a mix forest | 65.30 |
| 8 | Study of the potential of forest biomass usage for energy purposes in rural area | 63.70 |
| 9 | Monitoring of the forest situation and forest health situation in relation with climate change and sea level rise | 63.50 |
| 10 | Rehabilitation of burned forest area | 59.30 |
| 11 | Development of local forest sustainable development actions plans based on the national ones | 58.90 |
| 12 | Study on the firewood reduction ways out | 57.10 |
| 13 | Develop a new law on forest protection from fire associated with the reorganization of the fire protected service | 48.40 |

From the above table it is evident that the most significant technologies that really needs to be addressed and implemented in LUCF category in Albania are:

**Key technologies in LUCF**

1. Identification of firewood supply and demand for energy purposes in rural areas;
2. Reforestation of an area of 100,000 ha, on refused agriculture lands, using more capable species to absorb the $CO_2$ and fast-growing species;
3. Integrate climate change concerns into the National Strategy for forest development and to other related strategies;
4. Monitoring of fire situation to assess the more threatened forest areas from climate change point of view and the desertification scale due to fires;

### II.4 Identification of existing barriers and policy needs

Several barriers hinder the pathways and mechanisms of technology transfer in the LUCF category. They are also identified through a broad consultative process with experts and key stakeholders. These barriers are of different categories such as economic, organizational, legal, information, technical, awareness, etc. Specifically they are: (i) limited financial

resources, (ii) inadequate information on the cost and potential benefits, (iii) limited technical capacity, (iv) absence of adequate policies and institutions to process, evaluate and clear mitigation projects, (v) uncertainty regarding quantity of carbon abated and its permanence, (vi) low economic return for some technologies and (vii) relatively long period to release carbon benefits. In addition, the forestry sector faces land rules regulation and other macroeconomic policies that usually favour conversion to other land uses such as agriculture and cattle ranching. Insecure land tenure regimes and tenure rights and subsidies favouring agriculture or livestock are among the most important barriers for ensuring sustainable management of forests, which in turn ensures the sustainability of the $CO_2$ emissions abatement.

***Box II.2:***

*Forestry GHG mitigation activities generally face a wide range of technical issues that challenge their credibility. The twin objectives of using forestry to mitigate climate change and managing forests sustainability do pose a challenge in monitoring and verifying benefits from carbon offset projects in the sector. The emergence of improved monitoring methods could force reappraisal of the relative credibility of activities to manage carbon sinks. Monitoring and verification are key elements in gaining the credibility needed to capture the potential benefits of forestry sector response options, particularly in reducing deforestation. While this is a generic barrier to deforestation reduction initiatives, it also represent an opportunity for transferring the technologies needed to monitor land use change and carbon stocks and flows. Among the mitigation options, there is a high degree of certainty about reforestation / afforestation, less on forest management and even less on forest conservation.*

*IPCC Methodological and Technological Issues in Technology Transfer, 2000.*

In non-Annex I countries, mitigation measures under the LUCF category, like in all categories are going to be undertaken mainly in the basis of projects which are going to be funded by investors, bilateral and multilateral assistance agencies, NGOs and foundations largely based in Annex I countries.

Governments are going to play a critical role in promoting these projects and accompanying the process of the technology transfer between Annex I and Non Annex countries. Governments control multilateral agencies as well as bilateral development assistance. Some of the measures to be undertaken under such an assistance would be (i) support funding to the projects and programs through grants and low-interest loans for Sustainable Forest Management practices, industrial plantations, Protected Areas and forest restoration program; (ii) establishment of the forest monitoring and verification programs; (iii) provide funding for institutional and human capacity building and improving Research and Development capacities.

Clean Development Mechanism offers a potential for facilitating technology transfer in LUCF mitigation, even adaptation projects.

**II.5 Define and select actions**

A set of policies and measures for LUCF category along with other categories have already been proposed under National Climate Change Action Plan, developed under the Albania's FNC. Actions needed in the framework of the TNA, already identified for the LUCF category in Albania are addressed in the form of project ideas. A package of possible project ideas is designed by experts, which clearly address each of top 4 technologies selected for LUCF sector. The list of project ideas proposed for LUCF category are as following:

1. *Identification of demand and supply for firewood in rural areas;*

2. *Integrate climate change concerns and sustainable development into the Forest Management Strategies and plans;*

3. *Reforestation of an area of 100,000 ha, on refused agriculture lands, using more capable species to absorb the $CO_2$ and fast-growing species;*

4. *Monitoring of fire situation to assess the more threatened forest areas from climate change point of view and the desertification scale due to fires;*

Based on the selected technologies, project ideas have been developed and presented in Annex II.

## III. AGRICULTURE

### III.1 Overview of options and resources

#### III.1.1 Sector profile

Albania is predominantly an agricultural country. Albanian economy is and will continue to be dominated by agricultural activity for many years to come. Agriculture is a vital and one of the most important sectors of the economy, which provides significant part of GDP - 54.9 percent. In addition, the majority of population lives in rural areas and is self-employed in agriculture sector, reaching about 52.7 percent of the labour force. It accounts for 12.8 percent of total exports. Crop production accounts for 48.1 percent and livestock production 51.9 percent of total agricultural production.

The rapid privatization and redistribution of land in 1992 and 1993 and the scrapping of all producer price controls accelerated agricultural growth. Land was distributed proportionately to every family according to size and was graded on the basis of irrigation, shape renting and quality. The land market remains underdeveloped, with some shape renting taking place, but few sales. Restrictions on the sale of land were removed since July 1995. Currently there are no price controls or subsidies for agricultural products. Import and export quotas and restrictions have been removed. Owing to small farm size, farmers have only a small marketable surplus, lack access to credit and, thus cannot purchase the inputs required to improve productivity.

Further increases are at present limited by: small, fragmented family farms of an average 1.4 ha; the low productivity of farm technology and management systems; inadequate access to credit as well as input and output markets; and a predominantly subsistence approach to farming caused by risk aversion. Owing to population pressure and a lack of employment opportunities in other sectors, farm holdings are small and fragmented (on average four parcels per farm) and productivity is low. Farmers continue subsistence farming on diversified and extensive farms, faced with the collapse of basic state services and the poor maintenance of basic infrastructure. Efforts to minimize risks are based on continued insecurity regarding land rights, lack of access to agricultural services, such as irrigation and inadequate resources to invest in farm production.

Agro-food industries have been privatized with the assistance of various aid programmes, which provide credit, agribusiness management advice and extension services. About 52.7 percent of the population is engaged in agriculture and related industries, which provide the main source of rural household incomes.

A significant reallocation between crops and livestock took place by switching marginal cropland into pastures. Vegetable production is still increasing, while arable land devoted to grain has decreased. Industrial crop production remains still at a low level owing to the lack of agro processing markets for their products. Grape (for vine production) is steadily increasing. Pastureland has drastically increased whereas food cereals have lost importance since many years.

The livestock is the part of agriculture sector related to the GHG emissions. Even though small livestock production systems dominate, the share of market and processed oriented-production system dominate, the share of market and processed oriented – production is growing rapidly. The demand for livestock feeding stuff is increasing in this ever-growing sub-sector. Since the real possibilities to expand natural pastures are limited, the ever-growing demand for livestock feeding stuff should be met through improving production of forage crops like alfalfa, maize, etc as well as by using industrial by-products.

Dairy production, including butter and cheese, went up as a result of newly established dairy industries. Consumption of animal products (meat and milk) and fruits and vegetables also rose. Consumption of traditional staple food (cereals and bread) remained at the same level. For the year 2002, the Albanian consumer, consumed on average: milk around 198 l/person, meat around 30,5 kg/person and eggs 121/person.

### III.1.2 Policy and legal framework

#### III.1.2.1 Policy framework

From 1992 to 1996, the agriculture sector, have been developed in compliance with an "Agriculture Strategy" designed by the Government of Albania with the contribution of the World Bank (1992-1996) and for the period 1998-2001 under the "Green Strategy". The implementation of both strategies has enabled Albania's agriculture sector as one of the basic components of the integrated rural development passing through a long and proper direction way, since the beginning of transition period towards market economy.

Although the situation in Albania was not appropriate to face the drastic and very quick changes, compared to the way that other CEE countries faced them many of substantial reforms, which include among other, privatization, land distribution, and liberalization of market and prices, have been done. Important investments accomplished so far on the rehabilitation of infrastructure, have had an impact on development. The situation changed quickly due to rigid implementation of reforms, which brought about macroeconomic changes. The rural sector, not feasible and dominated by big state-owned enterprises and agricultural cooperatives, was transformed into fragmented rural sector characterized by thousands of small family farms, which even though small and fragmented registered an increase in production.

The fast market globalization for agro-food production, as well as the process of regional and EU integration requires the adoption of the Albanian agriculture with new conditions. The use of new technologies, which increase both production and income while respecting environment, become imperative. It is the time for natural agriculture applied in remote areas and conventional one applied at the lowlands, be substituted gradually by sustainable agriculture, as the alternative of the future for safe food and clean environment. For this reason a new "Strategy for the Development of the Agriculture and Food Sector" is developed in 2003. It was designed and adopted as part of the NSSED. It *aims* the consolidation of the achievements of the agriculture sector and laying out the basis for medium and long-term development. It *aims* a greater sustainability of the reforms realized in this sector, further consolidation of the public investments for a sustainable sectorial and regional development. It also *aims* the better utilization of the economic, social and financial resources, to ensure the increase of the public and private investments in the fields of marketing, agro-processing, food control and sustainable management of the natural resources. Food security remains a constant priority for the population, in particular in the remote areas.

The objectives of the Strategy for the Development of the Agriculture and Food Sector are in line with that of Action Plan in the frame of Stabilization Association Agreement, MDGs, objectives of Decentralization Strategy, through the transfer of management responsibilities of the local government of natural resources as land, forest, water etc., and objectives of the other sectorial strategies as Rural Development Strategy.

Regarding the livestock production, the strategy aims at consolidating the achievements reached so far, by building new production chains, in order to implement livestock racial program; increase production of combined livestock feeding stuff, and carry our qualitative production and market checks for the last ones.

### III.1.2.2 Legal framework

The legal framework[15] regarding the agriculture sector directly or indirectly related to emissions released into atmosphere is relatively young, since 11 years from now. The new Strategy for the Development of the Agriculture and Food Sector opens door to the improvement of the current legislation and development of the new laws aiming to regulate the agricultural activities, which in turn will reduce the impact to the environment like "Law on Land Protection"; "Law on pure breeders and racial flocks in livestock"; "Regulatory framework on livestock feedstuff inspection, for the certification of animals with racial values on the market, and provision of minimum standards for the pet breeding". The current relevant legal framework is summarized as following:

***Box III.1:***

- ***Legislation on land use:***
  - *Law "On land", No. 7501, dated 19.07.1991*
  - *Law "On some amendments of the Law no. 7501, dated 19.07.1991 "On Land"", No. 7715, dated 02.06.1993*
  - *Law "On some additions to the Law "On land" No. 7763, dated 25.10.1993"*
  - *Law "On creation and operation of land protection and administration structures", No 8752 dated 26.03.2001*
- ***Legislation on cultivated plants:***
  - *Law "On the service of plant's protection", No. 7662, dated 19.01.1993*
  - *Law "On the protection of the medicinal herbs fond", No. 7722, dated 15.06.1993*
- ***Legislation on the administration of waters for agriculture purposes:***
  - *Law "On water resources" No. 8093, dated 21.03.1996 and the by-laws on its implementation;*
  - *Law "On the regulatory framework of water supply sector and removal/treatment of waste waters", No. 8102, dated 28.03.1996*
  - *Law "On some changes and amendments of law no.8093, dated 21.03.1996 'on water resources" No. 8605, dated 20.04.2000*

### III.1.3 Overview of the work done under the Albania's First National Communication

Agriculture category is the second category that follows the energy one regarding its share against the net total emissions of greenhouse gases in Albania. Estimates from Albania's FNC, show that the Agriculture category contributes with [1,915.06 Gg] or has a share of 27.12% against the net total of greenhouse gas emissions [7,061.45 Gg], calculated for 1994 as the base year.

$CH_4$ is found to be the GHG that has the most significant contribution to the Agriculture category. Main source categories of $CH_4$ emissions are enteric fermentation with a share of 95% and manure management with 5.12%. Cattle category is the main contributor for $CH_4$ emissions from enteric fermentations with 72.26% followed by sheep category with16.27%.

$N_2O$ emissions are mainly released due to microbial processes in the soil, mainly by application of nitric fertilizers, which contribute with 84.81%.

Key sources analysis shows that the category of $CH_4$ from enteric fermentation is in the top of the key sources with a share of 22.49 %. Activity data for this category are very fragmentized. After 90's, state livestock farms and agriculture cooperatives were privatized and therefore the livestock breeding shifted from intensive to extensive.

The baseline scenario developed for the Agriculture category under the Albania's FNC, for the baseline 1994-2020, shows that by the year 2020 the $CH_4$ emissions are expected to reach the value of 114.16 Gg, compared to 79.91 Gg estimated for the year 1994.

[15] There are some relevant laws already mentioned in the Forests section like Law "On the meadows and pastures", No. 7917, dated 13.04.1995 which are not repeated in this section.

The baseline scenario [16] developed for the agriculture category predicts higher values of $CH_4$ emissions from manure management systems, nearly 10 times higher [40 Gg] in 2020 compared to 1994 [4.08 Gg]. Also the scenario predicts higher values (around 10 times) for $N_2O$ emissions released from manure management systems.

The abatement scenario for agriculture category consist on a qualitative analysis of a set of six measures and selection[17] of two key measures as the most appropriate ones for GHG mitigation from Agriculture category. Six measures proposed and analysed are listed as following:

*1. Improvement of diet quality and nutrient balance*
The improvement of diet quality and nutrient balance as part of the improved livestock management would considerably affect the amount of enteric methane. Low quality feedstuff is expected to produce a greater amount of methane per unit of production.

*2. Increase of the feed digestibility*
This measure is expected to reduce the amount of released methane especially in dairy cattle. The proposed measure stands in compliance with the government's main objective in the livestock sector, namely increase production supply by improving the breed, enhancing feed and controlling disease.

*3. Improvement of the animal genetics and reproduction.*
Research has also identified that some animals emit less methane than other animals of the same species. It may therefore be possible to selectively breed animals that have this characteristic.

*4. Reduction of the overgrazing pressure on marginal lands*
The proposed measure takes into account the mobility (nomadic life) of the small ruminants of Albania. Therefore increasing of the nutritional values of the pastures would increase the productivity of the grazing animals and reduce the methane emissions.

5. *Improvement of livestock manure management*
The improved management of the livestock manures through the implementation of the appropriate technologies is considered as an efficient measure for the decrease of the methane emissions.

*6. Increase of N fertilizer usage efficiency*
This measure, aims in matching N supply with crop demand and conserve plant residues N on the production site, thus contributing to the overall reduction of NO emissions from the agriculture sector.

The selection process made under the Albania's FNC concluded with the following two top measures: (i) *Increase of the feed digestibility and (ii) Reduction of the overgrazing pressure on marginal lands.*

[16] Baseline scenario of GHG emissions from Agriculture category is estimated for years 2010 and 2020. The IPCC methodology is used for estimates.

[17] A qualitative assessment has been made for the Agriculture category under the Albania's FNC. Criteria used under this phase were: (i) mitigation potential; (ii) economic impact; (iii) environmental (non-climate) impact; (iv) potential ease of implementation; (v) long term sustainability; (vi) consistency with national development goals; (vii) data availability for evaluation

### III.1.4 Take the stock of technologies currently in use

An inventory of the technologies that help in reducing the GHG emissions released from agriculture activities is made under the TNA. The following technologies are assessed to be less GHG emissions ones.

- *Treatment of maize straw with urea-ammonia for feeding cattle*

This low cost technology consisted in improving the feed digestibility through the increase of its crude protein content. The technology was largely implemented in the livestock state farms during the eighties and its purpose was somehow to preserve the lactating cattle productivity during the dry season. For this purpose chopped maize straw was treated with urea 20-40g some times higher dissolved in 500 ml water for each kg straw. The technology contributed in the reduction of the methane release as a consequence of the improved digestibility. Currently few livestock breeders in the country are using the technology.

- *Use of molasses blocks as feed supplement in cattle*

In the southeastern part of Albania (Maliq commune Korca region) molasses blocks have been used as feed supplement in cattle. This technology was related to the existence of a sugar beet processing plant in this area. Molasses was a major by-product of this plant and is a good, palatable and cheap source of energy for cattle. Since liquid molasses was difficult to be used in farming practices, the liquid form was put in moulds and solidified in blocks before getting used.

- *Composting of manure*

Small scale composting has been a traditional way of manure management by the Albanian farmers.

The decomposed residue has been subsequently used as a soil conditioner. Research and studies indicate that compost usage can reduce fertilizer requirements by at least 20%, thereby significantly reducing net GHG emissions.

***Box III.2:***

*Composting is the aerobic (requires oxygen) decomposition of organic matter by certain microorganisms. These microbes consume oxygen and use nutrients including carbon, nitrogen, phosphorus, and potassium as they feed on the organic matter. The resulting composted manure is humus-like organic material, fine-textured, low-moisture, and with a non-offensive earthy odor. If high enough temperatures have been reached during the composting process, pathogens and weed seeds have been killed.*

### III.2 Identify criteria for assessment

As for previous sectors, the same assessment criteria are used for the selection of the key technologies: (i) Development benefits; (ii) Social acceptability and suitability for country conditions; (iii) Market potential and (iv) Contribution to climate change. Also the weight and scores remain the same: 1 determines the maximum weight of factors and 100 determine the maximum score of sub-factors. See Annex I.1, Table 3.

### III.3 Selection of key technologies

For agriculture sector, a set of the following four technologies has been object of the analysis. They are more specific compared to the technologies/measures analyzed under Albania's FNC. The GHG abatement technologies analyzed and ranked according to the set criteria are as following:

*1. Implementation of low cost bio-digesters for the manure processing in the farming system.*

This low cost technology promotes the efficient use of manure in the farming system of Albania. The use of low cost plastic bio-digesters, apart from ensuring a better management of manure brings additional advantages to the economy and the environment (production of gas for cooking and effluent to fertilize ponds for fish, aquatic plants and crops). The most appropriate and cost efficient model of bio-digester appears to be the Taiwan model, which makes use of cheap polyethylene tubular film. The estimated cost for each device is 28 USD and can be covered by the farmers themselves.

*2. Implementation of anaerobic digester lagoon with methane gas recovery*

Anaerobic lagoons are perhaps the most trouble free, low maintenance systems available for the treatment of animal wastes. This is particularly true for the coastal area of Albania where winter temperatures are mild, permitting anaerobic digestion year around. The effluent from the digester is a valuable source of nitrogen for plants. Placing a cover over the lagoon for collecting biogas virtually eliminates odour from the lagoon. The collected biogas, which is up to 70% methane, can be a valuable source of energy.

*3. Use of urea molasses nutrient blocks as a supplement in the diet of ruminants.*

This technology approach appears interesting for smallholder sheep and goat farmers. Albania is basically a small ruminants breeding country and introducing this technology would raise interest among breeders. Feeding trials have indicated a positive response in terms of weight gains in animals. No signs of toxicity due to urea have been observed so far.

*4. The development of farming systems and practices that encourage efficient nitrogen uptake by plants and minimize loss of nitrogen through de-nitrification, leaching, burning and other processes*

The nitrogen fixation process offers a unique option for an efficient use of nitrogen fertilizers or organic amendments. In that respect *Rhizobium bacteria,* either as established soil populations or added as legume inoculants make significant contributions to total nitrogen inputs. Therefore the use of technologies that would ensure the survival of *Rhizobium bacteria* from the point of seed or soil application to the time of seed germination would ensure the functioning of the nitrogen fixation process. Some of these technologies that hold potentials of applications are as follows:

- Implementation of user-friendly inoculant's formulations and methods for application as seed dressing or direct to soil;
- Inoculant's products that are compatible with dry sowing that allow growers greater flexibility in sowing time;
- Diagnostic tools for the rapid assessment of population densities of *Rhizobium bacteria* in soil.

A ranking process of the scored technologies has followed and a set of top two technologies has been selected as key ones for intervention for the Agriculture category. The evaluation matrix of measures is available in Annex I, Table 3. The final selection table is presented below:

| No | Proposed technologies | Points |
|---|---|---|
| *1* | *Low cost bio-digesters for the manure processing* | ***750*** |
| *2* | *Use of urea molasses blocks as a supplement in the diet of ruminants* | ***700*** |
| *3* | Anaerobic digester lagoon with methane gas recovery | 500 |
| *4* | Implementation of user-friendly inoculants formulations for promoting the nitrogen fixation process | 400 |

From the above table it is evident that the most significant technologies that really needs to be addressed and implemented in Agriculture category in Albania are:

**Key technologies in agriculture**

1. Low cost bio-digesters for the manure processing;
2. Use of urea molasses blocks as a supplement in the diet of ruminants.

### III.4 Identification of existing barriers and policy needs

There are many barriers identified for the transfer of the identified key technologies in agriculture sector.

The main barrier identified that needs to be taken into account is the *lack of capital investment*. The above technologies, especially the second one proposed will not be so easily transferred mainly due to the relatively high cost. Albania, as a recipient country needs capital investment to access and adopt new technologies identified as appropriate to its conditions. This barrier may be mainly overcome by grants or loans provided by international donors. However, the financial aid may need to be accompanied by removal of *institutional* barriers that hinder the process of technology transfer. The government can facilitate the process through *incentives* by regulating and improving institutions.

Also *lack of information and education* remains as significant barriers of technology transfer for the agriculture sector. In developing countries there exist a lack of access to information and awareness of what technologies fit with their conditions and sources of information where they can find the appropriate ones. There is a need of information exchange on international technologies for overcoming this barrier. The public role in education is critical and well known and needs a lot of support. This could be mainly done through practical demonstrations through pilot projects.

Another barrier identified is that of *lack of human resources* to deal with technology transfer in this sector. This barrier can be overcome though capacity building and development in that regard, which also requires funding.

The main role in the technology transfer process in agriculture sector stands to the *government*. The government can promote effective modalities for the access and transfer of technologies. Some of the most significant actions that government can undertake are related to the resources mobilization for projects in agriculture sector that have a positive impact on climate mitigation, capacity building and development, research and development (R&D) focused on technological innovation and transfer, provide incentives, disseminate information on new technologies, etc..

Other players are *international organizations*, which mainly facilitate the process through funding for institutional and capacity development, R&D, provide grants through projects, develop information systems for information sharing, etc.

*Private sector* is also important in the technology transfer process. It can provide technical assistance to appropriate users on new technologies and promote cooperation on R&D activities directed at technological innovation and technology transfer for climate change

**III.5 Define and select actions**

Actions needed in the framework of the TNA, already identified for the Agriculture category in Albania are addressed in the form of project ideas. A package of two project ideas designed by experts clearly addresses each technology selected for agriculture category. The list of projects proposed for Agriculture category is as following:

*1. Use of low cost bio-digesters for the manure processing in Albania's farming system.*

*2. Industrial production of nutrient blocks for livestock feeding*

Based on the selected technologies, project ideas have been developed and presented in Annex II.

## IV.WASTE

### IV.1 Overview of options and resources

### IV.1.1 Sector profile

#### IV.1.1.1 Introduction

After '90s when the country started the way towards the market economy, the problem of solid wastes become a concern because of the generation of large quantities of urban wastes as a consequence of rapid increase of urban population due to the irregular migration and commercial exchanges with other countries as well.

The reduction of waste generation at source and the disposal of waste in a more suitable way as concerns the environment are lastly taken into consideration in the new legal framework in the waste field. Along with the increase of their production, Albania is faced with the inappropriate management of urban wastes. The wastes of the cities are not managed in a safe manner leading to serious concerns about their potential environmental risks such as contamination of soil, surface and ground waters with potential impacts to drinking water, inland and coastal waters; adverse aesthetic impact on the natural environment; risks of self-sliding of the amount of wastes deposited over time; existence of contaminated areas from the treatment and depositing of wastes for many years which increases the cost of urban development and also presents serious health and environmental risks.

Albania is not in the position to secure adequate funds for the introduction and implementation of modern technologies and disposal systems.

The composition of urban solid waste is one of the main factors influencing both: the amount and the extent of $CH_4$ production within solid waste disposal sites. Municipal Solid Wastes (MSW) typically contains quantities of degradable organic matter. The content of organic substances in total amount of waste generated in the country is high, that is a specific feature of the developing countries.

The dumping sites are practically the only disposal system for urban solid waste currently adopted in Albania. The technologies used for the final disposal are those, which do not include methane recovery systems.

The main solid wastes produced in Albania are urban domestic waste, industrial waste and hospital waste. The country situation is characterized by the increasing of the production of this kind of waste.

#### IV.1.1.2 Urban solid wastes

The increase of the generation of urban solid waste is the direct consequence of the products such as plastics, paper and cardboard, glass and cans. The introduction of these kinds of materials does not only worsen situation of the disposal of urban solid waste from a quantitative point of view, but also from a qualitative point of view.

Another essential datum is the present generation of waste per person and especially the tendency for the future. The essential information is that the present production of urban solid waste per person, which can be valued in about 0,7-0,8 kg/day, tends to develop or increase towards the typical value of 1 kg/day of western European countries due to population growth and increase of the construction activities.

The reasonable estimated valued quantities of the near future waste will be 0,8 - 0,9 kg/day/person, because it is foreseen a period of population growth and increase in the construction activities, while it will reach the value of 1.1 – 1.2 kg/day/person towards 2010.

At national scale, during 1998, approximately 520,000 ton of urban solid wastes have been generated. The major five cities: Tirana, Durres, Vlora, Shkodra and Elbasan, contribute with about 44 % of the total production of urban waste, while Tirana, the capital, contributes with about 116,000 ton, or 22 % of the total amount generated in the country.

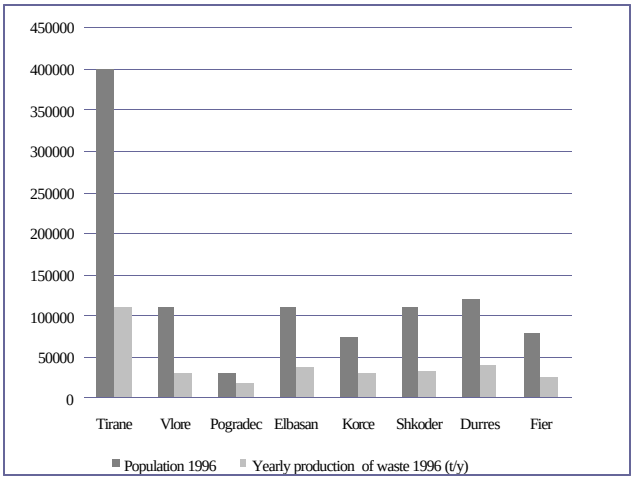



***Figure IV.1*** *Waste productions per year in main cities of Albania*

In the following table is presented daily production for some prefectures for 1999-2000.

***Table IV.1:*** *Daily production of MSW in some prefectures*

| Prefecture | City | Quantity (t/day) | Quantity ($m^3$/day) |
|---|---|---|---|
| Berat | Berat | 65 | |
| | Kucovë | 40 | |
| | Skrapar | 15 | |
| Dibër | Dibër | 57.5 | |
| | Mat | 47.9 | |
| | Bulqize | 40.5 | |
| Durrës | All Prefecture | 200 | |
| Elbasan | Elbasan | 100 | |
| Fier | Fier | 80 | |
| | Lushjnë | 80 | |
| | Divjake | 7 | |
| Gjirokastër | Këlcyrë | 6.8 | |
| | Përmet | 13 | |
| | Tepelenë | | 30 |
| | Gjirokastër | | 80 |
| Korcë | Korce | 70 | |
| | Pogradec | | 23.5 |
| Shkodër | All Prefecture | 55 | |
| Tiranë | Kavajë | 40; | |
| | Tiranë | 268.3 | |
| Vlorë | Sarandë | 14; 6 | |
| | Delvine | 7 | |
| | Vlorë | | 90 |

The composition of waste is one of the main factors influencing both the amount and the extent of $CH_4$ production and release from solid waste disposal sites. Municipal solid waste typically contains significant quantities of degradable organic matter.

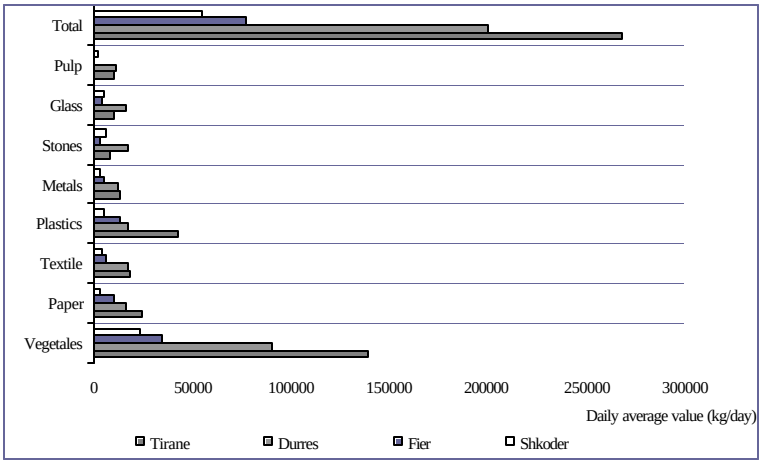



***Figure IV.2:*** *Waste compositions in 4 monitored prefectures*

These facts bring to consider the serious effects such as the potential pollution of the water–bearing strata, air, the emission of gas, smells, etc. The dumping sites are practically the only disposal system for urban solid waste in Albania.

### IV.1.1.3 Industrial wastes

In the past and up to now environmental problems deriving from industrial production have not been taken into consideration. The types of industries existing in the Country are those, which traditionally determine the serious conditions in terms of polluting emissions. Several chemical plants actually don't operate, or operate at low capacity, but they are sources of pollution for the environment.

The mining field has a great weight on the environment. Solid and liquid substances pollute rivers and lakes with chemical products. The quantity of industrial solid waste discharged by the enrichment plants is estimated around 1,2 million tons per year.

The industrial wastes, which contains toxic substances and which are produced by the treatment carried out by mining, metallurgical and other kinds of industries are simply stored up – without any preliminary treatments – in disposal sites. In consideration of the fact that suitable waterproof measures are not carried out as for the dumping sites, the water undergoes an uncontrolled contamination. The present moment, which the Albanian industry is passing through, limits the production of industrial waste.

### IV.1.1.4 Hospital wastes

At present there are 51 hospitals in Albania. The quantity of hospital waste produced daily has been estimated around 2 kg per patient. From the data analysis it was estimate that around 7,3 tons of hospital wastes are produced every day in seven cities. This amounts to 2.600 tons per year.

The waste and medications coming from infectious hospitals, or departments usually are treated in the hospital unit through incineration. The rest of the waste produced by the hospital is transported to the municipal dumping sites and are being disposed of the same of the urban solid waste, which has been generated in the city.

### IV.1.2 Policy and legal framework

#### IV.1.2.1 Policy framework

Since 1998 there exists a National Waste Management Plan. The Plan has been developed under the EU PHARE Environmental Program for Albania. The main objectives of this Plan were: (i) Define standards and regulations for classification and final disposal of urban and industrial wastes in Albania; (ii) Reduction of soil and water contamination caused by the uncontrolled disposal of waste; (iii) Recover a series of degraded dumpsites; (iv) Mitigate risk to human health from inappropriate waste collection and disposal methods; (v) Identify and recommend appropriate waste treatment methods and financing plans capable of providing necessary investments.

The National Waste Management Plan consists of the following components:

? Waste management laws, regulations and standards;
? Urban solid waste;
? Industrial waste;
? Hospital waste;
? Improvement of contaminated sites;
? Waste disposal systems and dumpsite design;
? Selection of an appropriate disposal site;
? Waste management proposal for main Albanian municipalities;
? Analysis and testing systems.

According to the Plan, the whole collection, transport and disposal system for urban solid waste must be completely reorganized. This should also keep into due consideration the actual financial situation or resources. There are two type of interventions proposed in the Plan: short term interventions and medium - long term ones. In the short term the priority would be given to simple technology interventions, because these interventions involve lower costs. It is recommended to construct series of sanitary landfills and also to carry out reclamations for the present plants. At the same time it will be important to carry out pilot interventions employing complex technologies, such as for example, small composting plants.

In the second stage, it will be important to carry out all those interventions which cannot be accomplished at the moment, because of the lack of financial resources, such as the carrying out of recycling and incineration plants, and systems such as the one for the differentiated collection of waste.

The subdivision of the national territory in collection basins has the substantial aim of having lower costs and also of improving the management of the services themselves as much as possible. 12 different collection basins have been foreseen for urban solid waste. For each basin the carrying out of a sanitary landfill is foreseen in the short term, this system has been chosen both because it involves lower costs in comparison to other systems, and also because this kind of intervention can be carried out on a national scale, thus reducing the costs even more.

One of the main parts of the National Waste Management Plan is the Plan Proposals. The most important points of these proposals are as follows:

- Prevention of waste production;
- Recovery and recycling of the waste produced;
- Safe disposal and reclamation of contaminated sites;
- Re-organization of the public services;

- Waste collection basins to carry out in the country;
- Institutional framework and policy development building;
- Waste management costs and financial instruments and resources.

There is a proposal to build environmentally sound landfills in six mayor cities of Albania, which, has been approved by the Government in 1999, but the funding has not been available. Some sorting of the glass bottles, paper, cardboard, scrap steel, aluminum cans and small quantities of scrap cooper takes place. There is no information available about the people and companies that sort and reuse such waste.

Since, due to lack of financial and human resources, objectives of such a Plan are not fulfilled. There is a strong need for the Plan to be revised.

The main institutions responsible for the waste management in Albania are Ministry of Environment, Ministry of Territory and Tourism, and Municipalities.

### IV.1.2.2 Legal framework

No specific law that intends to regulate the release of GHG emissions from the solid waste management processes exists in Albania. The main Law *"On Environmental Protection"* No. 8934, dated 05.09.2002 guides the current legal framework for waste management. Waste issue is a central topic under this law. Starting from Article 21, there are a couple of Articles of this law that address the waste issue. Article 20 of this law, namely waste management addresses the aim of this action.

Another important law that follows the Law on Environmental Protection is the Law *"On the Environmental Administration of Solid Wastes"*, No. 9010, dated 13.02.2003.The purpose of this law is to ensure the protection of environment and human health from the pollution and damage resulting from solid waste through their environmental treatment at every stage: creation, collection, separation, protection, transportation, recycling, processing and elimination leading to waste reduction and the reduction of their hazardous and dangerous impact.

There are also other Laws, Decisions of Council of Ministers and public regulations approved by the Local Government aiming to set rules for the landfills, for the transportation of wastes and for their disposal that fill the current legal framework. A clear picture on that is given in the following box:

***Box IV.1:***

- *Law "On the Environmental Protection" No. 8934, dated 05.09.2002;*
- *Law "On the Environmental Administration of Solid Wastes" No. 9010, dated 13.02.2003;*
- *Law "On the Public Waste Disposal" No.8094, dated 21.03.1996;*
- *Law "On organization and functioning of the Local Government", dated 8652, dated 31.07.2000*
- *Decision of Council of Ministers on Hazardous Wastes and residues No.26, dated 31.01.1994;*
- *Regulation "On the Waste Exportation and Transition" signed by the Minister of Environment on October 2003;*

As of June 1999, Albania became a contracting Party to the Basel Convention on the Control of Trans-boundary Movement of Hazardous Waste and their Disposal. The main objective of the Basel Convention is the Protection of health and environment from the negative impacts of the production, administration and trans-boundary movement of the wastes in general and hazardous wastes in particular.

### IV.1.3 Overview of the work done under the Albania's First National Communication

The national GHG inventory for the base year 1994, pointed out that the share of waste sector to the overall GHG emissions from waste sector is 4.81 % or 339.65 Gg $CO_2$ equivalent. Estimates show that $CH_4$ and $N_2O$ emissions released from waste category are respectively 13.94 Gg of and 0.152 Gg. The main source of $CH_4$ emissions is agriculture sector which has a share of 77,74 %, while the waste category contributes with a share of 13.60 % to the total $CH_4$ emissions. The net annual $CH_4$ emissions are released by unmanaged landfills or dumpsites.

Albania still has not wastewater treatment plant. Since the system is aerobic, it means that $CH_4$ emissions released are equal to zero.

***Box IV.2:***

*Methane is generated from solid waste and wastewater through anaerobic decomposition. Together, solid waste and wastewater disposal and treatment represent about 20% of human induced methane emissions. Methane emissions can be reduced in many ways, including reducing waste generation (source reduction), diverting waste away from disposal sites (i.e., through composting, recycling or incineration), recovering methane generated from waste, or ensuring that waste does not decompose in an aerobic environment. In general, every technique or technology that reduces methane generation or converts methane into carbon dioxide through combustion will reduce GHG.*

***IPCC Methodological and Technological Issues in Technology Transfer, 2000.***

According to the baseline scenario in 2020, the annual methane emissions from waste sector (landfills) are expected to raise to 66.917 Gg or around five times more compared with the base year, 1994.

Also the indirect nitrous oxide emissions from Waste Sector (human sewage) are foreseen to reach an amount of 0.267 Gg for the year 2020 from only 0.15 Gg in 1994. Their contribution in terms of $CO_2$ equivalent will be around 6% of the total GHG expected from waste category in 2020.

The abatement scenario developed for the waste category under the Albania's FNC consists on the following abatement options:

1. *Reducing the municipal solid waste generated;*
2. *Recycling and composting in order to reduce the organic matter;*
3. *Reduce the quantity of organic material in land filling waste;*
4. *Construction of sanitary landfills with recovery gas system;*
5. *Construction of MSW incinerator with energy utilization;*
6. *Construction of wastewater treatment (WWT) plants.*

Discussing over the criteria for screening options decided under the Albania's FNC, the following are selected as more optimal:

1. *Building new sanitized dumps and utilize the produced dump's gas;*
2. *Building a new MSW incinerator with energy use.*

### IV.1.4 Take the stock of technologies currently in use

The dumping sites are practically the only disposal system for *urban solid waste* adopted in Albania. These disposal plants don't have any drainage system as regards the percolation effect or efficacious compacting systems. The technologies used for the final disposal of urban solid waste do not include differentiation of wastes and methane recovery systems. Urban wastes are simply discharged. Existing landfills (actually simple dumpsites) do not have system to protect groundwater against the leachin g of hazardous substances. Few landfill sites for municipal disposal exist and they not meet the international landfill construction

standards and health norms. They are major sources of surface and groundwater contamination, especially industrial waste landfills.

As per the *industrial wastes*, the past industrial activities left Albania with a heavy inheritance in terms of industrial waste, which was not suitably disposed of but simply discharged on the territory. Because of the current situation that Albania industry is passing through, the industrial waste amount is passing through the limits of production. However, due to the lack of devices to limit the impact on environment as well as appropriate and suitable technologies, which are still obsolete the industrial wastes produced such as toxic gases, dust, waste waters are released without any kind of treatment.

As regards *hospital wastes*, the waste and medications coming from infections department and surgical department undergo in the Hospital University Centre based in Tirana incineration by means of a plant which is located inside the sanitary structure itself, while the rest of the waste produced by the hospital is transported with special vehicles to the municipality dumping site. These wastes share the same density as the normal urban solid wastes which have been produced in the city.

### IV.2 Identify criteria for assessment

Selection criteria remain the same as for other sectors under assessment: (i) Development benefits; (ii) Social acceptability and suitability for country conditions; (iii) Market potential and (iv) Contribution to climate change. 1 determines the maximum weight of factors and 100 determine the maximum score of sub-factors.

### IV.3 Selection of key technologies

Scoring of the technologies was the next step of the assessment followed by the ranking process. A set of top 2 technologies is found. Two top technologies have been selected as key ones for intervention for the Waste category. The evaluation matrix of technologies is available in Annex I, Table 4. The final selection table is presented below:

| No | Proposed technologies | Points |
|---|---|---|
| *1* | Construction of sanitary landfills with recovery gas system | **169.5** |
| *2* | Construction of MSW incinerator with energy utilization | **131** |
| *3* | Construction of WWT plants | **128** |
| *4* | Recycling and composting in order to reduce the organic matter. | **70.00** |
| 5 | Reduce the quantity of organic material in waste landfill. | **67.30** |
| 6 | Reducing the MSW generated | 67.30 |

From the above table it is evident that the most significant technologies that really needs to be addressed and implemented in waste category in Albania are:

**Key technologies in waste category**

1. Construction of sanitary landfills with recovery gas system
2. Construction of MSW incinerator with energy utilization

This assessment brought the same technologies selected under the Albania's FNC.

*Sanitary landfill* is the system, which has the lower costs, and it is the only system, which can be suggested – in the short-term – on the whole national territory. The cost of the plant per ton of solid urban waste does not decrease too much with the increase of the material and it does

not require a minimum quantity of daily material. If the quantity is low, it is possible to carry out a smaller plant or otherwise to extend its life span.

On the other hand, the sanitary landfills presents the problem of the limited period of its life, and especially the problem of the strong environmental impact during its working stage, which however, continues to show even after the end of its activity.

At the moment the landfill does not appear too expensive, therefore the solution of the landfill is the most obvious and above all the easiest to be carried out and managed by local enterprises. The actual composition of municipal solid waste, generally poor with a low heat power, does not suggest using other technologies (e.g. incineration).

As regards the technology of *incineration*, the investment cost of an incineration plant is much higher than for a sanitary landfill. Also, this kind of technology plants has high maintenance costs and needs technical preparation.

The present financial situation and the low profitability of the investments which derive from the small dimensions of the plants makes it difficult to carry out incineration plants in the short and medium term.

In the long term it might be possible to state that only the transport of the waste of the capital Tirana, which amounts 200-250 tons per day, would be able to reach the limit of the economic profitability for an incineration plant.

From a technical point of view, in the present situation of the Country, for short and medium term dumpsites or landfill is the only type of plant to represent an instrument at an accessible cost.

**IV.4 Identification of existing barriers and policy needs.**

Main barriers identified for the waste category include as following:

*Limited availability of funding*. Collection and treatment of urban solid waste and water waste in general is highly expensive. The case of waste incineration is too expensive compared to the construction of sanitary landfills (see section IV.3). In addition the cost of maintaining and upgrading waste management systems is relatively high. Therefore funding is a significant barrier for transfer of such technologies. At national level, the funding needs go beyond government capabilities. Innovative financing schemes are necessary to remove such a barrier.

*Limited institutional support.* This barrier is mainly linked to the scarce coordination between Ministries and institutions in charge of waste management issues. A good management of wastes require good cooperation between national entities responsible for strategies, policies, waste collection, disposal, treatment, revenues collected etc. A Clear-cut division of the responsibilities of different institutions on this issue is needed as well.

*Lack of a revised National Waste Management Plan* that along other issues must address the issue of GHG reduction and climate change implications. Policy, institutional framework and legal are critical to the attraction of the security of foreign investments in the waste sector.

*Lack of awareness.* There is no awareness on the benefits of a good management of wastes from the GHG reduction point of view.

*Lack of capacity building.* This includes lack of technical training in both, state and private sector regarding the managerial aspects of wastes. Also lack of information exchange on the modern waste management systems, which are changing rapidly.

Technology transfer in the waste category occurs predominantly along government pathways with participation both government levels, municipal and national. Experiences from other countries show that the role of the government to the technology transfer in waste management is key and will dominate in the future as well. The government role to design the right policy and legal framework; support and encourage the participation of the private sector; support, facilitate and encourage capacity building and in some cases provide incentives.

Lessons learnt from other country experiences have shown that waste sector can contribute to GHGs mitigation in ways that are economically viable and meet any social priorities. The technology transfer process in waste sector is underway, even in Albania because of the continuing and growing need to provide and improve waste management services for the people.

**IV.5 Define and select actions**

Actions needed in the framework of the TNA, already identified for the waste category in Albania are addressed in the form of project ideas. A package of two project ideas is designed for the waste category for the following projects:

*1. Construction of sanitary landfills for the urban solid waste management;*

*2. Construction of municipal solid waste incinerator with energy recovery for Tirana city.*

Project ideas can be found in Annex II.

## V. INDUSTRIAL PROCESES

### V.1 Overview of options and resources

#### V.1.1 Sector profile

The analysis of the economic development during the last decade shows a decline of the contribution of the industry sector to the national development. In other words, the contribution of the general industrial production in absolute values of GDP is much lower than used to be before 90's.

After the political and social transformations, the property changes and industrial enterprise management, there is a tendency towards a new stabilized situation, due to the establishing of the market economy. During 90's Albania's industry sector has accounted for a steady 12% of GDP.

The main industry sub-sectors developed in Albania are metallurgy, chemical, building materials, mining, food/beverage/tobacco, textile/leather/shows, wood/paper/printing, mechanical and others textile/leather/shows, wood/paper/printing, mechanical and others.

***Box V.1***

*The industrial sector is extremely diverse and involves a wide range of activities including the extraction of natural resources, conversion into raw materials, and manufacture of the finished products. IPCC defines the industrial sector as industry including the minerals processing industries. The sub-sectors that accounts for roughly 45%of all industrial energy consumption are iron and steel chemicals, petroleum refining, pulp and paper, and cement.*

*These industries are generally concerned with the transformation of the raw material inputs (e.g. iron ore, crude oil, wood) into usable minerals and products for an economy. Due to the wide variety in activities, energy demand and GHG emissions vary widely. Hence, the aggregate energy use and emissions depend on the structure (or specific set of activities) of industry, and the energy and carbon intensity of each of these activities. The structure of industry may depend on the phase of economy, as well as many other factors like resource and technology availability as well as historical factors.*

***Methodological and technological issues in technology transfer. IPCC. 2000.***

The statistics of last 10-15 years show a considerable decline of the heavy industry productions (metal minerals over 20 times, coal 50 times, oil and natural gas respectively 3 and 50 times, non-ferrous metallurgy over 100 times, chemicals over 70 times); cement and building materials over 3 times, mechanical industry over 50 times; light industry over 10 times; food industry over 10 times, etc. But meanwhile, it should be underlined that many industrial and energy products such as steel and ferrochromium, electricity, bricks, tiles and lime production, meat and milk by-products, refreshing drinks, cloths and leather production, despite many difficulties have occupied a large part of the market, playing an important role in the economy with a contribution of approximately 15% (or 360 Million USD) in the real GDP. During the last 10 years, the stabilizing developments and increasing tendencies in the processing industry are mainly based on the existing technology, with few positive developments. From energy consumption point of view, the industry continues to have very high intensity[18]. This means that the macro economic output normally denounced by the GDP (especially from industry sector), has been low compared with the overall energy consumption. The reasons are the same as for the other Central and Eastern European countries (CEEC), which have been orientated towards energy intensive industries such as mining and metallurgy, and where energy prices have been prevailing low. Anyway, the GHG emission and respective abatement technologies from the energy consumption in industry sector are considered under the energy and transport section (section I) and would not be analysed in this section.

[18] For each production unit in nature it consumes 0.1toe/ton and for each produced monetary unit it consumes: 0.8 toe/thousand USD (which means that in order to produce a value of 1000 USD from industrial products the energy cost is 200 USD).

All of Albania's industrial branches suffered from obsolete equipment, inadequate infrastructure, and low levels of worker skill and motivation. The equipment inherited at the start of the decade had mostly been supplied first by the former Soviet Union and then by China, little of which proved internationally competitive when Albania was opened to world markets.

Referring to the Albania's FNC, the following industrial sub-sectors are identified in Albania as responsible for the emission of direct and indirect GHG, therefore, they will be object of the analysis and consideration under this section: (i) Cement production; (ii) Chromium production; (iii) Iron and steel production; (iv) Copper production; (v) Nitric acid production.

### V.1.1.1 Cement production

Albania is a country with a geological structure, which provides raw materials for this purpose. For the cement production needs are built up some factories in Tirana, Shkodra, Fushe- Kruje, Elbasan and Vlora, which have been working on their full capacity up to 1990s.

Altogether a production of nearly 900000 tons Portland cement of the trademarks 400 to 600 has been statistically registered. About 200000 tons are exported, meanwhile for special works are imported large quantities of white cement, hydraulic cement, etc. Technologically more advanced objects are built up in 70's in Fushe Kruje and Elbasan, but still with deficiencies regarding the elimination of the dust and $CO_2$. After the 90's the production of cement had some oscillations because of the delay of plant privatisation process.

Nowadays, only the cement factories of Fushe Kruja and Vlora are working. There is imported clinker material in the first one, which is only grounded and packed. The dynamic of the production of the cement from 1994 to 2001 is as follows.

***Table V.1:*** *The annual production of cement and clinker in 1,000 tons*

| Factories | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|
| **FUSHE KRUJE** | | | | | | | | |
| Cement | 100 | 100 | 100 | 60 | 60 | - | - | - |
| Clinker | 80 | 80 | 80 | 40 | 40 | 200 | 200 | 200 |
| **ELBASAN** | | | | | | | | |
| Cement | 95 | 95 | 95 | 70 | 70 | 150 | 150 | 150 |
| Clinker | 80 | 80 | 80 | 70 | 70 | 200 | 200 | 200 |

### V.1.1.2 Lime production

After the year 1994 the production of lime had an annual growth, reaching out the point of 120,000 tons per year.

There have been built up too many limestone furnaces in the area of Shkodra, Kruja, Tirana, Elbasan, Ura-Vajgurore, etc. Being so spearheaded and of a small capacity, their technology has been generally backward, except of those in Metallurgical Complex of Elbasan and that of Soda-PVC plant in Vlora. Building up furnaces of opened type, has caused higher emissions of GHGs. On the other hand, coal of poor quality has been used (in the past) and after the '90s with the closing down of coal mines, these furnaces worked with combustible fuel out of the standard like the dust coal, residues of naphtha and finally auto tire. There is a strong need for filtering and other equipment to control air emissions released from lime furnaces.

### V.1.1.3 Chromium production

Albania is one of the richest countries in chrome mineral sources. Quantities of 1 million tons of minerals per year have been exported.

During the years 70's besides utilization of these minerals, was built up the metallurgy of the production of Ferro-chromium, firstly in Burrel and after that in Elbasan.

In 1994 the Burreli metallurgy has started the reconstruction of one of its melting furnaces, passing from the closed type to the opened one, intending the elaboration of the poor minerals, which in the same time decreases the possibility of the explosion and doesn't have rigorous requests for the granular content of the first stuff. But the use of the opened furnaces causes less control of gas emissions from the melting zone. After 2000 an Italian company, namely DARFO rendered the control to the mining and the industry of chromium production.

***Table V.2:****Industrial production of Ferro-chromium in 1,000 tons*

| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|
| Carbonic Ferro-chromium | 33.7 | 42.9 | 31.2 | 31.4 | 30.2 | 28.1 | 36 | 4 | 50 |

### V.1.1.4 Iron and steel

In Albania, iron and steel is represented by the production of cast iron and steel. The production of cast iron has begun in mechanical factories for their needs, following with steel and its production at Complex of Metallurgy in Elbasan in 1976. After the year 1994 on the ongoing of the process there have been some oscillations up to 1994 when the steel production started again, using as raw materials mainly scraps, both gathered in the country and imported ones. After the year 2000 the Turkish company namely KURUM hired the melting furnaces of steel production. In the future it is predicted to import scraps from the countries of the region.

***Table V.3:****Steel productions in 1,000 tons*

| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|
| Cast iron | - | - | - | - | - | - | - | - | |
| Steel | - | - | - | 22.23 | 22.16 | 23.8 | 64.8 | 71.9 | 80.2 |

It's worth to highlight that the emissions of direct GHGs are much higher in classical converters than these emitted from electrical furnaces, while the indirect GHGs are quite eliminated in the second ones.

### V.1.1.5 Copper production

The production of copper in Albania is known since ancient times from the elaboration of copper minerals. The industrial production has started in 1943 in Rubik of Mirdita Region (a rich area with copper mineral). Afterwards on 1960 is constructed the melting plant in Gjegjan of Kukes and than the melting plant using the electrolyze process in Lac.

In metallurgical plants, classical methods are used. From the environmental point of view these methods bring high emissions of gases like $CO_2$ and $SO_2$ and less CO and $NO_x$.

After 90's the production of copper has fallen down continually and after the year 2000, the metallurgy of copper doesn't work out any more.

***Table V.4:*** *The annual production of industrial copper in Rubik in 1000 t*

| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|
| Copper blister | 2.27 | 2.31 | 1.52 | 2.9 | 1.42 | - | 1.63 | 128 |

### V.1.1.6 Nitric acid production

The production of nitric acid is especially distinguished as a source of indirect GHGs. As of 1964, In Albania there has been produced two types of nitric acid: diluted 50-60% and concentrated 96-98%. Actually, the production of nitric fertilizers is stopped since 1994, mainly due to the lack of raw materials and methane gas.

## V.1.2 Policy and legal framework

### V.1.2.1 Policy framework

Until 2004, no national strategy for the development of the industry sector has existed. In April 2004 a National Strategy for the Development of the non-Food Industry Sector in Albania is adopted by the Council of Ministers according to the decision No. 269 dated April 23, 2004.

During 2000-2001 the respective national Institutes of metallurgy, chemistry, light industry, wood and mechanical industry agreed to develop a couple of strategic papers for the development of the each industry sector under their responsibility. This first attempt aimed at analysis of the sectors including investments from the private sector. An analysis of the positive and negative factors that impacted their development was done as well. The aim of these documents was the privatization and transformation of these industries and creation of a favorable environment for the development of the private sector in these sectors.

During the transition period many grants and funds from foreign donors have been used to facilitate the re-profiling and privatization of many non-food industry enterprises. The first group that passed to the privatization was some small and medium enterprises (SMEs) of the wood, handicrafts, etc. Their privatization consisted in the establishment of the joint ventures with foreign partners. As regards the big enterprises, they first went through the physical re profiling by establishment of some smaller units that would help the better unitization in order to facilitate their privatization in a latter stage. Most of these big enterprises were under the responsibility of the local government. After the collapse of the non-food industry during 90's it has started the reactivation thanks to the privatization of the majority of enterprises, which in turn brought a significant flow of the foreign investment. During 1998-2003 were privatized around 82% of the public ownership. In such circumstances the design of a national strategy for the development of the industry sector became a necessity.

The newly adopted strategy is an integral part of the NSSED. It covers all industry sub-sectors, except of food industry. It is a document, which shows the changes that have occurred to this sector in the course of the last years and identifies the pathways of development in a sustainable manner in the conditions of the market and global economy. The strategy aims at the transfer of the overall public ownership to the foreign and native investors through the privatization or concessions, which in turn will create the enabling environment for the reactivation, and development of the industry sector in Albania.

For the first time the document of the strategy identifies the chemical industry, that of leather treatment and metallurgical one as the most significant and hot ones that cause environmental pollution at dangerous levels in the country. The strategy addresses the environmental protection and proposes the development and transfer of the environmentally friendly technologies.

### V.1.2.2 Legal framework

Actually, as per other sectors there is no any law that explicitly regulate the GHG emissions released from industrial activities performed in Albania. The legal framework that currently

regulates industrial processes addresses indirectly the phenomena. From the point of view of GHG emissions it is very much related with the environmental protection legal framework, therefore both legislations are listed in the box below:

***Box V.2:***

- *Law "On minerals", no.7796, dated17.02.1994 and its amendments;*
- *Law "On Ionizing radiations", no.8025, dated 09.11.1995;*
- *Law "On hydrocarbons (research and production)", no.7746, date 28.07.1993 and its amendments;*
- *Law "On chemical substances"; no. 9108, dated17.07.2003;*
- *Decision of Council of Ministers "On hazardous substances", no. 459, dated 22.07.1998;*
- *Law "On environmental protection", no.8934, dated 05.09.2002;*
- *Law "On protection of air from pollution"; no.8897, dated 16.05.2002;*
- *Law "On solid wastes management"; no. 9010, dated 13.02.2003;*
- *Law "On Environment Impact Assessment"; no.8990, dated 23.01.200;*
- *Decision of Council of Ministers "On environment monitoring in the Republic of Albania"; no103, date 31.03.2002;*
- *Decision of Council of Ministers "On the norms of air emissions" no 435, dated 2002;*
- *Decision of Council of Ministers "On the temporary norms of air emissions" no 248, dated 2003;*
- *Decision of Council of Ministers "On the approval of National Environment Action Plan" no.34, date 28.01. 2002;*

### V.1.4 Overview of the work done under the Albania's First National Communication

Referring to the Albania's FNC the share of the industry sector to the overall Albania's anthropogenic GHG emissions for the base year 1994, accounts for 2,96 % or 206.01 Gg versus 7,061.45 Gg of $CO_2$ equivalents.

The main source of $CO_2$ emissions released from industry is the category of cement production. In 1994, $CO_2$ emissions released from cement production activities were 118.8 Gg or about 60% of total $CO_2$ emissions released from industry sector followed by chromium production with 43.89 Gg of $CO_2$ equivalent, iron and steel with 26.88 Gg of $CO_2$ equivalent, nitric acid with 11.16 Gg of $CO_2$ equivalent, and lime production with 4.5 Gg of $CO_2$ equivalent.

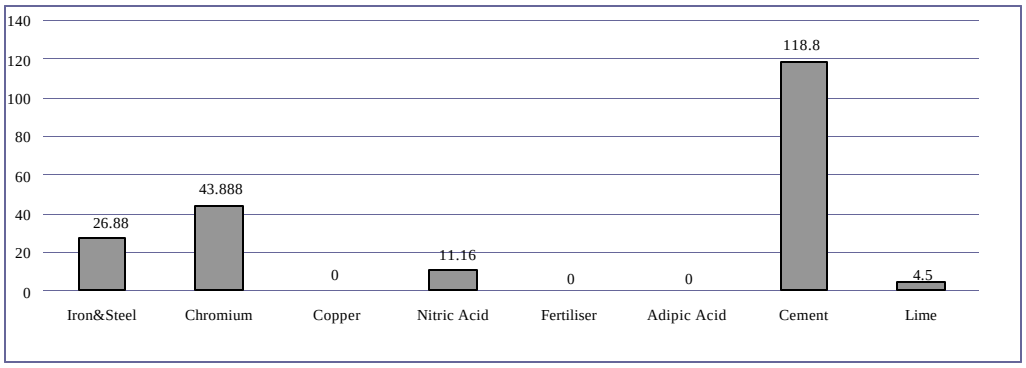



***Figure V.1:*** *Aggregated GHG emissions in $CO_2$ (eqv.) from Industrial processes [205.28 Gg], 1994*

Estimates show that $N_2O$ emissions released from industrial processes have a share of 3.77% or 0.036 Gg versus the $CO_2$ equivalent emissions released from industry sector.

As per the emissions of indirect GHG like CO, $NO_x$ and NMVOC for 1994, the industry sector has contributed with 0.21 % for $NO_x$ emissions, 0.04% for CO emissions and 1.23% for NMVOC emissions.

Referring to the baseline emission scenario developed for the industry sector, the cement industry will continue to be the largest contributor with around 817Gg by 2020, while the total $CO_2$ emissions coming from industry sector are expected to reach the amount of 992 Gg. The estimated amounts of $SO_2$ and NMVOC emissions by 2020 are expected to be relatively small, respectively only 0.6 Gg and 1.19 Gg.

Due to the lack of statistical data and having that the contribution of industry sector to the overall national GHG inventory in 1994 and towards 2020 is not significant, the national team did not develop an abatement scenario for that sector. A set of measures as options to abate GHG emissions from industrial processes was analysed qualitatively.

**V.1.4 Take the stock of technologies currently in use**

**V.1.4 .1 Cement industry**

The technology in the factories of cement industry is mostly the classical traditional one (wet way), while only that of Tirana works in a dry way. The produced cement is that of Portland type, which is widely used in the buildings as an adhesive hydraulic material, which gives concretes with a high mechanical solidity, sustainable to the air, water and frosts. Limestone and argyles are used as raw material, which in some cases are replaced with the slag of the furnace and sylicagel.

Portland cement is being produced by grinding thin preliminary materials, precisely dozed, mixed up with water, depending on the way of elaboration. Than, the material in the shape of the shllam shape gets baked in a high temperature of $1400\text{-}1500^0$ C, forming a solid material namely clinker. With its grinding is formed Portland cement. The technology foresees also the addition of some supplements with inertial and hydraulic features. The last process is that of packing or holding it in the bunker in the refuge shape. The technology is wet or dry depending on the environment when the grinding takes place. The technology is classical with Chinese implants of years 1966 and 1968, reconstructed in 1972 and 1976.

**V.1.4 .2 Lime production**

In Albania the lime is produced from the burned limestone. The process is developed in temperatures higher than $900^0$C in opened furnaces, where the pressure of $CO_2$ becomes equal with that of atmosphere. The technology is old, local, without technological lines and machinery.

**V.1.4 .3 Chromium production**

Industry of Ferrochrome is constructed firstly in Burrel and after that in Elbasan. Besides chrome- holder minerals are used also reducing materials with carbon content such as coal and coke. On the other side melts are used like limestone, quartzite and boxite.

Firstly the mineral of chrome gets chopped in big sizes of 300 mm, until the thin ones. After that it gets mixed–up with combustible, metallurgical coke and the melts (quartz). Reduction reactions of oxides with carbon in the process of the ferri bounds, goes on with the inhalation of the heat so it's needed an outer source of heat. Nowadays, carbonic Ferrochrome is produced in the electrical furnace with arc. The process of the Ferrochrome production stands in the reduction of the chrome and Ferro oxides with carbonic adapter in chrome mineral.

Concretely, the process of melting the Ferrochrome in Albania goes on in the closed furnaces of the well type in which is inserted the mixture of the chrome mineral chopped in 80 mm particles, the chopped coke in 25 mm particles and also the silica, which are loaded with the

portions covering the electrodes of the electric arc. The technology in Burrel and Elbasan is classical, imported from China in 1979.

### V.1.4 .4 Iron and steel

It's represented in Albania by the production of cast-iron and steel. First materials for the production of cast-iron are ferrous minerals like hematite, limonite, siderites and pyrites, which are mainly found in Middle and East Albania. The main process goes on in the furnace where are added other substances beside minerals of ferri, like melts as lime stone and dolomites which effect in the creation of scraps. On the other hand the burning substance is coke.

The process of the production of cast iron is classical, producing a melting mass of ferry with carbon linkage where the percentage of the last element is higher than 4%. Usually, besides the production of the cast-iron, takes place even the production of steel from cast-iron. The process goes on in the converter as a closed peer downward covered with heat shield material. Besides the melted cast-iron, other substances are added like melts, deoxidizes, refiners, trashes. The technology of the production is Chinese from years 1974-1976.

### V.1.4.5 Copper production

The industrial production has started on 1943 in Rubik. The industrial elaboration is based on utilisation of sulphur of copper mainly in the shape of chalcopyrite and calcozine.

In Albania the metallurgical production of copper is realized in the dry way (pirrometalurgy), melting the copper holding minerals with the combustible stuff, which are loaded in melting furnace that is closed or opened. During the melting, the metalline is earned. In these furnaces except the solid stuff, the oxygen is blown downward, that realizes oxidation of sulphur and carbon in $SO_2$ and $CO_2$. Besides metalline, the scraps are also separated. Meanwhile the metalline is subdued under further processes in converter oxidizing FeS, which turns into scraps in the presence of silica. CuS is than oxidized and passes finally into metallic copper, called blister with the rate of 98% cleanness.

The technology is that classical with the water-jacket furnaces built since 1943 from Italian industry, reconstructed twice in 1952 and 1971 by Albanian engineers. The further processes are the ones of thermal refinement profiting electronically copper, suitable for the processes of wires and cables production.

### V.2 Identify criteria for assessment

The same assessment criteria[19], weight and scores[20] are used as for the previous sectors.

### V.3 Selection of key technologies

Despite of its relatively low contribution to the overall GHG emissions, the industry sector was considered along other sectors. For this purpose a set of the following three proposed technology options has been object of the analysis. The GHG abatement technologies analyzed and ranked according to the set criteria are as following:

- *Steel production by using the stock of the scrap (country made and/or imported ones from the region)*

[19] (*i) Development benefits; (ii) Social acceptability and suitability for country conditions; (iii) Market potential and (iv) Contribution to climate change*

[20] *1 determines the maximum weight of factors and 100 determine the maximum score of sub-factors*

This way of steel production doesn't consist in a new applied technology. This implies in fact the recycling process in steel industry, where as raw material might be remaining scraps. This process brings advantages to both the economy and the environment by avoiding the process of minerals' elaboration that will produce steel. An important problem to be considered is the right ratio in favor of not oxidized scraps.

- *The use of hermetic technologies for cement production*

This technology option consists in amelioration of the pollution indexes introduced basically in the cement production process, which can be realized through:

(i) The preparation of the base mixture through a mixing system;
(ii) Full computerizing of the production regime;
(iii) Change of the technology from horizontal to vertical hermetic systems;
(iv) Introducing cleaning systems of technologic gases;
(v) The simultaneous production of the cement with betonies.

This practice is common for example in Germany where certain cement factories has also brought the decrease of cost production.

- *Small interventions in the main process of Ferro-chromium production*

This branch of industry is particularly important for Albania, due to huge mineral resources available in the country. The installment of a dust catch system (already present in one of furnaces of Metallurgical Elbasan Complex) is the first intervention to be undertaken. The second step is passing through furnaces into a direct hermetic system of dust catch. The third step might be the realization of Duplex systems.

A ranking process of the scored technologies has followed and top two technologies have been selected as key ones for intervention in the industry sector. The evaluation matrix of measures is available in Annex I, Table 5. The final selection table is presented below:

| No | Proposed technologies | Points |
|---|---|---|
| *1* | Steel production by using the stock of the scrap | ***209*** |
| *2* | The use of hermetic technologies for cement production | ***204*** |
| *3* | Small interventions in the main process of Ferro-chromium production | 176.25 |

From the above table it is evident that the top two technologies that really need to be addressed and implemented in industry category in Albania are those that got the highest scores:

**Key technologies in industry**

1. Steel production by using the stock of the scrap
2. The use of hermetic technologies for cement production

### V.4 Identification of existing barriers and policy needs

Albania, as all developing countries and economies in transition suffer from many barriers that hinder the technology transfer process. In addition, most of these problems are proved to

be present even in industrialized countries. *Lack of capital to buy the modern equipment* is a major barrier for this sector. It is then followed by the high inflation rates and economic and political instability of the country, which increase the risk for foreign and domestic investors, which in turn limit the capital availability.

*Lack of awareness* about climate change its impacts and human influences on it is also another barrier, which followed by lack of information on less-GHG emission technologies, becomes a real constraint for the diffusion and transfer of technologies.

*Lack of skilled and trained personnel*, especially in SMEs leads also to the difficulties even in the cases when new equipment is installed, as most personnel are always busy dealing and maintaining production rather than installing the new equipment.

Besides the above problems, *inadequate policies and institutional structures* to promote the diffusion of modern technologies in industry sector is another barrier. Institutional barriers and policies influence the transaction process as well as the efficiency of the transfer process.

***Box V. 2:***

*An effective technology transfer process in industry sector requires interactivity between various players like users, producers, and developers of technologies. The variety of the stakeholder specter makes it necessary to have a clear as part of the industry policy framework for technology transfer and cooperation. Such an framework may include environmental, energy, international trade, taxation, patent legislation as well as a variety of well-aimed incentives. Policy makers are responsible for developing such a framework. The interactive and dynamic character of technology transfer stresses the need for innovative and flexible approaches, though partnership between various stakeholders, including public-private partnerships. There is a strong need to develop the public and private capacitates to access and select technologies, in particular for state –owned and SMEs. Stakeholders (Policy makers, private investors, financing institutions) in developing countries have even more difficult access to technology information, stressing the need for a clearinghouse of information on climate change abatement technologies well integrated in policy framework. To be successful long-term support for capacity building is essential, stressing the need for public support and cooperation of technology suppliers and users.*

***Methodological and technological issues in technology transfer. IPCC. 2000.***

**V.5 Define and select actions**

Top two technology options selected in section V.3 are addressed in the project ideas proposed (see Annex II). There are two project ideas proposed in this Annex as flowing:

1. *Steel production by using the stock of the scrap*

2. *The use of hermetic technologies for cement production*

## CHAPTER II

## TECHNOLOGY NEEDS ASSESSMENT FOR ADAPTATION TO CLIMATE CHANGES

### Introduction

TNA for adaptation to climate change is a continuation of the work performed under the Albania's First National Communication on vulnerability and adaptation. Unlike the Albania's FNC the TNA for adaptation is focused on Albania's coastal area rather than on its overall territory.

### Why Albania's costal area?

Albania's coastal area is the most important part of the country from the economic and human activity viewpoint. It generates a large number of services and goods that are valuable to the country. It has attracted many people and investors, especially for the tourism development opportunities.

The vulnerability analysis under Albania's FNC has shown this area as of high vulnerability to current climate. Expected changes in temperature and precipitation patterns as well as the expected increase in sea level are likely to impact significantly in this area. This is the main reason that the vulnerability and adaptation team has decided to narrow the focus of assessment to this area.

***Box 1:***

*Coastal adaptation to climate change must be seen as part of broader coastal-management policy, which includes consideration of numerous non-climatic issues. It typically follows a continuous and iterative cycle involving four main steps: (i) information development and awareness raising; (ii) planning and design; (iii) implementation and (iv) monitoring and evaluation. To date, technology transfer for coastal adaptation has focused primary on the implementation stage: the actual hardware that can be employed to protect, retreat and accommodate. Coastal adaptation should also aim at increasing the extend to which mechanisms are in place and technologies, expertise and other resources are available to assist.*

***IPCC Methodological and Technological Issues in Technology Transfer, 2000***

# I. COASTAL AREA

## I.1 Overview of options and resources

### I.1.1 Profile of the coastal area

This area lies along the Adriatic and Ionic seas, the overwhelming part of the Western Plain, Albanian Rivera and the coastal area south of the country.

The littoral has a surface of 10.050 km $^2$ or 35% of the country. About 75% of this territory is plains and hills, while the rest are mountains. This area includes 14 districts, 119 (rural) communes and 30 (mainly urban) municipalities. In 2002 as compared to 1960, the number of cities covered by this area doubled from 17 to 34, while the number of villages grew 1,67 times i.e. from 624 up to 1,044.


Source: Encarta 200(

***Figure I.1*** *Map of Albania*

The southwestern coast of Albania gets on the Ionian Sea, which is known for its depth. Rivera is the hottest part of the country. The Ionic coast, about 100 km long is mainly high and eroded.

Mountains, reaching up to 2000 m high, dominate this coast. In various sectors they fall right into the sea. Erosion and the carstic phenomena have created in some places carstic pits, only small part of which have already been explored so far. In the other parts, landscape is completely different. Mountains are replaced by little plains. (Borshi, Qiparo, etc.).

Some lagoons are situated along the seacoast. The main ones are lagoons of Karavasta, Narta and Butrinti.

The total river discharge into the Adriatic Sea is of 25.6 km$^3$. This water volume corresponds to a mean annual discharge of 814 m$^3$/sec or a module of 29 l/s/km$^2$. The contribution of the rivers discharging into the Adriatic Sea (95%) is very large in comparison with the rivers discharging into the Ionian Sea (5%)

The coastal area is a region with scarce *water resources*. The water module of this region is less than 10 l/s/km$^2$. During the wet period of the year, the total annual precipitation in the coastal area is lower than in the other parts of the territory. Therefore there is a small contribution from this area to the water flow. The main water uses are: drinking water supply, industry, agriculture, hydropower etc. The drinking water is taken mainly from groundwater resources (captured at springs or pumped from wells)

*Agriculture* has always been, and is still, the main resource of Albania and therefore of the coastal area where it is more developed. The irrigation network is yet suffering by direct destruction or by lack of maintenance.

The *coastal forest* occupies only 33,700 ha or 3.2 % of the total forest area of the country. The forest area along the Ionian coast covers 12,700 ha or 37.6 % and that one along the Adriatic coast covers 21,000 ha or 62.4 %. Forests have a standing wood stock about

2,756,000 $m^3$ or 3.4 % of the standing wood stock of all the national forests. Over this territory everyone can see all the vegetation flats, beginning with oranges, olives and evergreen forests, continuing with deciduous forests, black pine, silver fir and Pinus leucodermus forests, with Mediterranean alpine pastures on the highest elevations.

The main forests are the mixed conifer and broadleaves forest in the Llogara region and single-species broadleaves forest in the Karaburun-Vlora district; the oak forest in Gradishta, Gjeneruk-Lushnje, Ishmi-Durres, Renci-Lezha and Shkodra; the Quercus aegilops forests in Mile, Kakome-Saranda, Himara, Karaburun and Tragjas-Vlora; the Mediterranean pine forests (Allepo pine and Stone pine) in Porro-Vlora and Fier districts and in Divjaka-Lushnje. All the man-made forests, mainly based on Mediterranean conifers, are located along the coast as a shelterbelt to protect the crops from sea sale winds (Kume of Vlora, Seman coast of Fier, Spille and Golem-Kavaja, Bisht Kamez and Rrushkull-Durres, Fushe Kuqe-Lac, Tale, Kune, Vain, Shengjin-Lezhe and Velipoja-Shkoder) and to green the territory (Saranda mountain); and shrubs which are mainly found along the Ionian coast [Demiraj *et. al*., 1996]. Also some experiments have been established by planting of fast growing and exotic species, such as the Monterey pine, red pine, eucalyptus species, etc. [Demiraj *et. al.*, 1996].

During 1960-1990 *the population* of coastal zone grew by average 28.429 inhabitants per year, Meanwhile during 1991-2002, the rate of grow was 21.217 inhabitants per year, and the population density reached about 200 inhabitants/$km^2$.

In early 2002, population of coastal zone was 2.15 times higher than in 1960 and 7,5% more than in 1990. In 1990, the share of population of the coastal areas was 52% and 60% in 2002.

### I.1.2 Coastal policy framework

Albania's coastal area has been and still is in the focus of many studies and development strategies of relevant sectors. Despite of those studies that address climate change issues the rest do not take into consideration adaptation issues of this area as a consequence of expected climate changes. A short analysis of these studies and strategies is given below:

*Coastal Zone Management Plan (CZMP) for the North and South Regions of Albania's coastal Zone* (PAP/MAP-UNEP, July 1995) and CZMP *for the Region of Durrësi –Vlora* (PAP/RAC, February 1996). This Plan analyzes coastal and marine pollution, inadequate water and waste management, over exploitation of natural resources, improper sitting of structures and settlements, inadequate protection of and research on archeological heritage, inadequate protection of biodiversity assets, incomplete strategy for the tourist development, inadequate protection of architectural resources, incomplete legislation, etc. It also proposes response actions for the management of the coastal zone of Albania. All proposed actions in the CZMP are evaluated taking into account (i) biodiversity and environmental protection; (ii) tourism, conservation and cultural heritage; (iii) institutional capacity building. Climate change impacts and adaptation issues are not considered at all.

*National Strategy for Development of Tourism.* The strategy is adopted in 2002 by Albania's government. It is conceived in two parts. The first part, namely analysis of potential and crossroads emphasizes that Albania may use more than actually its resources in the favor of tourism. The second part describes the conceptual strategy and the developing program for Albania to be a future tourist destination. This concept asks for Albania to increase at full blast the sectors' potential and to develop a sustainable tourism (in all sectors: cultural, social, environmental and economic)[21]. However, there is not consideration of the impacts and implications of expected climate change to this sector

[21] Tourism Development in Albania. May 2002

*Implications of climate change for the Albanian coast* (MAP Technical Reports Series, No. 98. 1996). This is a study performed under the UNEP Mediterranean Action Plan (MAP) and completed in 1996. Its summarizes the very first efforts of a multidisciplinary task team to examine the possible consequences of increases in temperature and mean sea level and of the changed climate for the Albanian coast and to estimate its possible implications for the terrestrial, aquatic and marine ecosystems, population, land use and other human activities. This is also the first study performed in Albania on climate change phenomena.

*Albania's First National Communication to the Conference of Parties of the United Nations Framework Convention on Climate Change.* This Report is performed in the framework of the project namely "Enabling Albania to prepare its FNC in Response to its Commitments to UNFCCC", funded by GEF and completed in 2002. Among other studies it includes a study on vulnerability assessment and adaptation options. It assesses the impact of expected climate changes and measures to adapt them. The study, carried out in accordance with the IPCC guidelines of 1994, is focused on the assessment of the expected climate impacts in hydrosphere, natural and managed ecosystems, energy, tourism, health and sanitation, and population. The study covers all the Albania's territory. In order to investigate the likely influence of climate changes three time horizons have been considered: years by 2025, 2050 and 2100. A set of alternative suggestions/recommendations that must be taken into consideration during the process of preparing the national strategies has been proposed guided by two main goals: (i) the promotion of the sustainable development (with the objectives: regional economic development, environmental protection, equity); and (ii) the reduction of vulnerability (with the objectives: minimize risk, minimize economic losses, increase institutional response).

*Preservation of Mediterranean wetlands and coastal ecosystems* (Narta/Karaburuni and Vlora). (UNDP/GEF, ALB/98/G33/1G/99). This is the national component under the Mediterranean regional project that includes Albania, Egypt, Lebanon, Morocco, Palestinian Authority and Tunis. The project is funded by GEF and is designed to reinforce the legal and regulatory conditions, the institutional conditions and the tools required for the conservation of biodiversity under threat in the wetlands and coastal areas of the Mediterranean basin, at the regional level, as well as at the national and local level in each of the countries having ratified the Convention on Biological Diversity. After a detailed assessment of the local threats to biodiversity on each of the selected sites, the project will identify and apply the innovative tools required for integrated management, including particularly the use of land policies complementing the regulatory system and formulating adequate policies for wetland management. It will endeavor to develop those management systems and build capacity both at the national and local levels, and focus on awareness-raising, information and participation of the various stakeholders, especially at the local level, whose involvement in the project will create the conditions required for its success and replicable to other sites, along the national coastline and in the Mediterranean region.

### I.1.3 Overview of the work done under the Albania's First National Communication

This section summarizes some of the main findings of the vulnerability and adaptation study performed under the Albania's FNC as regards the coastal area.

The expected changes are summarized in Table I.1.

| ***Table I.1:*** *Expected climate and sea level changes* | | | |
|---|---|---|---|
| **Scenarios for Albania** | **Time horizon (year)** | | |
| | 2025 | 2050 | 2100 |
| Annual temperature (°C) | 0.8 to 1.0 | 1.2 to 1.8 | 2.1 to3.6 |
| Annual precipitation (%) | -3.8 to -2.4 | -6.1 to -3.8 | -12.5 to -6.0 |
| Sea level (cm) | | 20 to 24 | 48 to 61 |

*Source: Albania's FNC*

Climate change scenarios for Albania lead to an annual increase in temperature up to 1°C, 1.8°C, 3.6°C respectively by 2025, 2050 and 2100 and a decrease in precipitation up to –3.8%, -6.1%, –12.5% by the same time horizons. Sea level is expected to increase up to 20 - 24 cm by 2050 and 48-61 cm by 2100.

Analysis of future scenarios on seasonal temperature and precipitation changes show that we may expect milder winters, warmer springs, drier autumn and hotter and drier summer. The expected severe summer with higher temperatures (increase up to 4.1°C) and lower precipitation (decrease up to –27%) over all the territory, followed by the increase in drought duration, intensity and frequency may impact negatively in many sectors. The vulnerability caused by extreme events is evident even nowadays (an example in figure. I.2), so the expected increase in their frequency might cause irreversible damages if no necessary adaptive measurements will be taken.

*Source IHM*

***Figure I.2*** *Case of extreme event, flood of Seman River on 25.09.2002.*

The most important vulnerabilities found under Albania's FNC that might impact especially the coastal area, are the following:

- Decrease in the long term mean annual runoff, estimated to vary between 9 and 23% by 2050 and wider limits by 2100 respectively would affect the surface water flow, reducing its amount;
- Under the conditions when climate change would modify rainfall, evaporation and soil moisture storage, the capacity of reservoirs and irrigation distribution systems will decrease more, therefore increasing the irrigation requirements;
- Insufficient irrigation would be a more important restrictive factor to the yield crops for the years 2050 and 2100, if appropriate measures will not be taken for the rehabilitation, the maintenance and improvement of the conveyance and distribution systems;
- Under reduced surface flow and increased evaporation, the storage of reservoirs will decrease, which will effect the energy production by hydropower stations;
- Albania is heavily reliant on hydropower electricity production. A 20% reduction in natural water runoff was estimated to cause a reduction in power generation of 60%. Thus, a heavy reliance of hydropower may be good for reducing greenhouse gas

emissions and improving air quality in Albania, but can increase vulnerability to climate change;

- Because of the reduction of stream flows in the wetlands, western part of Albania would experience both increased demand and reduced supply for water, which would decrease wetland area;
- Other consequences of expected warming include not only changes in total water amount and levels, but also erosion of riverbeds, and modification of turbidity and sediment load;
- Water quality is expected to degrade. This not only due to climate changes, but also because of the new industrial and agricultural development. The main hot spots for this problem are the districts of *Tirana, Fier, Korçë, Kavajë, Durres, Vlorë, Elbasan* and *Berat;*
- Agriculture may suffer from the reduction in the extent of arable land due to soil erosion and alteration. Changes in the growth cycles, harvest time and the quality of the agricultural production, especially along the coastal area, owing to an increase in salinity due to the sea level rise and intrusion of salt water into the soil, might occur.
- The expected changes are likely to bring about better living conditions for existing fish species or for the migration of others. The expected increase in salinity and sea water temperature could affect the inflow of nutrients from rivers or from the upwelling of deep water;
- A set of important impacts is specified in forestry. Eu-Mediterranean evergreen forest of Lauretum flat (*Lw- warm Lauretum*) would adapt to the expected conditions (temperature and precipitation) and would spread to higher altitudes, up to 150 m by 2025, 275 m by 2050 and 500 m by 2100. Eu-Mediterranean evergreen forest mixed with deciduous tree of Lauretum flat (*Lm- middle Lauretum*) would adapt and spread to higher altitudes about 150 m, 250 m and 500 m respectively by 2025, 2050 and 2100. etc.;
- The forest species that resist against high temperatures and severe long dry seasons would be able to over live. For those that need moisture (*silver fir*, etc.), the danger of being limited in distribution or disappearing does exist. Species that produce many small seeds and have a high distribution potential (*Pinus* etc.) would be able to survive and to spread at sea level, whereas oak species, which produce big seeds would occupy new areas but very slowly;
- Climate change may also affect the supply of energy from solar and wind power. A likely increase in the global solar radiation and the hours of sunshine will lead to an increase of potential for solar energy use in different energy services. The increase of the wind speed up to 1.3 to 2.3 % related to the period 1961 – 1990 by 2050 and 2100 respectively might be of interest to think about introducing wind energy in the energy schemes in the future;
- Shortage of drinking water of adequate quality could be especially keen during summer. As a consequence, an increase in contagious diseases cases, digestive system diseases, etc., is expected;
- Increase in temperature would not affect the physiological and compensatory system of healthy people. Thus, age groups like: babies, children and elders where the decrease in compensatory system is common, will have changes in their health condition, which would cause higher incidence of some diseases influenced by atmospheric changes. The infections in the respiratory system will be the most visible.

The sea level rise of 48-61 cm by 2100 might impact to:

- Direct flooding of coastal area. With increasing sea level rise, flooding will be intensified both directly by the sea and indirectly by changes in water tables. The beaches belonging to the areas affected by land subsidence (those of Shëngjin, Kune-Vain, Tale, Patok, Ishëm), and a substantial number of fields (drained in the late '50s and early '60s.) will be swept over by floods. Likewise, these floods will find their way into important segments of the local and national roads (including a part of the new road Fushë Krujë-Lezhë running through the former Lac swampland);

- Increase in the salinity of aquifers especially for the coastal area would impact the potable water supply sources (located in Lezha and Laç plains), as well as many lodging and tourism structures which have been, and continue to be built along these beaches;
- Floods will partially affect the beaches situated in the territories undergoing elevation (those of Durrës, Golem, Divjakë, Himarë, Borsh etc.), in addition to the tourism infrastructure. The same lot is expected to be suffered by agricultural land (in the former swamps of Durrës, Myzeqe, Narta, Vrug etc.) as well as dwelling centers and rural infrastructure which reach up to 50 cm above the sea level; then the entire dwelling places, hotels, roads and agricultural areas etc. situated in the lower zones of the Adriatic coastal line (excluding the territories under the effect of raising movements) will be flooded;
- Natural communities associated with such areas are expected to move inland. However, certain communities including existing coastal dunes, saline marshlands and wetlands are likely to reduce their surfaces and, although new dunes, marshlands and wetlands may gradually form elsewhere;
- Infrastructure such as sewers, water supply, electricity and other service could be flooded and corrosion of pipes and intrusion of seawater into pipes and sewage systems will occur;
- Sea level rise will impair estuarine water quality in other subtle ways, contributing to the degradation of in situ conditions for aquatic biota (e.g. increased temperature results in lower dissolved oxygen) and increasing the health risks of the populations dependent on withdrawals of fresh water from the rivers;
- Sea level rise, by directly influencing the increase in the ground-water levels and composition, would limit the growing of some forest species that do not like the moisture and salt along the Adriatic coast;
- Coastal tourism is expected to suffer the vulnerabilities caused by sea level increase. The possibility for new beaches to create (in a natural way) does exist, but building a new tourism infrastructure would require huge investments.

A set of adaptation options for each sector has been identified. A long list of adaptation options for every sector is already identified under Albania's FCN taking into account two main objectives (i) *promotion of sustainable development* and (ii) *the reduction of vulnerability.* The adaptation options are identified taking into consideration the principles such as prevention of loss, tolerating loss, sharing loss, changing use or activity, changing locations, research and restoration. The most important options are defined by a detailed selection procedure (using the screening, effectiveness and multi criteria analysis)[22].

The adaptation options proposed for each sector under analysis are given as following:

*Water resources:*
- Modification of existing physical infrastructure;
- Construction of new infrastructure;
- Water pollution control;
- Improvement of the monitoring and forecasting system for flood and drought;
- Drafting and approval of new legislation for water use;
- Setting a real price for water use;
- Implementation of the Integrated Coastal Zone Management.

*Natural ecosystems:*
- The establishment and maintenance of protected areas (in situ conservation);
- The active management of wild populations outside of protected areas (inter situ management);
- The maintenance of captive populations (ex-situ methods);

[22] Draft "Vulnerability Assessment and adaptation options"

- Monitoring of species.

*Agriculture:*
- Afforestation and the setting up of the barriers to protect the arable land threatened by soil erosion and alteration;
- Planning of agricultural production toward xerophilic crops to allow adaptation to the higher winter and summer temperatures and to the scarcity of water in summer. Agricultural development should be adjusted towards species that would adapt best to the expected soil and atmospheric conditions;
- A significant improvement of irrigation systems.

*Forestry:*
- Formulation of the Sustainable Forest Development Strategy;
- Preparation and implementation of the study-research programs for forest management;
- Increasing of the protected forest area;
- Reducing the illegal cuttings;
- Increasing of the investments to implement more actions in existing forests;
- Implementation of the actions to increase the existing forest productivity;
- Increasing of the forest area through reforestation;
- Monitoring of the forest health;
- Studying and monitoring the fire situation in forests;
- Reduction of the wood consumption for energy.

*Energy:*
- Consider runoff/water flow rate expected change in integrated resource planning;
- Account for the expected change in runoff/water flow rate in the design of thermal power facilities;
- Account for the expected change in runoff/water flow rate in the design of hydropower plants;
- Invest in energy conservation (Demand Site Management) measures for space cooling;
- Reduce energy subsidies.

*Sanitation and health:*
- Exercise permanent control over the drinking water quality through;
- Exercise permanent control over water supply and sewerage systems affected by salt-water corrosion and intrusion in coastal areas;
- Permanent monitoring and the drafting of a new law for air quality.

*Population, tourism*
As expected by 2025, about 60 % of the general population would be settled in the capital and the coastal area. The major economic sector will be that of services, which is expected to employ 40-50% of the active population in this region. To have a good functioning of the services sector, the following measures need to be taken:

? The provision of new potable water supply resources and the construction of new water supply, filtration and distribution systems;
? The provision of new power supply resources and the rearrangement of the appropriate distribution system;
? The construction of new sewage systems for both households and industry, as well as of new processing units for all the urban solid waste.

### I.1.4 Take the stock of technologies currently in use

This section makes a general review only for those adaptation technologies that are currently in use. These technologies are not applied for coastal adaptation purposes but indirectly help to adapt to the climate changes. The reviewed adaptation technologies that are currently in use in the coastal area are classified according to the following categories: (i) Climate; (ii) Water resources; (iii) Agriculture; (iv) Livestock; (v) Fishery; (vi) Forestry; (vii) Tourism and Population; (viii) Health.

#### I.1.4.1 Climate

The following technologies are related to the climate system. As highlighted above they are not applied for adaptation purposes but anyway their application helps to adapt to the current and future changes of the climate system.

##### I.1.4.1.1 Alternative sources of energy

The use of alternative energy sources such as solar, wind and hydro energy have significant impact to the reduction of GHG emissions which in turn will reduce air pollution. Efforts of utilization of solar energy have been done since the 80s, but its practice utilization in Albania in private form for the family use has been started after 90s. Utilization of this technology is very potential due to considerable number of sunny days per year.

As per the utilization of hydro sources it is very well developed. Albanian power system relies practically on hydropower plants. Over 90% of energy comes from hydro sources. For more information on alternative energy sources refer to chapter I, section I.1.4. As far as wind energy in Albania, it is still in research phase.

##### I.1.4.1.2 Air quality monitoring

There are actually five stations for monitoring of air-quality in our country. These stations are almost distributed uniformly to overall Albania's territory. There are measured some elements of air-quality such as dry deposits, chemistry of rain and are analyzed their physical-chemical characteristics. Perturbation of atmosphere and $SO_2$ concentration are measured only in Tirana station.

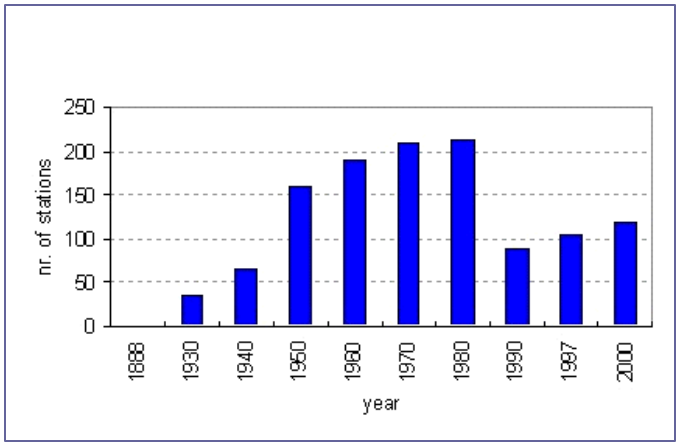
Establishment of the air-quality monitoring system is very urgent, as well as upgrading the existing meteorological service, in order to assess the possible increase in air contamination and in time danger warning.

##### I.1.4.1.3 Meteorological network

Monitoring of meteorological elements in Albania, which is very important to evident the climate changes and variability, has been started since the end of XIX century. It is established and strengthened in 50s, spreading out all the territory and in the same time increasing the number of meteorological elements measured. After its "blossoming" in the 1980 (about 230 meteorological stations) the national meteorological network in Albania reduced drastically in 1990 and nowadays grew up to 126 meteorological stations (Figure I.3).

In general, the current measurement technology used for some meteorological elements is very old and measurement error is considerable. In addition, lack of equipment remains a problem. The stock of equipment consists on: 10 pluviographs measure the intensity of atmospheric precipitation, 4 stations sunshine duration, 14 stations measure wind whereas only 3 of them have electric equipment. Meanwhile, the evidence of atmospheric events as

the number of dew days, number of frosty days, number of hail days etc. is monitored almost over all our meteorological stations. It is planned to replace gradually the old technology with a new one. Actually are installed 2 automatic stations.




***Source IHM***

***Figure I.3:*** *Changes of meteorological network.*

**I.1.4.1.4 Hydrological network**

The Albanian hydrological network is established in 1949, but before this date there were 4 water gauges observing the water level only.

In 1989 the National Hydrological Network (NHN) was composed by 207 stations, from which 159 in rivers (35 with recorders), 10 stations in lakes (6 with recorders), 32 stations in springs and irrigation channels and 6 stations in seacoast and lagoons (all with recorders). After 1990 the NHN was seriously damaged. The number of the stations was reduced and the quality and quantity of all hydrometric activity has been affected. Currently the NHN consists of 103 stations, from which 92 in rivers, springs and channels, 6 stations in seacoast and lagoons and 5 in lakes.

The main parameters monitored are: (i) *water level* by the staff gauges or automatic recording system (15 analogue water level recorder, 5 electronic level recorder and 2 D.C.P), (ii) *river discharge* by the method of flow velocities, using the current meters.

As far marine monitoring network, tide parameters, wind, water temperature and some chemical elements are measured. Currently, no recorder devices exist.

**I.1.4.1.5 Meteorological and hydrological data transmission**

At present, meteorological/hydrological data transmission (IHM) from stations to the gathering and processing center keeps control on the actions from its center in Tirana. The most important role, especially in using the meteorological data in weather forecast is the way of transmission meteorological data from stations to the Institute of Hydro Meteorological (IHM).

Actually, in some stations transmission is made by phone in daily basis for data of the extreme temperatures and precipitation. Monthly data monitored from all stations reach the center one month later by mail. For the field activities linked to hydrology (collection of

water level data, discharge measurements etc.) the tasks are distributed among 8 regional centers. All the data monitored on the site reach the center (IHM) once in two months.

This procedure is not available and effective for weather and extreme event predictions, and especially for prediction of river discharge and warning of the agriculture land inundation. This is why HMI is making efforts to build up a minimum network with automatic meteorological and hydrological stations in order to transmit in distance and in real time.

All the hydro meteorological information sent to Institute by mail, after processing is archived. This procedure needs a lot of time because for the lack of the network system computers. The meteorological archive consists on raw and processed data of air temperature (all indexes - minimum, maximum, mean air temperature); precipitation (daily, monthly, yearly amount, intensity for different time duration etc.); wind; sunshine radiation; humidity, etc. The hydrological data archived are the mean daily water level, monthly and yearly mean, maximal and minimal water level, daily discharge and monthly and yearly mean, maximal and minimal discharge. All these data are stored on the sheet format and only a part of it is of electronic format. Nowadays they are under digitizing process. A very simple method, the alpha numeric one, is in use so far. Updated software to create the hydro meteorological databank is imperative.

### I.1.4.2 Water resources

#### I.1.4.2.1 Defense structures

As previously highlighted, coastal and river's technologies are currently set up to cope with climate variability and not directly with adaptation to expected climate changes. However, they can be applied for adaptation purposes as well.

Technologies available in some considered hot spots consist on constructions of defense structures in river management as man made water falls, dams, forestry etc., in mid and lower Vjosa, Seman and Shkumbini basins. The same measures were taken in mid Osumi river basin around Berati city. There are some other unfinished measures in Buna River.

Saranda's immediate coastal zone has around 1 km area protected by coastal protection units (armour units- tetrapode shape). These measures were to avert coastal erosion and aid in pedestrian's circulation.

The same protection measures were undertaken years ago in the Durres coastal zone for the management of the coastal infrastructure (Currila Beach). The cubic armour units were used in this location. In Porto Romano (Durres) zone the coastal protection is protected with cross-section armour units (perpendicular to coastal line) and tetrapode armour shape, for some hundred of meters. This is build to protect the wetland from the sea erosion. The aforementioned cubic armour units are also used in Vlora beach to enlarge and facilitate the road circulation.

The main aim of these measures was the management of the coastal infrastructure but it is also a suitable adaptive technology to climate change. Unfortunately all these measures are not taken in the framework of a general management plan. Only in few zones an accurate study is performed. The Laboratory of Hydraulics has studied some particular aspects of the problem but the lack of the technology is a barrier for them. The most problematic zones near the seashore are listed below:

- *Zhuporo (Vlore).* In this area the erosion is already a well-known phenomena. This is a problematic zone and so far no measures are taken;

- *Lalzi (Durres).* During the last 20 years a big change of the seashore line has been observed. The intrusion of the sea in land is still a very problematic and uncontrolled event;
- *Patok Beach*. This beautiful beach now days don't exist any more. The sea has flooded all the area;
- *Velipoje.* If no measures are taken this beach is designated to disappear;
- *Karpen (Kavaje).* Significant erosion is observed in this area too. The dune along the seashore used to be meters far from the sea now are under the sea level;
- *The delta of Hoxhara Chanel* (Vjose-Seman) it's a heavily eroded zone, as well as *Terkuza delta*.

***Figure I.4*** *Bunkers into the sea as evidence of the sea intrusion. Porto Romano, 2003.*

For the *irrigation system* the most problematic systems are the drainage systems of Velipoje, Shengjin, Spitalle which are in danger. In the Karavasta area, Hoxhare, Vrina, Butrinti (Sarande) Narta (Vlore) an ecological disaster is inevitable. The existing irrigation system has a small hydro module and they have never been modified or reconstructed so far.

The same situation is for the hydropower stations. Only this year a discussion about a project to remove the sediments from the reservoirs has started.

### I.1.4.3 Agriculture

Currently, small farming practices and related businesses in Albania are risk-averse and use of new technologies is also discouraged through lack of information; financial and human capital, transportation, temporary tenure; and unreliable equipment and supplies.

Farming practices of the coastal areas of Albania have been challenged by the relatively long persistence of warm climate associated to extended periods of drought especially during the last decade. On the other hand, during the same period the coastal areas were demographically overloaded by new settlers, getting displaced from unproductive and poor agriculture areas of the north to the more fertile soils of the coast. However, the new settlers have predominantly populated the hilly areas located in the periphery of the big cities making possible the utilization of the agricultural land in those parts.

#### I.1.4.3.1 Land management practices

Dealing with the slope configuration like leveling, roughening, bench terracing of the occupied land helped new farmers incurring into some sort of spontaneous adaptation measures to ensure the expected production.

Land leveling has been practiced by the new settlers for the reduction of runoff and improvement of water uptake in soil surfaces less than 1 acre. This surface was barely able to cover the survival needs of a farmer's family.

Bench terracing and field subdivision was an approach applied to soil surfaces bigger than 1 acre and involving several farmer families with parental ties.

Roughening of the land surface was another approach. Although not at the extent of the previous measures, some farmer families have adopted this practice when settled in ridges nearby a stream.

The above set of adaptation measures was mostly spontaneous and lacked a genuine technology approach.

**I.1.4.3.2 Soil management practices**

The new settlers from the north who populated the coastal areas, made possible the utilization of the available free steep land surfaces, which were mostly highly eroded and suffered from lack of irrigation. To render the surfaces productive the farmers incurred the following measures:

Application of minimum tillage is usually applied, as it is rather inexpensive. However, it is time consuming. Especially the new settlers have used this adaptation approach in many farming practices.

Application of contour cropping to slope is another approach that has been principally applied by farmers making use of agriculture land bordering a slope prone to erosion. Mainly crops with a highly developed root system have been selected.

Use of lower planting densities is another practice that help adaptation, used mainly to conserve soil moisture and nutrients.

The persistence of drought in the coastal areas and the average increase of temperature has exerted a considerable moisture stress in cropping practices in the coastal areas. This has urged farmers to:

? *Change farming timing to better fit into new climatic conditions;*

This has been mostly achieved through *advancing the sowing dates to offset moisture stress during warm period.* Agriculture soils of the coastal areas in Albania have been persistently exposed to prolonged drought.

? *Improve water use efficiency and control erosion*

Shortages of the water resources due to persistent droughts imply problems with water availability and use by the farmers. To face the challenge many farmers have incurred into some adaptation measures such as: (i) Use of low cost pumps for water supply; (ii) Adoption of drip irrigation system; (iii) Digging of line canals or installing low cost pipes.

**I.1.4.3.3 Planting management**

Agriculture soils of the coastal areas in Albania have been persistently exposed to prolonged drought. On the other hand the shortages of the water resources imply constraints on water availability and utilization by the farmers. To face with these challenges many farmers have incurred into some adaptation measures aiming at better coping with current climate. Change of planting time through early sowing in order to offset moisture stress during warm period has started application in nowadays.

In addition, farmers are using other practices to overcome water shortages such as use of low cost pumps for water supply. This practice has been strongly supported by the counties water use associations, specially introduced and promoted through workshops organized with farmers.

In some areas the drip irrigation system has been adopted. The introduction of this low cost approach appears to have been very well accepted by some farming practices.

Digging of line canals or installing low cost pipes is another measure that has been extensively applied for irrigation purposes in farming practices of the coastal region.

Livestock and livestock production in the coastal area has been stressed by higher temperatures especially during the summer period. This has to a certain extent affected the expected yields and decreased the profits.

Therefore the animal husbandry practices have to a limited extent considered some adaptation measures aiming at:

**I.1.4.4 Livestock**

**I.1.4.4.1 Farmhouse microclimate control**

This is a kind of adaptation technology that helps keeping under control the farmhouse microclimate inside the range of thermal neutrality. This technological approach consists on the thermal insulation of the farmhouses. Thermal insulation is made through the use of thermal insulation constructing materials, sometimes by using asbestos as insulation material, which is not environmental friendly. Some big poultry breeders have invested in improving the ventilation devices of their premises and inserted in some cases air conditioning facilities.

**I.1.4.4.2 Disease prevention and control**

The general increase of temperatures and especially the mild winters of the last decade in Albania have apparently created the conditions for the breeding of previously unknown insect species mainly inhabiting the tropical regions. These insect species are notorious as vectors of infectious diseases spread in animals. A previously unrecognized parasite insect species, namely *Culicoides imicola* feeding on blood of its host (sheep) has recently appeared in Albania. With the appearance of this new species, a massive outbreak of a viral disease known as Bluetongue affected the sheep population of the country, which in turn impacted animal husbandry which suffered from considerable losses in terms of mortality, decrease of production etc.

Considering the situation the veterinary services have adopted a set of measures aiming at early identification of the disease in animals and the control of its widespread. These measures consist on a rapid serological test for the identification of the disease and stamping out of the infected animals to prevent the widespread of disease.

**I.1.4.5 Fishery**

Fishery activities along the coastal areas of Albania have been affected by the climate variations especially during the last decade. The eutriphication of some wetland areas, the increase of sea level and water temperatures associated to a decrease of salinity have brought to an abnormal growth of toxic phytoplankton.

As a consequence in some harvesting areas of bivalve mollusks, abnormally high levels of toxic phytoplankton have been detected. As a consequence, in some mollusks species, exceeded high levels of some neuroparalytic biotoxins have been detected.

There is a growing concern expressed by the mollusks breeders in terms of ensuring the safety of their products for human consumption**.** Measures are undertaken to combat the situation and consist on setting up of warning systems in the harvesting areas, to alert the onset of abnormal phytoplankton blooms. It is followed by a fast screening test for the detection of biotoxins in shellfish species.

### I.1.4.6 Forestry

The proposed technologies / measures under Albania's FNC for the forest categories are mainly a usual practice in Albania, but not properly applied. They do not take into consideration the expected changes of climate and measures to adapt the forest to these changes.

#### I.1.4.6.1 Addressing climate change issues to forest development strategies

The forest sector in Albania is being managed according to a National Strategy and Action Plan for Forests and Pastures. As highlighted in the chapter I, section II.1.2.1 the strategy and action plan *does not take into account the climate change and its implications*. In this context, it is an imperative need prepare e new strategy or to revise this strategy in order to reflect the climate change impact, implication and adaptation of forestry to climate change.

About 100 % of the forest area is managed under the management plans but these plans need to be reviewed according to the objective to adapt the forest system to climate changes. It is imperative to favor more adapted species to expected changes of climate and sea level rise also, and species that have not capability to occupy the flats in new likely conditions.

Many studies and research projects in forest sector are under way. Most of them lack to taking into consideration the climate change issue.

#### I.1.4.6.2 Increase of forest productivity

Actions to increase the existing forest productivity or average annual increment are undertaken through interventions in nature forests for rehabilitation of degraded forest, conversion of coppice and shrub forests to high stem forests with the same species, mainly broadleaf species or planting the fast-growing species or more capable species to sink $CO_2$ emissions. Interventions have always been made to have mix forests in a area over half of total forest area and, to better manage the pruned forest area (mainly oak and beech forests) for fodder in conditions of small livestock husbandry increasing, mainly goats.

There are experimented some fast-growing forest species and, some of them have resulted successful, such as poplar hybrids, Monterey pine, Douglas fir and, seaside pine. Some others are under experimentation. The possibility to plant some of them in considerable area is under the studying process. There is the need to import the seeds of controlled origin by USA or New Zeeland to plant some of American fast-growing species as Douglas fir, Monterey pine etc.

#### I.1.4.6.3 Reforestation techniques

Increase of the forest area through reforestation techniques is a practice that enables a better adaptation to climate change and rises of the sea level and enables species to sink $CO_2$ emissions especially on the eroded lands, refused agriculture lands and burned lands (about a area of 10.000 ha).

A lot of reforestation projects are implemented especially on the eroded lands and refused agriculture lands, and also on burned forest areas.

Too many man-made forests are set up through planting of Mediterranean pines (*Aleppo pine-Pinus halepensis Mill. Seaside pine-Pinus pinaster and Stone pine-Pinus pinea L.*) on the limestone geological formations and on sandy terns along the coast and black pine (*Pinus nigra Arn.*) on the serpentine geological formations, as well as poplars along the rivers on sandy terns. There were also planted some other broad live species as walnut (*Juglans regia*

*L.*), chestnut (*Castanea sativa L.*), Sweetball (*Laurus nobilis L.*) etc. and fast growing forest tree species as: Black-locust (*Robinia pseudoacacia L.*), and too little area with Monterey pine (*Pinus radiate D.Don.*), etc.

Even though the planting technology is known, the field experimentation is a useful tool to response in due time to the climate impact. Reforestation projects that foresee operations for rehabilitation of the burned forest area need to be prepared and applied, anyway.

There are the well-known traditional practices to cultivate the necessary seedlings for establishing of man-made forests but there is requirement to import the new technologies of the seedling cultivation, which are more effective from the economic point of view.

**I.1.4.7 Tourism, population**

In the course of last years is spoken for the climate change and its influence on the natural environment and socio-economic activities in Albania. Despite of that, no direct response measures for adaptation of population, settlements and tourism activities are implemented so far. However, some of the actions taken during the second half of the last century to the littoral site, for other purposes have indirectly influenced and will continue to influence positively for the adaptation to the climate change.

**I.1.4.7.1 Physical planning**

During the former times (until 1990) the construction of all buildings (residences, economic objects and tourist infrastructure) has been made under a planning process. The majority of buildings were constructed over high tracks; therefore they will be not threatened by the future sea level rise. After 1990, along the coast and often very close to the coastal line were built up over 2,400 illegal buildings, mainly used for tourism purposes, which have damaged the beaches, have polluted the environment and are threatened because of the expected increase of the sea level.

Both legal and illegal construction does not only reduce the agricultural and forest land, but also create hips of wastes, pollutes the environment and degrade the landscape. Spontaneity in construction has resulted in chaos, especially in the suburbs of urban centers and beaches.

**I.1.4.7.2 Drainage technique**

There is some experience in Albania regarding the drainage of the soils even when they are situated under the sea level. Until 1990 the drainage systems have well functioned. Some of them had a mechanical pumping system for water discharge into the sea. After 1990 many technical problems were generated. Investments are needed to recover.

**I.1.4.7.3 Coastal erosion prevention**

Damage of the natural and cultivated vegetation along the littoral sites and the utilization of the sand dunes and beaches have favored coastal erosion.

During 1945- 1990 the deforestation of the littoral land is made by the state for the purpose of for opening the news lands while after 1990 individuals cut hectares of forestland for private reasons. In both cases the damage is not only the decrease of the forest area, but it has also favored the coast erosion and the advance of the sea toward the land. So there are many sand dunes damaged in beaches of Velipoja, Vilun, Kune - Vain, Patok, Seman, Narte etc. In the last 150 years, in some areas such as Patok, Seman, etc, the sea has advanced 2.5-3 km toward the land Also the illegal utilization of the beach sand has favored the advance of the

sea toward the land. A typical example for the implication of such bad practices is the destruction of Seman beach.

Change of the river outfall was another practice of negative impact to the adaptation to climate change. The most negative consequence of this practice is the case of Ishmi River outfall change. Aiming at filling the Patok lagoon in order to provide agricultural land, during 1970, Ishmi River was obliged to discharge into the lagoon and, as a consequence, its deposits were accumulated there. This measure favored the sea erosion increase, which for 20 years managed to destroy totally the Patok beach, causing a big economic and environmental damage (all the tourist infrastructure is destroyed). Similar negative consequences have had the Butrint littoral by the change of the Bistrica and Kalase rivers' outfall.

Construction of the Hydropower dykes has especially influenced on stony discharges decrease in Drini and Mat Rivers (a significant amount of them are accumulated in the lakes of HPP) and therefore preventing the advance of rhythm of the river deltas toward the sea and to the creation of the littoral arrows and cordons.

The utilization of the inert in the riverbeds, during the last decade has also a negative consequence to the erosion. A significant amount of the stony deposits do not get to the sea, but they are accumulated into the holes created along their bed. Therefore, it is damaged the equilibrium accumulation in the river deltas causing erosion.

After some recent flooding, the Government has taken some response measures to the erosion prevention such as stopping the inert utilization from riverbeds and cutting of forest trees along the coast area.

**I.1.4.8 Health**

The community living in coastal areas is, in general, suffering by deficiencies in environmental infrastructure, mainly in running water supply, in wastewater discharge and its treatment. Actually sewage of urban areas discharges into surface waters (rivers) or directly into the sea and without any treatment before discharging.

The drinking water supply is provided at retailed and at limited hours to the population of the coastal area. The existing technology does not guarantee the quality of running water. This situation often brings about problems and consequence in public health. There are observed cases of infectious diseases, such as hepatitis viral B etc., caused by utilization of polluted water in coastal urban areas.

Intensive precipitation of fall 2002 and winter 2003 followed by flooding of north coastal areas (Kurbin, Lezha and Shkodra areas), caused outbreaks of Hepatitis viral A and Dysenteries in population of these areas, mainly due to the bad infrastructure of water supply.

The area between Lushnja and Vlora is considered as malaria area up to the end of 60s. Through a National Action Plan of 1957 (that year were registered 425 new cases of malaria) and a multilateral intervention, malaria was disappeared (by using DDT and other infrastructure and health interventions). After 1962 is observed the first case of malaria carried from abroad and up to 2002 the cases number accounts for 38. They are mainly imported by Asia (China -23 cases), Africa (Kenya, Tanzania -14 cases) and South America (1 case).

**I.2 Identify criteria for assessment**

As highlighted in the introduction section of this report, the assessment criteria used for adaptation technology needs are the same as for abatement technologies:

- Contribution to the achievement of most of the MDGs;
- Social acceptability and Suitability for Albania's conditions;
- Market potential;
- Contribution to climate change mitigation/adaptation.

The same sub-criteria already used for needs assessment of abatement technologies are used for adaptation technology assessment as well. As indicated to the introduction of this report an equal weight and scoring is used for assessment of adaptation technologies. A qualitative assessment is performed for each relevant category/section. For more details on evaluation matrixes please refer to Annex I (tables #6, 7 8…10).

**I.3. Selection of key technologies**

There are identified some adaptation technologies already proposed under Albania's FNC and somewhere used in Albania, taking into account that they are expected not only to reduce the vulnerabilities from impacts of climate change but also to reduce current damages (vulnerabilities) related to climate variability or extreme weather events. In addition, there are considered also some technologies already used in other countries with climate analogies as well as similarities in coastal features and socio- economic developments (for a considerable period of time).

Adaptation technologies are best implemented as part of a broader, integrated coastal management framework that recognizes immediate and long-term sectoral needs. Other countries experience have shown that win-win situations could be established when coastal adaptation technologies also provide benefits unrelated to climate change

The team has collected information on alternative adaptation technologies and related market (wherever possible) information for those sectors. This information is collected from existing studies and development plans for the related sectors or from literature and Internet. The set of adaptation technologies consists in a summary of alternative climate change response technologies for each sector that could easily meet local needs and circumstances. These technologies are divided in to three categories:

? *Data gathering technologies*, which enhance understanding of the basic geo-morphological characteristics of the coast as well as its dynamic processes including: *data* (gauges, sensors, remote sensing and monitoring), *management and decision* technologies (GIS, models, databases);
? *Coastal protection technologies*, which are incorporated within, or required to carry out, the implementation of the three main coastal adaptation options: *managed retreat* (e.g. movable structures, inland flood defenses, flood warning systems), *accommodation* (e.g. dune management, waste-water treatment, etc.) or *protection* (e.g. beach nourishment, sea walls, etc.);
? *Other sector-related technologies.*

After the evaluation, the selection process or prioritization has taken place for each sector under analysis. More information on selection process is provided through a summary table of priority adaptation technologies. For more information refer to Annex I, Table 11.

A detailed analysis of the selected priority adaptation technologies is provided below.

### I.3.1 Data gathering technologies

#### I.3.1.1 Establishment of a network of automatic meteorological stations

Automatic meteorological station is relatively a new way of measurement and transmitting of meteorological data. Data gathering of meteorological elements through automatic stations can provide information in real time, which is very useful for the prediction of floods and inundation of agriculture land. The elements monitored through these stations are: atmospheric pressure, air temperature, relative humidity, sunshine radiation, atmospheric precipitations, the wind direction and speed. On the other hand, interface equipment will be attached in the automatic station in order to get the possibility to connect with the central computer. In this way is supposed to realize a network for monitoring the meteorological elements and getting the information on central station in the real time.

The number of these automatic stations and distribution over the country depends on some factors. The most important one is the meteorological representativeness of the places where the station is decided to be set up as well as the cost. This information will be used more effectively in weather and hydrological forecast, especially in floods prediction, etc

The establishment of automatic stations network within the National Meteorological Network is the best but very expensive alternative. In case of lacking the appropriate funds, another alternative may be used: upgrading of existing network by substitution of following equipments with high quality recorders, such as wind recorders, pluviograph, pyranograph.

*Wind recorders* measure various proprieties of wind (e.g. strength, direction). Once installed, wind records require basic maintenance and data handling skills.

*Pluviograph* registers continuously the rainfall. The intensity of precipitation calculated from the diagram of pluviograph is a very important index for calculation of land erosion. Also it is used to perform predicting models of the floods and inundation of agriculture land.

*Pyranograph* registers continuously the total energy coming from the sun. These data serve to evaluate the possible sunshine radiation energy as clean energy source.

The establishment of an automatic station with all the elements mentioned above costs around 20,000 USD. Maintenance costs account for about 500 USD per year.

#### I.3.1.2 Establishment of a network of automatic hydrological stations

The automatic network requires advanced technology, which are accessible thanks to progress in electronics and data processing. Furthermore, they ensure greater reliability while being easier to use. They can be installed in uninhabited areas such as forests and pastures as well. Automatic stations are indispensable for purposes requiring real time data collection. These new methodologies make it possible to improve the organization of networks from several standpoints: follow-up of the proper functioning of remote stations, limited data handling and easier access to information. The information gathered in real time is used to better face the flooding problems.

Flood warning given several days in advance can make it possible to reduce the economic cost of floods. In the basin where the concentration time is a few hours, human life may be endangered by a sudden rise in the water level. In this case organizing rapid flood warnings becomes vital. Hydrological and meteorological measurement automatic network makes it possible to reach all these objectives.

Designed for different purposes, they have similar structures made up of standard components such as (i) Measurement station; (ii) Data transmission; (iii) Data collection and processing center

Measurement station is the chiefly handles water – level measurement. These sensors are connected to a data collection unit, which takes care of encoding, storing, and transmitting messages. On site data storage ensures considerable autonomy for stations to which access is limited.

Data transmission techniques are selected according to the performance, reliability, and speed desired. Satellite links are reliable and independent ways for transmitting data, allowing data collection in convenient delays for operational application.

Data collection and processing center aims at carrying out periodically interrogation of stations, monitoring, data filing, and display. It uses data in order to simulate phenomena in advance. It has hardware aspects, with its equipment for computing and storing data. It has also software aspects with the creation of real time modeling programs. This aspect determines the reliability of the forecast.

The measurement devices which are the basis of every operational system, gather data which, after coding are transmitted in real time or stored on the site.

In nowadays the condition for installing these new types of gauges is less constrained than those for conventional float gauges.

At present the technology for these sensors is evolving and new instruments have recently been developed. Taking into consideration the conditions of our country a perfect automatic station is one equipped with ARGOS system. This system is easier to install, to maintain, and to assist. They can be installed in the locations where it is difficult to be reached by the people, as mainly our hydrometric stations are. And the last but not the least is their relatively low cost.

There are different countries and specialized organization, which can provide this technology. The Hydrological Department in the Institute of Hydrometeorology has a good experience in the collaboration with ELTA (France) and OTT (Germany) etc. The project for an automatic network in our country includes at least two automatic stations in each river one upstream and the other downstream.

**I.3.1.3 Monitoring of sea and shoreline**

Shoreline and sea monitoring involves the collection of various kinds of quantitative and qualitative data.

- *Tide gauges.* The ability to detect changes in relative sea level is an extremely important aspect of adoption. Tide gages measure water levels relative to land. Requires very long-term commitment to maintain system of gauges and analyze data;
- *Wave gages.* Wave gages are used to measure various characteristics of water as: height, period, length, direction. Network of wave monitoring stations require sophistical maintenance and data handling skill;
- Current Meters. **C**urrent **M**eters are used to measure current velocity and direction as well as to map sea surface topography;
- Salinometers. Salinometers are instruments to determine the degree of salt water intrusion in coastal areas;
- Echo-Sounders (**E.S**.) and continuous seismic profilers *(CSP)*. They are used in bathymetric surveys to obtain information about the topography of the ocean bottom;

- Modeling of wave processes. Wave generation and wave transformation processes can themselves be modeling. High quality data input and training is necessary, while the results can be of limited accuracy.

All above-mentioned data can be collected and further processed using some of the technologies listed below:

- *Water Level Recorder*

The Water Level Recorder **WLR7** is specially designed to measure sea water levels. Mounted on the seabed, this instrument records pressure, temperature and salinity at regular intervals. On the basis of these data, precise variations in water level can then be calculated. This instrument is extensively used for monitoring seabed depression. Data collected by the **WLR7** is stored in the Data Storage Unit (DSU) 2990 which also records the time of the first measurement and subsequently the time of every first measurement after midnight. The data is simultaneously transmitted acoustically into the sea by keying on and off a 16.384 KHz carrier. These acoustic signals can be monitored at the surface by the use of Aanderaa's Hydrophone Receiver 3079.

? *Wave and Tide Recorder*

The **WTR9** is a rugged, self-contained instrument designed for mounting on the seabed a fixed structure for measurement of waves, water level and temperature in shallow waters. The recommended deployment depth is 15 meters (maximum is 60 meters). A quartz pressure transducer measures waves and tides and the temperature is measured by a Fenwall thermistor. The **WTR9** has selectable sampling intervals and the data are stored in Aanderaa's DSU 2990E storage unit. Real-time data can be brought ashore via cable and connected to a PC computer via Aanderaa's Dech Unit 3127 or Computing Unit 3015.

- *Doppler Current Meter*

The development of small, low power Doppler current sensors in recent years have opened up many interesting applications; one of these is the **RCM9**, a unique new self-contained instrument that can be moored in the sea for long periods of time. It measures the horizontal current speed and direction, temperature, conductivity and turbidity of the water as well as instrument depth. In addition, the RCM9 has a free channel for an optional sensor that can be supplied from the manufacturer or be built by the user. The recording intervals can be set from 1 to 120 minutes in eight steps, or can be set to operate continuously. At 60 minute recording interval the instrument can operate for more than two years.

- *Conductivity / Temperature Profile Recorder*

Information on vertical temperature profiles in the sea is of interest for numerous reasons. For some of these applications, in situ recording of data is satisfactory, for others, telemetry of data ashore or to ships is required. The **TR7** is suited for both applications. The **TR7** Temperature Profile Recorder is a rugged, versatile, high-precision instrument consisting of a 12 channel recording unit and a thermistor string. Four different temperature ranges are available. The **TR7**'s Recording Unit contains all necessary functions and electronics to scan and store the temperature values at preset, quartz clock controlled, and intervals.

The cost for this equipment is relatively high. They can vary from 10,000-20,000 USD each.

### I.3.1.4 Modernization of the hydraulic laboratories

Hydraulic laboratories are important for testing the engineering properties of structures in particular hydrodynamic conditions and can support various kinds of modeling activities: experimental; numerical; dynamical. Laboratories represent essential Institutional capacity to assist in coastal adoption. However, they are expensive to maintain.

All these data gathering technologies will help for data collecting and creation of data bank for different natural phenomenons. The use of these data is very necessary for predicting the defending tools for the coastal zone, especially for beaches, tourist infrastructure, housings and other material goods.

### I.3.1.5 Satellite remote sensing

Remote sensing technology refers to the techniques and methods used to acquire and process information about an object to be observed and studied, without getting physically in touch with it.

The space remote-sensing technology for the environmental observation and study, make use of orbiting satellite platforms, equipped with "sensors" devoted to acquire information about observed objects (targets) referred to land, atmosphere and sea.

From synoptic point of view no other technique can obtain such comparable results: airborne photogrammetry, for instance, due to its different characteristics, requires a number of time-differed passages to cover such extending areas.

The analyses of remote sensed data allows, for instance, the identification and classification of significant environmental parameters such as water surface temperature, sea and land surface color, sea and land roughness etc.

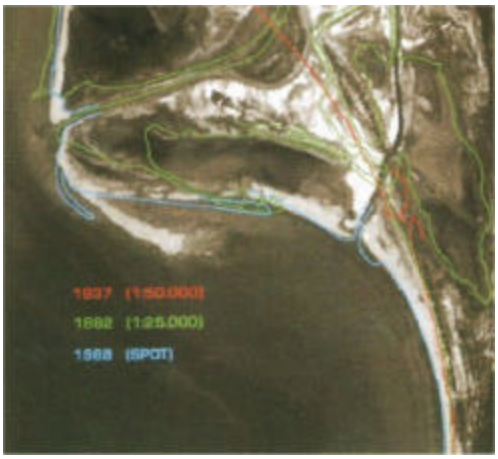
Remote Sensing data are successfully used both as a direct source of information (i.e. for the individuation of the characteristics of the target) and as geographical referent system where conventional data from the other sources.

This allows to evidence changes in environmental conditions, to plan -whenever necessary - with more accuracy, further ground investigations and a consequent considerable saving of time and costs in the carrying-out of them.

According to these potentialities, the satellite remote-sensing is usefully applied to the study, and to control many environmental phenomena, as well as to support several planning and control activity.

As far as, meteorology and climatology are concerned, remote sensing data have helped spawn a revolution and enabled a better understanding and knowledge on the climate dynamics and its evolution. For instance, remote sensing allows high frequency control of cloud patterns, assessment of temperature and moisture profiles, precipitation estimation, wind determination over the ocean and in atmosphere, etc.

In all above fields, the support of remote sensing proves really successful, and great scientific efforts are growingly improving the space remote sensing technology, thus contributing to the effective understanding of environmental conditions and changes



Source: ALBANIA CAMP

***Figure 4.1*** *Changes occurred in the southern zone of Shkumbini delta between 1937 and 1992.*

**I.3.1.6 Geographical Information System (GIS)**

GIS enhances understanding of the basic geomorphologic characteristics as well as its dynamic processes.

GIS combines computer mapping and visualization techniques with spatial databases and statistical, modeling and analytical tools. It offers powerful methods to collect, manage, retrieve, integrate, manipulate, combine, visualize and analyze spatial data. It derives information from these data that help to assess the expected vulnerabilities of climate changes. There is no doubt that GIS offers great potential for society wishing to anticipate and understand the consequences of climate changes to cope with the potential impacts.

First-order application of GIS in coastal adaptation would be overlaying scenarios of sea-level rise with elevation and coastal-development data to define impact zones. More sophisticated application may include morphodynamic modeling. GIS technology is evolving rapidly and is increasingly used for sophisticated modeling. GIS can provide excellent support to coastal managers for making decisions about adaptation.

Collected data can be stored in a GIS, combined to developed new insights and information, and visualized for interpretation. GIS can assist planners to identify appropriate adoption technologies as well as their optimal location for implementation.

Institute of Geographical Studies and Geographical Institute of Military are applying GIS technology in our country. Some efforts to implementation this technology is in process now, but there are some constraints such as high cost of computer hardware and software, lack of appropriate digitalized data, lack of collaboration between national research institutions, which delay it.

**I.3.2 Coastal protection technologies**

The coastal zone is not static, but a dynamic, unpredictable, adaptive and interdependent set of subsystems. While this idea is well internalized within the coastal zone engineering and management community, these characteristics are frequently ignored in the planning, design and implementation of coastal projects. Identifying specific technologies needed to respond to sea-level rise is therefore a complex task.

The dynamism of the coastal zone is both a problem and an opportunity for coastal managers. On the one hand, it can be difficult to model and predict the effectiveness of a particular coastal adaptation technology, or indeed the positive or negative side effects associated with the technology. Moreover, most existing coastal zone problems are the result of a cumulative set of maladaptive practices (e.g. development in hazardous zones, the use of inappropriate coastal adaptation technologies, etc.)

The team has recommended the following protection technologies as well as the adaptation options they could support.

**I.3.2.1 Coastal defense structures**

Considering climate similarities and marine common features (tide magnitudes, waves height) as well as coastal features and social- economic developments (for a considerable period of time), the team of experts came into the conclusion that technological approaches related to impeding the sea advancement applied into the Mediterranean area (Greece) and in the Black sea area (Georgia), could be considered for application in Albania as well.

- *Construction of a series of dams parallel and perpendicular to the coastal line as well as the intensive refilling of the beaches through a temporary bypassing*.

This technology can be used for the protection of the low type sandy coasts that Shengjin, Durres and Vlora beaches. It constitutes the most ambitious project implemented so far in Greece (Pierias coast) for the protection of the low type sandy coasts, with a very small inclination and with sectors below the sea level affected by waves of an average height of 2,5 m (in the southeastern part). The littoral transport of the sediments oriented to the north, has been disturbed by the construction of portal works along the coast. Solid carryovers of the water effluences were diminished also from the non-regulated collection of solid matter from the riverbeds. Within a short period of time the beautiful sandy beaches vanished and were substituted in turn by sandy and granular beaches. The costal protection study initiated on 1988 and included the 10 erosion most affected sectors. The coastal line has been stabilized and beaches have been recovered and used for tourism purposes. The results were moderate, since the sea is very shallow and the oceanographic conditions are suitable. The cost is estimated at 590 USD per linear meter of protected coast in stone build dams and about 1,200 USD/ml in concrete build dams (reference prices 1991).

- *Construction of dams parallel to the coast.* This technology can be used in the beaches of Currila, district of Durrës..

The project deals with the protection of the elevated rocky coast of the Aegean sea (the northeastern coast of the Skyros island). The coast has been affected by the natural erosion associated with prolonged perishes. The coast has been exposed to strong waves from the northeastern sector, with a maximal height of 4 m. According to estimation made during the twentieth century, the coastal line has retreated 40-50 m with an annual average of 40-50 cm.

The natural retreat has been additionally deteriorated by man-made activities. To build their houses on the verge of the frail coast the inhabitants have build up gigantic concrete walls. During the stormy weather, the waves struck the walls and collect the reduced amount of sand still present on the beach. The sector protection by a system composed by three separate dams has proven effective. Dams have functioned appropriately (1990) and as consequence sand has been deposited in a band with a width of 40 m at the place were the sandy beach disappeared since many years ago. The cost is evaluated about 1,300 USD for linear meter of protected coast.

- *Construction of a system of dams parallel and perpendicular to the coastal line above and under the sea level and the refilling of the beach with sand retrieved from the sea.*

This technology can be used in the small beaches of the Riviera. The project aims at restoring and regulating the Ixia coast in Rhodos - one of the best balnear and tourist centers of the island with a sheltering capacity of 10.000 beads situated within 2 km coastal length. The owners of the Hotels are very much interested at rendering the beach attractive to stimulate the balnear activities.

The project aimed at two principal objectives: obtain a wide sandy beach replacing the existing granular one and ensure a more stable coastal band than before. The protection works aimed also at scattering the energy of waves (up to 3 m of height) in order to protect the beach and ensuring a safer balnear zone.

The optimization of the master plan and the calculation of the efficiency for the envisaged works have been based on a detailed study design on the sedimentological reduction model. The study has also rendered possible the setting up of a cheaper configuration involving both initial and maintenance inputs.

There are achieved very good results. The length of the beach has increased at about 20% whereas its surface triplicates from 35000 up to 120.000 cubic meters. The Physical-sedimentological model proved to be an indispensable tool for big scale corrective studies. It should be considered a valuable mean for optimizing the protection systems both from the technical and economical viewpoints.

The cost of about 2800 USD for linear meter of protected coast, i.e. considerably higher compare to the previously described projects.

- *Supplying to the sea the sediment amounts* needed for the creation of beaches in places where they used to be. This technology can be used in the beaches of Patok and Seman.

Since a long time, the area lying between Sotchi and Batoumi (Black-Sea, Georgia) has been affected by the sea erosion. Starting from the eighties, Georgia lost almost 1400 acres along the 220 km of coastal line. To restore the coastal line the Georgian team choused the method of positive balance accumulation - erosion. The work performed was rigorously scientific. The utilized materials were similar to the materials transported by the local water effluences. The collection of materials was done at the rivers deltas before reaching the coastal sea canyons. Exact calculations were performed to estimate the necessary mass needed for refilling and for ensuring the beach appropriate inclination to protect from the sea erosion.

The monthly control of the beaches enables the evaluation of the expected results, undertake corrections, discover errors and provide the necessary assistance to preserve the obtained balance.

This method requires the compensation of the effects of the sea abrasion with carryovers of new material along the coast. However these balancing refills are moderate compared to the initial restoring process. The recreation of the beach requires on average the depositing of 2,000.000 cubic meter of material (sand, granules) for each km, whereas for preserving the situation created in filled (recreated beaches) in north Batoum an annual fortification of about 150,000 cubic meters for 50 km coast is required.

The obtained results are visible. The coastal line between Sotchi and Batoumi has been restored almost to its initial status. Since 1981 almost 50 km of beach has been recreated. The profiles of the newly created beaches are identical to the natural beaches. Therefore a highly qualitative tourist potential has been setup although not much exploited so far. The

implemented procedures in Georgia's coasts affected by tides with amplitude of 30-40 cm can be successfully implemented elsewhere for bigger tidal amplitudes as well.

- *"Building with nature" techniques.*

"Building with nature" techniques can include the creation, maintenance or restoration of wetlands, marshlands and dune systems. In cases where re-vegetation is required to simulate natural forms of dune or back-shore protection, this may involve the use of horticultural or arboricultural technologies to produce large numbers of seedlings or young plants needed to re-vegetate large areas. Re-vegetation does not disrupt costal processes. Indigenous "pioneer" species for dune stabilization are particularly effective as a "bridging technique" so that natural vegetation can be restored. It's important to choose the right vegetation, planting and fertilization for local condition.

These natural technologies may only accelerate existing morphological trends not change them. Such approaches may only work well for small wave climates and in particular seasons. They have relatively low-cost.

- *Protection of sandy dunes and dune management.*

Sandy dunes are excellent natural barriers for settlements and the entire tourist infrastructure. In our beaches they are at risk principally due to the collection of sand for construction purposes.

The active management of dunes can contribute to the reduction of human-caused stresses on the costal zone and wind damage and allow dunes to retreat landward. Potential drawbacks include reduced access and amenity and eventual land loss on the inland side of dunes.

- *Protective constructions in ports and inhabited areas.*

Constructing parallel dams perpendicular to the coastal line, traps and walls aiming at reducing and scattering the energy of waves. Faced with the need of preserving the sand banks near to the works, the specialists were focuses in improving the construction technology of the protective works. The proposed solution was the modification of the wall architecture abiding it to the environment, the form of waves and reducing their destructive impacts. Later cheaper concrete blocks were situated along the banks struck by the waves to reduce their destructive potential

- *Beaches refilling.*

The Americans have revolutionized the protective system in the sixties, when Army corps of engineers of the US inserted the "beach renourishment" system exerting a big influence in other countries as well. Hundred of American beaches have been systematically refilled.

- *Constructing and reconstructing the street and railway network.*

The road and railway network along the coastal line should be build up on high levels to cope with the envisaged increase of the sea level. The system should also serve the evacuation needs for people of the area in cases of need following sea storms

Coastal and flooding defenses are structures, which essentially create a new strip that that is vulnerable to more frequent flooding. The area behind the defense is less vulnerable. This is a potentially cheaper option than other protection technologies; though it involves the adoption of land use near the river. Such structures can be as following:

- *Gabions* that are low-cost wire or plastic baskets filled with local materials. The baskets vary in size from half to one meter cubed. Baskets are placed together as building blocks to form structures or buried revetments to act as a line of defense in high waters. The great advantage of gabions is that they can be constructed with a minimum of equipment. They are also portable and can be removed if not effective. However, they deteriorate rapidly. Some supervision may be required to fill with suitable size and shape rocks;

- *Hand-placed rock* walls are local rocks combined with other materials. Placed correctly and maintained hand-placed rocks walls have been demonstrated as an effective technology. Human-built structures can be surprisingly better than machine ones, as humans are good at packing and placing rocks. These walls are relatively simple to put in place but still need some skill. However, they have limited capacity to withstand inundations;

- *Breakwaters* are double – sided structures with water on both sides used to dissipate waters and current energy. They can be constructed perpendicular or parallel to the river or seashore. Breakwaters are generally expensive, sophisticated structures;

- *Coastal protection units (concrete units) are* an important technology of coastal structures. Concrete units are precast high-strength concrete structures. They are available in many different shapes and sizes;

- *Groynes* are structures placed perpendicularly to the shore to trap sediments. They re-distribute currents along the coast. Groynes are constructed using wood, local materials, concrete or steel;

- *Revetment* is a medium to high-cost structures, which provide protection to banks or cliffs of erodibile material.

### I.3.3 Other / sectorial technologies

#### I.3.3.1 Agriculture

Most available adaptation options take advantage of the general flexibility of the agricultural systems. However in Albania the margins of flexibility are often constrained by soil quality, water availability and a complex set of economic, technological and institutional barriers. Therefore the autonomous adjustment performed by farmers does not have the appropriate access to the right information and tools.

Thus, there are recommended to upgrade the following adaptation technologies, aimed at reducing runoff, improving water uptake through changes of land topography:

- *Land leveling.*

Land leveling might be described as a technology aiming at improving the water management, which in turn improves weed suppression and control, crop establishment, nutrient use efficiency, crop uniformity and maturation, drainage, yields, profits.

The benefit of land leveling is greater with more uneven land but cost increases with the amount of soil to move.

Land leveling has been practiced by the new settlers for the reduction of runoff and improvement of water uptake in soil surfaces less than 1 ha (average 0,5 ha), however in countries like USA, Australia fields may be leveled up to 4 ha or more. This surface was barely able to cover the survival needs of a farmer's family.

- *Bench terracing and fields subdivisions.*

Bench terracing is a technology, involving the construction of a series of platforms along contours cut into hill slope in a step like formation. These platforms are separated at regular intervals by vertical drops or by steep sides and protected by vegetation and sometimes by packed stones retaining walls. Terrace spacing is generally expressed as the vertical interval between two terraces. The vertical interval is dependent upon the depth of the cut and since the cut and the fill are to be balanced it is equal to double the depth of the cut. Normally the alignment of the bench terraces starts from the ridge and progresses towards the valley. This kind of approach involved soil surfaces bigger than 1 ha and involved several farmers' families with parental ties.

- *Roughening of the land surface.*

Surface roughening or scarification is a technology used for creating unevenness on bare soil to prevent slope erosion and the formation of rills. The primary functions of surface roughening are to reduce erosion potential by decreasing runoff speed, trap sediments, increase filtration of water into the soil and help the establishment of vegetative cover.

Although no to the extent of the previous measures this option has been adopted by some farmers, families settled in ridges nearby a stream.

This set of adaptation measures was mostly spontaneous and lacked a genuine technology approach.

Another major objective, prone to adaptation measures by the Albanian farmers was the conservation of soil moisture and nutrients and reduction of runoff control erosion. To render surfaces productive, farmers need to widen the application of following adaptation measures:

- *Application of minimum tillage.*

Minimum tillage as a technology approach can be defined in many different ways. It encompasses reduced tillage, no tillage and zero tillage. There is no single right method. Minimum tillage aims to retain crop residues and establish crops with the least realistic amount of soil disturbance while still maintaining crop yield.

Minimum tillage requires that each and every process or action, from harvest to harvest, is carefully assessed. It must be thought as a whole package, with practices adapted to the situation. Minimum tillage is not just "not ploughing"

This rather inexpensive but time consuming adaptation approach has been used in many farming practices especially by the new settlers.

- *Application of contour cropping to slope.*

This kind of practice consists in planting of alternate strips of different crops in the same field. The mostly used type of strip cropping in Albania is the contour strip cropping in the vicinity of slopes. However other techniques of field cropping are available such as the field strip cropping and buffer strip cropping

Farmers making use of agriculture land bordering a slope prone to erosion have principally applied this adaptation measure. Mainly crops with a highly developed root system have been selected for the purpose.

- *Use of lower planting densities.*

Another adaptation measure used mainly to conserve soil moisture and nutrients.

The persistence of drought in the coastal areas and the average increase of temperature have exerted a considerable moisture stress in cropping practices in the coastal areas. This has urged farmers to change farming timing to better fit the new climatic conditions.

This has been mostly achieved through

- *Advancing the sowing dates to offset moisture stress during warm period.*

To face the challenge many farmers have incurred into some adaptation measures aiming at improving the water use and availability and controlling erosion.

Some of the already adopted technologies consist in:

- *Use of low cost pumps an water supplies.*

This approach has been strongly supported by the counties water use associations, introduced and promoted through workshops organized with farmers.

- *In some areas the drop irrigation system has been adopted.*

The drip irrigation system consists in a network of pipes and tubes which form a delivery system to feed exact amount of water and agroinputs to each plant directly to its root zone, drop by drop.

Water is applied at low pressure and frequent intervals over a period of time as per plant requirement. This ensures optimization of produce without subjecting the plant to stress or strain.

The introduction of this low cost new technology approach appears to have been well accepted by some farming practices.

- *Digging of line canals or installing low cost pipes.*

Digging of line canals has been extensively applied for irrigation purposes in farming practices of the coastal region. In some areas installing of low cost pipes has been considered as well.

**I.3.3.2 Livestock**

Animal husbandry adaptation practices consist mainly at some measures aiming at keeping the farmhouse microclimate inside the range of thermal neutrality. The set of measures consist in:

- Use of thermal insulating constructing materials;
- Some big poultry breeders have invested in improving the ventilation devices of their premises and inserted in some cases air conditioning facilities.

As far as early identification of the disease in animals and the control of its widespread is concerned:

- Implementation of a rapid serological test for the identification of the disease;

- Stamping out of the infected animals.

**I.3.3.3 Fishery**

As there is a growing concern expressed by the mollusks breeders in terms of ensuring the safety of their products for human consumption, the adaptation technologies proposed need to be extensively adopted are:

- *Setting up of warning systems in the harvesting areas, to alert the onset of abnormal phytoplankton blooms.*

The system involves a system database integrating data flows from the 8 coastal districts of Albania dealing with fishing and bivalve mollusks harvesting areas. The system promptly uploads and downloads data from a specifically developed web site.

- *Implementation of fast screening tests for the detection of biotoxins in shellfish species*.

This kind of technology approach involves the use of fast screening tests for the prompt biotoxin detection and in particular the mouse bioassay-screening test and the lateral flow immunochromatography test. Both techniques are low cost techniques and easily transferable and implement able.

**I. 3.3.4 Forestry**

? *Revision of the forest and pastures development strategy.*

This measure aims at reviweing the forest and pasture development strategy based in the principle of sustainabile delopment and to consider the climate change implications and carbon balance.

It also aims at funding different studies and research projects such as:

- *Identification of the climate change impacts for 27 forest unit of 10 coastal districts.*

The project estimated cost is about 3,025,000 USD. The aim of this project is to know the impacts of climate change and to propose adaptation the actions for each management forest unit.

- *Study of genetically variation among forest tree species and inside species.*

The project estimated cost would be about 90,000 USD. The aim of the project is to know the genetically variation in relationship with actual climate conditions. It is expected to find out and to recommend the best forest species and provenances for adaptation to climate change.

- *Forest tree provenance and progeny tests in different conditions of climate.*

The estimated project cost would be about 120,000 USD. It aims at the experimentation of different forest tree provenance and progenies. It is expected to see the results of adaptation in different climate conditions.

- *The experimentation of fast-growing species to better adapt to new conditions and much capable to sink more $CO_2$ emissions.*

*The estimated project cost would be* about 120,000 USD. The project aims to find and to recommend the best fast-growing forest species, for cultivation to sink more $CO_2$ gas through the experimentation of fast-growing species.

- *The experimentation on rehabilitation of burned forest area.*

*The estimated project cost* would be about 90,000 USD. The aim of the project is to find the best method for rehabilitating the burned forest areas. This is expected to be achieved through experimentation of forest tree by sampling planting and pasture grasses seeds with different methods of land preparation.

- *The study and experimentation on better cultivation systems to adapt the forest to climate changes.*

*The estimated project cost* would be about 140,000 USD. The project aims to find the best cutting systems to favor the adapted species to climate change to occupy the terns with expected conditions and find the best agro-forestry systems in different climate conditions.

**I. 3.3.5 Health**

Polluted water is unsuitable for drinking or other uses. This effect is similar to reducing water supply. In addition, reduced runoff from climate change will most likely increase concentrations of pollutants in the water column. Reducing water pollution effectively increases the supply of water.

Climate changes can lead to the growth and proliferation of many disease-causing vectors, like malaria, hemorrhagic fever, etc. which have as a factor the evolution of insects and other hosts of these diseases. These disturbances can especially grow in coastal zones and mainly in swamps.

The lack of adequate infrastructure in coastal zones can cause environmental, earth and water pollution, causing the increase of rodents, pollution of water from bacteria, different viruses.

Climatic changes can even lead to predicted changes in food safety, mainly in agricultural products of coastal zones also as a result of the decrease of drinking water in the preparation of this food, that may be accompanied by health damages and various bacterial diseases, like gastro-enteritis, enterovirosis etc.

Predicted climatic changes require the intervention and the taking of some prior precautions for preventing the appearance of health damages and illnesses in different populations through:

- *Building a health information system (alert information system).*

It will make possible the right evaluation of the appearance of the vectorial diseases (malaria, hemorrhagic fever, etc.) and the specification of accurate intervention to diminish and erase them.

The existing alert information system cannot carry out the goal, because the connection is not totally electronic. This will require the placement of an electronic information system (starting from the health center – epidemiological regional service – the contagious disease central service. Now this system functions partially through the electronic information system and its upgrading all over the country according to the careful studied structure is required.

The cost for the establishment of an electronic information alert system accounts for approximately 1.5 million USD, (training of the personnel and the correct functioning of the network is included). This cannot be achieved counting only on the state's budget.

- *The improvement of community health infrastructure would make possible a better access of the population for health service.*

The establishment of over 80 health centers fulfills the structure of the existent sanitary map, giving the population access to the health service in the center of the community; at the same time evaluating in continuity the migration of the population and the restoration of the health service by the addition of new health centers. The infrastructural improvement and their provision will improve the quality of the health service and as a result the fast evaluation of the health condition of the population and the enhancement of the health condition.

The construction of health centers needs a budget of approximately 400,000 USD. The study of the sanitary map as a result of the migration of the population would require an amount of about 300,000 USD.

- *The establishment and the operation of the water quality monitoring system and its improvement in the bacteria and viruses containment control.*

By the improvement of the water monitoring schemes and the provision with apparatuses the quality of the monitoring will be enhanced, and at the same time, it will make possible the specification and evaluation of those parameters that actually are not realized. The placement of an analytical monitoring technology with electronic apparatuses will increase the guarantee of the consumers and the decrease the influences to their health.

To evaluate the monitoring scheme of drinking water quality and the master plan for the public health laboratories an amount of approximately 2.5 million USD is required. It cannot be completely provided by the state's budget and funding from donators is needed.

The establishment of the evaluation structures for the different illness causing vectors, because of the climatic changes, such as mosquitoes, rodents etc. are required.

The application of control and permanent monitoring schemes of the disease-causing vectors will be carried out by a trained staff and with the appropriate apparatuses in every region. Their supply with adequate technology, that now doesn't exist, as well as with disinfecting material, will bring the decrease in the damages in the population's health. To achieve this system is required the training of a team of 8-10 members and the specification of a monitoring scheme in all the country; and for the creation of an elaboration technology to fight the vectors a sum of 0.5 million USD will be required, which can not be realized by the state's budget. The World Health Organization can support it.

**I.4 Identification of existing barriers and policy needs**

Technology transfer in coastal zones faces a number of barriers. Many of these barriers are technology specific and site-specific and therefore require specific interventions and solutions. Among all barriers identified already by the team and stakeholder consultations the following ones are considered as the most significant ones: (i) lack of funds to cover the high cost of technologies; (ii) lack of information and knowledge regarding adaptation technologies; (iii) lack of capacities for technology utilization and maintenance; (iv) lack of coordination between different stakeholders and institutions; (v) lack of infrastructure like (electricity interruptions) that damage equipment.

The strongest pathway to adapt to climate change in coastal zone is found to be the public sector. Experiences with other countries show that the technology transfer process in coastal adaptation is mostly government drive process. It is the government that has to create and maintain the environment for an effective and successful transfer of technologies through its supportive policy. It is the government that has to encourage and promote national research institutions and organizations if research hand development activities in favor of adaptation technologies.

**I.5. Define and select actions**

All the adaptation technologies classified as priority ones are represented briefly as project ideas in the Annex II.

# ANNEX I - EVALUATION MATRIXES

- GHG Abatement Technologies
- Coastal Adaptation Technologies

## ENERGY

***Table 1:*** *Evaluation matrix for Energy and Transport*

| | | **Development benefits** (0.3) | | | | | | | **Social acceptability and suitability for country conditions** (0.25) | | **Market potential** (0.25) | | | **Contribution to Climate Change** (0.3) | | **TOTAL** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Technology** | **JW (50)** | **FS (50)** | **HI (100)** | **CB (50)** | **EES (50)** | **EIEI (100)** | **GE (50)** | **Yes (75)** | **No (0)** | **COC (50)** | **CA (75)** | **RPS (50)** | **GHG R (100)** | **AP (50)** | |
| | **Households** | | | | | | | | | | | | | | | |
| 1 | Introducing thermal insulation of households/service (public buildings) which use fuel wood, LPG, electricity and kerosene as energy source for meeting space heating demand; | 50 | 35 | 75 | 50 | 50 | 100 | 50 | 75 | 0 | 50 | 75 | 50 | 90 | 50 | **227.50** |
| 2 | Introducing solar water heaters instead of electric boilers in households/service sector; | 50 | 35 | 100 | 50 | 50 | 75 | 40 | 60 | 0 | 30 | 70 | 50 | 100 | 50 | **217.50** |
| 3 | Introducing LPG instead of electricity for space heating and cooking in households and service sectors; | 25 | 25 | 50 | 30 | 30 | 100 | 30 | 30 | 0 | 40 | 40 | 40 | 50 | 25 | **147.00** |
| 4 | Introducing efficient lighting (incandescent lamps instead of fluorescent ones) in households/service/industry; | 10 | 0 | 60 | 30 | 40 | 50 | 20 | 75 | 0 | 25 | 25 | 30 | 60 | 30 | **128.75** |
| 5 | Introducing thermas times witches in electric boilers (for DHW) in household sector; | 5 | 0 | 30 | 20 | 20 | 20 | 25 | 30 | 0 | 30 | 10 | 10 | 30 | 20 | **71.00** |
| 6 | Introducing prepayment meters in household sector; | 10 | 5 | 40 | 30 | 30 | 30 | 25 | 35 | 0 | 35 | 15 | 20 | 40 | 30 | **98.25** |
| 7 | Introducing efficient refrigerators in household/service sectors; | 15 | 25 | 40 | 20 | 30 | 30 | 40 | 60 | 0 | 30 | 40 | 10 | 30 | 30 | **113.00** |
| | **Service Sector** | | | | | | | | | | | | | | | **0.00** |
| 8 | Introducing central heating and district heating in public buildings and private buildings (hotels etc) in service/industry sector | 50 | 40 | 90 | 50 | 40 | 80 | 30 | 60 | 0 | 40 | 60 | 40 | 75 | 40 | **198.50** |
| 9 | Introducing combined heat and power plants in public buildings and private buildings (hotels etc) in service/industry sector | 50 | 40 | 100 | 40 | 50 | 100 | 40 | 75 | 0 | 35 | 70 | 50 | 90 | 50 | **225.50** |
| | **Industry Sector** | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | Improvements of efficient boilers which use coal/oil coke/residual fuel oil/heavy fuel oil as fuel; | 50 | 45 | 90 | 20 | 50 | 90 | 45 | 70 | 0 | 45 | 60 | 50 | 65 | 45 | **206.25** |
| 11 | Substitution of coal, residual fuel oil and oil coke fired boilers with heavy fuel oil fi red boilers; | 35 | 30 | 80 | 10 | 40 | 70 | 20 | 60 | 0 | 35 | 55 | 30 | 60 | 30 | **157.50** |
| 12 | Improvement of power factor in industrial & service consumers; | 50 | 35 | 80 | 30 | 50 | 100 | 20 | 75 | 0 | 50 | 75 | 50 | 85 | 40 | **209.50** |
| 13 | Introducing efficient electric motors in service/industry sectors; | 25 | 25 | 50 | 20 | 20 | 50 | 10 | 55 | 0 | 30 | 30 | 30 | 50 | 20 | **181.75** |
| | **Transport Sector** | | | | | | | | | | | | | | | |
| 14 | Introducing public passenger transport with buses and trains instead of cars and mini buses ; | 50 | 50 | 90 | 50 | 50 | 70 | 45 | 65 | 0 | 45 | 65 | 40 | 90 | 45 | **215.75** |
| 15 | Introducing freight transport with heavy trucks and trains instead of small trucks and medium trucks; | 35 | 30 | 60 | 20 | 30 | 50 | 20 | 55 | 0 | 25 | 55 | 40 | 80 | 35 | **151.75** |
| | **Agriculture Sector** | | | | | | | | | | | | | | | |
| 16 | Introducing efficient irrigation systems in Agriculture sector; | 40 | 40 | 50 | 20 | 25 | 25 | 30 | 35 | 0 | 20 | 25 | 20 | 60 | 30 | **121.00** |
| | **Transformation Sector** | | | | | | | | | | | | | | | |
| 17 | Introducing mini hydro power plants instead diesel generators; | 50 | 30 | 90 | | 50 | 65 | 45 | 75 | 0 | 40 | 75 | 50 | 90 | 48 | **200.40** |
| 18 | Introducing wind turbines instead of diesel generators; | 30 | 20 | 70 | 30 | 30 | 55 | 25 | 40 | 0 | 30 | 30 | 25 | 70 | 30 | **139.25** |
| 19 | Introducing gas power plants instead of heavy fuel oil power plants; | 20 | 10 | 60 | 30 | 30 | 70 | 10 | 50 | 0 | 20 | 50 | 40 | 60 | 30 | **136.00** |
| 20 | Introducing hydro power plants instead of heavy fuel oil power plants; | 30 | 10 | 70 | 30 | 40 | 60 | 10 | 30 | 0 | 20 | 40 | 35 | 85 | 35 | **142.25** |
| 21 | Introducing landfill gas plants with 70% recovery; | 20 | 5 | 75 | 30 | 35 | 25 | 25 | 55 | 0 | 20 | 10 | 15 | 45 | 35 | **113.50** |
| 22 | Introducing PV electricity instead of diesel generators; | 25 | 15 | 65 | 30 | 45 | 10 | 10 | 25 | 0 | 10 | 10 | 15 | 45 | 25 | **96.00** |

## Land Use Change and Forestry

***Table 2:*** *Evaluation matrix for Land Used Change and Forestry - Selected technologies*

| | | **Development benefits** (0.3) | | | | | | | **Social acceptability and suitability for country conditions** (0.25) | | **Market potential** (0.25) | | | **Contribution to Climate Change (0.3)** | | **TOTAL** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **JW (50)** | **FS (50)** | **HI (100)** | **CB (50)** | **EES (50)** | **EIEI (100)** | **GE (50)** | **Yes (75)** | **No (0)** | **COC (50)** | **CA (75)** | **RPS (50)** | **GHG R (100)** | **AP (50)** | |
| | **Technology** | | | | | | | | | | | | | | | |
| 1 | Development of local forest sustainable development actions plans based on the national ones | 6 | 0 | 30 | 11 | 30 | 21 | 0 | 19 | 0 | 13 | 19 | 13 | 30 | 15 | **58.90** |
| 2 | Monitoring of fire situation to assess the more threatened forest areas from climate change point of view and the desertification scale due to fires | 15 | 0 | 30 | 15 | 30 | 30 | 15 | 19 | 0 | 13 | 19 | 13 | 30 | 15 | **70.00** |
| 3 | Increase of the forest protected area | 6 | 0 | 30 | 15 | 30 | 30 | 15 | 19 | 0 | 13 | 19 | 13 | 30 | 15 | **67.30** |
| 4 | Conversion of the coppice forests to high stem forests by planting the fast-growing species or more capable species to sink $CO_2$ in an area of 20,000 hectares | 15 | 0 | 30 | 15 | 30 | 30 | 6 | 19 | 0 | 13 | 19 | 13 | 30 | 15 | **67.30** |
| 5 | Reforestation of an area of 100,000 ha, on refused agriculture lands, using more capable species to absorb the $CO_2$ and fast-growing species | 15 | 0 | 30 | 15 | 20 | 20 | 25 | 30 | 0 | 30 | 10 | 10 | 30 | 20 | **72.50** |
| 6 | Regeneration of a forest area of about 15,000 ha with more capable species to absorb $CO_2$ by planting the fast-growing species and more adapted species to the expected climate change and the sea level rise, harvesting therefore a mix forest | 15 | 0 | 30 | 15 | 30 | 30 | 6 | 19 | 0 | 5 | 19 | 13 | 30 | 15 | **65.30** |
| 7 | Study of the potential of forest biomass usage for energy purposes in rural area | 11 | 0 | 30 | 15 | 30 | 30 | 0 | 19 | 0 | 13 | 19 | 13 | 30 | 13 | **63.70** |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | Monitoring of the forest situation and forest health situation in relation with climate change and sea level rise | 15 | 0 | 30 | 15 | 30 | 30 | 0 | 19 | 0 | 5 | 19 | 13 | 30 | 15 | **63.50** |
| 9 | Integrate climate change concerns into the National Strategy for forest development and to other related strategies | 15 | 15 | 30 | 15 | 30 | 21 | 15 | 19 | 0 | 13 | 19 | 13 | 30 | 15 | **71.80** |
| 10 | Study on the firewood reduction ways out | 5 | 0 | 21 | 15 | 30 | 21 | 15 | 19 | 0 | 13 | 19 | 13 | 30 | 0 | **57.10** |
| 11 | Develop a new law on forest protection by fire associated with the reorganization of the fire protected service | 6 | 0 | 6 | 6 | 30 | 30 | 0 | 19 | 0 | 13 | 19 | 13 | 30 | 0 | **48.40** |
| 12 | Rehabilitation of burned forest area | 15 | 0 | 30 | 15 | 30 | 21 | 0 | 19 | 0 | 9 | 13 | 9 | 30 | 15 | **59.30** |
| 13 | Identification of firewood needs of farmers and their forest resources to meet them | 6 | 0 | 6 | 6 | 30 | 30 | 0 | 19 | 0 | 13 | 19 | 13 | 30 | 0 | **76.60** |

## Agriculture

***Table 3:*** *Evaluation matrix for Agriculture- Selected technologies*

| | | **Development benefits** (0.3) | | | | | | | **Social acceptability and suitability for country conditions** (0.25) | **Market potential** (0.25) | | | **Contribution to CC** ( 0.3) | | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **JW** (50) | **FS** (50) | **HI** (100) | **CB** (50) | **EES** (50) | **EI** (100) | **GE** (50) | **SA&S** (75) | **COC** (50) | **CA** (75) | **RPS** (50) | **GHG R** (100) | **AP** (50) | |
| | **Technology** | | | | | | | | | | | | | | |
| 1 | Low cost bio-digesters for the manure processing | 50 | 0 | 100 | 50 | 100 | 0 | 50 | 75 | 50 | 75 | 50 | 100 | 50 | **750** |
| 2 | Anaerobic digester lagoon with methane gas recovery | 0 | 0 | 100 | 50 | 100 | 100 | 0 | 0 | 0 | 0 | 50 | 100 | | **500** |
| 3 | Use of urea molasses blocks as a supplement in the diet of ruminants | 50 | 50 | 0 | 50 | 0 | 100 | 0 | 75 | 50 | 75 | 50 | 100 | 100 | **700** |
| 4 | Implementation of user-friendly inoculants formulations for promoting the nitrogen fixation process | 0 | 50 | 0 | 0 | 100 | 100 | 0 | 0 | 50 | 50 | 0 | 50 | 0 | **400** |

## Waste

***Table 4:*** *Evaluation matrix for Waste - Selected technologies*

| | | **Development benefits** (0.3) | | | | | | | **Social acceptability and suitability for country conditions** (0.25) | **Market potential** (0.25) | | | **Contribution to CC** ( 0.3) | | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **JW** (50) | **FS** (50) | **HI** (100) | **CB** (50) | **EES** (50) | **EI** (100) | **GE** (50) | **SA&S** (75) | **COC** (50) | **CA** (75) | **RPS** (50) | **GHG R** (100) | **AP** (50) | |
| | **Technology** | | | | | | | | | | | | | | |
| 1 | Reducing the MSW generated | 3 | 0 | 9 | 3 | 15 | 9 | 9 | 15 | 5 | 0 | 1.25 | 21 | 6 | **96.25** |
| 2 | Recycling and Composting in order to reduce the organic matter | 12 | 0 | 12 | 3 | 18 | 12 | 9 | 15 | 5 | 5 | 7.5 | 21 | 12 | **125.5** |
| 3 | Reduce the quantity of organic material in waste landfill | 3 | 0 | 10.5 | 3 | 15 | 9 | 18 | 0 | 5 | 0 | 7.5 | 18 | 6 | **95** |
| 4 | Construction of sanitary landfills with recovery gas system | 6 | 0 | 15 | 9 | 24 | 18 | 18 | 15 | 12.5 | 7.5 | 2.5 | 24 | 18 | **169.5** |
| 5 | Construction of MSW incinerator with energy utilization | 6 | 0 | 21 | 12 | 24 | 21 | 12 | 0 | 17.5 | 0 | 0 | 15 | 3 | **131** |
| 6 | Construction of WWT plants. | 6 | 0 | 21 | 12 | 24 | 9 | 6 | 15 | 10 | 5 | 5 | 9 | 6 | **128** |

***Table 5:*** *Evaluation matrix for Industry- Selected technologies*

| | | **Development benefits** (0.3) | | | | | | | **Social acceptability and suitability for country conditions** (0.25) | **Market potential** (0.25) | | | **Contribution to CC** ( 0.3) | | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Technology** | **JW** (50) | **FS** (50) | **HI** (100) | **CB** (50) | **EES** (50) | **EI** (100) | **GE** (50) | **SA&S** (75) | **COC** (50) | **CA** (75) | **RPS** (50) | **GHG R** (100) | **AP** (50) | |
| 1 | Steel production by using the stock of the scrap | 50 | 0 | 100 | 40 | 100 | 100 | 0 | 50 | 25 | 50 | 30 | 100 | 40 | **209** |
| 2 | The use of hermetic technologies for cement production | 50 | 0 | 100 | 50 | 90 | 90 | 0 | 75 | 50 | 50 | 50 | 100 | 50 | **204** |
| 3 | Small interventions in the main process of Ferro-chromium production | 50 | 0 | 90 | 40 | 80 | 80 | 0 | 40 | 25 | 50 | 50 | 80 | 30 | **176.25** |

## Climate monitoring

***Table 6*** *Evaluation matrix for climate monitoring*

| **Technology** | **Criteria** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Development benefit | | | | | | | | | Market potential. | | Contribute to CC | |
| | JW | FS | HI | CB | EES | EI | GE | SA&S | COC | CA | RPS | GR | AP |
| Meteorological automatic station | | | | + | + | + | | + | + | + | + | | |
| Satelite remote sensing | + | | | + | + | + | | + | | | | | |
| Wind records | | | | | | + | | + | | | | | |
| Pluviograph | | | | | | + | | + | | | | | |
| Pyranograph | | | | | | + | | + | | | | | |
| Predicting climate modeling | | | | + | + | + | | | + | + | + | | |
| GIS | + | | | + | + | + | | + | | + | + | | |
| Flood warning and emergency response systems. | + | + | + | + | + | + | | + | + | | | | |
| Better management of rain/waste water | + | + | + | + | + | + | + | + | + | + | + | | |

## Water Resources

***Table 7*** *Evaluation matrix for water resources*

| Technology | Criteria | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Development benefits | | | | | | | | | Market potential | | Contribution to CC | |
| | JW | FS | HI | CB | EES | EI | GE | SA&S | COC | CA | RPS | GR | AP |
| Flood warning and emergency response | + | + | + | + | + | + | | + | + | + | + | | + |
| Monitoring of sea and shoreline | + | | | + | + | + | | + | + | + | + | | + |
| GIS | + | | | + | | | | + | + | + | | | |
| Modernization of the Hydraulic laboratories | | | | + | + | + | | + | + | + | + | | |
| Satellite remote sensing | | | | + | | + | | + | | + | + | | |
| Construction of defences coastal structures Gabions, Hand-placed rock walls, Coastal protection units | + | + | + | + | + | + | + | + | + | + | + | + | |

## Agriculture

***Table 8*** *Evaluation matrix for agriculture*

| Technology | Criteria | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Development benefits | | | | | | | | Market potential | | | Contribution to CC | |
| | JW | FS | HI | CB | EES | EI | GE | SA&S | COC | CA | RPS | GR | AP |
| Land leveling | + | + | | + | | | | + | | | + | | + |
| Application of minimum tillage | | + | | | + | | | + | | | + | + | + |
| Application of contour cropping to slope | + | + | | + | + | | | + | | | + | | + |
| Advancement of sowing dates | | + | | | | | | + | | | + | | + |
| Introduction of salt tolerant and drought resistant plant species in arid areas. | + | + | | + | + | + | | + | + | + | + | | + |
| Use of thermal insulating material in farmhouse construction | + | + | + | + | | + | | + | + | + | + | + | + |
| Setting up of an "Alert" system for the early warning of abnormal toxic phytoplankton growth and biotoxins in sea water and bivalve mollusks. | | + | + | + | | + | | | | + | + | | + |
| Introduction of vacuum packaging for food preservation | + | + | + | + | | + | + | + | + | + | + | + | + |
| Setting up of an network "alert" system for the identification of vector borne diseases in farm animals | + | + | + | + | | + | | | | + | + | | + |

## Forestry

***Table 9****Evaluation matrix for forestry*

| | Technology | Criteria | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Development benefits | | | | | | | | Market potential | | | Contribution to CC | |
| | | JW | FS | HI | CB | EES | EI | GE | SA&S | COC | CA | RPS | GR | AP |
| 1 | Develop the Forestry Development Strategy that address the climate change issue | + | + | + | + | | + | + | + | + | + | + | + | + |
| 2 | To prepare the management planes guide basing to sustainability principle of development and …… | + | + | + | + | | + | + | + | + | + | + | + | + |
| 3 | To review, all the prepared development strategies (of Agriculture, Tourism …., etc.) considering the implication of climate changes to have a sustainable development. | + | + | + | + | + | + | + | + | + | + | + | + | + |
| 4 | Identification of the climate change and sea level rise affects for 27 forest units of 10 coastal districts. | + | + | + | + | | + | + | + | + | | + | + | + |
| 5 | Affectivity of forestry investments to climate change. | + | + | + | + | | + | + | + | + | | + | + | + |
| 6 | Study to increase the protection forest area. | | + | + | + | | + | + | + | + | | + | + | + |
| 7 | Study on desertification scale, due of fires. | + | + | + | + | | + | + | + | + | | + | + | + |
| 8 | Study and experimentation on better cultivation systems to adapt the forest to climate changes. | | + | + | + | | + | + | + | + | | + | + | + |
| 9 | Experimentation on rehabilitation of burned forest area. | + | + | + | + | | | + | + | + | | + | + | + |
| 10 | Study on genetically variation among forest tree species and inside of each one specie. | | + | + | + | | + | + | + | + | + | + | + | + |
| 11 | Forest tree provenance and progeny tests in different conditions of clime. | + | + | + | + | | + | + | + | + | + | + | + | + |
| 12 | Experimentation of fast-growing species to adapt better in new condition and more capable to sink more C02 gas. | + | + | + | + | | + | + | + | + | + | + | + | + |
| 13 | Study and experimentation on rehabilitation of degraded forests. | + | + | + | + | | + | + | + | + | + | + | + | + |
| 14 | study and experimentation on the productivity increasing of the low productivity forest. | + | + | + | + | | + | + | + | + | + | + | + | + |
| 15 | Preparing of Sustainable Development projects for 10 coastal districts | + | + | + | + | + | + | + | + | + | + | + | + | + |
| 16 | Preparing of management planes for 27 forest units of 10 coastal units, after the guide to consider the climate change. | + | + | + | + | | + | + | + | + | + | + | + | + |
| 17 | Applying projects to rehabilitate the degraded forest area of 800 ha. | + | + | + | + | | + | + | + | + | + | + | + | + |
| 18 | Applying projects to converse the coppice forests in high stem forests with the same species mainly broadleaf species in an area of 9.000 ha. | + | + | + | + | | + | + | + | + | + | + | + | + |
| 19 | Applying projects to converse the coppice and shrub forests in high stem forests planting the fast-growing species or more capable species to sink C02 gas always to have mix forests in an area of 9.800 ha. | + | + | + | + | | + | + | + | + | + | + | + | + |
| 20 | Applying projects to reforestate about a area of 8.300 ha, especially on the eroded lands and refused agriculture lands, ……. | + | + | + | + | | + | + | + | + | + | + | + | + |

## Tourism

***Table 10*** *Evaluation matrix for tourism*

| Technology | Criteria | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Development benefits | | | | | | | | Market potential | | | Contribution to CC | |
| | JW | FS | HI | CB | EES | EI | GE | SA&S | COC | CA | RPS | GR | AP |
| 1. Data gathering | + | + | + | + | + | + | | + | + | + | + | | + |
| 2. Construction of a series of dams intensive refilling of the beaches through a temporary bypassing | + | | | + | + | + | | + | + | + | + | | + |
| 3. Construction of dams parallel to the coast … protection of the elevated rocky coast | + | | | + | + | + | | + | + | + | + | | + |
| 4.Construction of a system of dams above and under the sea level and the refilling of the beach with sand retrieved from the sea. | + | | | + | + | + | | + | + | + | + | | + |
| 5. Supplying to the sea the sediment amounts | + | | | + | + | + | | + | + | + | + | | + |
| 6 "Building with nature" techniques. | + | + | + | + | + | + | + | + | + | + | + | | + |
| 7 Protection of sandy dunes and dune management. | | | | + | + | + | | + | + | + | + | | + |
| 8 Protective constructions in ports and inhabited areas. | + | | + | + | + | + | + | + | + | + | + | | + |
| 9 Beaches refilling. | + | | | + | + | + | | + | + | + | + | | + |
| 10 Constructing and reconstructing the street and railway network | + | | + | + | + | + | + | + | + | + | + | | + |
| Ensuring the efficiency and the upgrading of draining and pumping system | + | | + | + | + | + | | + | + | + | + | | + |
| 12 Preserving the river beds and ensuring their further deepening | + | | + | + | + | + | | + | + | + | + | | + |
| 13 Controlling and eventually stopping the collection of solid matters from the river beds | + | | + | + | + | + | | + | + | + | + | | + |

***Table 11:*** *Summary table of priority coastal adaptation technologies (ordered according to the priority)*

| Priority | Climate | Water | Agriculture | Forestry | Tourism | Health |
|---|---|---|---|---|---|---|
| I | Better management of rain/waste water | Flood warning and emergency response | Introduction of vacuum packaging for food preservation | Preparation of Sustainable Development Projects for 10 coastal districts | Construction of defense coastal structures | Monitoring system for the quality of drinking water |
| II | Flood warning and emergency response systems | Monitoring of sea and shoreline | Use of thermal insulating material in farmhouse construction | Preparing of management plans for 27 forest units of 10 coastal units that take climate change into consideration. | "Building with nature" techniques. | Improvement of health infrastructure ans services |
| III | Meteorological automatic station | Modernization of the hydraulic laboratories | Introduction of salt tolerant and drought resistant plant species in arid areas. | Study and experimentation on cultivation systems. | Data gathering (GIS) | Health information system (alert information system) |
| IV | GIS | GIS | Setting up of an network "alert" system for the identification of vector borne diseases in farm animals | Study of desertification scale, due of fires. | Protective constructions in ports and inhabited areas. | Improvement of structures for diagnosis of different disease-causing vectors |
| V | Predicting climate modeling | Satellite remote sensing | Application of contour cropping to slope | Experimentation on rehabilitation of burned forest area. | Ensuring the efficiency and the upgrading of draining and pumping system | |
| VI | Satelite remote sensing | | "Alert" system for the early warning of abnormal toxic phytoplankton growth and bio toxins in seawater and bivalve mollusks. | Study of genetically variation among forest tree species and inside each species. | Preservation of river beds and ensuring their further deepening | |
| VII | | | Land levelling | Fast-growing species to adapt in new conditions | Construction of a series of dams intensive refilling of the beaches through a temporary bypass | |
| VIII | | | Application of minimum tillage | Study and experimentation on rehabilitation of degraded forests | Construction of dams parallel to the coast …<br>Protection of the elevated rocky coast | |
| IX | | | Advancement of sowing dates | Implementation of projects for rehabilitation of the degraded forest area through conversion of coppice forests to high stem fo rests with the same species in an area a fast-growing species. Reforestation of the eroded lands and refused agriculture lands, and rehabilitation of the burned forest. | Construction of a system of dams above and under the sea level and the refilling of the beach with sand retrieved from the sea. | |
| X | | | | Study and experimentation on rehabilitation of degraded forests | Supplying to the sea the sediment amounts | |

# ANNEX II – PROJECT IDEAS

- GHG Abatement Technologies
- Coastal Adaptation Technologies

## ENERGY

| | |
|---|---|
| ***Project 1*** | *Introducing thermal insulation of households/service (public buildings), which use fuel wood, LPG, electricity or kerosene as energy source for meeting energy demand for space heating and air conditioning.* |
| **Sector** | Energy |
| **Objectives** | The overall objective of the project is to increase security of supply for electricity and heat in Albania by promoting the least cost solution in demand side through thermal insulation of the outside areas of the buildings in service (public) and households sectors (private buildings).<br><br>The immediate objective of this project is to enable the different Albanian stakeholders to take decisions regarding potential projects within thermal insulation of outside areas of public and private building stock.<br><br>Other related objectives are:<br><br>▪ Significant increases of the investment in Energy efficiency and savings in Albania's new private households and new public buildings through implementation of Energetic Building Code of Albania;<br>▪ Significant increase of energy supply security by increasing energy efficiency, which in same time will reduce GHG and acid rain gases and will be environment friendly;<br>▪ Significant increases of bankable projects in energy efficiency through demand side management (by introducing thermal insulation in existing and new stock of buildings) measures;<br>▪ Improvement of data reliability on energy efficiency in household and public buildings. |
| **Country** | **Albania** |
| **Budget,** | 54.28 million USD |
| **Project linkage to national priorities** | Climate change issue is seriously addressed in the National Energy Strategy which complements the National Strategy on Socio Economic Development (NSSED). Among other policies addressed in the National Energy Strategy is the thermal insulation of the buildings. In this regard the proposed project is expected to contribute in the implementation of the energy strategy and definitely contribute to the attainment of the sustainable development and Millennium Development Goals/Goal 7. Also the project will contribute in the meeting of the Albania's commitments under the UNFCCC, where it is a Party. |
| **Background** | The availability of energy supply in Albania is one of the key limitations on economic growth and power reduction. Electricity and other forms of energy are key inputs to support economic growth, income generation and job creation, industrial activities, commerce, the service sector, communications and transport. During the Albanian transition period, the chronically shortage in power supply has taken forms of sharp crisis especially during the winter periods. The increasing need for power supply in Albania cannot be met with only country resources anymore. Although the installed national productive capacity is around 1,600 MW, since it is based on hydropower production, it lacks efficiency and operates under its nominal capacity because of shortage on water resources as a consequence of prolonged dry seasons. In general the national power production satisfies actually less than 2/3 of the consumption needs, the balance is covered through imports and load shadings. Other reasons contributing to the worsening of the energy situation include the lack of sizeable investment in power production, the delays in sector regulation, unbundling and liberalization, the mismanagement of demand and supply balance, the weak cost recovery, the subsidized electricity costs, the pattern of energy consumption, the losses in the power transmission and distribution networks and the level of abuses and non-payment of electricity bills, which is still high. Since the electricity demand is estimated to increase with a rate of $8-9$ % per year during the coming years, it is evident that there is a need for new generation capacities, which should be mainly thermal, in the near future.<br><br>The households and service energy sectors are one of the important energy consuming sectors in Albania. Its importance is highlighted by the fact that it consumes large quantities of electricity, LPG and fuel wood, which has contributed to the country's current severe energy crisis. 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 regions by a 110 kV transmission line that is far away from the power plants. This phenomena has brought in a very low level of voltage in electricity supplied, which is down 150 V in household sector. 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.<br><br>Existing building stock in Albania is responsible for more than 48% of final energy consumption, a figure which will become higher in the future due to the coming stock to be built. The new stock is built without any idea to put in force the existing building code and the new energetic building code, which is prepared recently by National Agency of Energy. This is why it has much sense to know the potential for the penetration of thermal insulation in households and public buildings.<br><br><u>Thermal insulation in households buildings</u><br>In households, most part of energy resources is consumed for space heating, while most of the dwellings are not thermo-insulated, they have old windows and mostly electricity is used for space heating. Knowing that the main heat losses with transmittance and ventilation come from outside walls, roof/terrace and windows, the analysis has taken into consideration these elements separately and together.<br><br>▪ *Thermal insulation of roofs and terraces*<br>Normally heat losses from the roof/terrace are estimated at approx. 25-30% of total losses. Taking this into consideration, energy conservation from thermo insulation of roof/terrace was calculated through respective programs prepared by National Energy Strategy for different types of buildings. Table 5.1 foresees the thermo insulation percentages, for each zone (Albania is divided into three zones as per grouped heating degree days). The analyses include the investments starting in 2004 and terminating in 2015, for the whole existing stock to be thermo insulated. Based on calculating programs of heat losses and LEAP software, energy |

conservations from implementing of this measure together with the saved cost per kWh in 2015, are estimated and presented in table 1 as well.

***Table 1:*** *Main indicators of terrace/roof thermal insulation analysis*

| Name | | % of thermal insulation in 2015 | Total saving ktoe | Unit cost $/kWh |
|---|---|---|---|---|
| Zone I | Urban | 25 | 2.06 | 0.0288 |
| | Rural | 20 | 0.53 | 0.0592 |
| Zone II | Urban | 30 | 1.38 | 0.0283 |
| | Rural | 25 | 0.93 | 0.0580 |
| Zone III | Urban | 35 | 0.81 | 0.0255 |
| | Rural | 30 | 0.75 | 0.0385 |

As shown by the above analysis, the interference of thermal insulation in the existing stock is very effective, since the unit cost of thermal insulation varies from 2.6-5.8 cent/kWh.

- *Change of windows from single to double glasses*

Theoretically, heat losses through transmission and ventilation from the windows are 15-20% of the total losses in a dwelling. For Albania, energy savings from substitution of existing windows with duralumin double glasses ones was calculated according to the respective programs prepared by National Energy Strategy. As a consequence, for each zone are foreseen the percentages of changing the old windows with double glass duralumin ones, as given in Table 5.2. Investments are foreseen to start in 2004 and terminate in 2015. Energy saved from implementing of this measure was also calculated for each zone, as well as saved cost per kWh in 2015. All parameters are given in table 2.

***Table 2:*** *ain indicators of installing double glass windows analysis*

| Name | | % Installing double glass windows in 2015 | Total saving ktoe | Unit cost $/kWh |
|---|---|---|---|---|
| Zone I | Urban | 80 | 2.47 | 0.047 |
| | Rural | 70 | 1.18 | 0.057 |
| Zone II | Urban | 80 | 1.64 | 0.037 |
| | Rural | 70 | 1.12 | 0.068 |
| Zone III | Urban | 80 | 0.97 | 0.024 |
| | Rural | 70 | 0.91 | 0.043 |

As indicated by the above analysis, the introduction of duralumin windows with double glasses is efficient with an investment unit cost of 2.4-6.8 cent/kWh.

- *Thermal insulation of outside-walls*

The third element analysed are the sidewalls, where transmission thermal losses reach a level of 40-50%. Based on world experience and calculations made by NAE for different types of buildings, for each zone are foreseen the percentages of sidewalls thermo insulation, given in table 3. As indicated by the table, the percentage of sidewalls thermo insulation in the third zone will be higher due to greatest effect. Investments are foreseen to start in 2004 and terminate in 2015. Energy saving from implementing of this measure was also calculated for each zone as well as unit cost per kWh of saved energy in 2015. All parameters are given in table 3.

***Table 3:*** *Main indicators of thermal insulation of outside wall analysis*

| Name | | % Installing outside walls in 2015 | Total saving ktoe | Unit cost $/kWh |
|---|---|---|---|---|
| Zone I | Urban | 15 | 3.67 | 0.013 |
| | Rural | 10 | 0.96 | 0.023 |
| Zone II | Urban | 20 | 2.46 | 0.014 |
| | Rural | 15 | 1.68 | 0.023 |
| Zone III | Urban | 25 | 1.45 | 0.011 |
| | Rural | 20 | 1.35 | 0.022 |

*Thermal insulation of public buildings*

In the service sector, particularly in the public buildings, most part of energy resources is consumed for space heating. The existing stock of buildings is not thermo insulated, it has old windows and in most cases electricity is used for space heating. Based on world experience and studies carried out by NAE and other institutions, and taking into account that the main losses of heat in buildings are those from heat transmission from walls, roofs and terraces as well as those from ventilation and transmission from windows, was foreseen that the public building stock till 2015 will be thermo insulated and the existing windows substituted with double glasses windows. These measures are foreseen to save energy from 0.5 ktoe in 2004 to 10.5 ktoe in 2015, affecting on electricity and fuel wood consumption decline.

It should be emphasized that this is a measure with a longer-term effect in the energy save, based on the longevity of thermal insulation, which is 40 years. In the figure 1 is shown the energy saving of public buildings and the figure 2 shows investments for thermal insulation of public buildings (US$ million).The total investments for thermal insulation till 2015, are foreseen to be 18.8 Million US$ and energy saving 25.5 ktoe. The total unit cost of three thermal insulation interferences is within the range of 1.1-6.8 cent per kWh. The calculation of unit cost does not take into consideration the fact that the energy savings profits will continue after 2015, otherwise this fact would reduce even more the unit cost of energy savings. As a conclusion, thermal insulation is a measure

with economic profit and necessary to be implemented. The positive effect of thermal insulation will be even higher (and unit cost would be even lower) if one takes in consideration the effect on energy demand reduction regards air conditioning.

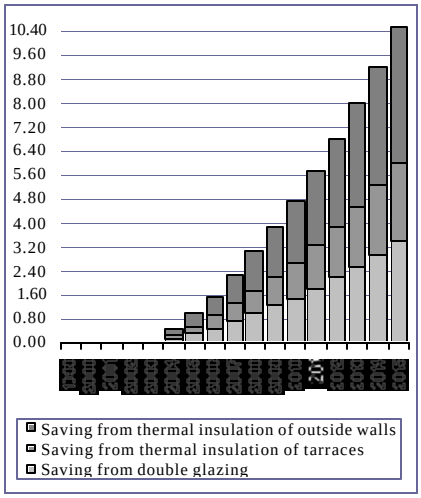



***Figure 1:*** *Energy save from thermal insulation of public buildings (ktoe)*

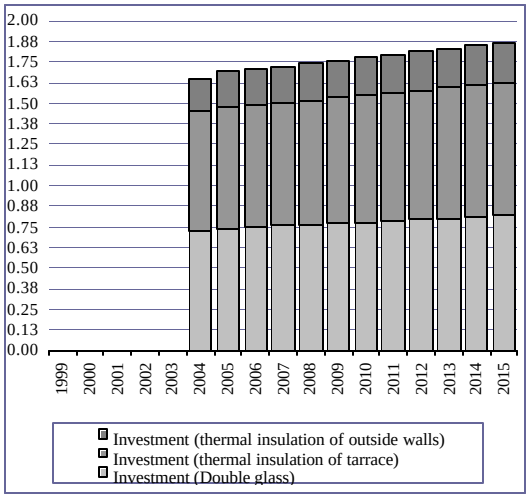



***Figure 2:*** *Investments for thermal insulation of public buildings (US$ million)*

**Expected outputs**

The main argument in favor of thermal insulation is that it enables an advantage of meeting space heating demand (and air conditioning demand) with less energy commodities. Other detailed specific benefits are:

- Increased energy security of supply in general and electricity supply in particular by introducing thermal insulation in service and households sectors;
- National energy efficiency improved;
- Reduced levels of GHG emissions and other environmental pollution substances such as $SO_2$, NOx which cause the acid rain phenomena;
- Promoted investments and job created in service and households sectors;
- Increased reliability of energy data necessary for household and service sectors concerning energy commodities in space heating and air conditioning;
- Estimated investment needs and a cost benefit analysis of a short-term, 3-5 years, and programme aiming at improving the energy efficiency in building stock;
- Increased levels of trained stakeholders.
- Higher oil and total self-sufficiency, which mean lower trade deficit from energy sector.

**Stakeholders to be involved**

NAE, the EEC, Ministry of Industry and Energy, Ministry of Environment, Ministry of Finance; Environmental NGOs; different private installing companies of thermal insulation (ESCO model) concerning all issues of thermal insulation;

**Required Technologies**

After the Second World War Eastern European countries (including here even Albania) had a very large housing problem. An extreme demand for modern dwelling existed. The requirements at a short construction time, low costs and industrialized production at building elements led to mass-construction and prepared concrete building. Unrealistically low energy prices and lack of appropriate building materials has resulted in buildings with low levels of thermal insulation, little or no means of regulating the heating levels and individual metering or billing of energy consumption. This has resulted in very high-energy consumption especially for pre-fabricated buildings.

Four principally different types of buildings have been designed:

- Wall made of heavy-weight solid concrete blocks with all elements as load carrying parts;
- Wall-size solid concrete elements with doors and windows installed, already at the concrete plant;
- Insulation in the corners to reduce thermal bridges because of complaints from the occupants about the low levels at thermal comfort. The size of the rooms and the wall elements is increased. Also the window area is increased and a different type of concrete is used to improve the thermal performance;
- From the beginning at 1980-s the wall had a layer at interrelation (mainly polystyrene) between two layers at light-weight concrete.

In particular buildings erected between the 1950 and the mid at 1970 have higher energy consumption levels. About 60% of the total amounts at prefabricated buildings are of this type. Buildings constructed later have a better thermal performance but still have very low level of insulation.

Insulation methods
It may be tempting only to insulate the parts of the buildings where large amounts of heat are lost, like the roof and the gables, to reduce costs, which have been the most, used method in eastern and central European countries. In many cases, however, it is not a very good economic solution, because the major costs for renovation for buildings are often the costs for scaffolding and workers and the material itself. If the performance of the whole building is improved, the investments for energy saving will be much lower. In

some cases partial insulation can even make the situation worse and increase the heat losses. If the insulation material is glued directly into the gables, which has been the common method for applying insulation in eastern and central European countries, large movements in the wall elements can cause cracks in the insulation material and the concrete, more heat to escape through the envelope and to increase the amount of thermal bridges. To achieve maximum effect from retrofitting and to reduce the energy losses from the building surface, it is necessary to access how the following areas can be improved:

- Walls
- Roofs
- Basements
- Windows/doors
- Opening in the building surface.

Insulation of walls
Thermal retrofitting of wall can be carried out into different ways:

- Internal insulation
- External insulation

For both types of insulation the major advantages are decrease in energy consumption as well as the increase in thermal comfort due to increased wall surface temperatures.

*Interior Insulation*
This method is mainly used for retrofitting of older building where the facade must be kept in the original form, for buildings only use occasionally and where the occupants are interested in individual solutions The advantages with interior insulation are that the costs of material and the costs of installation are relatively low. However the following problems can arise with interior insertion:

- Front damage to pipe in the outer wall;
- The outer walls are exposed to the weather, which means thermal movements in the walls. Cracks can occur;
- Existing moisture problems must be dealt with before the fitting of the insulation;
- It is difficult to install the insulation behind pipes, radiators etc;
- Electrical wiring must be reinstalled and condensing water can penetrate wall sockets;
- The dew point will be in the wall construction or on the surface of the inside of the wall which can lead to severe damage due to condensation;
- It is practically impossible to avoid thermal bridges.

This method should, due to the above-mentioned problems, be avoided if other possibilities exist.

*Exterior Insulation*
Using exterior insulation can eliminate existing thermal bridges, concrete damage can be repaired and significantly reduced losses and the lifetime of a building will be extended. Problems with condensation are generally avoided, the dew point is not in the wall anymore and the construction is kept dry. Before installing an exterior layer of the insulation the load bearing abilities of the wall must be testing and existing damage and cracks must be repaired. Furthermore it is often necessary to test the concrete. The costs for installation can be reduced significantly if it is carried out in combination with general renovation of the building: composite constructions with a ventilated air void, and direct application of the insulation without an air void.

*Roofs*
The installation of roof insulation is relatively easy and the pay-back period is short. No scaffolding is required and the insulation can be fitted either directly on the existing roof or under the roof. The heat losses from roofs can be very large due to night-time radiation to the sky. Large amounts of energy can therefore be saved by installation of insulation.

*Flat roofs/heated roofs*
In this case, no cavity exists between the roofing surface and the existing insulation. A vapour barrier exists on the heated side of the insulation. Insulation on the inside of the roof must be avoided. A reverse roof is better, where e.g. polystyrene boards can be quite directly onto the existing water-proof roofing felt with a layer of gravel that is at least as thick as the layer of polystyrene.

*Cold roofs*
Here a void exists between the existing layer of insulation and the water-proof layer of roofing felt. The void is ventilated vapour barriers exist on the inside of the roof. The vapour barrier is removed and an extra of insulation can be installed as well as new vapour barrier.

*Pitched roofs*
Mineral wool bats can be installed between the wooden beams. A vapour barrier on the "worm" side of the insulation is necessary. In northern European Countries a thickness of 20 cm or more is common for roof insulation.

*Basements*
To avoid large losses from basements it is also necessary either to insulate the ceiling of the basement or to continue the external insulation to at least 30 cm under the ground level. If this is not done the floor will act as a thermal bridge.

*Windows and doors*
The windows are normally the weakest points of a building from energetic point of view. The losses can be divided into transmission losses and ventilation losses. The transmission losses through glass are 4-6 times bigger than the walls and often-thermal bridges exist between the frame and the wall. The ventilation losses also can be very high if the windows do not close tight or if there are gaps between the frame and the wall. Large amounts of heat are lost when the windows are used for fresh air supply. Installation of double glassing can reduce the transmission losses from windows. The k-value can be reduced from 3-5 [$W/m^2$ K] to lower than 2

[W/m$^2$ K]. New types of glass materials exist with k-value of about 1.2 [W/m$^2$ K], but are still in the developing phase. Weather proofing of the windows (foam material, tape or cloth) can reduce the unwanted ventilation losses significantly. To reduce the thermal bridges it is necessary to improve or replace the material between the frame and the wall.

**Reduction potential of GHG emissions**

A reduction in the amount of pollution follows from the more efficient energy commodities will come from the penetration of thermal insul ation in private and public buildings.

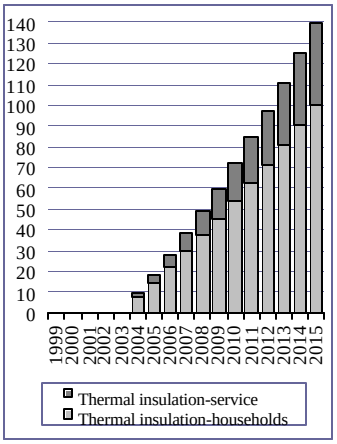



***Figure 3:*** *GHG reduction from the introduction of thermal insulation measure (1000000 kg)*

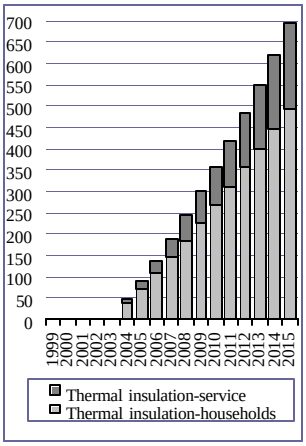



***Figure 4:*** *$SO_2$ reduction from the introduction of thermal insulation measure (1000 kg)*

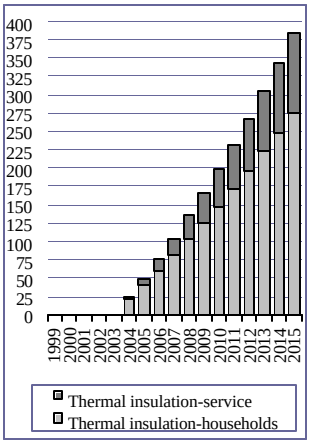



***Figure 5:*** *NOx reduction from the introduction of thermal insulation measure (1000 kg)*

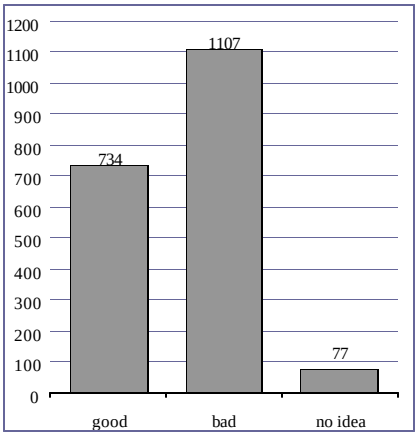
In the figures 3, 4 & 5 are shown the reduction of green houses gas emissions and $SO_2$ & $NO_x$ from the penetration of thermal insulation measure. As it is shown in the figure the amount of reduction for GHG, $SO_2$ and $NO_x$ will be respectively 139.4 Million kg, 693.6 thousand kg and 383.3 thousand kg in the year 2015. The cost of GHG reduction is 6.5 cent/kg.

**Barriers and additional information**

Most of the barriers regarding to thermal insulation are related to the identified through surveys carried our concerning the thermal insulation situation of existing stock of buildings. Questions and results made during the surveys are as following:

*How is the thermal insulation state of your dwelling?*

The main scope of this question is to know in what state are the dwellings from thermal insulation point of view (as is shown in the figures 6 & 7). The processing of data received from the analyses of questionnaires indicates that 59% of them (1187 from 2000 interviewers) are in bad state.



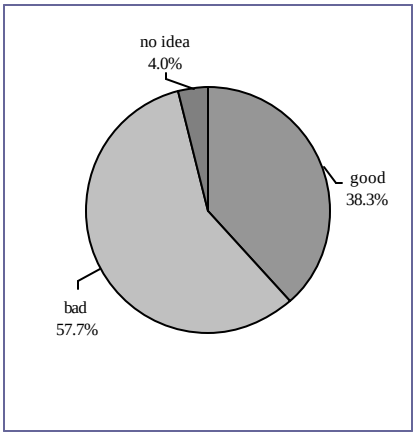
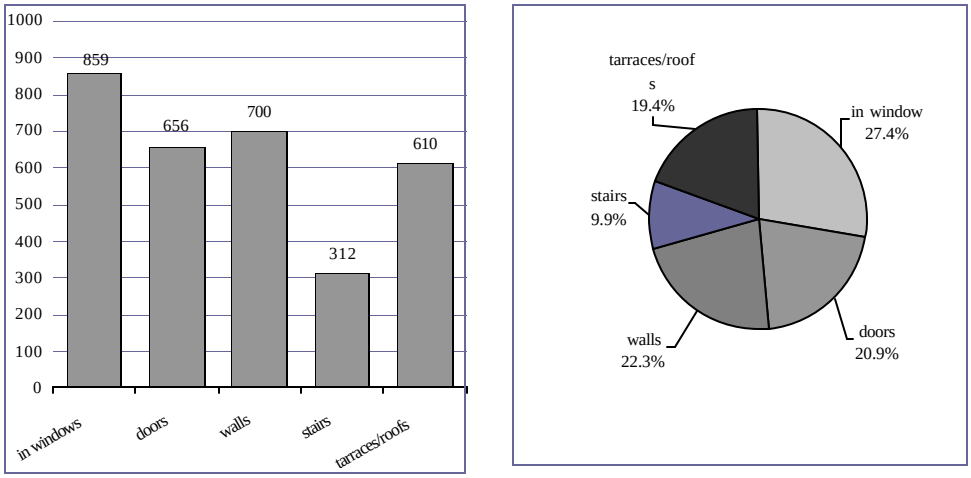




***Figure 6 & 7:*** *Number of interviewers related with thermal insulation state of their dwellings.*

Second group of 37% declares that their dwellings are in good conditions seeing it from thermal insulation point of view. The third group, which is 4% of all interviewers, accepts that they have no idea concerning thermal insulation state of their dwellings. From this analysis result a main conclusion: **the existing dwellings stock is in very bad conditions as regarding thethermal insulation, consequently all energetic institutions engaged at the dwellings energetic state should have as a crucial problem the dwellings thermal insulation**. The improvement of the existing dwellings stock from the thermal -insulation point of view and construction of new dwellings based on the new energetic code (that is approved already by the Albanian Parliament on September 2002) will make possible the saving of energy sources that are used for the space heating. On the other side the energy saving which results

consequently from the dwellings thermal insulation will make possible to burn less fuel in order to fulfil the heating needs and consequently less chemical polluters will be thrown on the environment.

*And if it is bad, where is it?*
In the analysis done for the question 2 resulted that 59% of the dwellings (houses) in Tirana city are in bad conditions. Immediately after this observation, naturally is done the other question: in which elements the thermal-insulation is in worst conditions? Figures 8 & 9 illustrate graphically the interviewers' distribution as per their answers on this question. From elaboration of the survey data results that 27% declared that windows are the more problematic elements. From the energetic building theory it is known that the bad condition of windows has two big defects: first – there are big losses because of the increased ventilation and second - the heating losses because of thermal-insulation are increased, i.e. when the windows are in bad conditions we have a high heating transmission coefficient. The second more problematic elements, as is shown by the figures, are the lateral walls, which consist in 24% of the interviewers' answers. The bad conditions of the walls from the point of view of thermal-insulation makes possible that general heat transfer coefficient for the entire house to be much higher.




***Figures 8 & 9:*** *Number of interviewers related with elements of dwellings with bad situation of thermal insulation.*

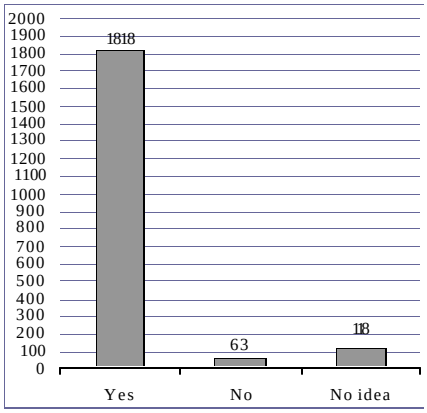
The third more problematic element is dwelling external doors. From the elaboration of the data results that 205 from them (656 from 1187 that have declared that the thermal insulation state is bad) are in bad conditions. This without doubt sends us in the same situation as with bad windows. The fourth more problematic problem is the dwelling terrace. From its bad condition we have also big energy losses. The final conclusion of this analysis is:

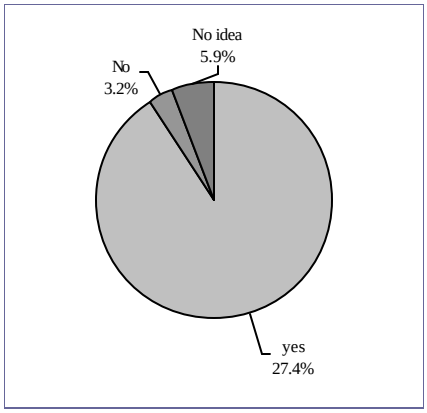
**From the bad condition of all elements: windows, walls, doors and terrace will result a high transmission heating coefficient of the dwelling, that means more burned fuels to fulfilling the request for heating and cooling. This will lead in more emissions of the chemical polluters in the environment consequently leading to a more stuffy environment where we live, a contribute growing for the acid rains and the chances growing of the greenhouse gases effect or global warming.**

Do you think that renovation of thermal insulation in yours dwelling and new energetic standards of construction will helpsaving of energy and a clean environment?

The Albanian Energetic Building Code was prepared and approved by the Albanian Parliament on September 2002 and has entered into force since December 2002.

From the answers of the interviewers, 91% of them (1818 from 2000 interviewers) think that the renovation of thermal insulation in their dwellings and new energetic standards of construction will help energy savings and protect our environment. In Figures 10 and 11 are given graphically the distribution of the answers on this question.




***Figures 10 & 11:*** *Number of interviewers related with idea that renovation of thermal insulation and new energetic standards will contribute on energy savings and a clean environment*

*Do think that you can improve thermal insulation state of your dwelling?*

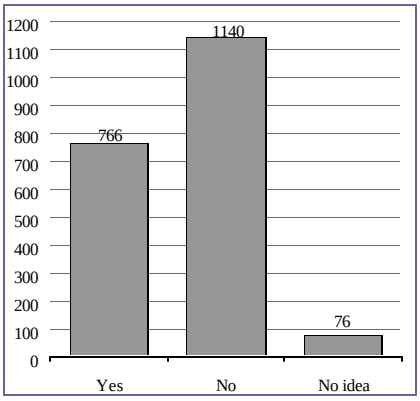
After analysis of the background of the thermal-insulation issues, their advantages on the energy saving, environment protection and the barriers for implementation of this technique at our homes, we tried a direct question: Do think that Yourself can improve thermal insulation state of your dwelling?

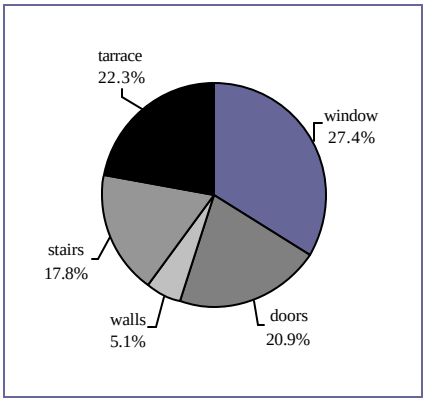
The difficult financial conditions of a lot of Albanian families are behind the responses of the most of the interviewers (57%): they are not able to realize by themselves the thermal-insulation of their building even though they are conscious for the importance and profits of the thermal-insulation as confirmed by them on the above questions. In Figures 12 and 13 is given the graphic presentation of the interviewers' answers distribution on this question.

The situation gets more difficult if we underline that the Albanian banking system for the credits giving is very weak, there is no credits giving and in the case of getting credits the bank interest are very high over 25% pro year (when the maximum in West Europe are 5-7%). These high interests lead to negative profitable investment results when realizing the building thermal-isolation.

Therefore everywhere in West European countries and in some countries in Central Europe (Poland, Check Republic) are established funds for the energy saving programs. These funds support the Energy Saving Law that is compiled in these countries and at the same time in most of the cases they are in co-operation with the funds for the environment protection, because every measure being taken for the energy saving has also lead simultaneously to the environment protection.

As the present realties in West countries, it is necessary for these funds to be soft loan and to be paid off on a long period. This line should be proceeded also in Albania to make possible having always a big number of axes in realization of the thermal-insulation of their buildings, because this is on their interest (decreases the heating and cooling cost) and in the interest of the whole country because it brings the reducing of the energetic needs in national rank, the increasing of fuel reserves and the environment protection.



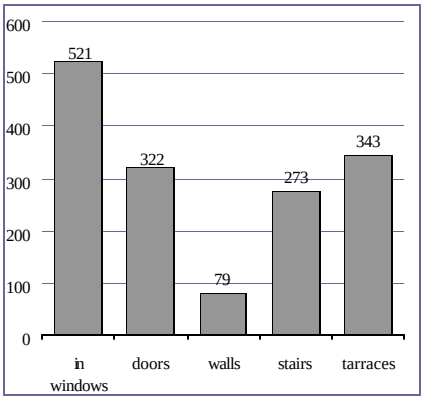

***Figures 12 & 13:*** *Number of interviewers related with idea that if they can contribute in thermal insulation of their dwelling*

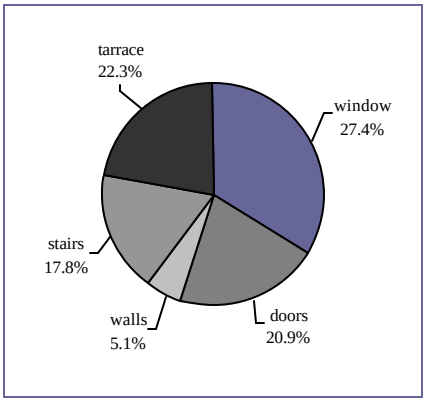
From the above analysis, there is also the promising fact that 38.5% (766 from 2000 of the interviewers) have been positively answered: Yes, they may realize with their budget the building thermal-insulation. This is very important because they not only understand the priority the thermal-insulation for the energy saving and the environment protection brings, but in distinction from the above group they dispose the necessary familiar budget to realize the thermal-insulation, a investment that without fail will bring them a financial profit, without any risk and a self-payment investment period less than three years.

And if "Yes" where?
Figures 14 and 15 show graphically the distribution of answers as per the elements of the buildings the interviewers think is more profitable to intervene.

The biggest group (39.6% or 491 of the interviewers) has declared that is better to thermal -insulated their windows. As has been also declared in the genuine scientific analysis of energetic building experts the weaker point from the energetic point of view in one building are the windows, and the interviewers with their vital intuition know this. This is very important because we do not need to explain everything on this problem.

The second group (22,7% or 491 of the interviewers) have declared they will thermal insulate the terrace and the roof of the building. This is also very important because is well known that through the terrace and the roof the total heating losses of all building may reach till 30%.




***Figures 14 & 15:*** *Number of interviewers related with elements of dwellings where they can contribute to apply thermal insulation*

On the third group are included those, who declare that would dedicate more attention to the outer building's doors. This group constitutes 21.4% of the interviewers and does not have any big difference with the second group. On the last group are included they who think that may realize by themselves the thermal insulation of the out building walls. In this group are included 18.1% of the interviewers who answered positively to the eight questions.

**The final conclusion of this analysis regarding thermal insulation issues is that the interviewed people with their own intuition go in accordance with the scientific ones.**

| *Project 2* | ***Introducing District Heating (DH) and Combined Heat and Power systems in industry, service and households sectors to meet energy demand for heating and electricity in Albania*** |
|---|---|
| **Sector** | Energy |
| **Objectives** | The overall objective of the project is to increase security of supply of electricity and heat in Albania by promoting the penetration of DH & CHP schemes in industry, service and households sectors.<br><br>The immediate objective of this project is to enable the different Albanian Stakeholders to take decisions regarding potential projects within DH and CHP, and to develop a project document for a feasible pilot in Tirana.<br>Other related objectives:<br><br>▪ Increase possibilities to invest in those schemes through Albanian private money and foreign investors;<br>▪ Increase capacity building to enable the different Albanian Stakeholders (energy and environmental institutions and as well as the public private businesses like industrial enterprises, hospitals, hotels etc) independently undertake similar projects in the future. |
| **Country** | Albania |
| **Budget** | 96.3 Million USD |
| **Project linkage to national priorities** | Climate change issue is seriously addressed in the National Energy Strategy which complements the NSSED. Among other policies addressed in the National Energy Strategy is the promotion of DH and CHP systems. In this regard the proposed project is expected to contribute in the implementation of the energy strategy and definitely contribute to the attainment of the sustainable development and MDGs/Goal 7. Also the project will contribute in the meeting of the Albania's commitments under the UNFCCC, where it is a Party. |
| **Background** | Combined Heat and Power Plants (CHP) in 1960-1980 has been more developed than Heat only Boilers (HOB), which from their side are used only in hospitals, Student City, industry, institutional buildings and in any other small place. CHP, instead HOB, has played an important role in supplying technological process heat to industrial customers. To a minor extent it has also provided a source of heat for the space heating needs of industry, service and the household sectors.<br><br>The first TPPs installed in the early mid 1950s at Maliq, Kucova, Vlora, and Cerrik, had capacities smaller than 10 MW, and were coal fired. All of the 9 TPPs installed in Albania produce both heat and power. Four of them (Ballshi, Kucova, Cerrik, and Maliq) are dedicated plants serving heat only to the respective refineries, and the other five were planned to serve electricity and heat to a variety of end users. During the 90s heat distribution to industrial customers is severely reduced due to low industrial demands. However, many of the older plants have very degraded heat distribution systems, which have not allowed their full capacity. Therefore some of them are stopped now, as Tirana and Korca and only them were planned to provide heat supply to the household sector.<br><br>CHP and DH sector in Albania needs rehabilitation, suitable adaptations in equipment and operating methods to reduce damage to heating and generating units. There are studies for new thermal power plants and for the expansion of the existing facilities. Based on the general rule that District Heating (DH) is not economically feasible in buildings that are not equipped with a hot-water circuit, DH may be a viable option in colder urban areas in Albania, with many flats or larger buildings, new ones, that are already equipped with hot-water boiler system.<br><br>In order to know the potential for the penetration of district heating and combined heat and power plant in the National Strategy of Energy are established two scenarios: passive and active. Heating demand for both scenarios are respectively 800 $GWh_{thermal}$ (active) and 180 $GWh_{thermal}$ (passive) for the year 2015 for three sectors.<br><br>This heat as emphasized above will be provided through central heating schemes and SSCHP. Figures 16 and 17 shows the forecast for future production of heat in the respective plants according to active and passive scenarios. In active scenario the main role in heat production is foreseen to be played by CHP plants, while in passive scenario are the central heating plants. This is another advantage of active scenario compared to the passive one, because it makes possible to produce heat with a much higher efficiency (85-90% from SSCHP) compared to the production from central heat plants (70%). |

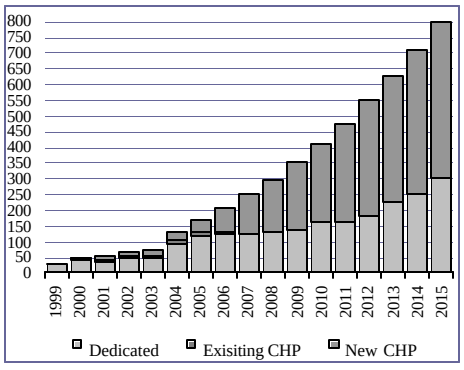



***Figure 16:*** *Demand for heat in households, industry and service according to active scenario (GWH).*

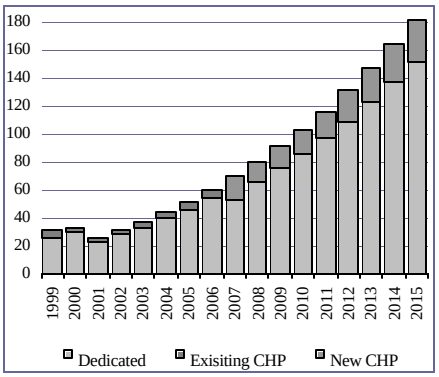



***Figure 17:*** *Demand for heat in households, industry and service according to passive scenario (GWH).*

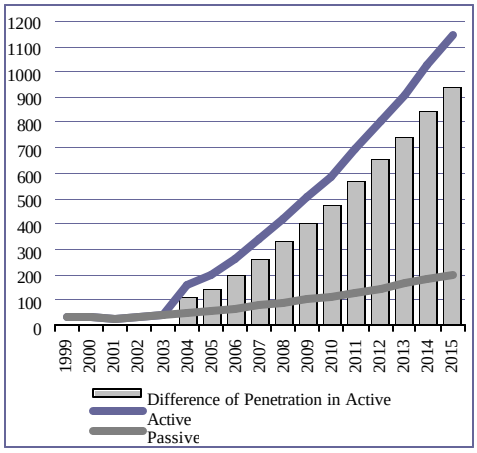



***Figure 18:*** *Forecast of heat and electricity production from central heat plants and SSCHP according to active and passive scenarios, (GWh).*

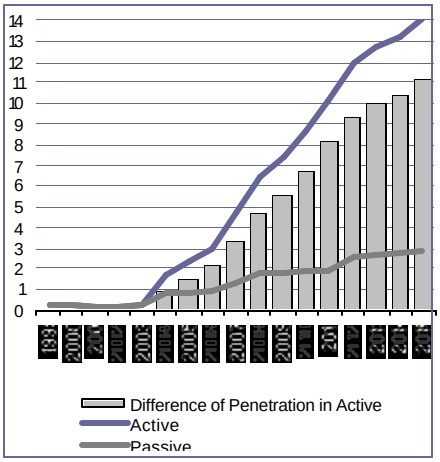



***Figure 19:*** *Forecast of necessary investments for central heat plants and SSCHP according to active and passive scenarios, (Million US$).*

Figure 18 shows the forecast of heat and electricity production from central heating plants and SSCHP according to active and passive scenarios, and the difference between them (GWH). Figures 19 shows the assessment for necessary investments according to both scenarios for the instalment of central heat and cogeneration plants. The required value of investments for year 2015 is foreseen to be 14 million US$.

**Expected outputs**

The main argument in favor of CHP is that it enables an advantage of producing electricity locally and at the same time it enables the use of 2/3 of the non-used heat. Other detailed specific profits which can be considered as expected outputs are:

- Increased security of electricity supply by introducing DH & CHP schemes in industry, service and households sectors. An installed capacity of DH would be 100 MW and for SSCHP would be 75 MW;
- Improved levels of the national energy efficiency;
- Local electricity production which in turn reduces technical losses and energy transportation cost;
- Reduced levels of GHG emissions and other environmental pollutants like $SO_2$, NOx which cause the acid rain phenomena;
- Promoted investments in industry, service and households sectors;
- Different feasibility studies (technical, financial, economic and environmental) prepared. This is expected to create the basis for a priority ranking for different sites.
- Fully developed bankable project, for the selected sites;
- Designed proper tariff system for electricity and heat for the chosen site including any data bases and data processing programme used during all activities;
- Increased levels of trained stakeholders

**Stakeholders to be involved**

NAE, Ministry of Industry and Energy, Ministry of Environment, Albanian Power Corporation (KESH), and Electricity Regulator Body; Ministry of Finance; Environmental NGOs and different ESCO companies concerning all issues of CHP.

**Required Technologies**

District Heating may be defined as the supply of the space heating and hot water to a number of buildings from a central heating plant or a group of heating plants, which are link to each other. In many cases some of them may be a Combined Heat and Power Plants. The heat produced in this plat is delivered to the consumers as hot water or steam through an insulated, double pipe line system. The heated water is carried in the supply pipeline. Having given up its heat, the cooler water returns to the plant in the return plant for reheating. As it is known the district heating systems may vary in size from those serving a small group of houses to those covering a whole metropolitan area. Any kind of fuel or any source of waste heat may be utilised in district heating system, and systems over a certain size may comprise more than one heating stations eventually using different kind of fuels. The pipeline network will often comprise both large line linking the major plants with population centres as well as smaller lines for distribution to the individual users. The heat is transferred from the transmission lines to the distribution network via heat exchangers.

District Heating gives the consumer a comfortable and reliable supply. It is easy to use, can't be seen, heard or even smelled. The absence of individual smoke stacks makes it an environmentally sound heating solution. It has a long tradition in many countries dating back to the early decades to previous century. The predominant sources for heat production have been coal, lignite, oil, natural gas, peat, straw, and wood chips have been used by a number of various plant manufacturers. Plant size may vary from a few to some sources of MJ/second. Combined production of heat and power has demonstrated improvements in efficiency from 35-40% or less in most old types of condensing power plants (for producing only electricity) up to 85-90% in modern CHP plants built as extraction types or back pressure units. In general, low temperature district heating is favourable because of reduced losses. In CHP/DH systems also low temperature mean an increased electric efficiency at the power station.

The extent and branching of the system are determined according to the location of the heating plants, the location of consumers, the possibility of the practical placement of the pipes, and a financial evaluation that takes into consideration the heat loss from the pipeline. The larger district heating connection over a given are, the better efficiency. In order to ensure a sufficient supply temperature, the flow and return piping are sometimes "short-circuited" by means of bypasses. One often distinguishes between the following types of district heating pipes:

- Transmission pipes leading heat from large heating production plants (e.g. heat and power stations) to one or more local distribution networks, where the heat is transported further on, first passing a heat exchanger;
- Main pipes leading heat from a heat exchanger/district heating stations to the service pipes. The main pipes normally follow streets and roads;
- Service or branch pipes leading heat from the main pipes to individual consumers.

Main pipes and service pipes constitute the actual district heating system. The construction of district heating systems requires large investments in capital-intensive installations, not only in productions units but in well-insulated long transmission lines. The economic consequences for the companies and consumers that follow the introduction of a new DH project, a systematic analysis of the socio-economic consequences is necessary for a complete evaluation of the project.

SSCHP Technology: Energy schemes, which combine electricity generation with heat for ensuring space heating and/or specific industrial processes, are frequently referred to as Combined Heat and Power (CHP) or cogeneration. CHP schemes can incorporate district heating.

Cogeneration cycles can be categorized according to the sequence in which the power and thermal energy are produced. The typical topping cycle cogeneration system produces firstly electricity and after that fuel gases are used to produce as by-product heat. This is based on a gas combustion turbine; however, reciprocating engines and steam turbines are also consistent with topping cycle cogeneration. The turbine drives a generator while the exhaust gases, which are generally in excess of 400-500 0C, are routed to a heat recovery steam generator (HRSG), where they are used to produce steam. In some cases the exhaust gases can be used directly, eliminating the need for a HRSG. A bottoming cycle cogeneration system is one in which the fuel is first used for some thermal processes, with the exhaust gases being the by-product that is used to produce power. Most cogeneration systems utilize a topping cycle.

There are three main types of prime movers used as CHP plants: steam turbines, gas turbines and internal combustion engines.

Gas turbines have captured the largest share of the recent cogeneration market. Typical gas turbines applications range from a few hundred kW to 500 MW. Now day's combustion turbines are commercially available in packages ranging from 200 kW to more than 150000 kW. Those plants have been applied to both base loaded and peaking application and provide a number of benefits, including relatively small size, high temperature recoverable heat, high reliability and availability, and relatively low cost maintenance. Much of their success in the cogeneration industry is a result of low initial costs, high availabilities, excellent and low-cost maintenance characteristics, fuel-switching capabilities, high-quality heat that can be simply recovered, and high efficiencies in large sizes.

Gas turbines concepts are simple as compared to other technologies. The simplest open-cycle system operation consists on three major components and operates through a Brayton cycle. Gas turbine cogeneration plants are becoming more popular part particularly of their optimum heat/power ratio of around 3:1. CHP plant can now be run with the philosophy of matching the demand for heat, and exporting excess power to help with economics of the plant. This concept will be also used at the Student City. A prime mover (motor) as it is gas turbine with a lower heat/power ratio will help in this concept. A gas turbine used for CHP would normally be fuelled by natural gas and diesel as preferred fuels, but gasified heavy fuel oil can be used as well.

Internal Combustion Engines. All internal combustion engines operate in the same way when acting as CHP units; power is used to drive a generator and heat is recovered from the engine exhaust, jacket water and lubrificanting oil. The size range is enormous: from the 15 kW diesel/natural gas units for the use in the domestic/service consumers to 50 MW diesel units (or some time heavy fuel oil) for use in the industrial sector. The largest diesel units operate at heat/power ratios of around 1:1 whereas some other units can operates efficiently around 2:1. Additionally, reciprocating engines are extremely efficient in small sizes, are available over a broad range of sizes ranging from tens of kW to 50 MW, can be fired on a broad variety of fuels and have excellent availability. As a result, they have been used in a numerous cogeneration systems serving residential, commercial, service, institutional and small industrial loads.

Steam-turbine-based power generation cycles have been the workhouse of the power generation industry. They are available in a broad range of sizes from a few hundred kW to more than 1000 MW. After many decades of focusing primarily on increasing system size, the turbine industry has recently turned towards increasing efficiency and availability. Because of their energy characteristics and the need to operate the steaming portion of the cycle, steam-turbine based systems have been used primarily for base loaded applications, with older plants being relegated to intermediate duty. Finally, because of the availability to extract steam at various ports throughout the expansion process, they allow for grater flexibility in matching cycle thermal capabilities with loads.

In order to know the DH & SSCHP Plant no special "know-how" technology is required apart from some training seminar organized at the different energy and environment Albanian institutions and at the consumer level for introducing and instructing also the ESCO Companies how to operate those plants.

| | |
|---|---|
| **Volume of Potential reduction of GHG emissions** | A reduction in the amount of polluters follows the application of DH & CHP schemes coming from the more efficient conversion of fuels. Also, the more efficient use of exhausts gases in, say, a heat recovery steam (water) boiler, (where, if supplementary firing take place, the fuels are more completely burned), will reduce pollution of greenhouse gases and acid rain gases. In the figures 20 & 21 re shown the expected reduction of greenhouse gases emissions and $SO_2$ & NOx ones from the penetration of DH & CHP Schemes, which are respectively 304.3 Million kg, 2330 thousand kg and 836.1 thousand kg in the year 2015. The estimated cost of GHG reduction is 5.27 cent/kg. |

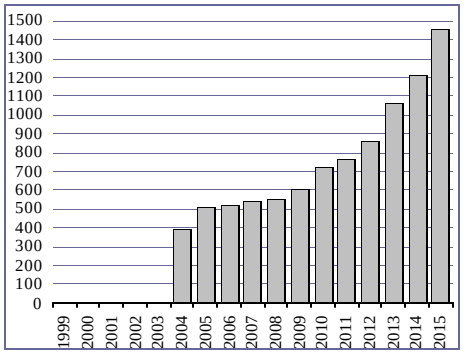



***Figure 20:*** *GWP reduction from the introduction of DH & CHP for industry, service and households sectors (1000000 kg)*

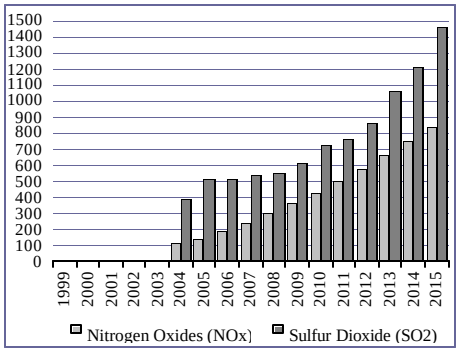



***Figure 21:*** *$SO_2$ & NOx reduction from the introduction of DH & CHP for industry, service and households sectors (1000 kg)*

**Barriers**

DH & CHP is such an attractive proposition thermodynamically that many wonder why it is not used more widely in industrial, service and blocks of multi store buildings, since these technologies are well known since many years ago. As we will analyze the reasons are largely economic and relate to financial evaluation of capital investment. Detailed arguments are as follows:

If an industry decides to invest in CHP plant then it is committed to a course of actions and expenditures for a number of years. The financial appraisal of such a project involves a number of assumptions on the future energy demands of company, fuel prices and availability, taxes, discount rates, maintenance costs, which may be accurate only in the short term.

It may be safer for a consumer simply to purchase the electricity from national grid and generate heat from own boiler than to generate both of them from a CHP.

Any change in consumer behavior may result in a later demand for more/less heat or power, which on the other hand requires more plants at a cost much higher than initial installation.

Any CHP plant design will include a provision for back-up to ensure security of supply for heat and electricity. Any support plant can only be regarded as spare capacity, which, by definition, will not be frequently used, and therefore will not generating sufficient savings to offset the initial capital costs.

Apart from the capital costs of the prime power motor, there are large costs associated with the distribution of heat in pipelines. These costs may be a significant part of the initial investment unless the heat user is relatively near prime power motor.

| *Project 3* | ***Introducing Solar Water Heater systems in households/service (public buildings), which use electricity, LPG and fuel wood as energy source for meeting energy demand for space heating and air conditioning.*** |
|---|---|
| **Sector** | Energy |
| **Objectives** | The overall objective of the project is to increase security of supply of electricity and heat in Albania by promoting the least cost solution in supply side through installation of Solar Water Heater Systems in households sectors (private buildings) and service (public).<br><br>The immediate objective of this project is to enable the different Albanian Stakeholders to take decisions regarding potential projects within solar water heater systems in public and private building stock.<br><br>Other related objectives are:<br><br>▪ Significant increases of the investment in utilisation of solar energy in Albania's new private households and new public buildings to meet the demand for domestic hot water in households and service sectors;<br>▪ Significant increase of energy supply security by utilisation of renewable energy sources in general and solar energy in particular, which in same time will reduce GHG and acid rain gases and will be environment friendly;<br>▪ Significant increases of bankable projects by utilisation of renewable energy sources in general and solar energy in particular;<br>▪ Improvement of data for the potential of renewable energy sources in general and solar energy in particular in different district of Albania and evaluation of solar water heater systems market in households, public buildings and tourist hotels in Albanian coast line. |
| **Country** | Albania |
| **Budget** | 74 million USD |
| **Project linkage to the national priorities** | Climate change issue is seriously addressed in the National Energy Strategy which complements the National Strategy on Socio Economic Development (NSSED). Among other policies addressed in the National Energy Strategy is the promotion of the renewable energies and specially the solar energy which is available in the country, specially in the coastal zone. In this regard the proposed project is expected to contribute in the implementation of the energy strategy and definitely contribute to the attainment of the sustainable development and Millennium Development Goals/Goal 7. Also the project will contribute in the meeting of the Albania's commitments under the UNFCCC, where it is a Party. |
| **Description** | The energy consumption of the household and service sectors is divided into four parts describe as much basic energy uses with widely differing characteristics: space heating, water heating, cooking, lighting and electrical appliances. Residential sector occupies the second place in the consumption of energy resources in the country. As a consequence, it is important to know the consumption of electricity, fuel woods, LPG and kerosene for each service. Up to 1990, the energy supply and demand for space heating, cooking and hot water preparation (using mostly fuel woods) remained in balance. After 1990, there was a massive decline of fuel woods supply from forest to residential zones. This resulted in a massive cutting of fuel woods (most illegal) and overload of electricity equipment (substations, transmission and distribution lines). Environmental effects resulting from earth erosion due to massive cutting were of large sizes.<br><br>In order to calculate the needs for hot water it was considered the quantity of sanitary water needed for one person per day for different services: shower, laundry dishes, etc. The main demand will be met by electricity with 70% in 2015 followed by fuel woods and LPG in passive scenario. The estimates show that solar energy will have a small increase, contributing with 4% in 2015.<br><br>Albania has a considerable potential for the exploitation of the solar energy due to the high number of sunshine hours and high values of solar radiation (see chapter 1, energy sector, section 1.1.2.6) NAE and EEC have carried out a number of studies for installing solar panels in both residential and service sector. Albanian citizens have started installing solar panels for hot water promoted repeatedly by the EEC through various awareness campaigns. If the solar panel systems in Albania would be developed similarly with that in Greece, the potential production of hot water shall be equal with the energy amount of 360 $GWh_{th}$ (or 75 $MW_{th}$ of installed capacity). These figures correspond to a total surface of solar panels of 300 000 $m^2$ (or 0.3 $m^2$/family), while the solar panel penetration in countries such as Israel and Greece is actually greater than 0.45 $m^2$/family.<br><br>For many reasons penetration was foreseen to be different in different zones of the country. Three zones are taken into consideration already divided according to level of intensity and solar radiation duration. The largest effects of this measure are evidenced in Zone I were the intensity is higher and the time period of solar radiation is longer. Table 4 shows the data for penetration of solar energy use according to respective zones in households. Penetration norms of solar panels have been selected based on experience of neighbour countries such as Greece and Turkey that after 30 years of experience have managed to provide at national level the production of hot water in values of 80-85%. |

***Table 4:*** *Main indicators of installing double glass windows analysis*

| Name | | % of penetration of SWHS in 2015 | Total saving ktoe | Unit cost $/kWh |
|---|---|---|---|---|
| Zone I | Urban | 20 | 6.8 | 0.065 |
| | Rural | 15 | 1.7 | 0.042 |
| Zone II | Urban | 15 | 1.8 | 0.085 |
| | Rural | 10 | 1.2 | 0.062 |
| Zone III | Urban | 10 | 0.8 | 0.096 |
| | Rural | 8 | 0.3 | 0.084 |

As shown by the table, the unit cost to substitute one kWh of electricity is different for different zones. It should be emphasized that the forecasts for investments and saving have started in year 2004 and will terminate in 2015. Investments up to 2015 will save for many years after 2015, which was not reflected in Table 4 in value of unit cost that if taken into consideration would obviously result lower.

According to different studies done in our country and other countries experience, some of which with lower solar energy potentials compared to Albania, the use of solar energy for preparation of hot water is foreseen as a real possibility in the Active Scenario.

The use of solar panels for preparation of hot water, particularly in modern private services such as hotels, tourist centres, offices, etc, particularly in seashore and hilly areas where the potentials of the solar radiation are higher is economically feasible. Referring to the National Energy Strategy the objective for period 2000-2015 is the installment of solar panel systems in order to provide 62.9 ktoe of energy in 2015.

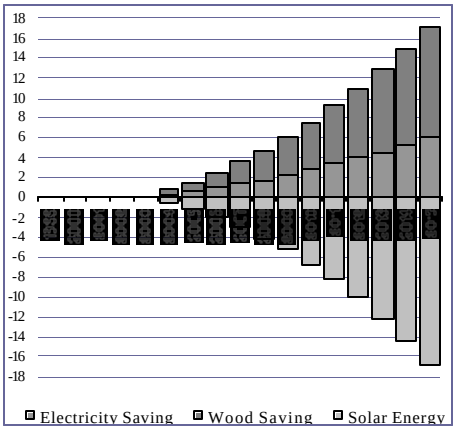



***Figure 22:*** *Energy produced by solar panels (wood and electricity savings) for preparation of DHW in Active Scenario for households (ktoe)*

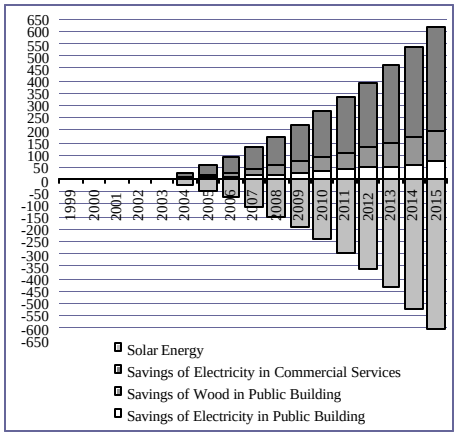



***Figure 23:*** *Energy produced by solar panels (wood and electricity savings) for preparation of DHW in Active Scenario for service sector (ktoe)*

**Expected outputs**

The main argument in favors of solar energy is that it enables an advantage of meeting domestic hot water demand by substituting electricity and fuel wood. Other detailed specific benefits are:

- Increased energy security in general and electricity supply in particular by introducing solar water heater systems in service and households sectors;
- Increased share of the utilization of renewable energy sources in general and solar energy in particular in Albania;
- Reduced levels of GHG emissions and other environmental pollutants;
- Promoted investments and jobs created in service and households sectors by installation of solar water heater systems;
- Increased reliability of energy data on solar energy;
- Estimated investment needs and a cost benefit analysis for a short-term period (3-5 years), and programmes aiming to promote the installation of solar water heater systems;
- Trained stakeholders

| | |
|---|---|
| **Stakeholders to be involved** | NAE, the EEC, Ministry of Industry and Energy, Ministry of Environment, Ministry of Finance ; different environmental and energy NGOs; different private installing companies of solar water heater systems (ESCO model); |

**Required Technologies**

Solar systems, designed for heating water, are made up of the following parts (see figure 24).

- The solar collector area;
- The hydraulic circuits and heat exchanger;
- The hot water storage tank;
- The back-up heating system.

The solar collector is used to transform incident solar radiation into heat. There are over 3.6 million square metres installed throughout the European Union and most of them are used for producing domestic hot water, either in private houses or for collective installation. Many different products have been tested; the best of them are in conformity with national standards and are guaranteed by their manufactured.

The conventional "flat plate" solar collector consists of an absorber plate, with its hydraulic circuits, fixed behind a sheet of glass, in a watertight case. Thermal losses are reduced by both the greenhouse effect of the glazing and the thermal insulation of the casing. This type of collector can work efficiently throughout the year, heating a heat transfer fluid up to 50 [$^0$C] more than the ambient outdoor temperature. As these collectors are used throughout the year, an antifreeze fluid is generally required. Therefore, the solar installation needs to have tow independent hydraulic circuits, linked by a heat exchanger:

- The "primary circuits" is the circuit flowing through the collectors using an anti-freeze heat transfer fluid;
- The "secondary circuit" is the domestic hot water circuits flowing through the heat exchanger to the hot water storage tank.

Collective installations are generally equipped with two separate hot water storage tanks (see figure 25). One of them is used for storing the water heated by the sun and the other is linked to a back-up heating system, which is only used when is needed. In this way, the hot water running through the distribution network is supplied, in priority, by the solar system and when the solar energy supply is insufficient, the hot water is maintained at a constant temperature by means of the back-up system. Each of these components should be sized in order to offer optimal system efficiency. Only the good working order of all the parts together can make it possible to guarantee the performance of the installation and its energy production.

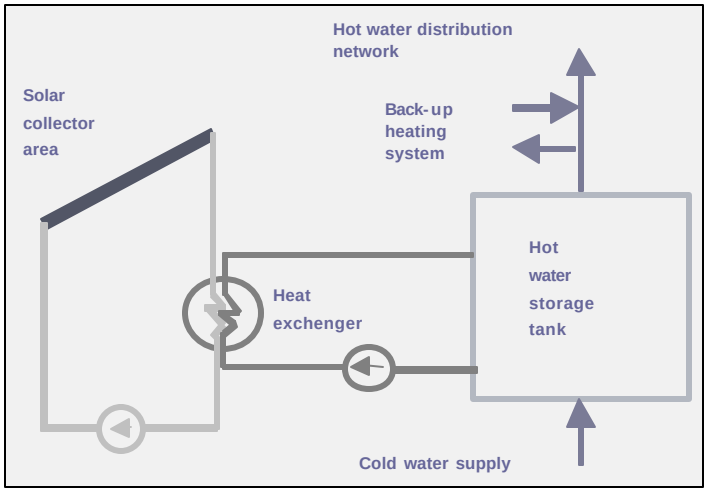



***Figure 24:*** *Schematic layout diagram for a individual solar hot water system*

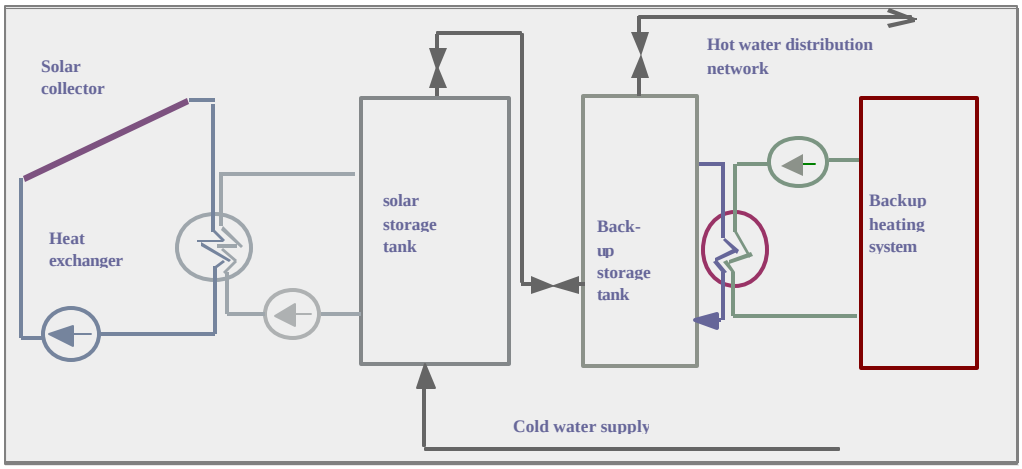



***Figure 25:*** *Schematic layout diagram in a collective solar installation at the collective consumer (for example in the Tourist Hotel).*

In order to have good promotion of solar panels in different consumers in very important that solar panel suppliers to secure a guaranteed service. Guaranteed service is the difference between a company that says, "We deliver quickly" and another that affirms, "we deliver with an hour, or you get your money back". A "guaranty service" must fulfil 4 conditions:

- It should be simple to understand and be clearly defined;
- It should be easily put into practice;
- The guarantor should be able to insure his responsibility;
- Compensation in case of failure should be in proportion to the prejudice.

The need for domestic hot water should be established with care. They are defined by the average daily consumption for each month and are generally expressed in litre for day. So, there should be 12 monthly figures.
For new buildings, hot water consumption figures must be estimated from following data:

- The number of people in family;
- Number of showers in day;
- Use of hot water for other different propose and nature;
- Amount of water for shower, for bath and so on) of the points at which water is drawn;
- The required water temperature;
- The planned extensions.

In the existing buildings, daily consumption should be measured over a period of at least two months. If necessary, a water meter should be installed on the pipe leading to the existing water heater. This meter will be re-used for monitoring the solar installation. The chosen months should be representative of annual requirements. In all cases, the water temperature will be the temperature of hot water distribution circuit fixed by the regulations.

The technical consultant generally requests serious guarantees from the different suppliers:

- A year guarantee, for the solar collectors;
- A year guarantee for the different water storage tanks;
- A two years total guarantee, covering all the other materials.

These guarantees refer to the maximum guarantees proposed by certain manufactures. The installer can subscribe to a complementary insurance if it is considered to be necessary.

The maintenance contract for the (3-4) year should be included in the construction work contract. In this way, all the expenses are covered throughout the period of the contract. In conclusion, the contract must offers 4 essential advantages:

- No financial risks; the user is guaranteed a certain annual energy supply and so the investment pay-back time is also guaranteed;
- No breakdown worries; the user is not troubled by the system failure. Not only are repairs and maintenance guaranteed, but it is also in the interest of the "technical pool" to carry out the repairs as quickly as possible;
- Easy bank loans; the absence of financial risks makes it much easier to borrow the money needed for investment costs;
- Preferential funding; subsidies for collective solar installation are now linked to guaranteed performance.

**Reduction potential of GHG emissions**

It is true that Southern Europe receives more sunshine than the North. But in reality the variations are less important than generally believed. The productivity of a solar system is indirect relationship to the insolation. But other factors can also help in saving conventional energy. For example, a solar installation as a back up during the winter and work alone in summer. In this way, the conventional energy boiler will only be used during the period of the year when space heating is needed and its efficiency is at its best. Moreover, the use of a solar energy is one of the best ways of limiting the emission of carbon dioxide and its effects on global warming. The reduction of $CO_2$, brought about by the use a solar system, depends on the source of the energy that replaces. A solar collector with an area of 1 square meter, installed near the Mediterranean (as our country), can reduce $CO_2$ emissions by the following amounts every year.

- 440 kg, if the replaced energy is fuel oil (50 % conversion efficiency);
- 195 kg, if the replaced energy is gas (75% conversion efficiency);
- 380 kg, if the replaced energy is electricity (with a 50% nuclear contribution).

These figures are far from being negligible and if one considers that, in the Southern European countries, every other domestic water heater could eventually be solar (as in Cyprus already) the total emission of $CO_2$ could be reduced by nearly 10% in these countries.

A reduction in the amount of pollution follows from the utilisation of solar energy. In the figures 26, 27 and 28 are shown the reduction of green houses gas emissions and $SO_2$ & NOx from the penetration of thermal insulation measure. As it is shown in the figure the amount of reduction for GHG, $SO_2$ and NOx will be respectively 240.98 Million kg, 1198.96 thousand kg and 661.98 thousand kg in the year 2015. The cost of GHG reduction is 4.32 cent/kg.

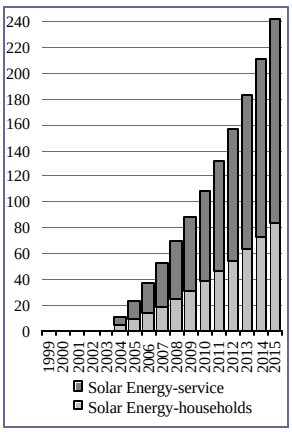



***Figure 26:*** *GHG reduction from the introduction of solar energy measure (1000000 kg)*

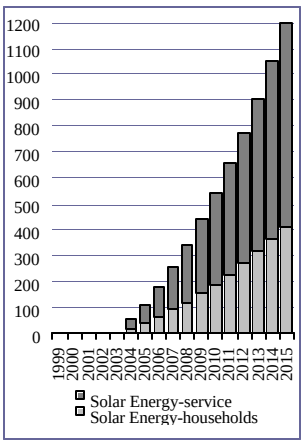



***Figure 27:*** *$SO_2$ reduction from the introduction of solar energy measure (1000 kg)*

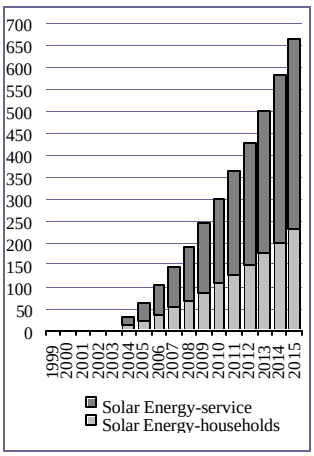



***Figure 28****: NOx reduction from the introduction of solar energy measure (1000 kg)*

**Barriers**

Most of the barriers regarding to solar energy are identified through surveys carried our concerning the installation of SWHS. The interviewed group is not selected completely in random manner, because the team knows that will have differences in the answers. So the team decided to choose 500 families and service consumers in Tirana city and they are chosen based on the idea to have a right division between different kinds of dwellings: individual houses, old apartments, new apartments and new villas. Questions and results made during the survey are as following:

Does your building have around the clock could water supply?
The main scope of this question is to know if their building have around the clock could water supply. The processing of data received from analysis of questionnaires indicates that 65.1% of them have around the clock can water supply. The second group is 34.9% (174 from 500 interviewers). They declare that in their buildings has not around the clock can water supply.

From this analysis a main conclusion results: only 2/3 of interviewers has around the clock could water supply and this number is decreasing year by year due to lack of investment in water supply network. This is a big barrier related with installation of SHW. If is not in place around the clock could water supply is not possible to have utilization of solar energy.

If yes, from where are you supplied?
In the analysis done resulted that 65.1% of the buildings in Tirana city have around the clock could water supply. Immediately after this observation, naturally is done the other question: from where are they are supplied? From elaboration of the survey data results that 54.2% declared that they are supplied from their own reservoirs. From the water supply point of view this is a very bad panorama since is telling us that the Albanian consumers have lost their trust into Water Supply Company. So to have water supply during all the day they are investing in the worst way: each family one reservoir.

A second group in interviewed afterwards. The second group is the group which is supplied by the main network of the Tirana City. This group consists of the 37% of the total interviewers and the third group are the families and the businesses, which are supplied by their own well. The questions made to them areas following:

How do you prepare Domestic Hot Water (DWH) for daily needs?
Albanian families and some service sectors are using in the most of the cases for preparing DHW electric boilers. This group consists on 68.34% of all interviewers. In the second group are included families which are using electric stuffs (15.53%) for DHW supply.

Based on this important conclusion, it is clear that Albanian people are using electricity (85%) for preparing hot water for their daily needs. This figure put Albanian Power System in a very bad situation, because almost all this electric water heaters are put on during the peak time for electricity system. This is another reason that explains why our power system can not supply with electricity the consumers during the period of peak time. Also should be mentioned that firewood and kerosene almost have lost their dominant position actually and a new energy source is in place: this is utilization of solar heater, which are now in use in Albanian Energy Market.

Do you know that the installation of a Solar Water Heating System in Your building will bring energy saving to you, will protect the Electricity System from its continuous destruction and will protect the environment?
As it known worldwide utilization of solar energy brings important advances in the field of: a better energy supplied, reducing the imported fuels, protecting environment and for Albanian Power System. So having this in mind we wanted to know if the interviewers know the advantages above mentioned.

The conclusion coming out from the answers' distribution analysis is: 79.2% of the interviewers have declared "Yes" i.e. they know that the installation of a Solar Water Heating System in Your building will bring energy saving to You, will protect the Electricity System from its continuous destruction and will protect the environment.

Do you think that the installation of a Solar Water Heating System in Your building is feasible compare with other traditional techniques for preparing the Domestic Hot Water?

From the data processing resulted that 47.2% of the interviewers think that the installation of a Solar Water Heating System in their building is very feasible compared to other traditional techniques for preparing the Domestic Hot Water. This is very important and tells us the right message, which has the household and service consumers. Also the interviewers group which are thinking that the installation of solar panels is feasible investment is not a small one, it includes 21.8%.

The biggest second group (22.4%) is composed of the interviewers, which think that the installation of a Solar Water Heating System in their building is not feasible compared with other traditional techniques for preparing the Domestic Hot Water. The conclusion is that much more information is needed on the advantages and utilization of solar collector systems.

| *Project 4* | *Increasing the share of public transport to the passenger transport in Albania* |
|---|---|
| **Sector** | Energy and Transport |
| **Objective** | The overall objective of the project is to increase the share of public transport, which in turn would increase security of the supply for energy in Albania through promoting the public transport in passenger transport.<br><br>The immediate objective of this project is to enable the different Albanian stakeholders to take decisions regarding potential projects within passenger public transport.<br><br>Other related objectives are:<br><br>▪ Significant increase of the investment in promotion of public passenger transport by reducing growth rate of cars and minibuses and increasing growth rate of buses and railways passenger transport;<br>▪ Significant increase of energy supply security by structural changing of transport modes: reducing the share of less efficient modes of transport like cars and mini buses and increasing higher efficient modes like buses and railways, which in same time will reduce GHG and acid rain gases and will be environment friendly;<br>▪ Significant increases of bankable projects by promotion of public passenger transport through improvements in roads and railways infrastructures;<br>▪ Improvement of necessary data for all modes the private and public transport and their efficiency and emissions factors related to their ages, load factor (number of passengers) speed of movements and conditions of roads and railways. |
| **Country** | Albania |
| **Budget** | 89.12 million USD |
| **Project linkage to national priorities** | Climate change issue is seriously addressed in the National Energy Strategy which complements the National Strategy on Socio Economic Development (NSSED). Among other policies addressed in the National Energy Strategy is the promotion of public transport. In this regard the proposed project is expected to contribute in the implementation of the energy strategy and definitely contribute to the attainment of the sustainable development and Millennium Development Goals/Goal 7. Also the project will contribute in the meeting of the Albania's commitments under the UNFCCC, where it is a Party. |
| **Background** | The transport sector in Albania started to develop with fast rhythm after '50, when, in addition to the quantitative increase of road transport means, the infrastructure and transporting capacities of the road, railway and sea means where developed, establishing the transport structure. The transport sector plays an important role in the consumption of energy resources. The evident increase of the number of the transport means after 1990, especially in the road transport, was accompanied with increase of transport activity and an evident increase of the fuel consumption, mainly diesel and gasoline.<br><br>Figure 29 shows the consumption of the energy resources in all economic sectors during the period 1990-2001. As indicated in the respective figures, the consumption has declined from a peak of 2.26 million ton oil equivalent (Mtoe) in 1990 to 1.22 Mtoe in 1992. Since that year the consumption of energy primary resources has increased reaching a value of 1.84 Mtoe in 2001. In 1990, the industry consumed 50% of the total sources, declining to 35% in 1992 and 17% in 2001. Transport was the sector that experienced a continuous increase of the energy sources consumption. In 1990 the transport sector consumed 6% of the total energy consumption, reaching the value of 44% in 2001. Another sector that experienced changes was the residential sector, with a consumption of 14.6% of the total in 1990 reaching a level of 21% in 2001. Service sector also experienced high rates of increase of energy consumption passing from 5.4% in 1990 to 16.5% in 2001. |

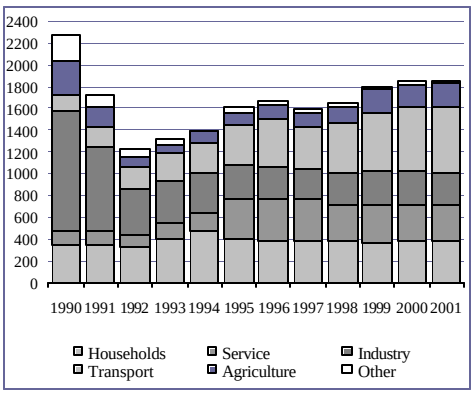



***Figure 29:*** *Contribution of each sector in energy consumption (ktoe)*

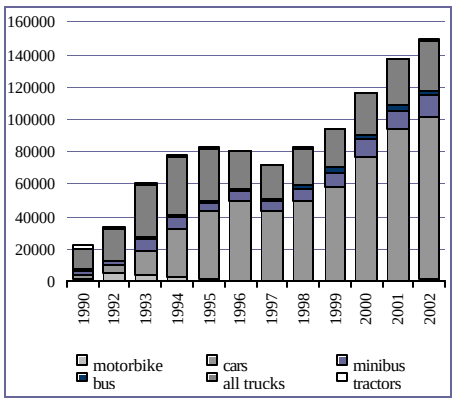



***Figure 30:*** *Trend of vehicle stock in Albania*

In figure 30 is shown the vehicle stock in Albania. The biggest share belongs to cars and is this idea why the passenger transport sector is so inefficient compared to other countries. In order to become more efficient passenger transport it is profitable from energy saving point of view and environmental protection point of view to introduce public transport (buses and trains) instead of private transport (cars and mini buses). Reducing share of cars and minibuses does not mean that it would reduce the absolute number of cars, which will be increased more in the future, but would reduce their growth rate in the future in order to live more space for buses and trains.

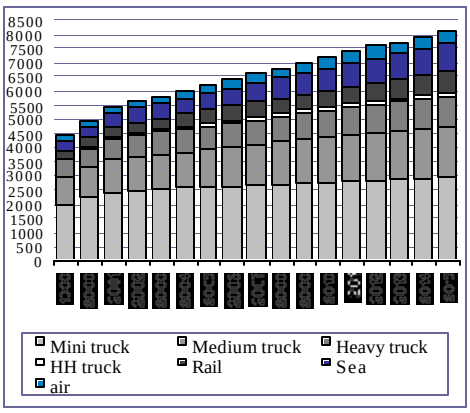



***Figure 31:*** *Forecast of trend of the indicator passenger-km for all types of transport (million passenger-km) in passive scenario.*

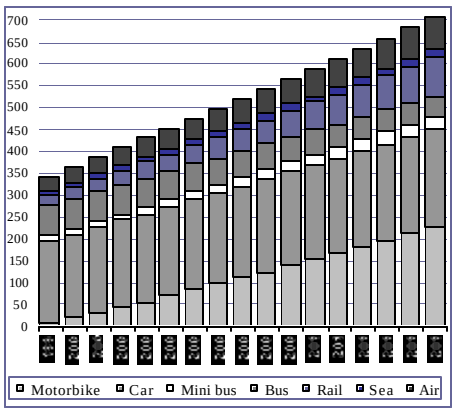



***Figure 32:*** *Forecast of energy demand for passengers in passive scenario (ktoe).*

The transport of passengers has also increased, particularly after 1990. This is dedicated to the use of private cars and the travelling of Albanian citizens (emigrants) out of the country. The trend of the main indicator passenger-km for the period 1990-2015 is shown in figure 31 for passive scenario. This is the basic indicator that will be used as driving factor to calculate the energy demand of the sub sector. It should be underlined that by the Ministry of Transports are elaborated other important indicators that have been used as driving factors such as the fuel consumption for each type of transport and the stock of road, railway, sea and air means. As a consequence, the contribution from each type of transport and the energy intensities were selected for the period 1999-2001, based on real consumption in the transport sector.

Figure 32 idicates that the passenger transport is more focused on the road transport, increasing two times in 2015 compared to 1999. The railway transport will increase 4 times compared to 1999. This is a positive indicator but not sufficient as will be shown in active scenario.

This section describes the energy needs in the transport sector according to active scenario for the period 1999-2015. In total they are not foreseen to change in both scenarios. There will be changes particularly in sub sectors. According to active scenario, is foreseen the decline of work volume in road transport of passengers and increase of the railway transport, while the work volumes in the sea and air transport are not foreseen to change. The trend of indicator passenger-km according to active scenario for each sub sector is given in figure 33. This foreseen measure that should be applied is the total reduction of passenger's number in car transport and the covering of the difference with railway transport. This forecast that enhances the railway transport is based on the railway infrastructure improvement, and substitution of a part of the existing trains with very rapid trains with low fuel consumption.

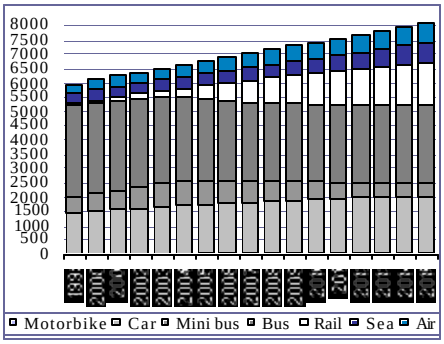



***Figure 33:*** *Forecast of trend of the indicator passenger-km for all types of transport (million passenger-km) in active scenario*

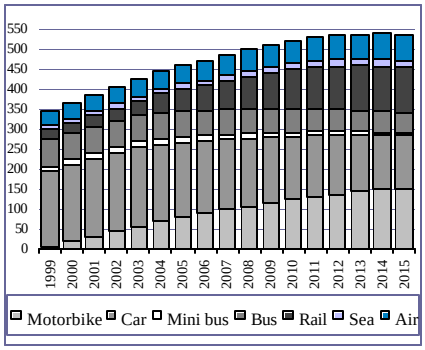



***Figure 34:*** *Forecast of energy demand for passengers in active scenario (ktoe)*

Based on the world experience these measures have been foreseen to encourage the public transport of passengers compared to the private transport that will lead to a reduction of fuel consumption, lower cost of transport and the reduction of harmful emissions in atmosphere compared to the passive scenario. This will be accompanied with an economic save that may be used in the improvement of road and railway transport as well as to encourage the citizens to use the public transport through lower tariffs.

Taking into account the above analysis, the total demand for energy in passenger transport sector in 2015 according to passive scenario will be 728 ktoe, while according to active scenario, as a result of the quantitative measures, the demand is foreseen to reduce to a value of 538.4 ktoe that means a saving of 26.4%.

| | |
|---|---|
| **Expected outputs** | The main argument in favors of passenger public transport is that it enables an advantage of meeting transport needs in the future. Other detailed specific benefits are: |

- Increased energy supply security in general and oil in particular by introducing public transport in Albania;
- Increased share of the utilization of buses and trains in the future;
- Reduced levels of GHG emissions and other environmental pollutants which come from transport sector which in turn will reduce the incidence of illness related to the pollution from transport;
- Promoted investments and job created in passenger's public transport;
- Increased number of stakeholders for promotion of passenger public transport.

**Stakeholders**

NAE, EEC, Ministry of Industry and Energy, Ministry of Transport and Telecommunication; Ministry of Finance, Ministry of Environment, Ministry of Health; Institute of Public Health; Different environmental NGOs.

**Required Technologies**

Transport is the main energy -consuming sector, in which the government is facing some difficulties with identification of GHG emissions mitigation policies. Transport is a large consumer of fuel and energy. Therefore the structural reconstruction policies must base upon the saving and rational use of fuel and energy resources and development of effective control and regulating equipment. Recently needs of the railway system for GHG emissions reducing technologies were studied and relevant proposals were prepared.

Currently the national railways are in need of a new technologies introduction, while the substitution of old equipment is required as well. As a result of conducted studies there were identified the most potential sectors for implementation of new technologies serving for GHG emissions mitigation:

Full rehabilitation of the railways might reduce the consumption of fuel by 2-3 times;
Implementation of energy saving activities would lead to 10% economy of energy in passenger transport due to demand side management.

**Volume of Potential reduction of GHG emissions**

A reduction in the amount of pollution follows from the promotion of public passenger transport. In the figures 35, 36 and 37 are shown the reduction of green houses gas emissions and $SO_2$ & $NO_x$ from the introduction of public transport measure.

As it is shown in the figure the amount of reduction for GHG, $SO_2$ and $NO_x$ will be respectively 493 Million kg, 545.4 thousand kg and 4.2 million kg in the year 2015. The cost of GHG reduction is 3.59 cent/kg.

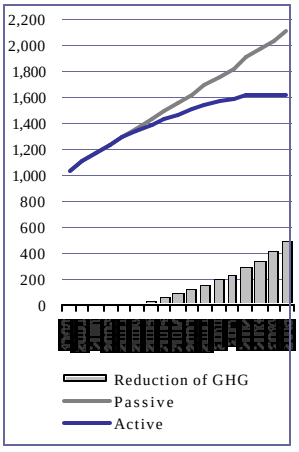



***Figure 35:*** *GHG reduction from the introduction of public transport (1000000 kg)*

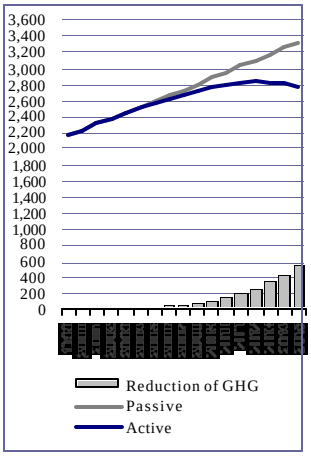



***Figure 36:*** *SO reduction from the introduction of public transport (1000 kg)*

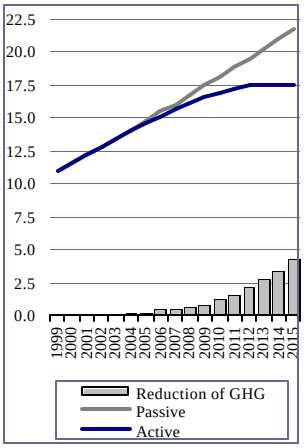



***Figure 37:*** *Nox reduction from the introduction of public transport (1000000 kg)*

**Barriers**

In passenger transport due to foreseen measures according to active scenario developed under the Energy Strategy, the transport that will have a sensitive increase will be road transport with buses and railway transport. Application of these measures requires investments, for the passenger transport. In order to apply the energy saving approach in the transport sector the following policy needs are required:

- Continue the implementation of the Government measures to improve the road and railway infrastructure;
- Construction of new roads;
- A better management of transport sector;
- Encourage use of cars with lower engine power and more efficient;
- Establish higher custom taxes for used cars compared to new ones;
- Establish and prepare environmental taxes according to emissions in atmosphere;
- Undertake and realise different awareness campaigns to enhance the public transport.

## LAND USE CHANGE AND FORESTRY

| *Project 1* | *Identification of demand and supply for firewood in rural areas* |
|---|---|
| **Sector:** | Land Use Change and Forestry |
| **Objective:** | Reduction of the uncontrolled cutting of forest trees in rural areas, which in turn would contribute to a better management and enhancement of the sink capacity of forests in the future. |
| **Country:** | Albania |
| **Budget:** | 0.110 million US $ |
| **Project linkage to national priorities** | The proposed project is expected to contribute to the attainment of the sustainable development and Millennium Development Goals/Goal 7. In the meantime the project will contribute in the meeting of the Albania's commitments under the UNFCCC, where it is a Party. |
| **Background:** | Every year are pruned of 298,690 hectares of forest area, from which high stem forests 93.890 hectares, coppice forests 83.040 hectares and shrubs 121.760 hectares. Data on illegal cutting of trees for firewood are not reported anywhere The average annual increment is reduced to 0.5 $m^3$/hectare/year.. |
| **Expected outputs:** | The expected project outputs:<br>▪ Evaluation of the forest biomass demand for energy purposes.<br>▪ Evaluation of the forest biomass supply for energy purposes |
| **Stakeholders:** | General Directorate of Forests and Pastures; Ministry of Agriculture and Food; Livestock Research Institute; Ministry of Energy and Industry; Ministry of Environment; National Energy Agency; Forest and Pastures NGOs; Private companies interested in Forest activities; etc |
| **Required Technologies:** | Survey techniques to estimate the forest trees cut for energy purposes. Training of experts on data collection and processing. |
| **Volume of Potential Reduction of GHG Emissions:** | Not Applicable |

| *Project 2* | ***Integrate climate change concerns and sustainable development into the Forest Management Strategies and plans.*** |
|---|---|
| **Sector** | Land Use Change and Forestry |
| **Objectives** | The overall objective of the project is to increase the sink capacity and decrease the level of GHGs emissions from Albania's Forests through integration of climate change concerns and sustainable development into the forest Management Strategies. |
| **Country** | ALBANIA |
| **Budget** | 9,525 million USD |
| **Project linkage to national priorities** | The proposed project is expected to contribute to the attainment of the sustainable development and Millennium Development Goals/Goal 7. In the meantime the project will contribute in the meeting of the Albania's commitments under the UNFCCC, where it is a Party. |
| **Background** | Most of the national sectoral development strategies, whenever they exist do not integrate principles of sustainable development and particularly environmental concerns. Exception is made for the National Energy Strategy, where principles of sustainable development are highly addressed. Climate change issue is not yet explicitly addressed into the Forest Strategies and Plans). Having the impact of LUCF category to the overall GHG emissions and sinks, the need to apply policies and measures for GHG mitigation in the LUCF sector is becoming more evident. The Forest Management Strategies and Plans must consider and take into account the expected climate changes and foresee policies and measures in order to mitigate the GHG emissions released from LUCF activities. |
| **Expected outputs:** | The expected project outputs:<br>▪ Climate change concerns integrated into the national policy and planning of the LUCF sector.<br>▪ Sustainable development principle integrated into the national policy and planning of the LUCF sector<br>▪ Mitigation of GHG emissions from LUCF category<br>▪ Enhancement of sink capacity<br>▪ Sustainable Forest Management practices developed<br>▪ Optimum land use scenarios developed<br>▪ Scenarios for the sustainable forest management developed<br>▪ Reliability of LUCF data increased<br>▪ National capacities to address climate change concerns into national planning and policy developed |
| **Stakeholders** | General Directorate of Forests and Pastures; Ministry of Agriculture and Food; Livestock Research Institute; Ministry of Tourism; Forest and Pastures NGOs; Private companies interested in Forest activities; etc |
| **Required Technologies:** | Geographical Information System (GIS) equipment; ARCHINFO soft -ware and Land Analysis Laboratory equipment; the current and processed climatic data system; current situation of land use, forests, agriculture, population (age groups, education levels, professions, emigration, traditions, desires, needs, etc.), used technologies. Also, training of the experts in Forestry, Pasture, Agriculture, Livestock husbandry and Tourism on Sustainable Forest Management practices is required. |
| **Reduction Potential of GHG Emissions:** | A reduction of emissions and enhancement of sinks, respectively by 1,085.00 ton/year and 1,861.000 ton/year is expected. |

| *Project 3* | ***Reforestation of an area of 100,000 ha, on refused agriculture lands, using more capable species to absorb the $CO_2$ and fast-growing species*** |
|---|---|
| **Sector:** | Land Use Change and Forestry |
| **Objective:** | Increasing the forest in Albania and in turn the sink capacity of forests. |
| **Country:** | ALBANIA |
| **Budget:** | 102,005 million US $ |
| **Project linkage to national priorities** | The proposed project is expected to contribute to the attainment of the sustainable development and Millennium Development Goals/Goal 7. In the meantime the project will contribute in the meeting of the Albania's commitments under the UNFCCC, where it is a Party. |
| **Description:** | There are about 100,000 hectares remained undistributed arable land area to farmers or private owners, as refused lands or unused for crops cultivation. The area is distributed among all districts of the country. This area need to be converted by using the techniques of reforestation. |
| **Expected outputs:** | The expected project outputs:<br>▪ Forest area increased by 100,000 hectares<br>▪ Increased annual increment by 4,0-6,0 m3/hectare/year<br>▪ Sink capacity of forests enhanced<br>▪ Protection against erosion in mountainous –hill zone and flooding in plane zone enhanced |
| **Stakeholders:** | General Directorate of Forests and Pastures; Ministry of Agriculture and Food; Livestock Research Institute; Communes, Ministry of Tourism; Forest and Pastures NGOs; Environmental NGOs; etc |
| **Required technologies:** | Modern seedling cultivation system (Green HouseCultivation System). Trained experts. |
| **Reduction Potential of GHG Emissions:** | An increase of sink capacity up to annual average 337,000 ton/year by the year 2020 and 964,000 ton/year after. |

| *Project 4* | ***Monitoring of fire situation to assess the more threatened forest areas from climate change point of view and the desertification scale due to fires*** |
|---|---|
| **Sector:** | Land Use Change and Forestry |
| **Objective:** | The overall objective of the project is to increase the sink capacity of forests and decrease level of GHGs emissions through monitoring of the fire situation in Albania's forest. |
| **Country:** | ALBANIA |
| **Budget:** | 1,460 million USD |
| **Project linkage to national priorities** | The proposed project is expected to contribute to the attainment of the sustainable development and Millennium Development Goals/Goal 7. In the meantime the project will contribute in the meeting of the Albania's commitments under the UNFCCC, where it is a Party. |
| **Background** | Being a Mediterranean country, with very hot summer season, Albania has much risk of fires in forests which can disappear or desertity considerable forest and pasture areas. This risk is expected to become higher due to expected climate changes. Referring to the current data the on forest fires, during last years an increased number of burned forest areas is observed. Therefore the amount of GHG emissions released due to this phenomena is increased and the sink capacity is decreased too. |
| **Expected outputs:** | The expected project outputs:<br>▪ Higher levels of GHGs emission reduction<br>▪ Higher forest sink capacity<br>▪ Higher effectives of operation of the forest services against fires<br>▪ Correlation between forest fire situation and climate change found.<br>▪ Scenarios of future forest fire situation developed. |
| **Stakeholders:** | General Directorate of Forests and Pastures; Ministry of Agriculture and Food; Livestock Research Institute; Forest service against fires; Communes, Ministry of Tourism; Forest and Pastures NGOs; Private companies interested in Forest activities; etc |
| **Required Technologies:** | Geographical Information System (GIS) equipment, monitoring equipment and training of experts on fire monitoring systems. |
| **Reduction Potential of GHG Emissions:** | The expected reduction of GHGs emissions is as following:<br>▪ Reduction of $CO_2$ emissions from -129.14 Gg to -1.32 Gg.<br>▪ Reduction of $CH_4$ emissions from 0.28 Gg to 0.01 Gg.<br>▪ Reduction of CO emissions from 2.53 Gg to 0.09 Gg.<br>▪ Reduction of $NO_X$ gas emissions from 0.07 Gg to 0.00 Gg. |

## AGRICULTURE

| *Project 1* | *Use of low cost bio-digesters for the manure processing in the farming system of Albania* |
|---|---|
| **Sector:** | Agriculture |
| **Objective:** | Promote the efficient use of manure in the farming system of Albania and bring additional advantages to farmers through the methane recovery and its potential use for cooking and heating purposes |
| **Country:** | Albania |
| **Budget:** | 2 million USD |
| **Project linkage to national priorities** | The proposed project is expected to contribute to the attainment of the sustainable development and Millennium Development Goals/Goal 7. In addition the project will contribute in the meeting of the Albania's commitments under the UNFCCC, where it is a Party. |
| **Background:** | The project will introduce the aerobic digestion technology in the farming practice of Albania through the use of low cost plastic bio-digesters at the farm level. The bio-digesters make use of cheap polyethylene tubular films. It is estimated that the cost for each device would be approximately 28 USD. |
| **Expected outputs:** | The implementation of this technology in the farming system of Albania is expected to bring additional advantages to the farmers in terms of production of methane gas for cooking as well as effluents to fertilize ponds for fish, aquatic plants and crops. |
| **Stakeholders:** | Ministry of Agriculture and Food; Livestock Research Institute; Ministry of Energy and Industry; Ministry of Environment; National Energy Agency; Forest and Pastures NGOs; Private companies interested in Forest activities; etc |
| **Required Technologies:** | No special "know-how" technology is required apart from some field seminar organized at the farm level for introducing and instructing the farmers how to operate the plastic bio-digesters. |
| **Volume of Potential Reduction of GHG Emissions:** | An additional 10-15% of methane release reduction is expected upon the completion of the proposed project. |

| *Project 2* | *Industrial production of nutrient blocks for livestock feeding* |
|---|---|
| **Sector:** | Agriculture |
| **Objective:** | Promote the improvement of feed digestibility in ruminants by bringing additional feed supplements in their diet |
| **Country:** | Albania |
| **Budget:** | 1,8 million USD |
| **Project linkage to national priorities** | The proposed project is expected to contribute to the attainment of the sustainable development and Millennium Development Goals/Goal 7. In addition the project will contribute in the meeting of the Albania's commitments under the UNFCCC, where it is a Party. |
| **Background:** | The project's purpose is the setting up of a production line for the manufacturing of urea molasses blocks to be used as feed additives by ruminants. The blocks will be consequently distributed (sold) to the farmers, which will be instructed about the modalities of their use for feeding the animals. |
| **Expected outputs:** | The implementation of this technology in the farming system of Albania is expected to bring additional advantages to the farmers in terms weight gain for their animals and increased production in general. |
| **Stakeholders:** | Ministry of Agriculture and Food; Livestock Research Institute; Ministry of Energy and Industry; Ministry of Environment; National Energy Agency; Forest and Pastures NGOs; Private companies interested in Forest activities; etc |
| **Required Technologies:** | No special "know-how" technology is required apart from some field seminar organized at the farm level for introducing and instructing the farmers how to use the nutrient blocks as feed additives in their animals. |
| **Volume of Potential Reduction of GHG Emissions:** | An additional 15-20% of methane release reduction is expected upon the completion of the proposed project |

## WASTE

| *Project 1* | *Construction of sanitary landfills for the urban solid waste management* |
|---|---|
| **Sector:** | Waste management |
| **Objective:** | GHG mitigation and management of urban solid wastes through the economically viable method of sanitary landfills. |
| **Country:** | Albania |
| **Budget:** | USD Million 1,5 – 2 |
| **Project linkage to national priorities** | The project idea is in line of the National Waste Management Plan and revised NEAP and many other policy papers of the Ministry of Environment, which in turn contribute to the achievement of the MDG #7, namely Environmental Sustainability. In addition, the project will contribute in the meeting of the Albania's commitments under the UNFCCC, where it is a Party. |
| **Background** | Urban wastes in Albania are simply discharged. The dumping sites are practically the only disposal system for *urban solid waste* adopted in Albania. These disposal plants don't have any drainage system as regards the percolation effect or efficacious compacting systems. The technologies used for the final disposal of urban solid waste do not include differentiation of wastes and methane recovery systems. Existing landfills (actually simple dumpsites) do not have system to protect groundwater against the leaching of hazardous substances |
| **Expected outputs:** | ▪ Environmental pollution from urban solid wastes monitored and controlled<br>▪ GHG emissions reduced |
| **Stakeholders:** | Ministry of Public Works and Tourism; Ministry of Environment; Ministry of Local Authorities and Decentralization; Municipalities |
| **Required Technologies:** | The technology to be applied consists on that of sanitary landfills. They are supplied with the necessary waterproofing protection as for percolations in the soil, include methane recovery systems and the final covering layer. Landfills often comprise several successive infield phases of permitted waste, which are spread, compacted and covered daily with soils. Principal site liner containment components include natural/or synthetic plastic materials, with soil protection layers above and beneath, a porous leachate drainage layer and a top. |
| **Volume of Potential Reduction of GHG Emissions:** | This method of waste disposal will reduce the quantity of $CH_4$ from 38,15 Gg to 31,57 Gg $CH_4$ expected by 2010. |

| *Project 2* | *Construction of municipal solid waste incinerator with energy recovery in Tirana city* |
|---|---|
| **Sector:**<br>**Objective:** | Waste management<br>GHG mitigation and management of municipal sold wastes through introduction of the modern technology for the incineration of urban solid waste with energy recovery |
| **Country:** | Albania |
| **Budget:** | USD million 25 |
| **Project linkage to national priorities** | The project idea is in line of the National Waste Management Plan and revised NEAP and many other policy papers of the Ministry of Environment, which in turn contribute to the achievement of the MDG #7, namely Environmental Sustainability. In addition, the project will contribute in the meeting of the Albania's commitments under the UNFCCC, where it is a Party. |
| **Background** | Urban wastes in Albania are simply discharged. The dumping sites are practically the only disposal system for *urban solid waste* adopted in Albania. These disposal plants don't have any drainage system as regards the percolation effect or efficacious compacting systems. The technologies used for the final disposal of urban solid waste do not include differentiation of wastes and methane recovery systems. Existing landfills (actually simple dumpsites) do not have system to protect groundwater against the leaching of hazardous substances |
| **Expected outputs:** | ▪ Environmental pollution from urban solid wastes monitored and controlled<br>▪ GHG emissions reduced<br>▪ Methane generated utilized for energy purposes |
| **Stakeholders:** | Ministry of Public Works and Tourism; Ministry of Environment; Ministry of Industry and Energy; Ministry of Local Authorities and Decentralization; Municipalities. |
| **Required Technologies:** | The required technology is that of incinerator. Equipment will be imported. It is expected the plant to treat about 200 tons daily. That would be able to reach the limit of the economic profitability for an incineration plant. |
| **Volume of Potential Reduction of GHG Emissions:** | This method of waste disposal will reduce the quantity of $CH_4$ from 66,917 Gg to 41,02 Gg $CH_4$ expected by 2010. |

## INDUSTRIAL PROCESSES

| *Project1* | *Steel production by using the stock of scraps* |
|---|---|
| **Sector:** | Industry |
| **Objective:** | Reduction of GHG emissions and cost of production by using the stock of the scrap as raw material for steel production |
| **Country:** | Albania |
| **Budget:** | 1.5 million US $ |
| **Project linkage to national priorities** | The proposed project is expected to contribute to the implementation of the national strategy of industry and attainment of the sustainable development and Millennium Development Goals/Goal 7 and Goal 1. In the meantime theproject will contribute in the meeting of the Albania's commitments under the UNFCCC, where it is a Party. |
| **Expected outputs:** | ▪ Monitoring and control of the environmental pollution due to avoidance of the process of minerals' elaboration;<br>▪ A long-term sustainable option in consistency with national development goals;<br>▪ A good quality of steel produced, a lower cost production and an improvement of the employment level in Elbasan region.<br>▪ Scraps exploited from different sources in the country due to the closure of industrial factories. |
| **Stakeholders:** | Ministry of Public Works and Tourism; Ministry of Environment; Ministry of Local Authorities; Municipalities |
| **Required Technologies:** | No special "know -how" technology is required |
| **Volume of Potential Reduction of GHG Emissions:** | An additional of 10 – 20% of $CO_2$ and CO release reduction is expected upon the completion of the proposed project. |

| *Project 2* | *Use of hermetic technologies for cement production* |
|---|---|
| **Sector:** | Industry |
| **Objective:** | Reduction of GHG emissions released from cement production activities through enhancement of efficiency of production in the stock of cement factories. |
| **Country:** | Albania |
| **Budget:** | 2.3 million US $ |
| **Project linkage to national priorities** | The proposed project is expected to contribute to the implementation of the national strategy of industry and attainment of the sustainable development and Millennium Development Goals/Goal 7 and Goal 1. In the meantime the project will contribute in the meeting of the Albania's commitments under the UNFCCC, where it is a Party. |
| **Expected outputs:** | Amelioration of the pollution indexes introduced basically in the cement production process, which can be realized through:<br>▪ The preparation of the base mixture through a mixing system;<br>▪ Full computerising of the production regime;<br>▪ Change of the technology from horizontal to vertical hermetic systems, introducing cleaning systems of technologic gases;<br>The simultaneous production of the cement with betonies. |
| **Stakeholders:** | Ministry of Public Works and Tourism; Ministry of Environment; Ministry of Local Authorities; Municipalities |
| **Required Technologies:** | The project will introduce the updated technology of cement production through the change of the basic technology from horizontal to vertical and total computerization of the production system. An example might be the German experience in this field. |
| **Volume of Potential Reduction of GHG Emissions:** | An additional of 120% of $CO_2$ release reduction is expected upon the completion of the proposed project. |

## CLIMATOLOGY

| *Project 1* | ***Establishment of meteorological automatic station network for measurement and transmition of meteorological data.*** |
|---|---|
| **Sector** | Climatology |
| **Objective** | Use of new technologies to measure and transmit meteorological data. |
| **Country** | Albania |
| **Budget** | 0.5 million USD |
| **Description** | Meteorological automatic station is relatively a new technology of measurements and transmitting of meteorological data. Data gathering of meteorological elements by the automatic stations will provide information in real time, which is very useful, on the prediction of floods and inundation of agriculture land. Their number and distribution over the country depends from some factors, most important among them is the meteorological representativeness of the places where the station are decided to install as well as from the cost needed to realize this network. This information will be used more effectively in weather and hydrological forecast, especially in floods prediction, etc. |
| **Expected outputs** | Data gathering of meteorological elements (atmospheric pressure, air temperature and relative humidity, sunshine radiation, atmospheric precipitations, the wind direction and speed) by the automatic stations will provide information in real time, which is very useful, on the prediction of floods and inundation of agriculture land. |
| **Required Technology** | Automatic stations with all the elements mentioned |
| **Adaptation potential** | High |

| *Project 2* | *Satellite remotesensing* |
|---|---|
| **Sector** | Climatology |
| **Objective** | Use of satellite remote sensing technology to acquire and process information of environmental data. |
| **Country** | Albania |
| **Budget** | Cost unknown exactly |
| **Description** | Remote sensing technology refers to the techniques and methods used to acquire and process information about an object to be observed and studied, without getting physically in touch with it.<br>The analyses of remote sensed data allows, for instance, the identification and classification of significant environmental parameters such as water surface temperature, sea and land surface color, sea and land roughness etc.<br><br>The remote sensing technology is the best but very expensive alternative. |
| **Expected outputs** | As far as, meteorology and climatology are concerning, remote sensing data have helped spawn a revolution and enabled a better understanding and knowledge on the climate dynamics and its evolution. For instance remote sensing allows high frequency control of cloud patterns, assessment of temperature and moisture profiles, precipitation estimation, wind determination over the ocean and in atmosphere, etc. |
| **Required Technology** | Remote sensing technology, thus contributing to the effective understanding of environmental conditions and changes. |
| **Adaptation potential** | High |

## HYDROLOGY

| *Project 1* | *WOISA - Water Observation and Information System in Albania* |
|---|---|
| **Sector** | Hydrology |
| **Objective** | Provision of scientists, researches and end-users dealing with Global Change with real-time-data on the quantity and quality of water resources of Albania thorough promotion of Water Observation and Information System |
| **Country** | Albania |
| **Budget** | 0.5 million USD |
| **Description** | In order to assess water resources, their spatial and temporal variability influenced by Global Climatic and Environmental Change and by human activities, it is necessary to improve the studies concerning:<br>? Hydrological cycle mechanisms;<br>? Environment and its evolution under human influence;<br>? Water use.<br>To facilitate these studies, hydrologists, meteorologists, agronomists, ecologists etc. must set up opened and up dated knowledge data base and information systems.<br>The project will ensure the real time data flow and availability of historical information on water resources and their related environment to local and international community. |
| **Expected outputs** | Data base and information system of hydrological elements (precipitation, river stage, discharge, water quality parameters etc) will provide information in real time and historical data, which are useful for warning and forecasting of floods and flooding of agriculture land, water use for hydro-energy production and other end users. |
| **Required Technology** | A hydrological automatic station with all the elements mentioned above |
| **Adaptation potential** | High |

| *Project 2* | ***Information system for an integrated and sustainable use of water resources in Drini River*** |
|---|---|
| **Sector** | Hydrology |
| **Objective** | The main objective of the project is to offer knowledge database and associated tools for decision support to the scientific community and to decision-makers. |
| **Country** | Albania |
| **Budget** | 0.6 million USD |
| **Description** | The fact that 4 countries, Macedonia, Albania, Greece, Serbia and Montenegro including Kosovo, share this complex water system, make more difficult a real hydrological analyze.<br><br>This situation needs good collaboration between researchers of the 4 countries and exchange of scientific information in order to create a Unique Database of this system.<br><br>Until now, data and information are dispersed between various institutions of each country.<br>Four main actions are proposed:<br>? establishment of an information system (IS) bringing together all geo-morphological, hydrological, meteorological and ecological data and related information (papers, maps, etc.) of Drini (Drim) region;<br>? implementation of a monitoring program (MP) on water quantity and quality parameters which will provide in real time or near real time the Information System;<br>? implementation of a web site and end-users interfaces. |
| **Expected outputs** | Information System<br>The collection of all data and information available on water quantity and quality parameters, their checking and analysis, their storage and their dissemination to the partner teams of researchers can not be overlooked and must make up the basis of the work of multidisciplinary research.<br>All information concerning already published papers, maps etc. must be included into the Information system. Geo-morphological data, Digital Elevation models, remote sensing Images and more generally all spatial data will be stored in the information system.<br><br>The knowledge database must be available on Web for the researchers involved in the project as well as a part of this data and information and products must be in free access to be used by large public for awareness and pedagogical purposes.<br><br>Specific tools must be adapted to the needs of the decision-makers. |
| **Required Technology** | The Project will support a well-coordinated monitoring program through the purchasing of monitoring equipment and the development of a monitoring system for monitoring the quantity and quality of the waters of Drini River.<br><br>A hydrological automatic station with all the elements mentioned |
| **Adaptation potential** | High |

## AGRICULTURE

| *Project 1* | *Use of vacuum packaging technology for the preservation of food products in Albania* |
|---|---|
| **Sector** | Agriculture |
| **Objective** | Improve the quality of food products in the market, by combining cooling and freezing technology with the vacuum packaging. |
| **Country** | Albania |
| **Budget** | 2 million USD |
| **Description** | The average increase of temperatures especially during the summer increases the risk of food spoilage as well. Therefore additional measures are necessary to ensure the adequate preservation of food items. The implementation of the vacuum packaging technology for the preservation of food will reduce the food spoilage and ensure their proper storage on the market in combination with the cooling and freezing technology. The technology is particularly adequate for preventing, food spoilage from aerobic bacterial strains and moulds, which can be additionally aggravated by the envisaged average temperature increase. |
| **Expected outputs** | The implementation of this technology in the food processing and marketing units of Albania will prevent the food spoilage and contamination, increase their shelf life, reduce losses associated to food deterioration and increase food safety for the consumers. |
| **Required Technologies** | A special vacuum packaging line needs to be installed inside a food processing or distribution center. Some short training periods might be necessary for the operators. |
| **Adaptation potential** | High |

| *Project 2* | ***Implementation of thermal insulation system in the remodeling or building of livestock farm houses*** |
|---|---|
| **Sector** | Agriculture |
| **Objective** | Provide environmental conditions to match the thermal requirements of animals in view of the envisaged increase of the average ambient temperatures. |
| **Country** | Albania |
| **Budget** | 15 million USD |
| **Description** | Ensuring an adequate thermal balance during the livestock breeding cycle is of a primary importance for getting the expected production yields. Proper installation of perimeter insulation in the existing structures or in new buildings serves the purpose. In new farmhouses constructions it is advisable to make use of rodent-proof and waterproof insulating materials and if not available, proceed with the incorporation of polyethylene vapor barriers and rodent control measures. |
| **Expected outputs** | The implementation of this technology in the farming system of Albania is expected to bring additional advantages to the farmers in terms of weight gain for their animals and increased production in general. |
| **Required Technologies** | Staff training can be necessary regarding the "know-how" of the properties and characteristics of the insulation materials, alternatives of insulation, how to make a choice, cost-benefit analysis etc. |
| **Adaptation potential** | High |

## LAND USE CHANGE AND FORESTRY

| ***Project 1*** | ***Preparing of sustainable development projects for 10 districts.*** |
|---|---|
| **Sector** | Land Use Change and Forestry |
| **Objectives** | Promotion of sustainable development of forests for 10 districts through development of optimum land use and sustainable development scenarios. |
| **Country** | ALBANIA |
| **Budget** | 3.025 million USD |
| **Description:** | There is no any optimum land use plane for the Albanian coast or 10 districts with a priority to develop the tourism, to adapt the forests according to the expected climate changes to have the integrated and sustainable development with the other branches of economy. |
| **Expected outputs:** | Would have the land use and sustainable development scenarios very important for decision-makers to decide on the development directions to adapt the forests to the expected climate changes. |
| **Required Technologies:** | ? GIS equipments;<br>? Training of 5 specialists. |
| **Adaptation potential** | High |

| *Project 2* | ***Study and experimentation on the best cultivation systems to adapt the forest to climate changes.*** |
|---|---|
| **Sector** | Land Use Change and Forestry |
| **Objective** | Adaptation of cultivated systems to the expected climate changes through selection and utilization of the best cultivation systems. |
| **Country** | ALBANIA |
| **Budget** | 0.14 million USD |
| **Description:** | There is no any study and any experiment to select the traditional cultivation systems and the agro-forestry cultivation systems. |
| **Expected outputs:** | Better cultivation systems applied in forests and in agriculture areas. |
| **Required Technologies:** | ? Importing of modern seedling cultivation systems;<br>? Training of 2 specialists. |
| **Adaptation potential** | High |

| *Project 3* | *The experimentation on rehabilitation of burned forest area* |
|---|---|
| **Sector** | Land Use Change and Forestry |
| **Objective** | Enhancement of adaptation capability of burned forests through experimentation of planting of forest tree species that can better adapt to new conditions. |
| **Country** | ALBANIA |
| **Budget** | 0.09 million USD |
| **Description** | Because of the burning of the forest and pasture areas, the ecosystem situations changes and therefore, there are too much difficulties in selecting the species to rehabilitate them. |
| **Expected outputs** | Getting information in selecting the adapted species to rehabilitate the burned forest and pasture areas in order to achieving success. |
| **Required technologies** | ? Importing of modern seedling cultivation systems;<br>? Training of 2 specialists. |
| **Adaptation potential** | High |

| *Project 4* | *Study of genetically variation among forest tree species and inside each species.* |
|---|---|
| **Sector** | Land Use Change and Forestry |
| **Objective** | Enhancement of adaptation capabilities of forests through selection best adapted forest tree species and races to the expected climate changes. |
| **Country** | ALBANIA |
| **Budget** | 0.09 million USD |
| **Description:** | There is no study on the genetically variation among forest tree species and inside of each one specie, to identify them and to use them afterwards in adapting conditions. |
| **Expected outputs:** | The best possibility to select the most adapted forest tree species and races to the different expected climate changes. |
| **Required Technologies:** | ? Equipment;<br>? Training of 2 specialists. |
| **Adaptation potential** | High |

| *Project 5* | *Forest tree provenance and progeny tests in different climate conditions* |
|---|---|
| **Sector**<br>**Objective** | Land Use Change and Forestry<br>Enhancement of adaptation capability of forests through selection an planting of the best adapted forest tree provenance and progeny to the expected climate changes. |
| **Country** | ALBANIA |
| **Budget** | 0.12 million USD |
| **Description:** | There is no study and experiment on the forest tree species provenance and progeny, to have their results and to use them afterwards in adapting conditions. |
| **Expected outputs:** | The best possibility to select the most adapted forest tree specie provenances and progenies to the different expected climate changes. |
| **Required technologies:** | ? Importing of modern seedling cultivation systems;<br>? Training of 2 specialists. |
| **Adaptation potential** | Too High |

| *Project 6* | ***Experimentation of fast-growing species to better adapt to the expected climate changes*** |
|---|---|
| **Sector**<br>**Objective** | Land Use Change and Forestry<br>Enhancement of adaptation capabilities of forests through selection and planting of the best adapted fast-growing species to the different expected climate changes. |
| **Country** | ALBANIA |
| **Budget** | 0.12 million USD |
| **Description:** | There are some experiments and their results on planted fast-growing species such as: hybrid poplars, Monterey pine, Douglas fir and etc. |
| **Expected outputs:** | The best possibility to select the most adapted fast-growing forest tree species to the different expected climate changes. |
| **Required Technologies:** | ? Importing of fast-growing species seeds;<br>? Importing of modern seedling cultivation systems;<br>? Training of 1 specialist. |
| **Adaptation potential** | High |

## HEALTH

| *Project 1* | *Improvement of the infrastructure of the health services* |
|---|---|
| **Sector** | Health Service |
| **Objective** | Improvement of health services through the upgrade of health centers, their supply, training of medical and paramedical personnel, quality of the service, diagnosis and treatment of diseases. |
| **Country** | Albania |
| **Budget** | Cost not known exactly |
| **Description** | Building health centers in every commune will improve the health service to the community. Training medical personnel with adequate curricula will improve the quality of the service. The supply with some medical equipment will make possible the performance of some laboratory examinations that will fulfill the needs of the patients and doctors in setting the diagnosis. |
| **Expected outputs** | Through these interventions the patients will get a qualitative health service in their community, by gaining time (by not going to the hospital) andquick a recovery or amelioration of the health. |
| **Required Technologies** | Medial equipment like: blood, urine and sugar in blood testers, thermometer, and laryngoscope will improve doctor's job in setting quickly and correctly the diagnosis. Training of the personnel for the maintenance of this equipment is necessary. |
| **Adaptation potential** | High |

| ***Project 2*** | ***Prevention of vectorial diseases*** |
|---|---|
| **Sector** | Health service and local government |
| **Objective** | Study of the disease-causing vectors and their growing possibilities through intervention programs that will help their elimination and prevention. |
| **Country** | Albania |
| **Budget** | Cost not known exactly |
| **Description** | Groups of specialists (biologists, of public health, epidemiologists, veterinarians) will study the zones, growing places and biologic development cycles of the disease-causing vectors. The specialists will compose programs and schedules for treating the growing zones of the disease-causing vectors. The specialists will define the tools, equipment, and pesticides to elaborate the growing places of the vectors. |
| **Expected outputs** | By treating the growing and multiplying places of the disease-causing vectors will be achieved the decrease in number of their species, by eliminating the possibility of the transmission of diseases through these vectors. |
| **Required Technologies** | Vehicles, spray for sprinling the growing and multiplying zones of the disease-causing vectors and their utilization with appropriate pesticides will bring the elimination of the vectors and diseases (malaria, hemorrhagic fever, etc). Training of the personnel will make possible that the treatment of the zones with vectors will not pollute the environment (earth, water, plants). |
| **Adaptation potential** | High |

## GEOGRAPHICAL INFORMATION SYSTEM (GIS)

| *Project title* | *Geographical Information System (GIS)* |
|---|---|
| **Sector** | Cross-cutting |
| **Objective** | Use of Geographical Information System (GIS) to collect, manage, retrieve, integrate, manipulate, combine, visualize and analyze spatial data. |
| **Country** | Albania |
| **Budget** | Cost not known exactly |
| **Description** | GIS combines computer mapping and visualization techniques with spatial databases and statistical, modeling and analytical tools. It offers powerful methods to collect, manage, retrieve, integrate, manipulate, combine, visualize and analyze spatial data. It derives information from these data that help to assess the expected vulnerabilities of climate changes.<br><br>First-order application of GIS in coastal adaptation would be overlaying scenarios of sea-level rise with elevation and coastal-development data to define impact zones. More sophisticated application may include morphodynamic modeling. GIS technology is evolving rapidly and is increasingly used for sophisticated modeling. GIS can provide excellent support to coastal managers for making decisions about adaptation.<br>Collected data can be stored in a GIS, combined to developed new insights and information, and visualized for interpretation. GIS can assist planners to identify appropriate adoption technologies as well as their optimal location for implementation. |
| **Expected outputs** | There is no doubt that GIS offers great potential for society wishing to anticipate and understand the consequences of climate changes to cope with the potential impacts. |
| **Required Technology** | Geographical Information System technology. |
| **Adaptation potential** | Too High |

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