SECOND PART OF THE NATIONAL STRATEGY OF ENERGY

Energy Sector Development according to the Passive Scenario

II.1 INTRODUCTION

With the purpose of analysing and forecasting the development of the energy sector in the future as regards energy supply-demand, NAE in cooperation with the members of the technical group, has collected all the necessary data. Assisted by USAID, the NAE and MIE specialists were trained in USA on using of LEAP software. After the training, the NAE compiled various scenarios representing the possible "path" for the future development of the energy system. Two scenarios will be analysed more in details:

- **THE PASSIVE SCENARIO: according to which the Government measures in the frame of the Power Policy Statement for the short-term period (till 2006) are not rigorously applied according to the action plan. The scenario indicates that the non-implementation of the measures creates great difficulties and obstacles for the energy sector in general and the electricity sector, in particular. The Scenario provides a quantitative assessment of the energy demands and the cost to fulfill them, indicating the necessity for a rigorous implementation of the Power Sector Policy Statement, in order to avoid the total collapse of the power system. As a conclusion, the scenario provides a quantitative assessment (instead of a qualitative one as described in the Power Sector Policy Statement) of the necessity to avoid the energy sector development according to the Passive Scenario.** The scenario assumes that most of the future demand for electricity will be fulfilled by the extension of thermal generating capacities (based on marine diesel fuel, light fuel oil, heavy fuel oil or imported natural gas) and the hydropower. This chapter analyses in details the consumption and the forecast of the energy demand according to the Passive Scenario for each sector (residential, service, industry, transport and agriculture) as well as the supply with energy resources (oil, gas, coal, renewable energy sources and electricity).

- **THE ACTIVE SCENARIO: is the most important scenario analyzed during the preparation of the National Strategy of Energy. The scenario implies the stability of the Albanian energy sector development in general and electricity sector, in particular, by rigorously implementing the Power Sector Policy Statement till years 2006-07. The Active Scenario describes the additional measures (besides those provided by the Statement) for the period year till 2007 (especially for the other sectors not analyzed by the Statement) and for the long-term period 2007-2015. The Scenario provides a quantitative description of the measures needed to increase the energy efficiency and to introduce alternative sources in the energetic system.** The Scenario shows that these measures will transform the energy system into a supporting sector for the development of the Albanian economy and the increase of the general well being. By quantifying the energy demand and the financial packet to meet this demand, the active scenario shows the necessity for a rigorous implementation of the additional measures besides those provided by the Power Sector Policy Statement and as a conclusion, provides a quantitative assessment of each measure to be taken in order to increase the energy efficiency and of the necessity for the

decision makers to be convinced and take measures for the development of the Albanian energy sector according to the active scenario.

In order to provide the necessary analysis and to give realistic recommendations for the energy strategy, a general model of energy has been adapted for the Albanian conditions, which is the LEAP software (**L**ong **E**nergy **A**lternative **P**lanning). The soft illustrates the different scenarios till 2015 and the consequences of the energy policy and external effects related to them. The program is useful and quite comfortable with Albanian energy system, because the forecasts are based on **generating parameters** (the growth rate of GDP and the growth rates of added values, for each sector or sub-sector of the economy), on the models of **sector demand** and lately on **energy intensities**. On this basis has been forecasted the energy demand for each energy source by the sectors. LEAP software calculates the demand for primary energy sources and the necessary costs related, the investments and use-maintenance cost, all in economic and social level. LEAP also calculates the emissions from the fuels in the atmosphere. The basic characteristic of LEAP is that the calculation of the demand is based on the **"bottom-up"** method with many decentralized data, based in the penetration percentages of different equipment and on energy intensities.

II.2 General macro-economic indicators of the energy sector development

The relation between the country's economic development and the energy demand is considered as a key issue and is represented as a closed cycle. This cycle includes many economic, social and technological analyses and in order to clearly define the correlations between them, many studies are needed in the economic and social development sectors. They are the basis for challenges and commitments of the Albanian energy sector in order to provide the optimization of the energy resources with the lowest cost, to guarantee the energy supply level to meet the customers demand and establish conditions for a sustainable economic development. The growth rate of the energy supply should correspond to the increase of the economic and social development and the establishing of a functional equilibrium between the increase of macroeconomic indicators and the energy balance, although it doesn't mean to keep the same ratio of steps. This issue will be analyzed more in details during the description of the Passive and Active Scenarios.

The scenarios do not pretend to be precise forecasts, but they rather outline two limits within Albanian energy system probably will develop. The scenarios describe the medium-term development possibilities of the Albanian energy sector based also on future predictions of technological and economical development of its neighboring countries with their economic development and climacteric conditions, associated with the acceptance of some future development tendencies of the country, described in the first part of this document.

Based on the World Bank study "Albanian Power Sector Study", three economic development scenarios were described for Albania, as shown in table II.1:

Scenarios	Table II.1.: GDP growth, 2002-2015				
	GDP Annual Average Growth (%)				
	2002	2003-2005	2006-2010	2011-2015	2002-2015
Low	5.00	3.82	3.17	2.33	3.00
Average	5.00	5.94	5.27	4.36	5.07
High	5.00	6.83	6.20	5.29	6.00

The scenarios were built based on some main developments:
The assessment of macroeconomic indicators trend show that in year 1998 the country's economy was reinforced due to the development of Construction, Service and Agriculture sectors as well as the rehabilitation of the industry and remittances from emigrants. It should be underlined that during the period 1992-2001, the foreign financial aid reached up to US $818 Million. Taking into consideration the economic indicators, Albania is in conformity with the obligations settled by the IMF and the process of the Pact of Stability and Association with EU. Forecasts are based on the National Strategy for the Economic and Social Development either for the economy as a whole or for specific sectors based on short and long term possibilities of development.

The general scenarios, Passive Scenario and Active Scenario (as well as the others) are based on the same economic-growth rate of **+5.5% per year in GDP**. Thus, all the analysis will be based on this GDP growing indicators. Figure II.1 forecasts the GDP for each sector till 2015, based on the World Bank study and consultancy from various national and international institutions. As shown in figure II.1, the main GDP contribution will be provided by agriculture followed by the service sector. The main parameter used to forecast the energy demand of the Agriculture, Industry and Service Sectors would be their contribution in the total GDP. As shown in figure II.1, the main contribution in relative terms in the total GDP will continue to be provided by agriculture sector with a slight decrease from 48.7% in 2002 to 39.2% in year 2015, followed by an increasing sector of construction from 16.4% to 17.8%, and the service sector from 20% to 23.4%. The contribution from the industry and transport sectors in year 1999 was respectively 11.2% and 3.7%, while in year 2015 the contribution is expected to increase to 15.8% and 3.9%. Another important indicator affecting the country's development is the trade deficit. Figure II.2 indicates its trend for the period 1993-2002. Analysis show a negative indicator of the macroeconomic balance that creates a crucial situation that may be aggravated if necessary measures are not taken. Currently, imports have higher values than exports that mean more currency is going out than entering, in an increase of debts and lack of the appropriate budget for investments in the infrastructure in general and in energy sector, in particular.

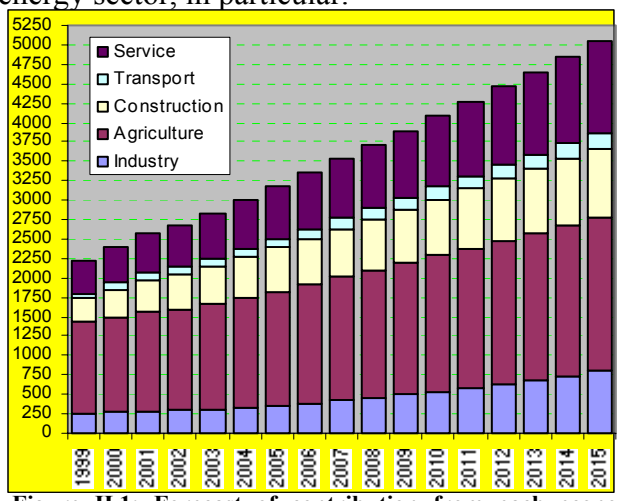

Figure II.1: Forecast of contribution from each economic sector in GDP (US$ million)

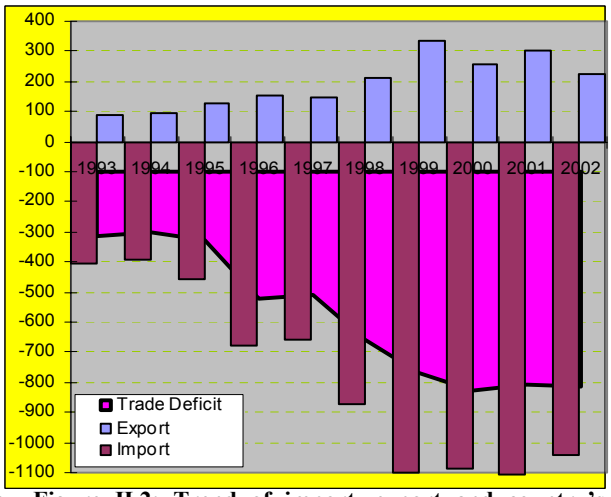

Figure II.2: Trend of import, export and country's trade deficit (US$ million)

Another important guideline for the preparation of the National Strategy of Energy is the growing rate of the population and the ration between urban and rural population. Figure II.3 shows the trend

of demographic changes in the country for the period 1990-2015. The forecast of the population increase for future years is calculated at an average of 1.1% per year, while the tendency of the urban and rural population is based on the migration from rural to urban zones, accompanied with changes in the living standard and economic activities. The movement is accompanied with the change of the consumer's behavior towards the energy demand and the increase of demand for different kinds of energy and as a consequence, with a structural change of the energy demand.

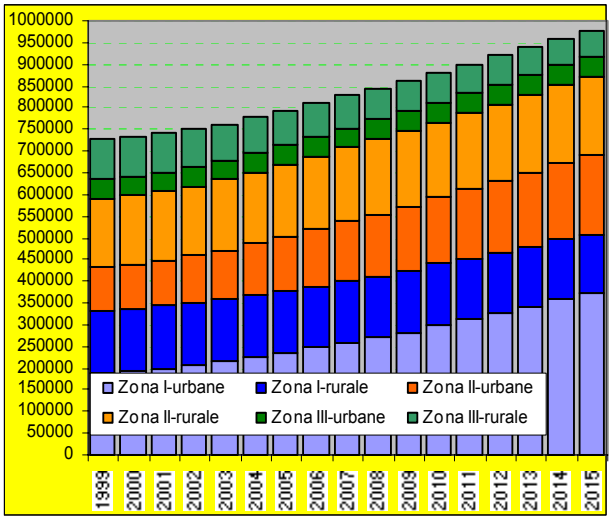

Figure II.3: Trend of urban and rural population and future forecasts (US $ million).

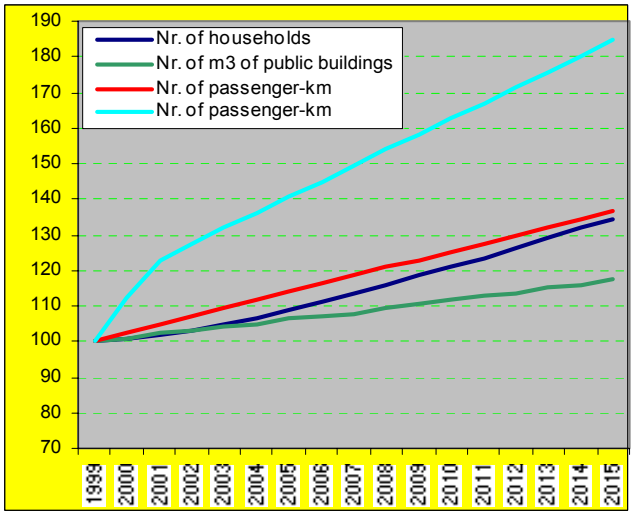

Figure II.4: Trend of the main driving factors for calculation of energy demand according to passive scenario

The main parameter used as driving factor for calculation of the energy demand in the household sector is the number of dwellings for the basic year (1999) and the future forecast. Parameters for years 1999, 2000, 2001 are realistic and based on the last census of INSTAT in year 2001 and future forecasts. Figure II.4 shows a normalized indicator with 100% in 1999 and the analysis indicates that till 2015 the household stock will increase by 35%. A more detailed analysis for this parameter according to climacteric and urban/rural zones is given in the energy demand forecast in the household sector.

In addition, figure II.4 indicates the trend of two main driving factors for calculation of the energy demand in the transport sector: passenger-km is the driving factor for the forecast of the demand in the passenger transport sector and ton-km is the main driving factor to calculate the energy demand in the goods transport sector. According to forecasts, the indicator ton-km is expected to experience an important increase with 85% compared to 1999, while the indicator passenger-km will increase 37% compared to 1999. A more detailed analysis about these parameters, as a base to calculate the energy demand for each sector, will be given in the respective analysis of the energy demand forecast. These indicators, that in cooperation and mutual influence affect the future energy for respective sources, have been taken in consideration while preparing the National Strategy of Energy. Other specific indicators for each sector are taken in consideration during the analysis of the energy demand forecast.

II.3 Forecast of energy demand in residential sector according to the passive scenario

Energy consumption and demand in residential sector was carefully discussed due to its importance, first because of its contribution with over ¼ of the total energy and secondly because of the very high consumption of electricity leading to a very difficult supply situation with frequent interruptions. The population number is an important driving factor used for the calculation of the energy demand in the residential sector. The family number for each climacteric zone based on the degree-days for urban and rural families was used as a basic factor in the residential sector. Table II.2 gives the division for year 1999 and the future trend is based on INSTAT and World Bank studies. The trend is shown in figures II.5 and II.6. The division includes 3 sub sectors according to the average number of annual degree-days determining the theoretical space heating and hot water needs. This was done in order to prepare further detailed analysis of the potential for implementing different energy efficiency measures and as a consequence the calculation of different ways to meet the demand for space heating and domestic hot water. A considerable increase of the number of families is forecasted for zones I and II (from 45.68% and 35.07% in 1999 to 52% and 37% in 2015, respectively and a decline in zone III (from 19.25% to 11%) due to migration towards warmer zones with more development perspectives. Urbanization of rural zones and the family movement towards urban zones is also taken into consideration.

Table II.2: Family distribution based on CENSUS 2001 registration, from INSTAT

No.	Zones	Zone I (under 1200 d-d)		Zone II (over 1200 and under 2000 d-d)		Zone III (over 2000 d-d)	
		Urban	Rural	Urban	Rural	Urban	Rural
1	Berat			11839	17663		
2	Bulqize					2194	6841
3	Delvine	1126	2069				
4	Devoll					1622	6416
5	Diber					3139	14250
6	Durres	29260	15779				
7	Elbasan			24489	28910		
8	Fier	19740	27857				
9	Gramsh			2487	5123		
10	Gjirokaster			6152	7882		
11	Has					630	3158
12	Kavaje	7213	11523				
13	Kolonje					1921	2337
14	Korce					16085	19293
15	Kruje			4569	9979		
16	Kucove			4719	3899		
17	Kukes					3444	9572
18	Kurbin			5823	7022		
19	Lezhe			4116	11626		
20	Librazhd					2769	12551
21	Lushnje	9603	22384				
22	Malesi e Madhe					939	8098
23	Mallakaster	2137	6634				
24	Mat			3252	10270		
25	Mirdite			2213	5951		
26	Pegin			1724	5291		
27	Permet					2618	3790
28	Pogradec					6016	10907
29	Puke			1364	6232		
30	Sarande	3928	5909				
31	Skrapar					3324	3582
32	Shkoder			22424	23659		
33	Tepelene			2877	4686		
34	Tirane	92509	36536				

35	Tropoje					1678	4544
36	Vlore	21952	14523				
37	Albania	187468	143214	98048	148193	46379	105339

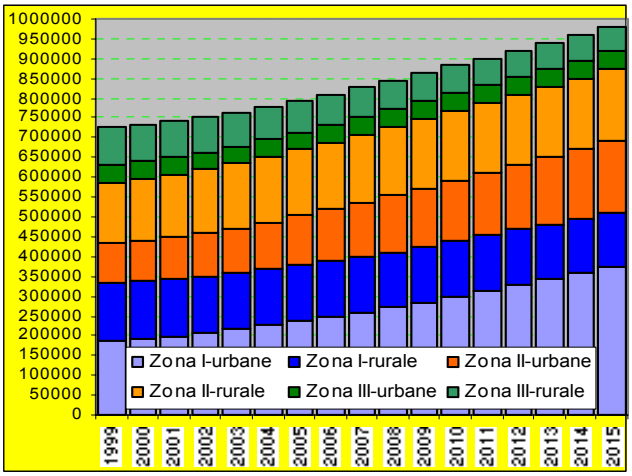

Figure II.5: Forecast of number of families for the zones and division in urban and rural zones

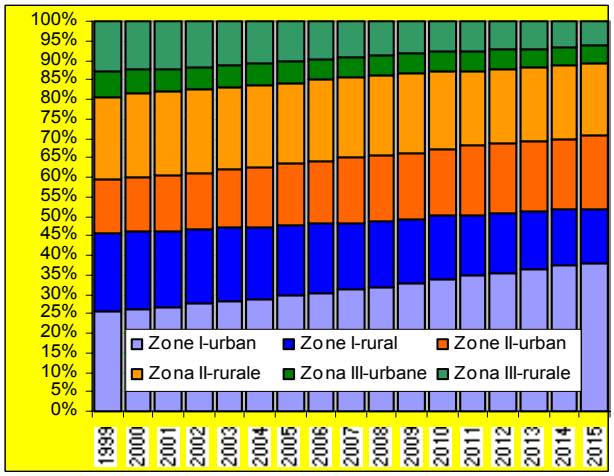

Figure II.6: Forecast of number of families in% for each zone and the division in urban and rural zones

Energy consumption in residential sector is divided in five parts with different characteristics: **space heating, air conditioning, domestic hot water, and cooking, lighting and electric 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. Since year 1990, the energy supply and demand for space heating, cooking and domestic hot water (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.

Surveys are very important to focus on the changes occurred in the residential sector as regards the energy consumption. The structure of the energy demand has drastically changed in urban areas where electricity meets 62% of the total energy demands, almost twice compared with fuel woods. In rural areas, the historical dominant position of fuel woods still continues, meeting 50% of the total demand while only 25% is met by electricity.

In order to have an accurate calculation of the energy consumption for each service, a number of surveys were completed since 1992. In 1993, World Bank prepared the first survey on the energy services and household sector. The survey included data from 750 respondents in different zones and showed the quantity of energy consumed for space heating, cooking, hot water, electric appliances and lighting. The survey calculated also the contribution of each energy source for different services. The only defect of the survey was that the indicated outcomes were in national level instead of regional level. In 1998, the National Agency of Energy prepared the second survey to evidence the energy consumption for each service and energy source. Differently from the World Bank survey in 1993, the NAE survey included 2700 respondents distributed in three climacteric urban and rural zones. This provided a more accurate data system for the planning of the energy demand in the residential sector. The World Bank study on the Albanian power sector, completed at

the end of January 2003, prepared a detailed survey to assess the energy demand in the residential sector for each service, with families selected from different urban and rural climacteric zones and categories, based on their income level and type of dwelling.

This experience and the World Bank study provided the necessary data on the realistic energy consumption for the years 1999, 2000, and 2001, for space heating, cooking, domestic hot water, lighting, electric appliances and air conditioning in three urban and rural zones. The surveys show also the contribution from each energy source to meet the demand for each service (in each zone) and the tendencies of these important parameters for the planning of energy demand in the residential sector. The demand calculation for the above services was based on the contribution of energy sources and their real consumption. For each energy source was also forecasted the type of electric appliance that should be used and its efficiency. In order to calculate the quantity of energy demand for space heating was taken in consideration the household stock and its forecasted change till 2015. In addition, four types of dwellings were taken in consideration in the zones divided according the degree-days with a general coefficient of volumetric heat loss (Gv) given in table II.3. For the new households, the calculations were based on the implementation of the law ***"On heat conservation in households"***, already approved in September, 2002.

Table II.3: Coefficient of Volumetric Heat Losses Gv of buildings according to the zones [W/m$^{3\,0}$]

Type of Building	Zone I: less than 1200 d-d	Zone II: between 1200-2000 d-d	Zone III: more than 2000 d-d
Existing villas	1.78	1.42	1.22
New villas	1.42	1.07	0.88
Existing multiple store dwellings	1.05	0.87	0.73
New multiple store dwellings	0.74	0.61	0.52

Based on the above surveys, was concluded that in 1990 only 35% of the dwellings space was heated, while in 2015 based on the last decade trend (1993-2002) was accepted that 45% of the dwelling will be space heated. The same assumption was made by the last study of World Bank. Another important indicator to calculate the space heating needs is the average surface per inhabitants and its future development. Based on the data from the Household Department of Ministry of Territory Adjustment and Tourism the World Bank study, was supposed that the average surface would increase from 14.4 m^2/inhabitants in 1990 to 20 m^2/inhabitants in 2015.

Based on the above mentioned assumptions, the energy demand for each service was calculated. The outcomes of the analysis are described following, starting with space heating. Figures II.7 and II.8 show the energy demand for space heating for three zones and the energy commodity.

The energy demand for space heating is expected to increase from 101 ktoe in 1999 to 233 ktoe in 2015. Although with the largest family number, the energy consumption for space heating in the first zone will occupy 38.2% of the total in 2015, as shown in figure II.7. The energy demand for space heating in 2015 is foreseen to be met by electricity, fuel woods and LPG, with 86.5 ktoe, 73 ktoe and 5.2 ktoe, respectively. It is important to underline that the LPG contribution is expected to increase 8 times and this increase from 8% in 1999 to 30% in 2015.

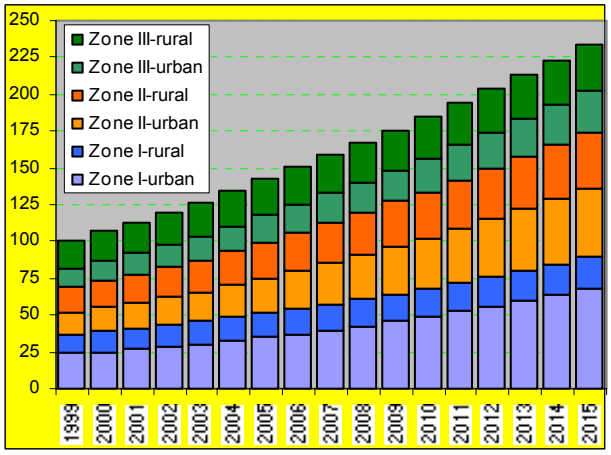

Figure II.7: Forecast of energy demand for space heating in each zone (ktoe)

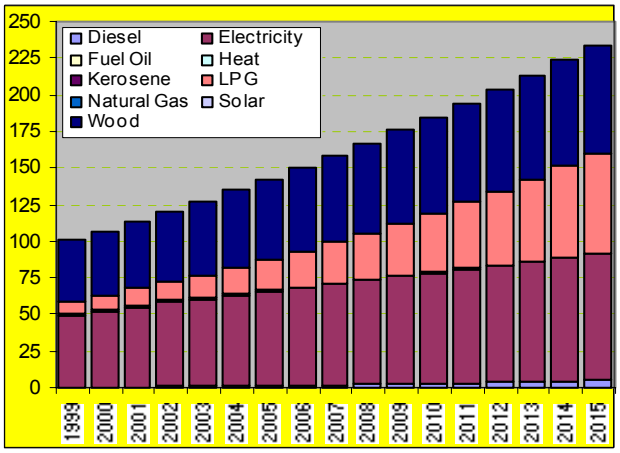

Figure II.8: Forecast of energy demand for space heating for each the energy commodity (ktoe)

Figure II.9 shows the energy quantity and the contribution of each energy commodity for the domestic hot water. In order to calculate the needs for domestic hot water was considered the quantity of sanitary water needed for one person per day for different services: shower, laundry, dishwasher, etc. The quantity of hot water needed was based on different surveys, described above. As shown in figure II.9, the energy demands for preparation of domestic hot water in 1999 were 72 ktoe while in 2015 is forecasted to reach 121 ktoe. The main demand will be met by electricity with 70% in 2015 followed by fuel woods and LPG. The figure shows that solar energy will have the major increase, contributing with 4% in 2015. Figure II.10 shows the forecast of the energy demand for cooking in the residential sector. The total demand in 1999 was 103 ktoe expecting to increase to 168 ktoe in 2015. Electricity, fuel woods and LPG will contribute, respectively with 72 ktoe, 46 ktoe and 49 ktoe, in 2015.

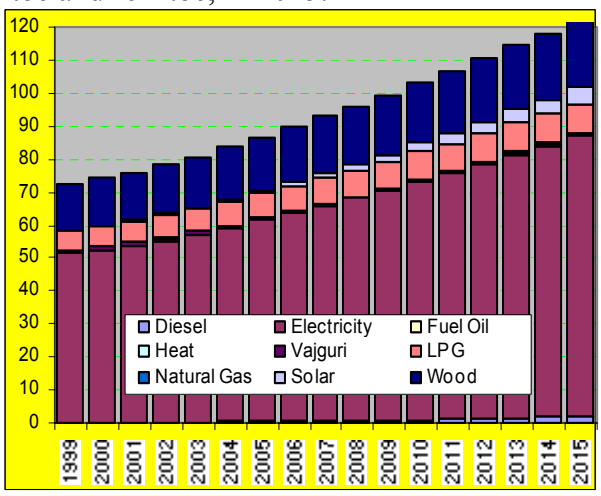

Figure II.9: Forecast of energy demand for preparation of domestic hot water for each energy commodity (ktoe)

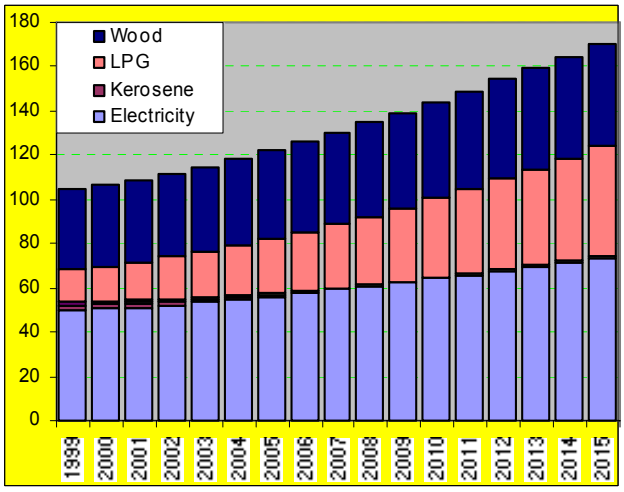

Figure II.10: Forecast of energy demand for cooking for the energy commodity (ktoe)

Figure II.11 shows the energy demand for lighting, which is forecasted to increase from 31 ktoe in 1999 to 43.3 ktoe in 2015. As a special characteristic after 2007 is the use of two kinds of lamps: fluorescent and incandescent ones. The group of electric appliances includes: radio, TV, videos, washing machines, refrigerators, ironing, tape recorder, computers and water pumps. The NAE and

WB survey show the electricity consumption for use of these appliances during one year from urban and rural families in three zones. The outcomes have also been used as basic data for 1999 while an increasing tendency has been forecasted for the coming years taking into account the consumption in neighboring countries and the increase of the living standard of Albanian families. Figure II.12 gives the forecast of electricity demand for electric appliances and air conditioning. The demand for electric appliances is expected to increase from 75 ktoe in 1999 to 122 ktoe in 2015.

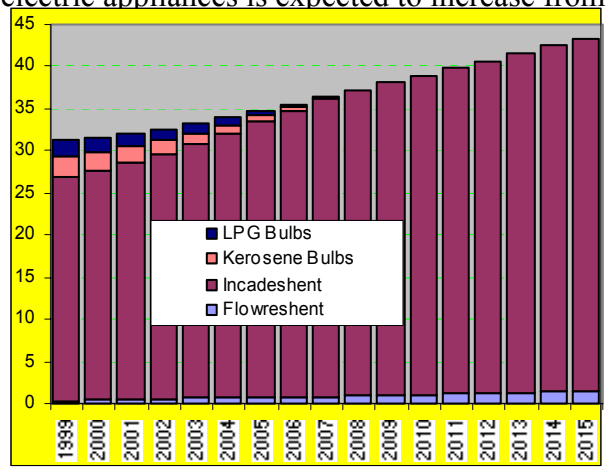

Figure II.1: Forecast of energy demand for lighting for each energy commodity (ktoe)

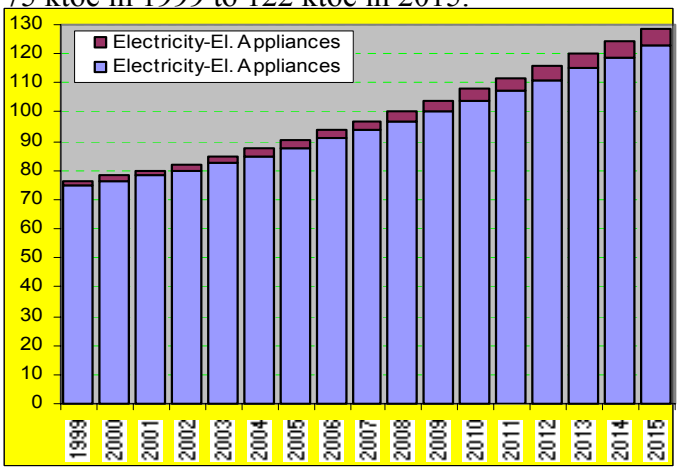

Figure II.12: Forecast of energy demand for electric appliances and air conditioning (ktoe)

As above mentioned, air conditioning is a new service in the residential sector. Based on surveys, conditioner penetration (heat pumps) in 1999 was respectively for urban and rural families 30% and 15% in the first zone, 25% and 10% in the second zone, 10% and 5% in the third zone. The average penetration of conditioners in the whole country in 2015 is expected to be 28%. The electricity demand to guarantee air conditioning according to the above conditions were 1.51 ktoe in 1999 and is foreseen to be 5.9 ktoe in 2015.

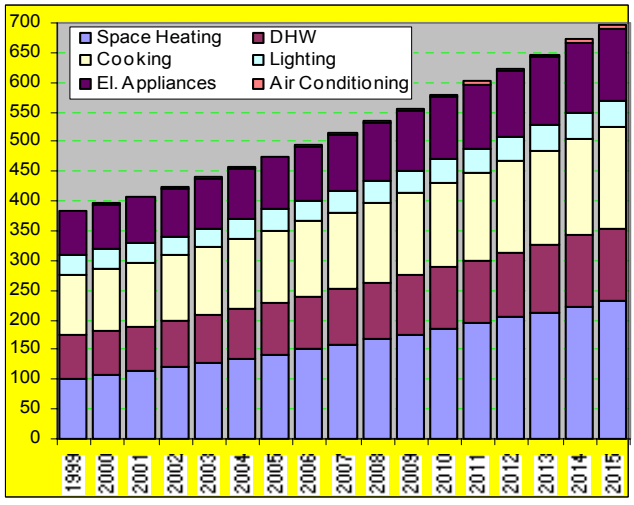

Figure II.14: Forecast of energy demand for residential sector for each service (ktoe)

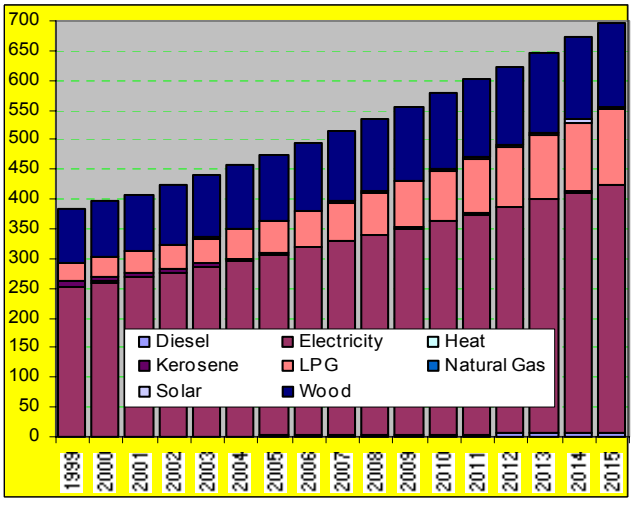

Figure II.13: Forecast of energy demand for residential sector for each energy commodity (ktoe)

Figure II.13 summarizes the energy demand to guarantee each service. As shown in the figure, in 2015 space heating is expected to play the main role with 33.50%, followed by cooking 24.27%, domestic hot water 17.52%, electric appliances 17.63%, lighting 6.23% and air conditioning 0.85%. Figure II.14 summarizes the energy demand for each energy commodity in the residential sector. As

shown in the figure, the main role will be played by electricity with 59.84% followed by fuel woods with 20.16%, LPG with 18.11% and the remaining part for other resources.

II.4 Forecast of energy demand for service sector according to the passive scenario

In order to calculate the energy demand, the Service Sector was divided in two branches: Public Service and Private Service. The Public Service Sector has a traditional experience in the heat demand, based mainly on the old technology, installations and organization, but in some cases new schemes have been introduced. The data system for the quantity of energy demanded for each service and the contribution of each energy commodity is based on different surveys prepared by NAE and the last World Bank study. It should be underlined that space heating, domestic hot water and lighting for all sub-sectors is generally realized with a very low quality, due to old energy infrastructure in the public service institutions and lack of budget.

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

Analysis of the energy demand is based on the general tendency of the previous period. A number of driving factors were taken into consideration as determining factors for the future energy demands. The public service buildings have as a special driving factor the total volume (12.6 mil.m^3), divided in the heated stock (35% for 1999) and unheated stock (1999). In order to increase the service quality, improve the working conditions and the comfort for the public administration, was forecasted that until the end of the period 1999-2015, the existing ratio would change in favor of the heated stock, covering 90% in 2015. The GDP growth from the service sector will be accompanied with energy demand increase due to high comfort requirements, the qualitative improvement of the services and changes of the ratio between the urban/rural population in favor of the former. The analysis of the country's macroeconomic indicators, show that the service sector currently gives approximately 17% of the GDP and will continue to grow with the same rate, as shown in figure II.1.

Energy consumption in the public sector will gradually increase together with the increase of the number of heated buildings and the improvement of the service conditions. Structural changes are also foreseen: elimination of coal use and the increase of oil by-products role in the consumption structure. Figure II.15 shows the energy demand for the public service sector for the heated and unheated stock. The detailed analysis of energy demand in the public service buildings indicates that the role of the unheated stock in the total volume of the public buildings will considerably decline from an actual 65% to 10% in 2015, with only 3.5 ktoe consumed in 2015 from 14 ktoe that was consumed in 1999. Energy demand for space heating, occupying 32.5% of the heated stock consumption in 1999 will continue to grow with high rates reaching to 82.4 ktoe in 2015.

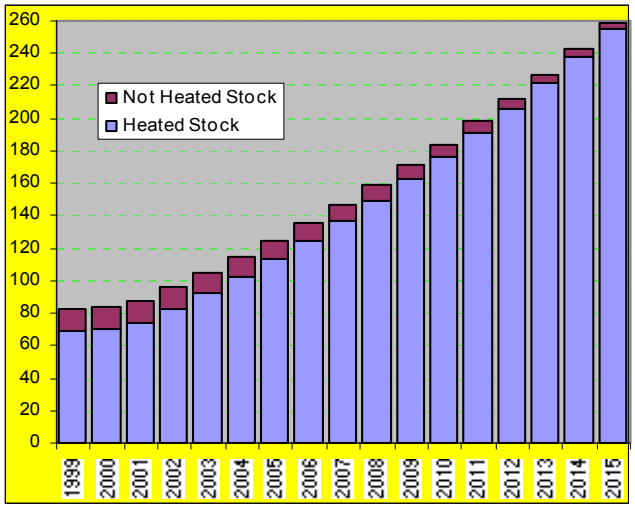

Figure II.15: Forecast of energy demand for public service sector (ktoe)

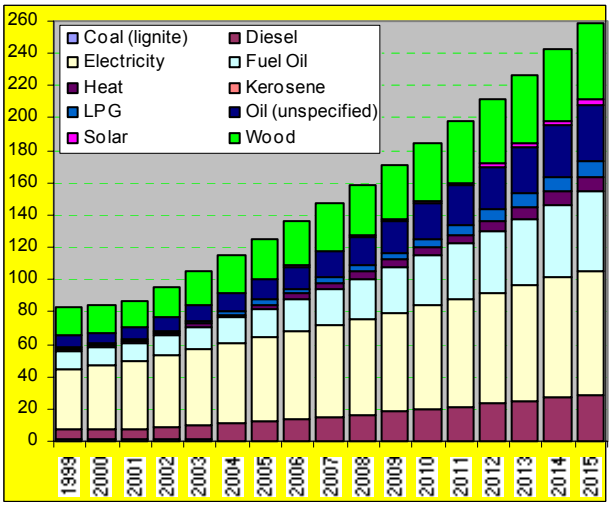

Figure II.6: Forecast of energy demand for public service sector for each energy commodity (ktoe)

The use of liquid fuels will progressively increase from 10.3 ktoe in 1999 to 50.6 ktoe in 2015 (as shown in figure II.16). The preparation of domestic hot water that actually needs 23.1 ktoe (or 33.5% of the consumption) will continue to grow to 93.5 ktoe in 2015, maintaining the tendency of the large increase of oil by-product consumption. The increasing energy demand for cooking will be mainly met by fuel woods and LPG. For air conditioning, lighting and other electric appliances is forecasted that energy consumption will increase from 14.2 ktoe in 1999 to 51.3 ktoe in 2015, aiming a qualitative improvement of the lighting (reduction of incandescent lamps and increase of fluorescent lamps) and the increase of spaces with air conditioning.

The Private Service Sector is expected to experience a large increase of the energy demand. According to the passive scenario, the demand will have an annual average increase of 8%, determined by modern developments in tourism, business, trade and other qualitative services. Figure II.17 gives the forecast of energy demand for the private services during the period 1999-2015 for each energy commodity. Energy demand for these services is forecasted to increase from 104 ktoe in 1999 to 351 ktoe in 2015. The actual tendencies in the passive scenario foresee a structural change due to decline of electricity contribution from 49% in 1999 to 42% in 2015; decline of fuel woods contribution from 20% to 8%. Both these developments will be accompanied with the increase of oil by-product consumption from 28% in 1999 to 46% in 2015.

Figure II.18 shows the energy demand forecast for public and private services. As shown in the figure, the contribution of public service will increase from 55.6% in 1999 to 57.68% in 2015. Figure II.19 shows the energy demand forecast for each energy commodity.

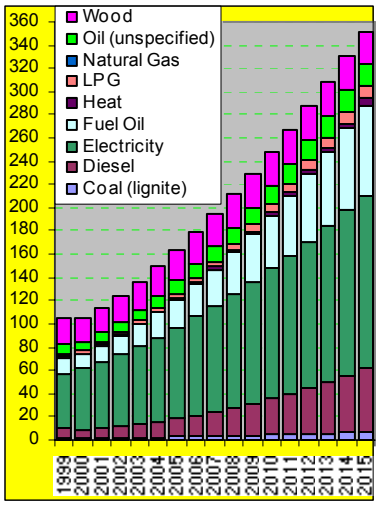

Figure II.17: Forecast of energy demand for private services for each energy commodity (ktoe)

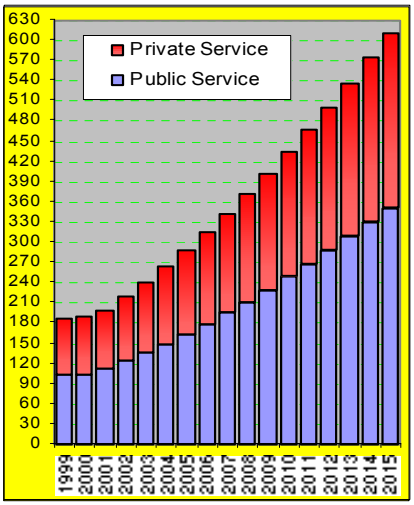

Figure II.18.: Forecast of energy demand for public and private services (ktoe)

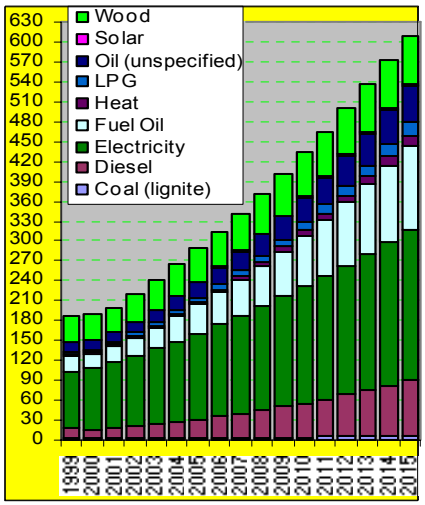

Figure II.19: Forecast of the energy demand for services for each energy commodity (ktoe)

Figures clearly show that the consumption in the service sector will increase with high rates. In 2015, the energy demand in the sector is expected to reach 610 ktoe with the following structure: fuel woods 74 ktoe; oil by-products 285 ktoe; electricity 226 ktoe; coal 7 ktoe; heat 15 ktoe and solar energy 3.3 ktoe. If the passive scenario is followed without measures to increase the efficiency and reduce the consumption, the energy demand in the service sector will be 3.26 time higher in the year 2015 compared to year 1999.

II.5 Forecast of the energy needs for the industry sector up to the passive scenario

The **Industry Sector** in the National Strategy of Energy is divided in the following sub sectors: Metallurgy, Chemical, Building Materials, Mining, Food/Beverage/Tobacco, Textile/Leather/Shows, Wood/Paper/Printing, Mechanical and others. The analysis of the economic development during the period 1990-2002 shows a decline of the contribution of the Industry Sector in 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. Meantime, 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.

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 standpoint, the industry continues to have very high energy

intensity for each production unit in nature it consumes: 0.1 toe/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).

The statistical system of the energy resource consumption in the industrial sector has experienced essential changes during the last 10 years, but the database is not always reliable, as a consequence many analysis and verifications are needed to approach the reality and the logic of phenomenon. In this direction NAE has completed in 1999 a large industry sector survey, analyzing 2100 industrial enterprises in all sub sectors mentioned above. The survey has served as a base to prepare the energy balance since 1998 and calculate the energy intensities and contribution of each energy commodity for each industrial sub sector.

The Passive Scenario assumes the development of different industrial branches, maintaining the actual form of energy supply, generally expressed in energy intensity and energy source contribution for each industrial sub sector. So far, the responsible institutions have not prepared assessments in nature or value for the expected developments of the industrial branches.

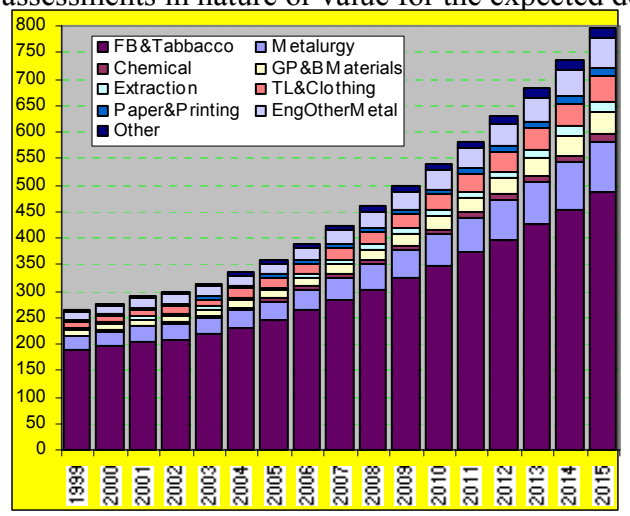

Figure II.20: Forecast of contribution from each industrial sub sector in the industrial GDP (US$ million)

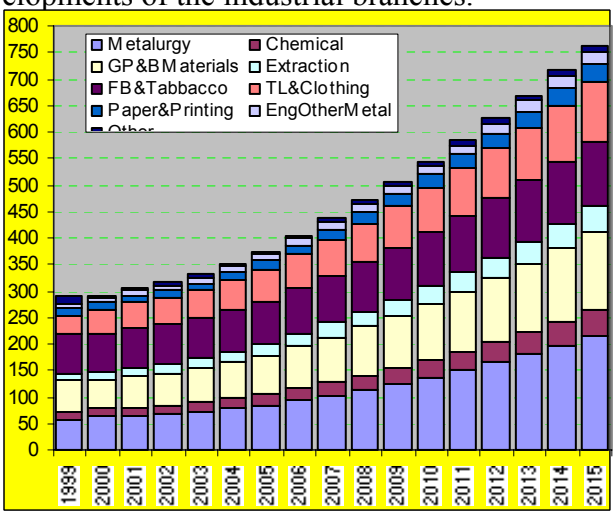

Figure II.21: Forecast of energy demand for industry sector for each sub sector (ktoe)

Based on previous potentials and the actual possibilities as well as on macroeconomic indicators that have oriented preparation of the National Strategy of Energy, development schemes have been prepared taking into consideration the World Bank study and the sector financial growth indicators provided by International Monetary Fund. Figure II.1 shows the trend of the industry sector GDP as a whole, while figure II.20 shows the contribution of each industrial sub sector. As indicated in figure II.20, the biggest contribution in GDP comes from Food/Beverages/Tobacco, Metallurgic and Building Materials sub sectors followed by the others. Figure II.21 shows the demand forecast for energy sources for all industrial sub sectors. The main contribution regarding consumption of energy sources comes from metallurgy, building materials, food and textile (light industry). Figure II.22 shows the demand forecast for energy sources till 2015, according to the passive scenario. Figure II.23 shows the contribution of the energy sources till 2015. Figure II.23 shows that in order to meet the energy demand of the industrial sector, according to the passive scenario in 2015 are needed: Oil and by-products approximately 375 000 ton; electricity approximately 2400 GWh; fuel woods approximately 1.05 million mst; coal and metallurgic coking coal approximately 65000 ton.

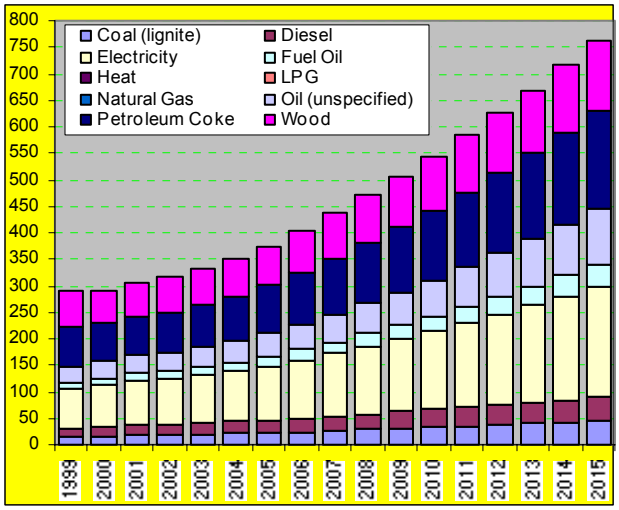

Figure II. 22: Forecast of energy demand for industry sector for each energy commodity (ktoe)

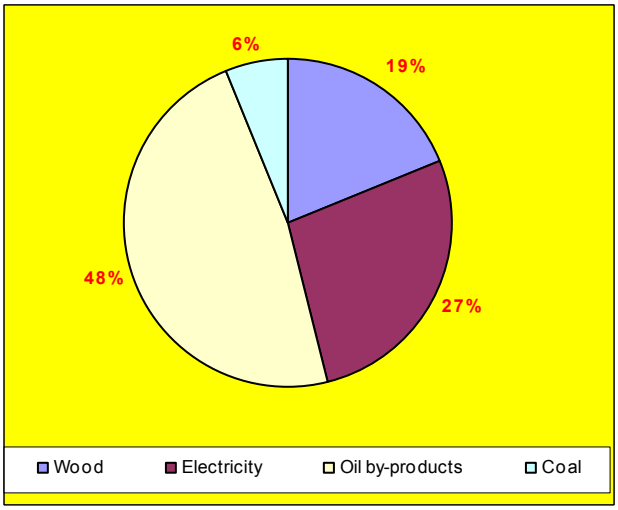

Figure II.23: Contribution of each energy commodity to meet industrial demand in the year 2015

Figures II.24 and II.25 show the energy forecasts for heat processes and processes that need driving forces (energy consumed in electromotor and other moving systems) in all industrial sub sectors.

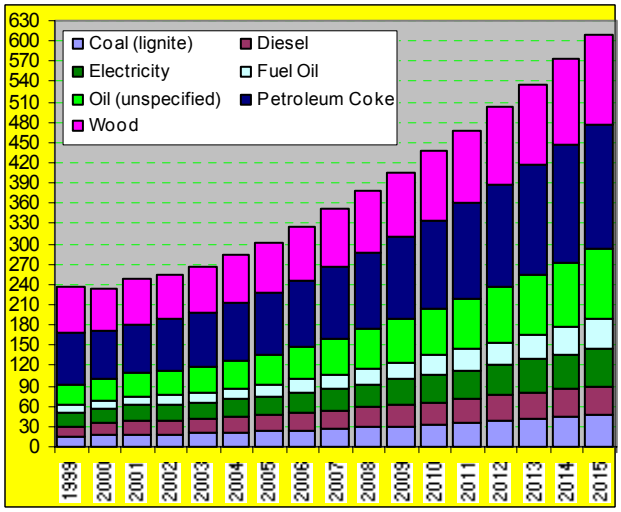

Figure II.24: Forecast of energy demand for providing heat process (ktoe)

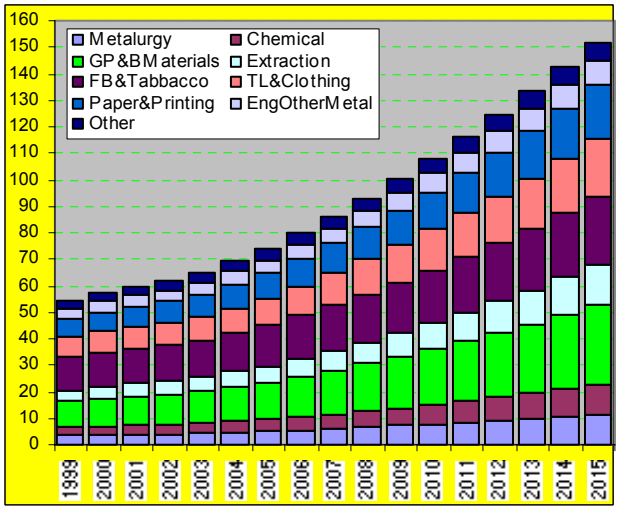

Figure II.25: Energy demand for moving energy in each industrial sub sector (ktoe)

The above analysis shows the necessity of the security of energy supply (quantity, quality, reliability and timing), for sectors and industrial branches that play a key role in the economic growth, employment and living standards. The reduction of the energy demand, without damaging the economic and social development indicators, is the common goal when analyzing the above factors. This objective requires forecasting and implementation of the Active Scenario that implies other measures as regards the energy efficiency increase, which are treated more in details in the following chapter.

II.6 Forecast of energy demand for transport sector according to passive scenario

The transport sector in Albania started to develop with fast growth rate after '50, when, in addition to the quantitative increase of road transport means, the infrastructure and transporting capacities of the road, railway and sea modes 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 modes 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. In order to calculate the future energy demand, the sector was divided in two sub sectors: transport of freight and passenger.

The transport of freight had a very strong increase during the period 60-70', where it consumed an average of 15% of the total energy consumed per year. The increase in 1970 was in average only 2.4% per year and in 1980 the transport activity of freight dropped to approximately 20%, reaching the level 1147 ton-km/year in 1989. The main part of the decline could be attributed to the decline of the activity in the sea transport of exported products, especially oil. During the period 1990-1999 a big number of changes occurred in transport of freight and above all there was an increase of contribution of road transport activity in 1997. The trend of basic indicator ton-km for the period 1999-2015 is shown in figure II.27. This is the basic indicator that will be used as driving factor to calculate the energy demand of the sub sector. The transport of passengers has also increased, particularly after 1990. This is dedicated to the use of private cars and the traveling 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 II.26.

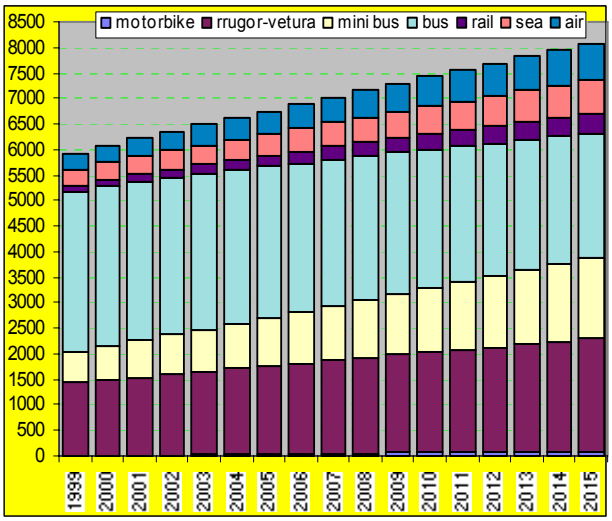

Figure II. 26: Forecast of trend of the indicator passenger-km for all types of transport (million passenger-km)

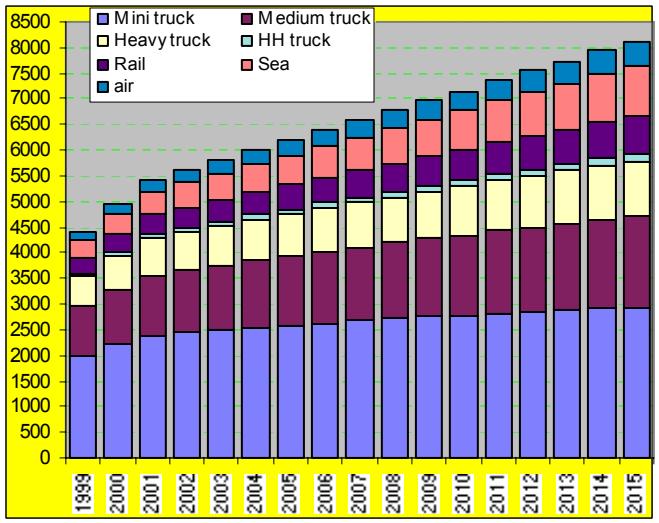

Figure II. 27: Forecast of trend of the indicator ton-km for all types of transport (million ton-km)

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, like road, railway, sea and air modes. 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 II.28, shows the forecast of the energy demand for each sub sector till 2015, where the passenger transport dominates with approximately 2/3 of the total demand during the period. The total energy demand in the transport sector is foreseen to be 1000,6 ktoe increasing twice in 2015 compared with 1999.

Figure II.29 indicates that the demand for diesel in 2015 is expected to be 1.5 times higher than in 1999 playing the main role during the whole period even though it will drop from 69% in 1999 to 54% in the year 2015. The demand for gasoline is foreseen to occupy 33% of the total in 2015 increasing 3.17 times compared to the year 1999. The demand for kerosene for air transport will increase 2.23 times, but its contribution will be only 8% of the total demand.

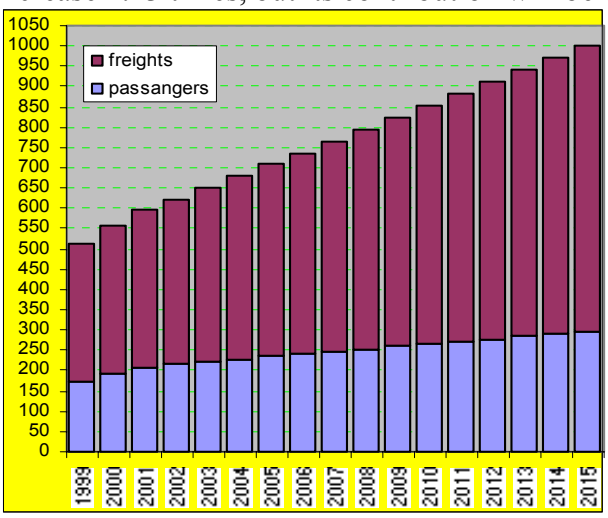

Figure II.28: Forecast of energy demand for passengers and freight (ktoe)

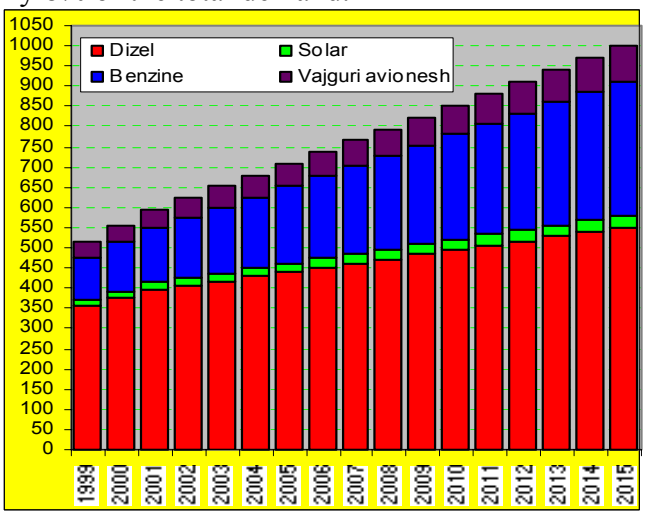

Figure II.29: Forecast of energy demand for passengers and freight for each fuel (ktoe)

Figure II.30 indicates 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.

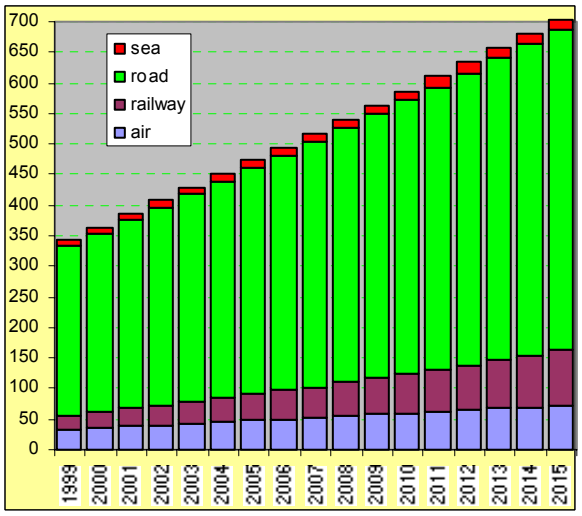

Figure II.30: Forecast of energy demand for passenger road transport for each type of transport (ktoe)

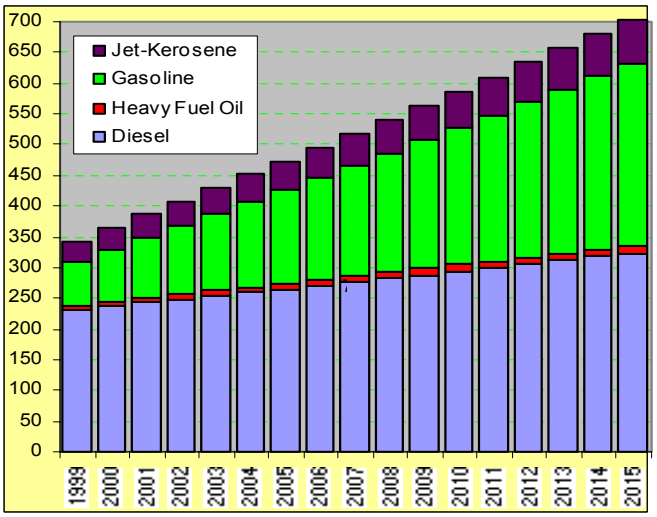

Figure II.31: Forecast of energy demand for passenger transport for each fuel (ktoe)

Figure II.31 indicates that the dominating fuel in the passenger transport will be diesel with 65% of the total, while gasoline will occupy 20% of the total. The growing rates will be approximately equal for deisel, gasoline and kerosene for airplanes. Figure II.32 shows the contribution of each group of road trasnport means during the period 1999-2010. The analysis shows that the car passenger transport will play the main role. Figure II.33 shows the forecast of the energy demand for the transport of freight with the main contribution coming from the road transport. Figure II.34 shows the forecasts for the fuel needed to meet the consumption of the freight transport. The analysis indicates that the main role will be played by diesel. Figure II.35 shows the forecasts of energy demand for the transport for each group of automobilistic means, with the main role played by low tonnage trucks.

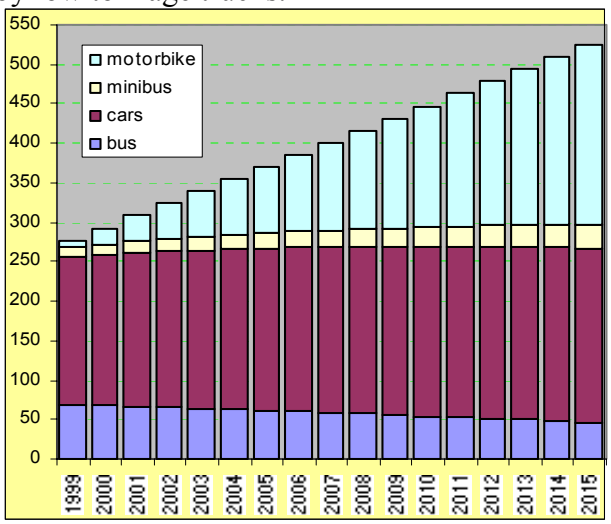

Figure II.32: Forecast of energy demand for the passenger road transport (ktoe)

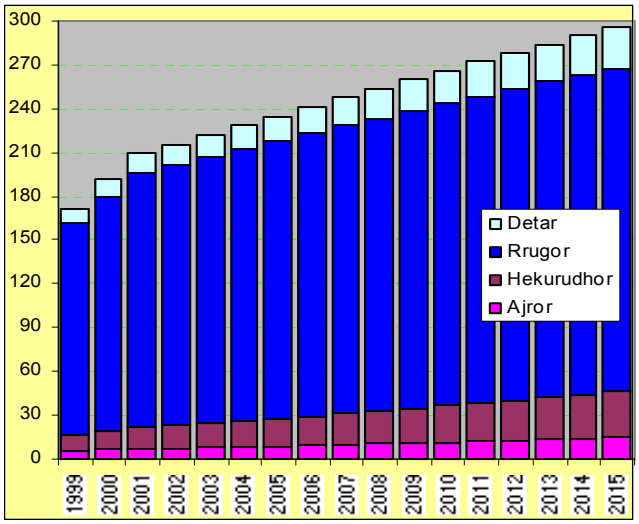

Figure II.33: Forecast of energy demand for transport of freight for each type of transport (ktoe)

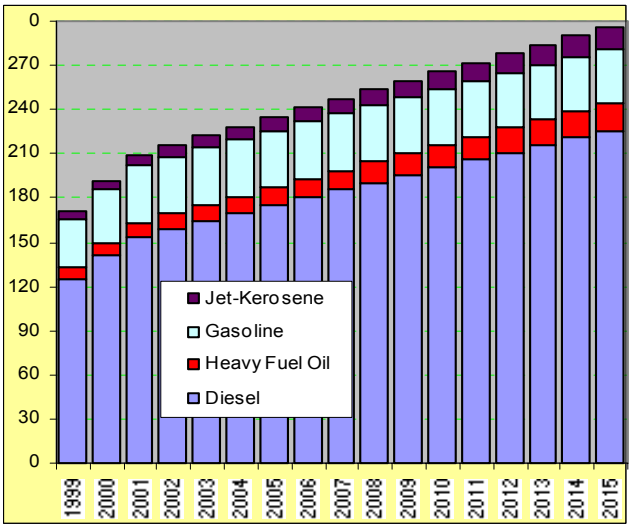

Figure II.34: Forecast of energy demand for the freight transport for each fuel (ktoe)

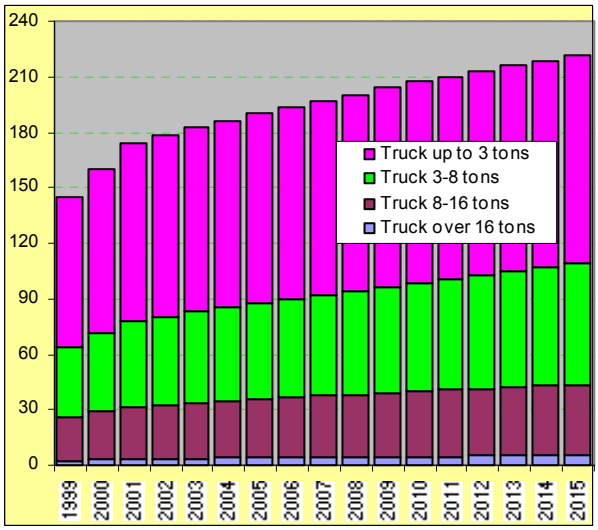

Figure II.35: Forecast of energy demand for the freight transport for each road transport mode (ktoe)

The analysis shows once again the need for a better energy management in the transport sector. As a conclusion, analyzing the transport sector according to passive scenario, for 2015, is foreseen that the energy demand for transport of passengers will be 704.8 ktoe, which is the double of the 1999

demand, while the demand for transport of freight will be 295.8 ktoe. Meanwhile, it should be underlined that the reduction of energy demand in this sector will affect the trade balance and reduce the environmental pollution. This will be analyzed more in details in the Active Scenario.

II.7 Forecast of energy demand for agriculture sector according to passive scenario

Albania will continue to remain for many years a country where the agriculture dominates. The specific weight of the GDP growth from agriculture sector was 25.1% in 1990, approximately 53% in 96 and still remains 46% till 2002. The income increase from the plants production, livestock, agro-industry, fishing and forestry remains the main alternative for the economic and social development of the country. The development of the agriculture sector is conditioned by many factors where the most important are:

- Farms of minimal sizes and fragmented,
- Problems over arable land property,
- Very high prices of inputs and a unorganised and non-effective production and distribution system of agricultural production,
- Lack or insufficiency of agriculture crediting,
- Lack or insufficiency of agriculture mechanics.

The passive scenario, assumes the above factors to be mitigated but not in the required level for an intensive agriculture as foreseen by the Active Scenario. For the scope of energy demand forecast, the sector was divided in 4 sub sectors: Agriculture, Livestock, Forestry and Fishing. The calculation of future energy demands is based on the added value of GDP, which for the agriculture sector was US$ 1167 million in 1995 increasing 1.7 times in 2015 (GDP tendency in the agriculture sector is indicated in figure II.1). The added value from the agricultural sector and the energy intensities has been used as basic activity to foresee the future energetic demand of the sector.

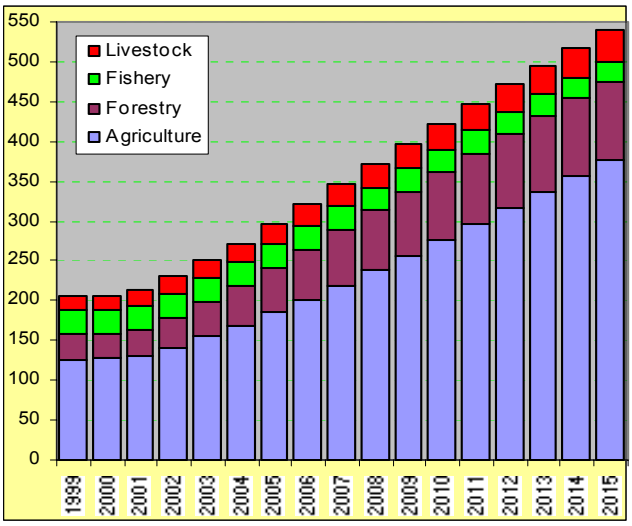

Figure II.36: Forecast of energy demand in agriculture sector for each sub sector (ktoe)

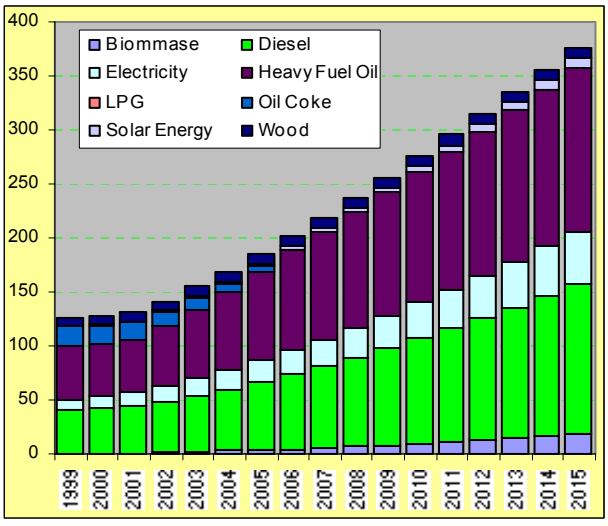

Figure II.37: Forecast of energy demand in agriculture sector for each fuel (ktoe)

The intensities have been calculated as the ratio between the consumption of energy resources and the activity level of the respective sub sector, expressed in US$ million. Figures II.36 and II.37 indicate the forecast of the energy demand till 2015 for each sub sector and oil by-product. The agriculture sub sector will have the highest demand for energy increasing, from 61% of the total demand in 1999 to 70% in 2015, followed by fishing, from 15% in 1999 to approximately 20% in 2015. The forecasted energy demand in the agriculture sector will considerably increase to support the development of this important sector for the Albanian economy. Diesel consumption is foreseen to increase considerably in the future in order to face the agricultural production growth and reduce in maximum the use of the manual work from Albanian farmers. As indicated by figure II.37, the dominant fuels in the sector are: solar with 40% and diesel with 37%. The figure also indicates that electricity demand will increase till 2015, although with a low percentage in the total of energy commodities, due to the modernisation of the irrigation systems.

II.8 Forecast of energy demand for all consumption sectors according to passive scenario

Energy balances prepared by NAE, the data collected by the Technical Group for preparation of the Strategy, and the World Bank Study on the power system development, provided to the LEAP software the necessary data for calculation of the energy demand for each sector, as described in above sections. As a consequence, figures II.38 and II.39 show the forecast of the energy demand for each sector and the forecast of the demand for each energy source.

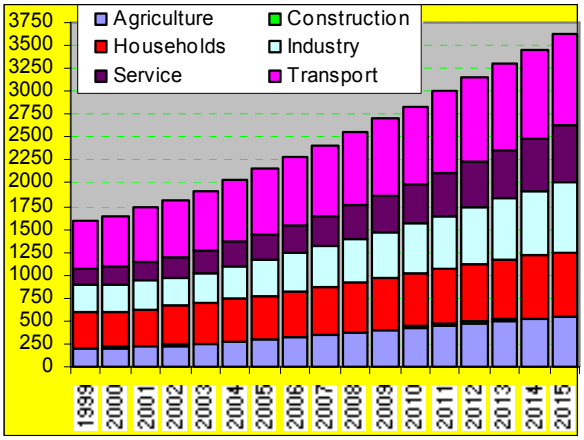

Figure II.38: Forecast of energy demand for each sector according to the passive scenario based on LEAP (ktoe)

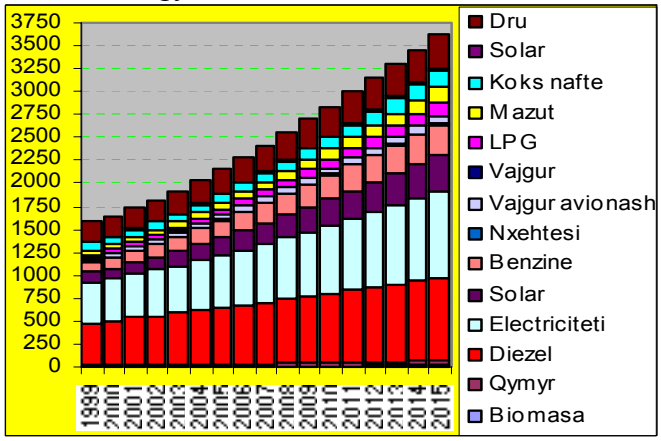

Figure II.39: Forecast of energy demand for each energy source according to passive scenario based on LEAP (ktoe)

The analysis of figure II.38 shows that the energy demand for each sector will increase: from 205 ktoe in 1999 to 539 ktoe in 2015 for agriculture sector (the agriculture contribution in the total energy demand will increase from 12.9% in 1999 to 14.9% in 2015); from 385 ktoe in 1999 to 696 ktoe in 2015 for the household sector (the contribution of the household sector in the total energy demand will increase from 18.3% in 1999 to 21.0% in 2015); from 187 ktoe in1999 to 572 ktoe in 2015 for the service sector (the contribution of the service sector in the total energy demand will increase from 11.8% in 1999 to 16.8% in 2015); from 4.3 ktoe in 1999 to 16.4 ktoe in 2015 for the construction sector (the contribution of the construction sector in the total energy demand will increase from 0.3% in 1999 to 0.5% in 2015); and last, from 515 ktoe in1999 to 1001 ktoe in 2015 in the transport sector (the contribution of the transport sector in the total energy demand will decline from 33.8% in 1999 to 27.6% in 2015, although the absolute consumption will increase

twice). The analysis of the supply of energy sources shows that the main role will be played by electricity, diesel, solar, fuel woods, LPG, with a respective contribution: 25.7%, 25%, 10.9%, 10.4%, 9.2% and 4% in 2015. The other energy sources, as shown in figure II.39, will contribute with only 14.8% in 2015.

II.9 Forecast for electricity demand according to passive scenario

The passive scenario for the electricity demand reflects the consumption of electricity that would be provided by electricity network assuming a reliable electricity supply. The scenario does not take in consideration the barriers of the implementation due to high investments needed to face the high electricity demand in the future. The scenario does not consider as a barrier the period of time needed for the construction of new generation, transmission and distribution facilities. The passive scenario aims to aware the consumers and the large public on how to apply the respective measures recommended in the Power Sector Policy Statement, and others recommended by the Strategy in order to avoid the development of the power sector spontaneity. For the first time, during the preparation of the scenario, the quantity of electricity that will not be supplied to the customers till 2008 was calculated. In this scenario is assumed that only after 2008 there will be a reliable electricity supply without shortages. The same was accepted by the World Bank study.

LEAP software forecasts may directly express the effects of tariff increase and the problem of reduction of non-technical losses. The soft was modeled to show how those two parameters would affect the reduction of the electricity demand in the active scenario. As regards the trend of the demand in the passive scenario, there will be a smaller effect, since these measures are not supposed to have a high penetration. Another model developed for KESH in 2002 by the WB, through Decon/Lahmayer/EDF/LDK Consortium, focuses on the analysis of the electricity sector and other energy sectors in Albania. The objective was to prepare the Generation, Transmission and Distribution Master Plan and to propose a least cost investment program as well as to establish the electricity tariffs in order to cover the marginal long-term running cost of generation, transmission and distribution. As such, the model was built “bottom-up”, starting in 1999 with the actual figures of electricity consumption. This is a high quality model especially related to the assessment of the development plans, cost analysis and tariff structure. The outcomes show a difference of 3.8% between the Consortium scenario and the passive scenario.

In figure II.49 is shown the forecast of the electricity demand for the residential sector according to the passive scenario. The basic assumption for the electricity demand in residential sector according to the passive scenario is that electricity will continue to be the main energy commodity to cover the demand for space heating, hot water, cooking and other services. As indicated, electric appliances and space heating are the main electricity consumers in the residential sector. The forecast of electricity demand shows that the consumption is expected to increase from 3000 GWh in 1999 to 5000 GWh in 2015. Despite the above increase, it should be underlined that the forecast of the electricity demand in 1999 is approximately 10% higher than the real consumption figure in 1999. Use of LEAP software and the assistance provided by its designers made possible to calculate and forecast the unsupplied quantity of electricity to customers.

Figure II.41 shows the forecast of the electricity demand for public buildings and commercial services. As indicated, most part of the consumed electricity will guarantee the main commercial

services. Figures II.42 and II.43 show the forecast of the electricity demand in industrial and agricultural sectors.

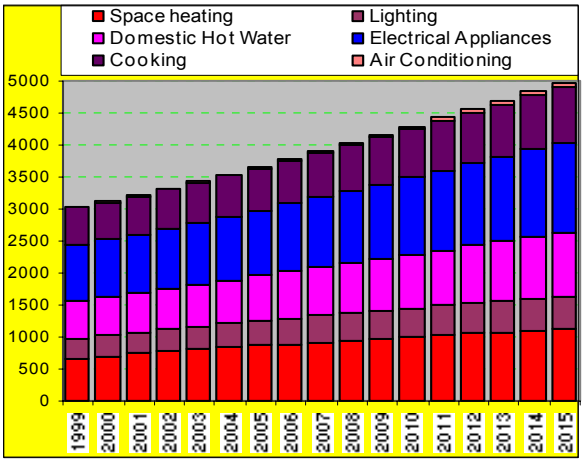

Figure II.40: Forecast of electricity demand in residential sector to guarantee main services (GWh)

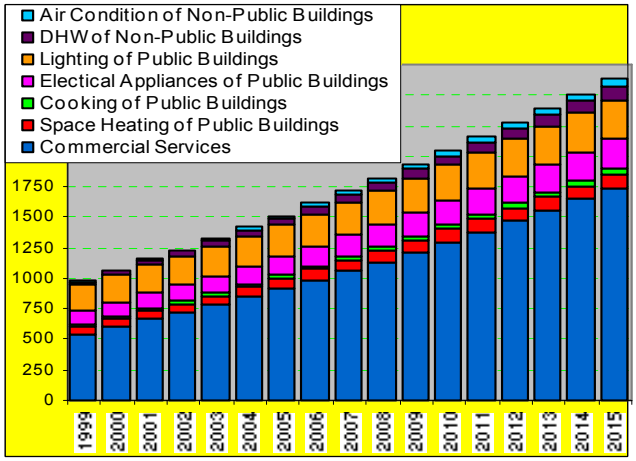

Figure II.41: Forecast of electricity demand in public building service sector (PB) and commercial buildings to guarantee main services (GWh)

As shown in the figure, the main industrial sub sectors that will absorb most part of electricity are food/ beverages/tobacco, building materials industry, and leather/shoes/textile, followed by other industrial sub sectors. The total electricity consumption will increase from 890 GWh in 1999 to 2400 GWh in 2015. As shown in figure II.43, the electricity demand in the agriculture sector will increase from 200 GWh in 1999 to 800 GWh in 2015, intensifying the agriculture sector in a large scale. Agriculture (for irrigation purposes mainly) and animal farming will be the main absorbers of the sub sector. As a conclusion, figure II.44 indicates the forecast of energy demand for each sector. As shown in figure, the biggest consumer during the whole analyzed period will be the residential sector. What should be underlined in the passive scenario is a light decline of the relative consumption of the residential sector from 57.69% in 1999 to 44.64% in 2015.

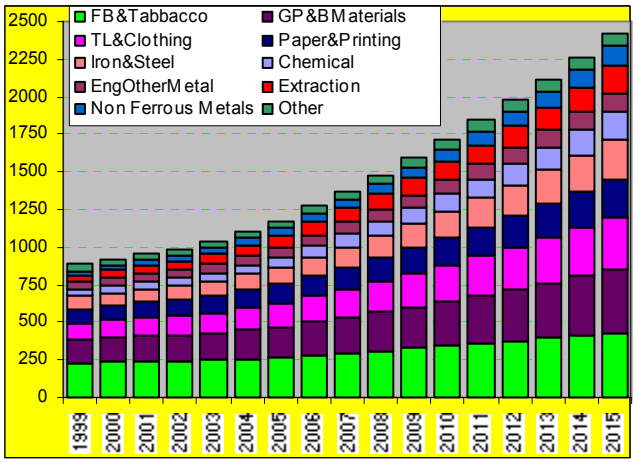

Figure II.42: Forecast of electricity demand in industrial sector (GWh)

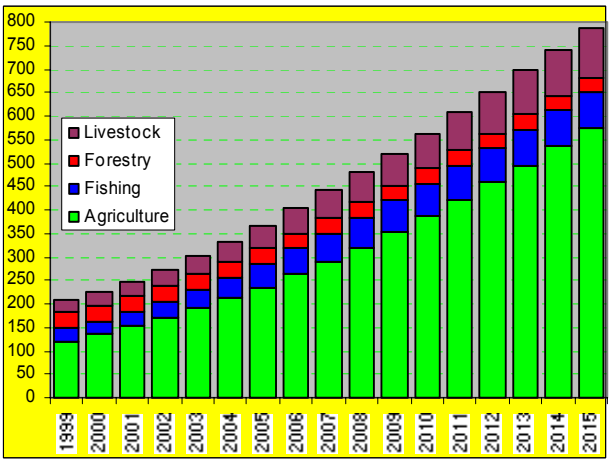

Figure II.43: Forecast of electricity demand in agriculture sector (GWh)

On the other hand, the industrial and service sectors will experience a relative increase, from 18.05% and 18.86% in 1999 to 22.30% and 24.24% in 2015, respectively. In figure II.45 are shown the electricity demand and forecasted power losses for 1999-2015 period. Actually, losses in the

transmission and distribution systems are 25.5% and a number of actions are undertaken with the goal to reduce them. As pointed out in the description of power sector situation, based on the action plan, a number of objectives are set to be achieved in reducing the level of losses. **As it is analyzed in the World Bank study, to reduce these losses from 25.5% to 6% some US$ 680 million (respectively US$ 450 million in distribution and US$ 230 million in transmission) are required. Level of 6% losses is assumed in the active scenario analyses.**

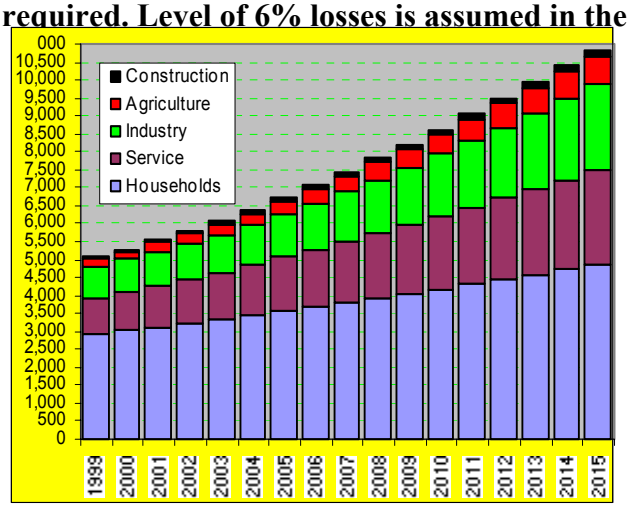

Figure II.44.: Electricity demand forecast for all sectors (GWh)

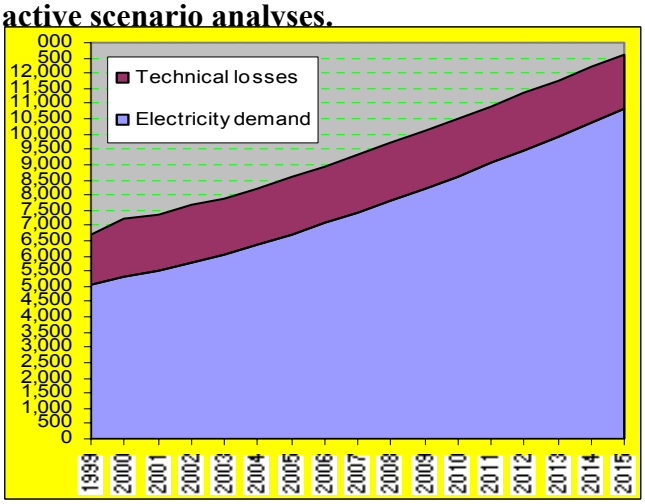

Figure II.45.: Forecast of electricity demand and technical losses (GWh)

Actually, for rehabilitation of transmission and distribution systems, only $230 million are made available through various projects, which are being carried out or are pending to start, therefore the objective of 6% of technical losses can't be achieved. For this reason, an objective of 14% of losses is set for 2015, while the passive scenario is developed. As a conclusion, the electricity demand in year 2015 to meet the demand and achieve the above level of losses is 12600 GWh. This is practically impossible to become true, because it requires doubling of supply within a 12-year period with a very high cost, as it is shown in the analysis below. However, it should be emphasized that even you disregard for a moment the very high cost you will lack the necessary time to install sufficient capacities to meet the demand till year 2008. In other words, according to this scenario we have assumed that a 24-hour non-stop supply will not be achieved till 2008.

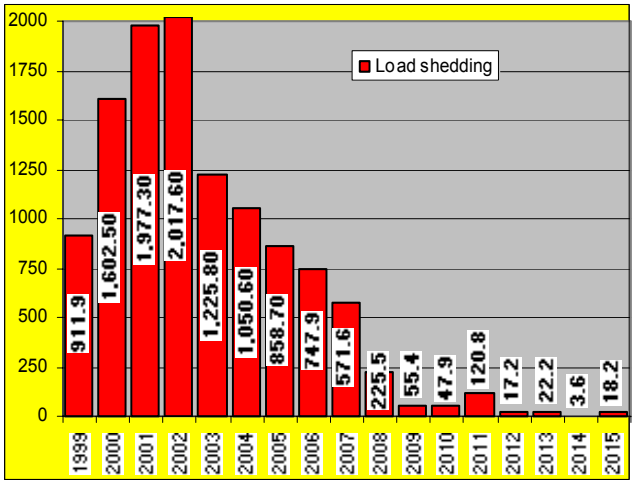

Figure II.46.: Forecast of load shedding for all sectors (GWh)

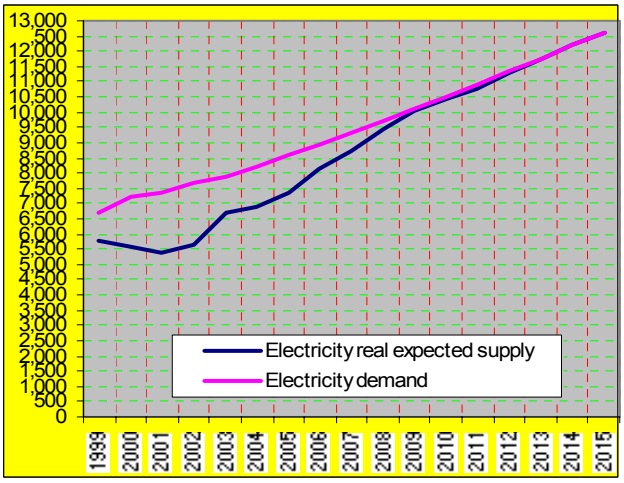

Figure II.47.: Electricity demand and real expected supply (GWh)

For this reason, in cooperation with American experts of LEAP software, basing on the statistical records of electricity load shedding for 1999-2002 period, the modeling of load shedding for 1999-2015 period was made possible. This analysis is shown in figures II.46 and II.47.

II.10 Forecast of generation capacity to cover electricity demand

Taking into account the load shedding, in the figure II.48 are shown the needed non-interrupted electricity supply (which will be covered by existing and new generators, and import) and the real supply. The real demand to be supplied is shown in figure II.48, while peak load is shown in figure II.49. Since the existing generators can't meet the forecasted demand according to passive scenario, a need for new capacities was considered. In order to evaluate the development options, five different technologies for new capacities are tested, using the "modeled program for evaluation of long run marginal cost of generation for different plants". The program calculates the net present value (NPV) for one generated kWh in relation to load factor of the electrical plant.

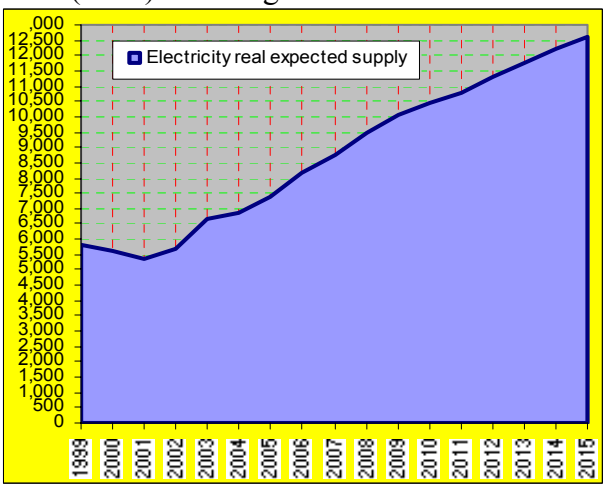

Figure II.48: Forecast of electricity supply for all sectors (GWh)

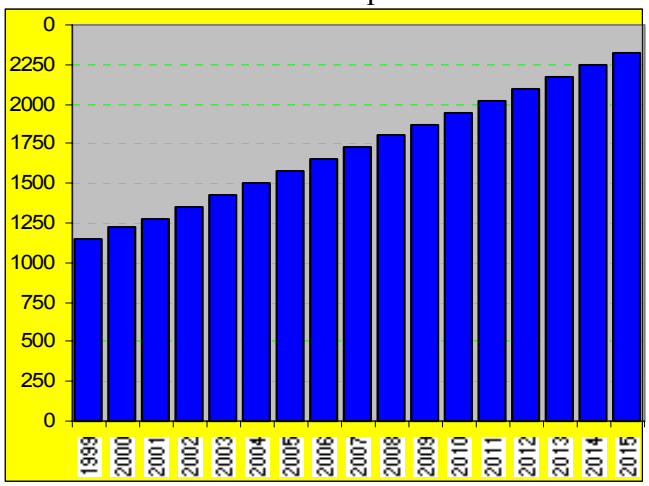

Figure II.49: Forecasted peak power demand according to passive scenario for 1999-2015 period (MW)

Program calculates actual cost of generated electricity unit including: discounted norm of interest, initial investment for all type of plants, fixed and variable operation cost, fuel cost and cost of equipment for reduction of various polluters released from heavy fuel oil and coal based plants, which maintain the emission level of SO_2 and NO_x within permitted norms. Based on what is stated above, this program may be used for evaluation of different technologies for general purposes as well as for the load model. Six technologies are tested, using the indicators of electrical plants considered by the World Bank power sector study.

In all calculations, a discount rate of 12% per year is used, the same rate recommended by the World Bank. Fuel prices are taken respectively: the international price of imported coal for coal; the Mediterranean region market price for marine diesel; the importing price plus local transportation cost according to the WB study for natural gas; the lowest price of regional market for heavy fuel oil or light fuel oil. Analyses, based on unit cost of electricity generation are given in the figure II.50 for plants operating in peak and medium load and for plants operating in base load. Analyses show that the best plants are combined cycle TPP operating with marine diesel and covering the base load, and gas turbine TPP operating with marine diesel. Based on WB study, the best alternatives for new HPP are evaluated those of Bratila and Kalivaci HPPs.

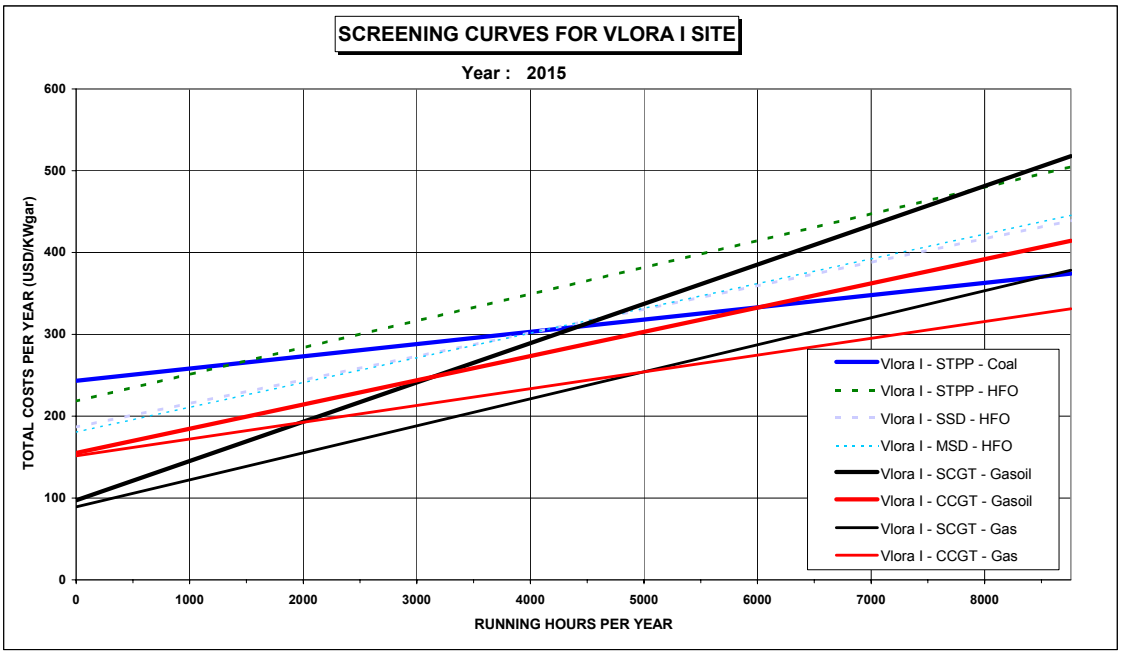

Figure II.50.: Analyses based on long run marginal cost for generation of an electricity unit [US$/kWh]

As regards the use of coal as fuel in the new TPP, the analyses showed that coal is not an economically viable option for small units. Coal-based TPP are economically viable in cases when installed capacity for each unit is bigger than 400-500 MW. Use of imported coal would require, also, harbor facilities for load-discharge activities. Coal-based TPP would require high initial investments for installment of SO_2 and NO_x reduction equipment in order to meet the environment norms and standards. Also, if imported coal would be used, the plants have to be built closed to cost line to make possible reduction of transport cost of coal from harbor to TPP. This would create serious problems to the tourist activities, which based on the Economic Development Strategy are considered as a priority.

On the other side, in the World Bank study, the use of imported natural gas is analyzed. As it is analyzed in the respective chapter, penetration of natural gas in the Albanian energy sector is not likely to happen before 2008. But, the analysis of the World Bank study shows that, if natural gas penetrates in energy sector, its use for power generation is more feasible than marine diesel. It should be emphasized that, from financial point of view, the best technologies for natural gas-based TPPs are the combined cycle TPPs to cover the base load, and TPPs with simple cycle gas turbines to cover peak load. As a conclusion, the best technologies from technical and financial point of views are the combined cycle TPP (that cover base load) and TPP with simple cycle gas turbines operating with marine diesel (that cover peak load) as long as natural gas will be available and these TPP will switch to natural gas.

Short-term solution of the problem of electricity supply may be achieved elaborating and implementing scenarios which will take into consideration electricity saving and introduction of other alternative energy sources. But there should be no doubts to build new TPPs because they have high security in power generation, and if built in the south of the country they will reduce technical losses of power system and secure diversification of power generation. Based on these reasons, the Albanian Government together with donors, agreed since November 2001 to carry out

an economic feasibility study for a new TPP working in base load with big installed capacity. This TPP will be built in three stages (3X100 MW) and it was already agreed that WB, EIB and EBRD would finance the first unit with a value around US$ 110 million.

Seven potential sites are studied, evaluated and listed based on criteria fully determined by World Bank. These areas are: Vlora, Durres, Fier, Korce, Elbasan, Cerrik and Shengjin. In each site, primarily, the possibility of building this TPP in abandoned ex-industrial zones and afterward, virgin areas closed to ex-industrial areas were analyzed. Each zone is evaluated for three different fuels that may be used: oil distillate (marine diesel), natural gas and coal. Some of main considerations, which are analyzed for site selection during investigation stage, include:

- Areas of Albania which are far from existing plants and close to customers;
- Possibility of providing fuel (marine diesel, natural gas and coal);
- Distance of transmission lines from the site to be selected and reserve capacity available for transmitting of power generated by TPP;
- Potential possibility of effects the new TPP would have for reduction of technical losses and overloading of transmission network as well as increase of security of supply;
- Possibility of capacity expansion of this TPP with new units;
- Social-economic development effects (i.e. employment; development of certain zones of the country; construction closed to industrial centers, etc.);
- Access to roads, railways and harbors;
- Access in water supply system;
- Other general issues relating to site preparation.

All above factors were analyzed with appropriate multi-criteria methodic for site selection. Without focusing on the analysis of other areas, more advantageous areas were identified Vlora B (virgin area at Triportet closed to new harbor), Fier (area behind the existing TPP) and Durres (Bishti i Palles area). In the World Bank study the module of Power Generation Master-plan was completed as well, and a similar conclusion with that of the study carried out by American company MWH was reached, where as the best sites for construction of new TPP were: Vlora (CCGT TPP with marine diesel covering base load) and Durres (TPP with simple cycle gas turbine). Based on these conclusions, the Albanian Government has already approved the construction site for Vlora TPP. This analysis made possible optimization of covering electricity demand for all the analyzed period. As figure II.51 shows, electricity import will remain more or less stable with about 2400 GWh/year, while generation from HPPs will increase from 3300 GWh/vit in 2002 to 4800 GWh/year in 2015 due to construction of Kalivaci and Bratila HPPs. TPPs contribution will increase as well from 150 GWh/year in 2002 to 5600 GWh/year in 2015.

In figures II.52 and II.53 is given the power production from HPPs, TPPs and import. As it shown by figure II.53, contribution of TPPs in 2002 was 1.43%, while in 2015 it will be 44.7%, that of HPP will decrease from 58.53% in 2002 to 37.6% in 2015 and import contribution will decrease from 40.05% in 2002 to 17.07% in 2015.

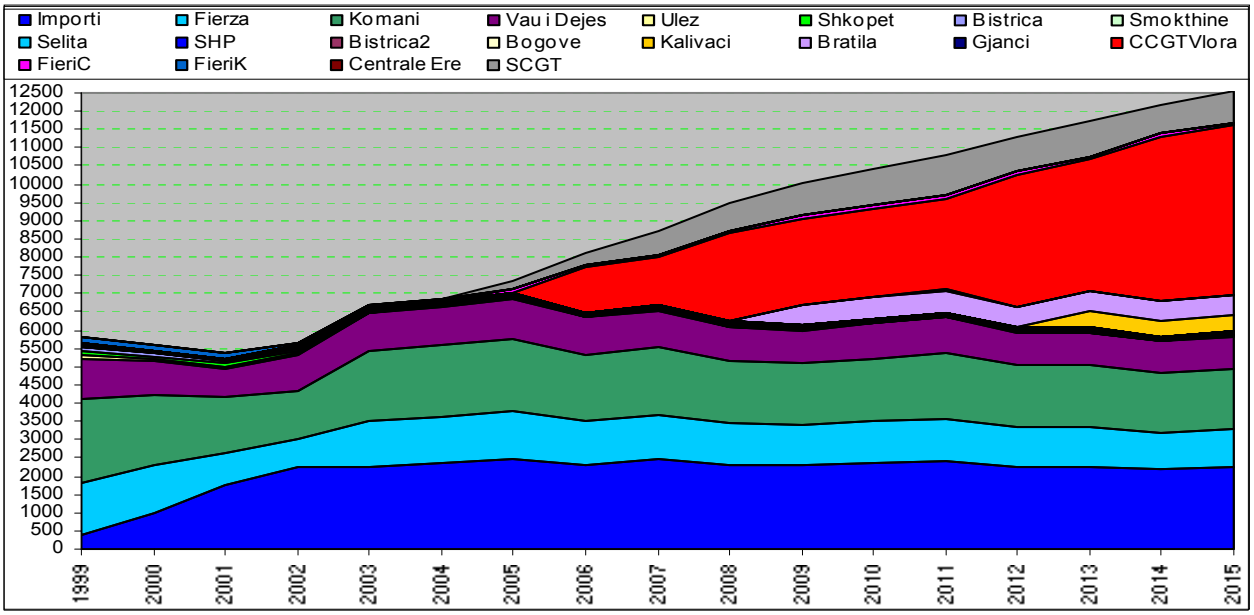

Figure II.51.: Optimization of covering the demand from import, existing power plants and new plants [GWh]

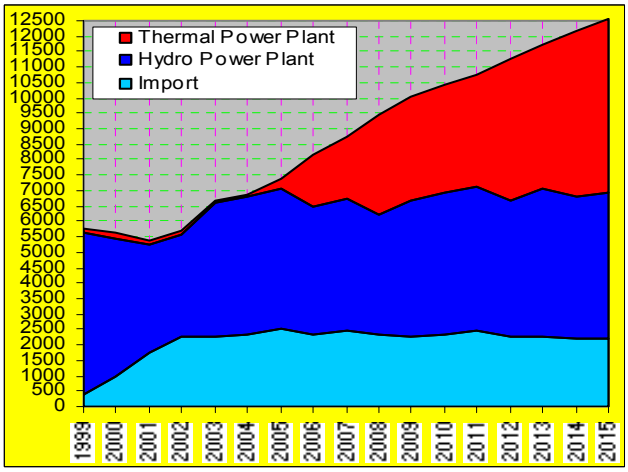

Figure II.52.: Forecast of electricity supply from HPP, TPP and import (GWh)

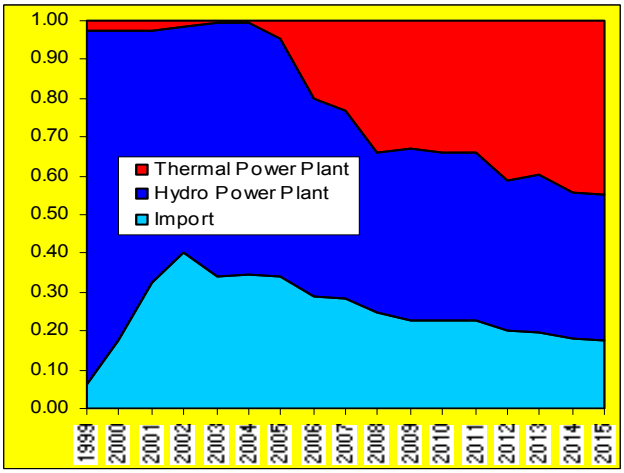

Figure II.53.: HPP, TPP and import contributions in electricity supply (GWh)

In table II.4 the main technical and financial parameters of passive scenario are given.

Table II.4.: Main characteristics of selected power generation plants according to Generation Master-plan for Albania according to passive scenario, 2003-2015

Years	03	04	05	06	07	08	09	10	11	12	13	14	15
New capacities (MW)													
SCGT TPP with oil distillate			100	200	400	600	800	900	900	900	900	900	900
Bratila HPP							115	115	115	115	115	115	115
Kalivaci HPP											90	90	90
Small HPP		10	30	30	30	40	40	40	40	40	40	40	60
CCGT TPP with oil distillate				204	204	420	420	420	420	650	650	850	850
Total of new capacity	**0**	**10**	**130**	**434**	**634**	**1060**	**1375**	**1475**	**1475**	**1705**	**1795**	**1995**	**2015**

Generation (GWh)													
SCGT TPP with oil distillate	0	0	220	333	666	759	891	1032	1093	949	950	774	889
New HPP	0	0	0	0	0	0	567	584	602	562	1000	959	982
Existing HPP	4352	4460	4550	4152	4251	3904	3842	3955	4070	3810	3802	3647	3743
CCGT TPP with oil distillate	0	0	0	0	1246	1273	2407	2367	2439	2511	3633	3625	4542
Import as base load	2268	2362	2495	2328	2457	2328	2290	2359	2429	2270	2266	2171	2225
Total generation	**6668**	**6870**	**7373**	**8135**	**8741**	**9473**	**10033**	**10444**	**10779**	**11300**	**11718**	**12168**	**12570**
Consumed Fuel (1000 ton)													
CCGT TPP with oil distillate	0	0	0	214	219	414	407	419	432	625	623	781	801
SCGT TPP with oil distillate	0	0	42	64	127	145	170	197	209	181	182	148	170
Total Fuel	**0**	**0**	**42**	**278**	**346**	**559**	**577**	**617**	**641**	**806**	**805**	**929**	**970**
Disbursement schedule (MUSD)													
SCGT TPP with oil distillate	0.0	0.0	4.8	9.5	19.1	28.6	38.2	43.0	43.0	43.0	43.0	43.0	43.0
CCGT TPP with oil distillate	0.0	0.0	0.0	14.9	14.9	30.7	30.7	30.7	30.7	47.6	47.6	62.2	62.2
Small HPP	0.0	2.6	2.6	2.6	2.6	4.3	4.3	4.3	4.3	4.3	4.3	4.3	7.7
Bratila HPP	0.0	0.0	0.0	0.0	0.0	0.0	13.6	13.6	13.6	13.6	13.6	13.6	13.6
Kalivaci HPP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.7	13.7	13.7
TOTAL	**0.0**	**2.6**	**7.4**	**27.0**	**36.6**	**63.6**	**86.8**	**91.6**	**91.6**	**108.5**	**122.2**	**136.8**	**140.2**

As it was stated at the beginning of this scenario, high rate growth of electricity demand will require a new capacity of 2015 MW to be installed. From this total capacity, 900 MW will be open cycle gas turbine TPP serving for peak load, 265 MW will be new HPP and 850 MW will be CCGT TPP covering base load. To guarantee power generation, both TPP types will consume large quantities of marine diesel, which value in 2015 is estimated to be around 970000 tons. This will increase considerably fuel consumption, and, as a consequence, the self-sufficiency with oil, in particular, and with energy sources, in general will decrease significantly, if this scenario will become reality. On the other side, as it is emphasized, this will have a significant adverse effect in the growth of country's trade deficit. As it shown in table II.4, if this situation comes true it means that within 15 years some 2015 MW new capacities should be installed, which practically is impossible due to a very high cost of new plants needed.

In figures II.54 and II.55 is given the average annual cost of power system for three periods of time. Analysis shows that, for period 2001-2005, there are no initial investments, while for period 2005-2010 the initial investments are expected to reach an annual value of US$ 57.54 million/year. As a consequence, the total investments required for period 2003-2015 are foreseen to reach the value of US$ 915 million, putting KESH in a very difficult economic and financial situation to find investments for installment of new plants.

During given period, the operation and maintenance cost increases progressively where fuel cost is determinant. In first part, this cost is practically zero since, as it is emphasized, electricity is produced by hydro power plants. Analysis of the results indicates that annual fuel cost will reach the value of US$ 99.94 million/year during 2001-2005, US$ 117.3 million/year for 2005-2010 and some US$ 137.6 million/year for 2010-2015 period. All together, these costs will put power system in a very critical position, if consumption continues with

this pace, and future of power sector will converge towards the passive scenario. For this reason, it is necessary to take actions, which will be recommended by the Implementation Plan of the National Strategy of Energy in order that energy system in general and power system in particular develop according to the active scenario.

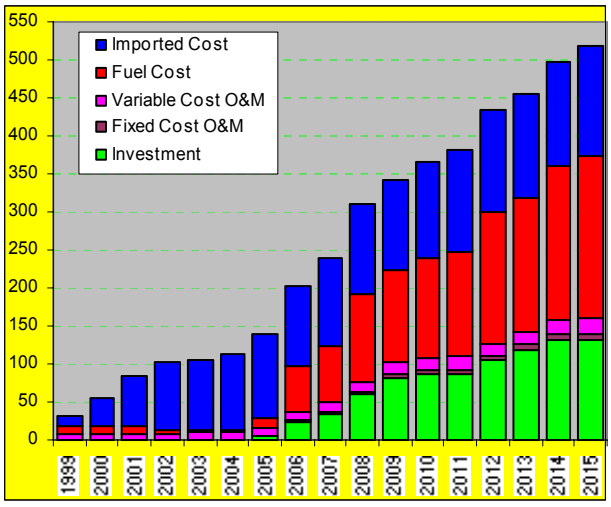

Figure II.54.: Annual cost of electricity from HPPs, TPPs and import (US$/MWh)

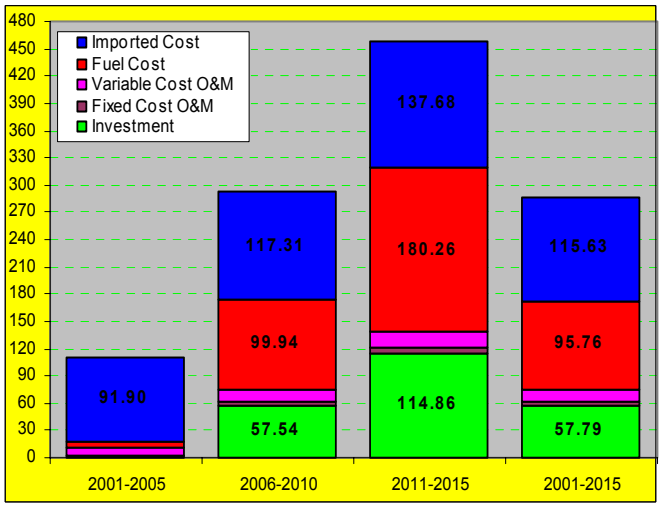

Figure II.55.: Average annual cost of electricity from HPPs, TPPs and import (US$/MWh)

II.11 Forecast of oil and by-oil products demand according to passive scenario

Actual average annual oil production is of a range of 0.35 million tons. Up to 1992, market of by-oil products was developed only for industrial consumers and for power generation because no private sector was developed. After 1992, due to occurred changes, the demand for oil by-products experienced drastic transformations, where industry and power generation sectors were the big losers, while demand from private sector, composed by transport, agriculture and service sectors, was punctually increased. Under these circumstances, the balance of oil by-products market shifted towards dominant position of heavy oil by-products versus those light ones. In the passive scenario oil and gas industry is assumed to continue the existing development trend. Oil production is assumed no to be superior than 0.4 million tons per year.

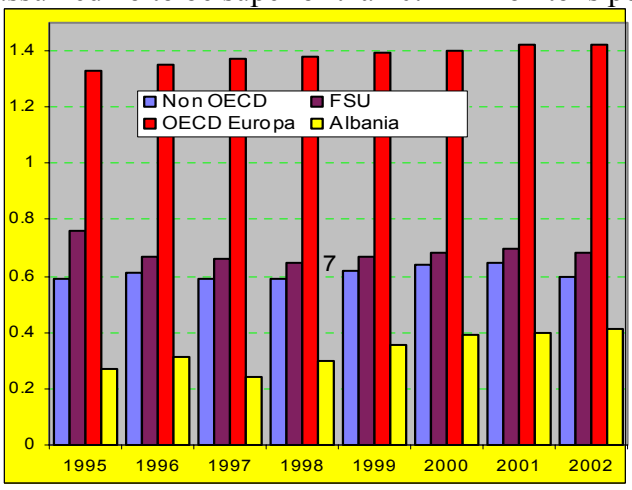

Figure II.56: Oil by-product consumption per capita for some countries (toe/capita)

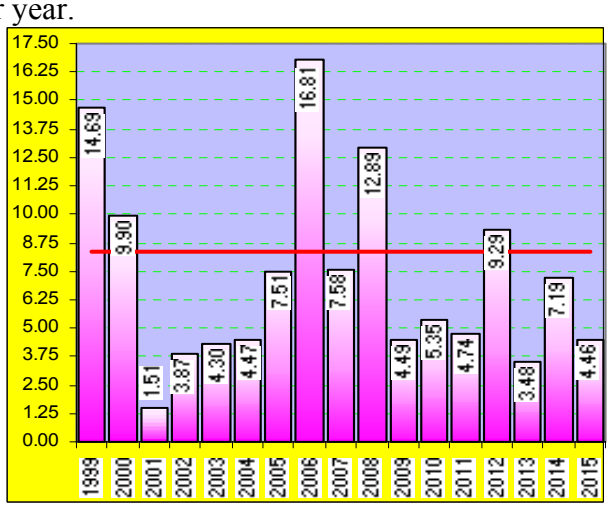

Figure II.57: Growth rate demand of oil by-products (in %)

As developing the scenarios, data of oil by-products market for years 1999, 2000, and 2001 were extracted and gathered from the energy balances prepared by the National Agency of Energy, where various issues regarding the demand of oil by-products market are described. These data have been a subject of a careful and concentrated work particularly regarding oil and oil by-products supply and evaluation of oil by-products consumption for oil by-products in each sector. Evaluations show that oil by-products consumption has an average progressive increase of 7% per year, reaching an actual consumption around 1150 ktoe. Despite this consumption is 32% higher compare to that of 1995, it should be underlined that consumption per capita of oil by-products is relatively low comparing to the other countries. This consumption results 5 times lower than that of the developed European countries and 2.5 lower than that of the Central and Eastern European countries. In figure II.56 the tendency of consumption of oil by-products per capita is given.

Forecast of growth rate of oil by-products demand (shown in figure II.57) illustrates an average increasing trend of 8.32% till 2015, reaching the peak demand in 2006, when new TPPs are expected to be commissioned (working with marine diesel). Forecast of demand for oil by-products in industry, services and agriculture sectors is done taking into account the same driving factors, which are described in detail in the analysis of demand forecast for each sector. Forecast of growth rate of oil by-products demand, given in figure II.57, shows that an increase of demand, particularly for LPG, gasoline and diesel, will be occurred. As regarding LPG, it should be underlined that its market is experiencing a fast growth of demand, if we compare 18 ktoe of LPG consumed in 1998 with 40 ktoe consumed in 2002. For diesel and gasoline, the average growing rates will be, respectively, 8.4% and 6.8%, increasing their demand from 419 ktoe in 1999 to 1792 ktoe in 2015 for diesel and from 104 ktoe in 1999 to 337 ktoe in 2015 for gasoline.

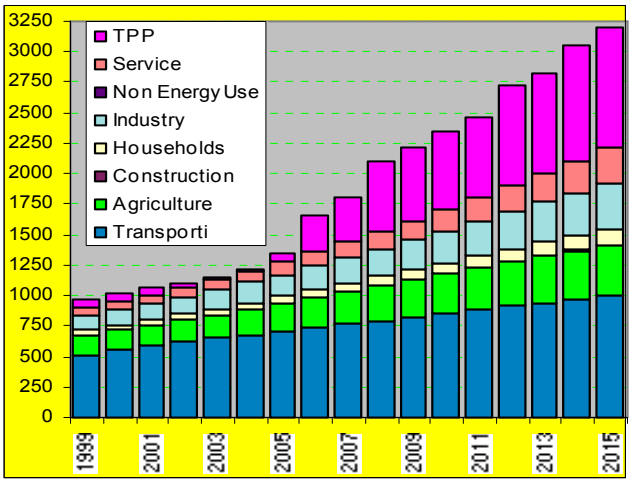

Figure II.58.: Consumption of oil by-products for each sector

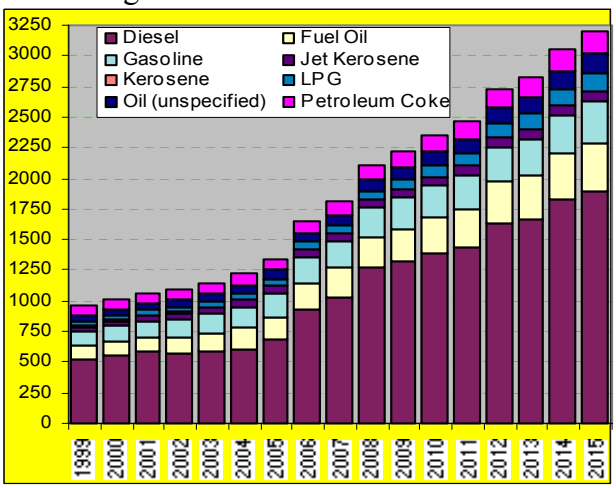

Figure II.59.: Consumption of oil by products for each type

Transport sector is one of the sectors with fastest growth of fuel consumption, particularly of diesel and gasoline. However, if we compare the actual consumption level in this sector with that of developed European countries, our country is still far in developing this sector. Low level of transport in our country compare to that of the European countries is related to the low economic development of the country. Greece, which has a less developed transport sector than the other EU members, has a transport sector 6 times more developed than our country, while Italy merely 11 times. If we refer to the analysis of final consumption of oil by-products for year 2015, we may

notice that transport is very important sector consuming around 31.3% followed by agriculture with 12.9%, industry 11.7%, services 8.9%, and residential 4.32%, while power generation (TPP) is expected to consume 31% of total amount. Despite of growth rate of sectors, transport sector and power generation (TPP) will have the greatest shares of oil by-products consumption.

II.12 Forecast of production and importing capacities (including storage capacities) of oil by-products according to passive scenario

Based on performance indicators of last 10 years in production and consumption of natural gas, oil and their by-products, a significant decline of natural gas production and consumption may be perceived, while for oil, a stopping of its decline oil production is observed after a negative period during 1999-2002. In the passive scenario a slight growth of oil production is forecasted reaching 400 000 tons in 2015, assuming that the joint project of Albpetrol and Group of Foreign will not give positive results. **While in the active scenario a number of actions for increase of oil production above 400 000 tons after 2004 is supposed to be implemented. These actions are described in more details in the chapter of the active scenario.**

In 2001, some 900 ktoe oil by-products were imported, which represent around 75% of total consumption of oil by-products. This means that import is increased about 160% during last 6 years, causing a ratio of imported by-products with domestic production from 75:25% in 2002 to 90:10% in 2015. In this scenario, influence of the imported oil by-products will continue to rise, increasing with 3.5 times compare to year 1999. Figure II.60 shows the tendency of domestic oil by-products according to the passive scenario for 1999-2015.

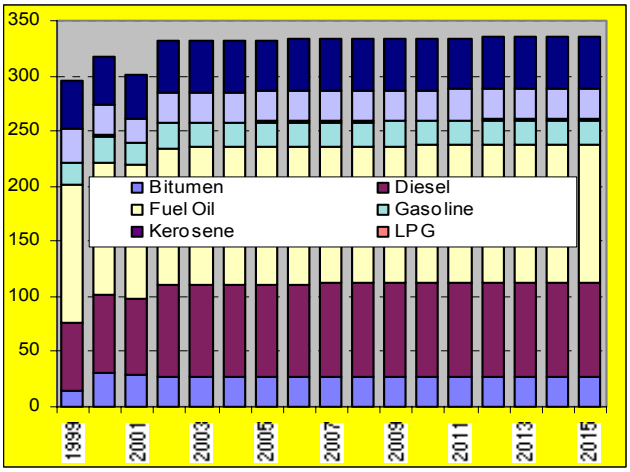

Figure II.60.: Trend of production of oil by-products according to passive scenario *(ktoe)*

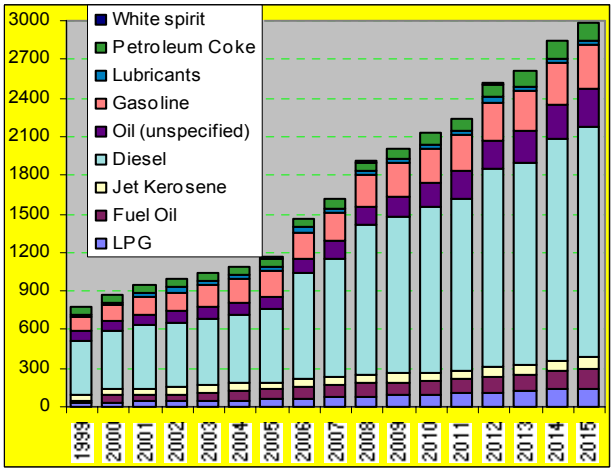

Figure II.61.: Trend of imported oil by-products according to passive scenario *(ktoe)*

Figure II.61 indicates that the import of oil by-products will increase up to 3 million tons, causing a considerable growth of trade deficit for the country. Great share of imports, according to the passive scenario, will come from neighbors such as Greece and Italy. Transport will be done mainly with tracks and a small part with ship. Such a logistic structure could be accepted for a short time, but it can't be a supply base in medium and long term, when a considerable growth of consumption is expected to occur. Up to date, our country is not connected to the international railway system, except the line with Montenegro, which is not in good technical conditions and does not permits the import of oil by-products. As regarding the infrastructure of sea transportation of oil by-products, actually it functions in Vlora storage, which is owned by ARMO, in Saranda, Durres and Shengjini

harbors where storages, and harbor services of loading and unloading are privately owned or rented to privates by the state. Fuel storages in our country do not meet operation and safety normal parameters. Low sized storages and their non-uniform management have created problems regarding instability of market price of oil by-products and low levels of security and emergency oil reserves. Last times, the Government has undertaken some actions for a modern development of oil by-products storages, unifying the parameters of two main storages with international operation parameters.

Economic parameters used in LEAP software for oil extraction industry such as variable and fix costs, investments in years, show that the cost of oil extraction varies from US$ 70/ton to US$ 130/ton for 2002-2015, which is considered high compare to the oil market price. According to the passive scenario, based on data provided by Albpetrol, investments in the existing oil fields are minimal. Figures II.62 and II.63 give a picture of variable and fix costs and investments for production of crude oil for periods 2001-2005, 2006-2010 and 2011-2015 as well as the tendency of total production unit cost. As it is shown in figure, investments planned by Albpetrol according to the passive scenario are very modest, while maintenance and operation costs, due to depleted extraction technology and big number of employees, are very considerable.

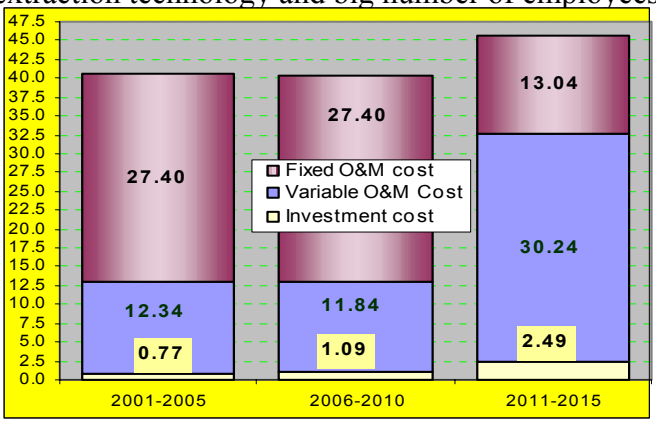

Figure II.62.: Average annual cost for extraction of crude oil *(US$ million)*

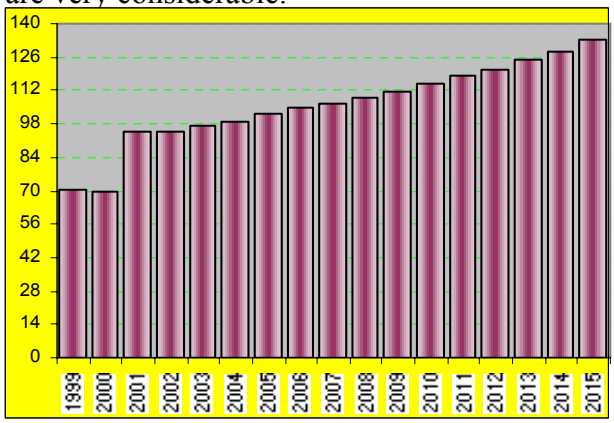

Figure II.63.: Average unit cost for extraction of crude oil *(US$/ton)*

II.13 Forecast of refining capacities according to passive scenario

In the passive scenario is assumed that our refineries will maintain the same output level they have actually because, as it was mentioned above, production of crude oil is expected to increase moderately. Investments in refining and marketing areas will conserve an output level just to meet the modest increase of crude oil production. Actually, only two refineries are working, Ballsh and Fier refineries. Due to lack of crude oil and their physical depreciation, both refineries operate with a capacity of 30%. High imports of oil by-products is conditioned from decline of crude oil production and lack of appropriate infrastructure to import crude oil, which do prevent the refineries to operate with full capacity. These refineries require a detailed feasibility study. In the analysis of active scenario get their answers a lot of important questions relating to oil refining such as: Is economically viable the rehabilitation of our refineries to do the refining of additional crude oil whether it's from domestic production or import? It is feasible construction of a new refinery to meet the demand for oil by-products when total needs are some 3 million tons, while total capacity of our refineries after full rehabilitation would be as half of total needs? Investment in Ballsh and Fier refineries according to the passive scenario are assumed in minimal values just to keep both refineries in operation. According to this scenario, the refinery products can not meet the quality

level required by the market. Illustrations of investments, fixed and variable costs in the graphic below show that our refineries operate with very high unit cost. These very high costs are related to the old technologies and high number of employees. Total costs of refineries for periods of 2001-2005, 2006-2010 and 2011-2015 are given in figure II.64, while the total unit cost of refineries output, which varies from 140 to 180 US$/ton, is shown in figure II.65. This very high cost requires rehabilitation of our refineries to be competitive with imported oil by-products.

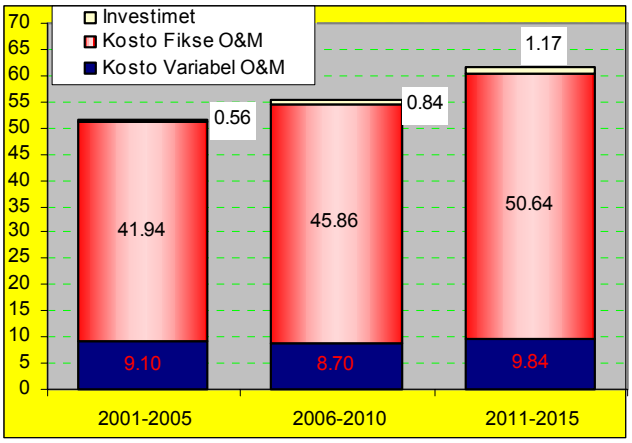

Figure II.64.: Average annual costs for crude oil refining (US$ million)

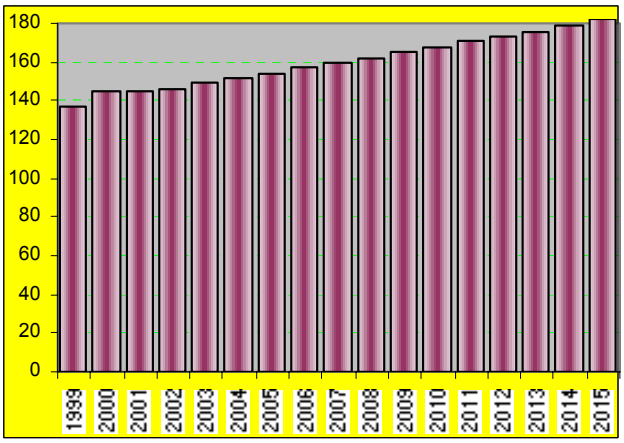

Figure II.65.: Average unit cost for crude oil refining (US$/ton)

II.14 Forecast of production capacity of natural gas and associated gas according to passive scenario

Actually, the total production level of natural gas is some 80000 m^3N/day, from each 48000 m^3N is connected with the gathering and distribution centers of gas (Fier, Ballsh) and is centrally delivered.

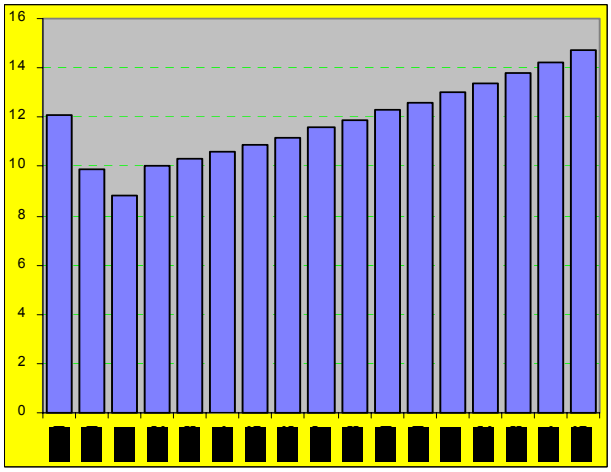

Figure II.66: Trend of natural gas production according to passive scenario (ktoe)

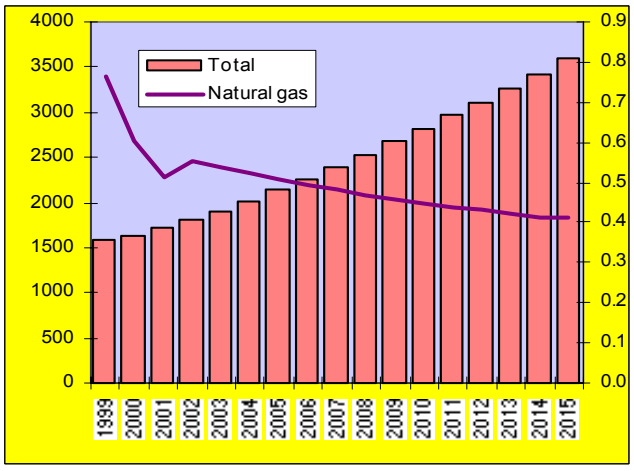

Figure II.67: Trend of total supply with energy sources (ktoe) and natural gas contribution (%)

The remaining of 32000 m^3N is not transported to the gathering and distribution centers, but it is consumed mainly by oil extraction affiliates for their technologic processes. As it appears from description of gas sector situation, natural gas consumers can't meet their demand. Therefore, the only solution for a secure supply with gas is the interconnection of Albania with the international natural gas network. According to the passive scenario, the growth of natural gas production is expected to be minimal (given in figure II.66), reaching a level of 15 ktoe in 2015. This is shown,

also in figure II.67, where natural gas contribution in the total demand for primary energy sources decreases from 0.8% in 1999 to 0.4% in 2015. Calculation of cost items are done based on Albpetrol data assuming that gas production will slightly increase. Total cost for gas extraction for periods 2001-2005, 2006-2010 and 2011-2015 are given in figure II.68, while the total unit cost of natural gas is given in figure II.69.

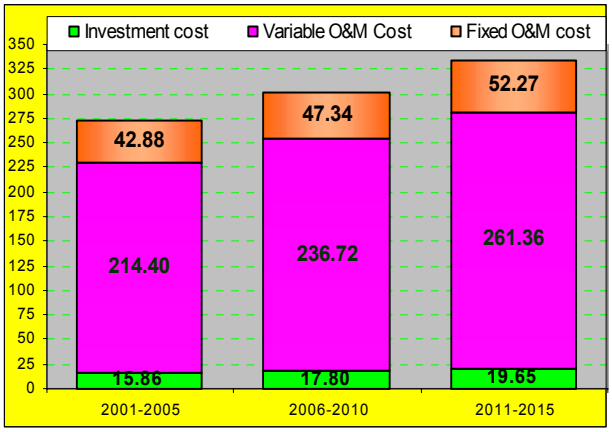

Figure II.68 Average annual cost for natural gas extraction (US$ million)

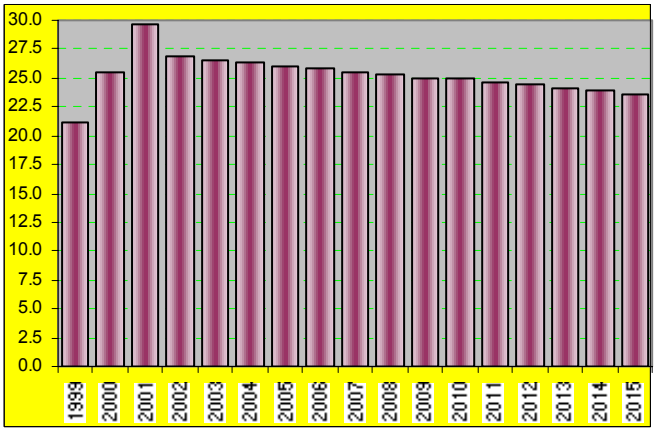

Figure II.69.: Average unit cost for natural gas extraction (US$/ton)

II.15 Evaluation of natural gas market according to passive scenario

To evaluate the natural gas market according to the passive scenario a couple of assumptions are done: first, the capacity of investments needed to be interconnected to the international natural gas network is not taken into account; second, taking into account time factor for construction of pipeline inside and outside the country, it is forecasted that in 2007 natural gas will penetrate for power generation in TPP, in 2008 will penetrate for consumption by large industries, in 2009 it will penetrate in service sector (particularly in hotels and tourism) and in 2010 it will penetrate in residential sector. In figure II.70 is given the estimation of energy demand of residential sector with a fast penetration of natural gas in this sector to cover the demand for space heating, cooking and hot water. The penetration level of natural gas, in an optimistic version is assumed 20% for zone I, 17% for zone II and 12% for zone III.

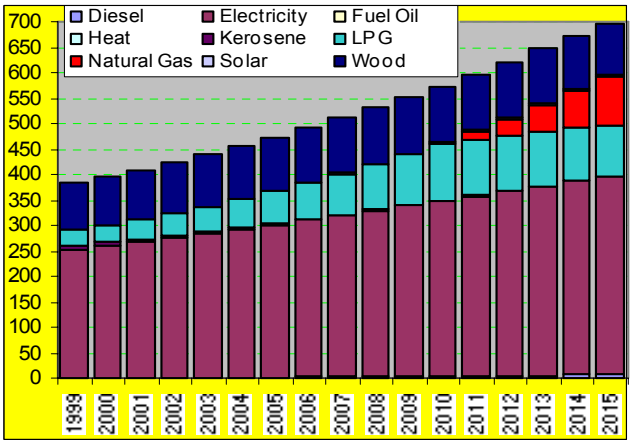

Figure II.70: Forecast of Natural Gas demand for residential sector (ktoe)

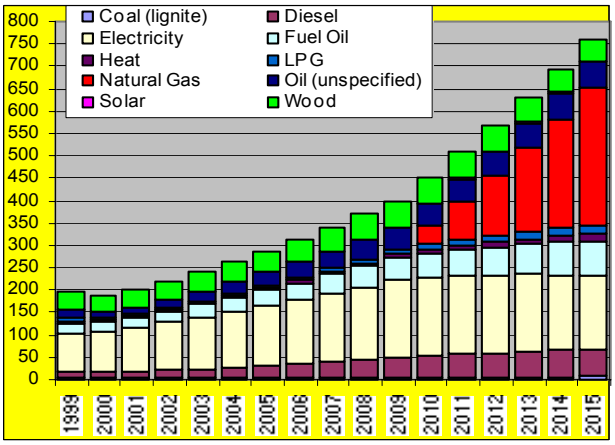

Figure II.71: Forecast of Natural Gas demand for service sector (ktoe)

As it was emphasized above, the natural gas is assumed to start penetrating in residential sector in 2010, because just to bring natural gas in Albania it will require a two-year period (2003-2004) for

completing a comprehensive feasibility study, the technical study and securing of financing (this in an optimistic version). In addition of that, it will require the construction period, which will last 2-3 years (2005-2007).

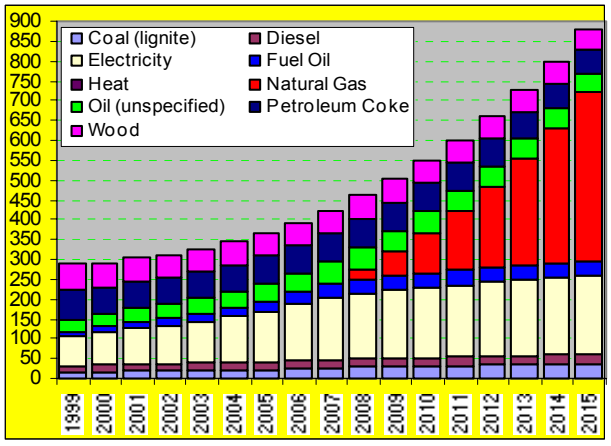

Figure II.72.: Forecast of Natural Gas demand for industry sector (ktoe)

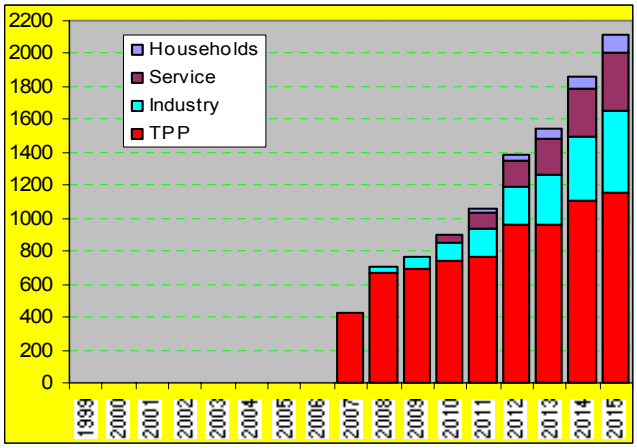

Figure II.73.: Forecast of Natural Gas demand for all sectors (ktoe)

As a third phase will be considered the time needed for the construction of transmission network inside our country, connecting firstly TPPs and the large industries. According to the optimistic version, TPPs connection will be done in 2007. According to the same version the penetration of natural gas in service sector to meet the demand for space heating and hot water in public services, is assumed to start in 2009 to reach 35% of the total demand in 2015. For the same needs, the penetration of natural gas in private services will start in 2009 to reach 25% of the total demand in 2015. As far as the industry sector is concerned, the natural gas penetration will start in 2008 to reach meeting 60% of demand for industrial heating processes in 2015. Of course, this scenario is very optimistic because even in countries like Italy, where the penetration of natural gas has started 45 years ago, the average penetration level for industry and service sectors is 39.6%.

In figures II.70, II71, II.72 and II.73 are given the natural gas demands for residential, services and industry sectors, and the total demand based on aforementioned assumptions. As it is shown in figure, in 2015 natural gas demand will increase to 108 million m^3N, 283 million m^3N and 496 million m^3N, respectively, in residential, services and industry sectors and 961 million m^3N in all consumption sectors. In figure II.73 is given the total natural gas demand. According to the passive scenario, the natural gas demand for power generation is 1.12 billion m^3N, while the total demand is 2.1 billion m^3N.

It should be emphasized that despite it may appear that we are dealing with a large market of natural gas, we should bear in mind that it is not the passive scenario that Albanian energy sector should follow, but the active scenario. As it is concluded in the analysis of active scenario, the natural gas market is merely two times smaller than that according to the passive scenario.

II.16 Forecast of coal demand according to passive scenario

The capacities of coal sources in our country are very considerable. After 1992, the coal production from our mines declined drastically and coal has lost its market. Actually, the capacity of our mines has dropped in minimal levels, covering only few modest coal consumers of our economy. In figure

II.74 is given the coal consumption according to the passive scenario, which is consumed only by industry and service sectors. In the industry sector, consumption varies from 16 ktoe in 1999 to 46 ktoe in 2015, while in service sector from 3.5 ktoe to 7 ktoe. Coal import, according to the passive scenario, will continue with the growth rate as shown in figure II.75. Calculations of cost for coal production are based on actual extraction technologies, which, according to the passive scenario, will continue to be the same with no substantive changes. Since actual coal production is very low, a growth of production up to 50 thousands tons is forecasted for 2015. The total costs of coal extraction for periods 2001-2005, 2006-2010 and 2011-2015 are given in figure II.76, while the production unit, cost varying from 22-28 US$/ton, is given in figure II.77.

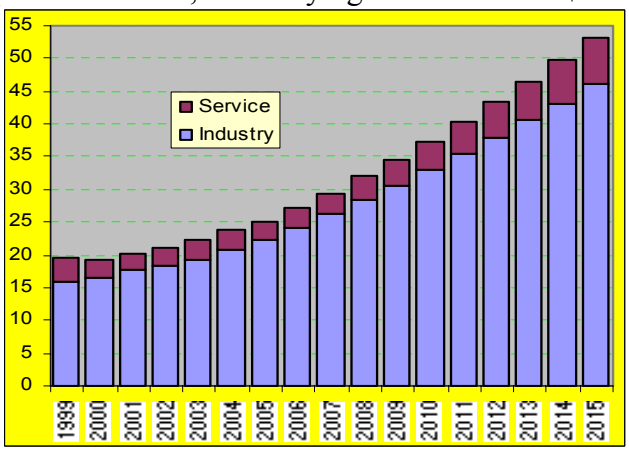

Figure II.74.: Trend of Coal Consumption for each sector according to passive scenario (ktoe)

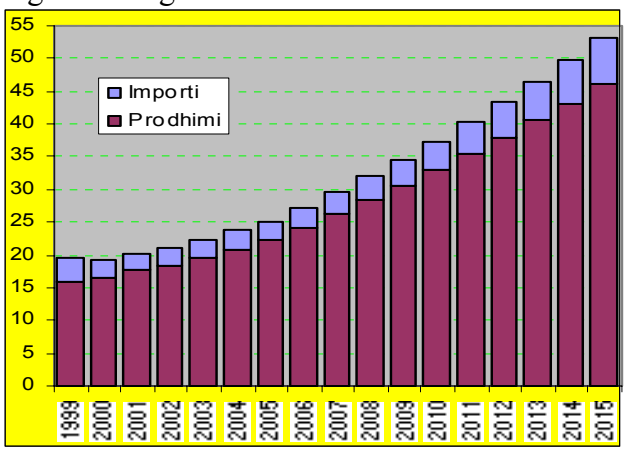

Figure II.75.: Trend of coal production and import according to passive scenario (ktoe)

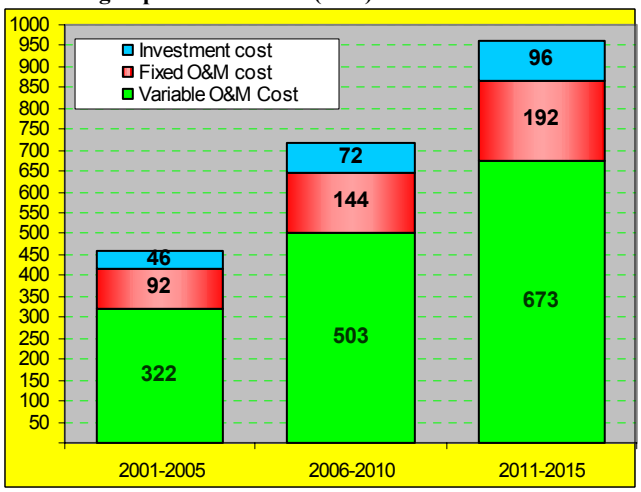

Figure II.76.: Average annual costs for coal extraction according to items (000 US$)

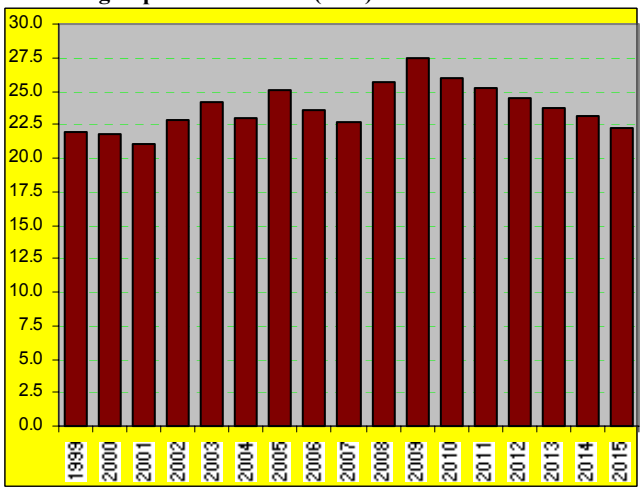

Figure II.77.: Average unit cost for coal extraction according to items (US$/ton)

II.17 Demand forecast for primary energy sources according to passive scenario

In figure II.78 is shown the demand forecast for primary energy sources according to the passive scenario for 1999-2015 period. It should be underlined that for 1999-2001 are real data, while for the remaining period are forecasted. As it is shown in figure mentioned above, there are seven primary energy sources, which contribute to meet energy demand, only three of them, oil, hydro-energy and fuel wood, have the greatest shares. In the year 2015, their contribution will be

respectively 74.95%, 14.00% and 8.51%. Figure II.79 shows that, with passing of years, the import of energy sources will increase to meet energy demand. As a consequence, in 2015 the indigenous energy sources will contribute with 29.06%, while imported energy sources will contribute with 70.29% of the total energy supply. Two other important indicators computed by LEAP software, are oil self-sufficiency and total self-sufficiency with primary energy sources. Tendency of these indicators is shown in figures II.80 and II.81. As described in aforementioned sections, the oil self-sufficiency indicator continues to decrease since 1975 (when country was oil exporter and self-sufficiency with oil was 246%) reaching 27.47% in 2002. According to the passive scenario, the oil self- sufficiency is foreseen to decrease furthermore reaching 11.61% in 2015.

Situation of the total self- sufficiency with primary energy sources is a little more positive. In 1990 this indicator has been 95.39%, has decreased till 2002 (44.81%) and is foreseen to decrease furthermore till 2015 (29.06%).

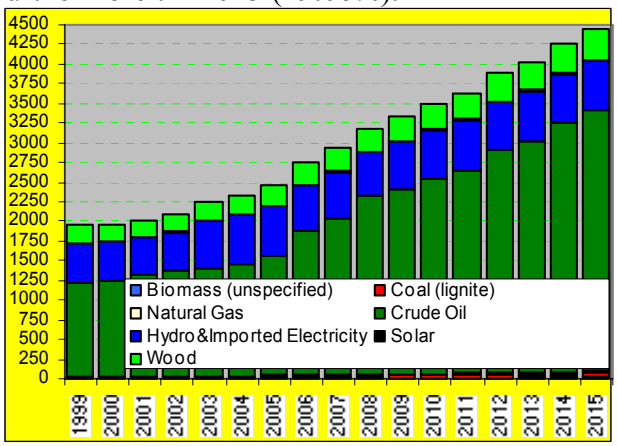

Figure II.78.: Forecast of supply with primary energy sources according to passive scenario (ktoe)

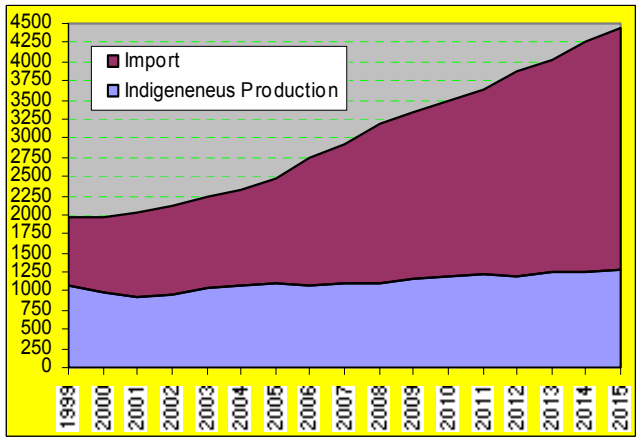

Figure II.79.: Forecast of supply with primary indigenous and imported energy sources according to passive scenario (ktoe)

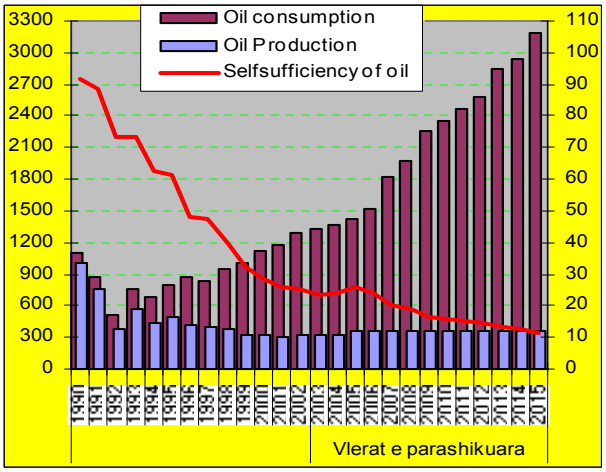

Figure II.80.: Oil demand, endogenous production and self-sufficiency and supply (ktoe)

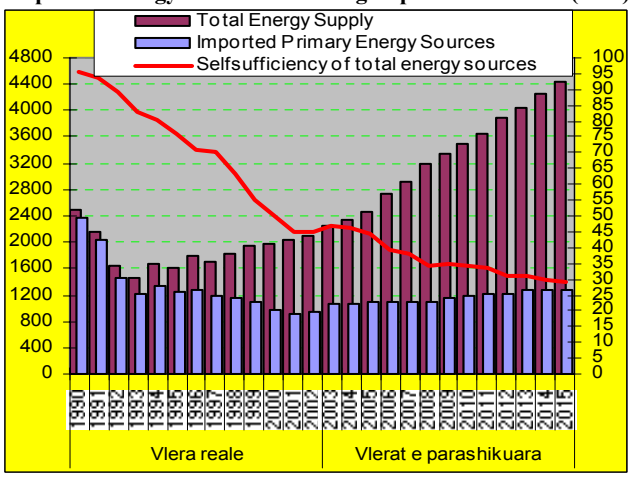

Figure II.81.: Demand, domestic production, self- sufficiency and supply with primary energy sources (ktoe)

Determination of the contribution of renewable energy sources is another important analysis while elaborating the strategy. During elaboration of the passive scenario is assumed that their contribution will continue to increase with the actual pace without carrying out any specific program for this purpose. Renewable sources are composed by hydro-energy, fuel wood, biomass and solar energy, which in 1999 have contributed, respectively, with 404 ktoe, 227 ktoe, 0.1 ktoe

and 0.13 ktoe. In year 2015 these sources are forecasted to contribute respectively, with 431 ktoe, 378 ktoe, 18 ktoe and 19.1 ktoe. In figure II.82 is given the total that the renewable energy supply sources will provide according to the passive scenario. Analysis shows that, despite their absolute value increases, their ratio towards the total supply decreases, reaching the value of 19.03% in 2015.

This fall of contribution of renewable energy sources will have its adverse impact on the Albanian energy balance (as it is described below) and on increase of gas emission in the atmosphere. In figure II.83 are given CO_2 emissions released in the atmosphere from energy sector computed based on LEAP software and selecting as emission factors those of IPCC methodology. Analysis show that great part of emissions is released from combustion of oil by-products and fuel wood, which in 2015 will contribute respectively, with 83.5% and 14.7% of the total emissions.

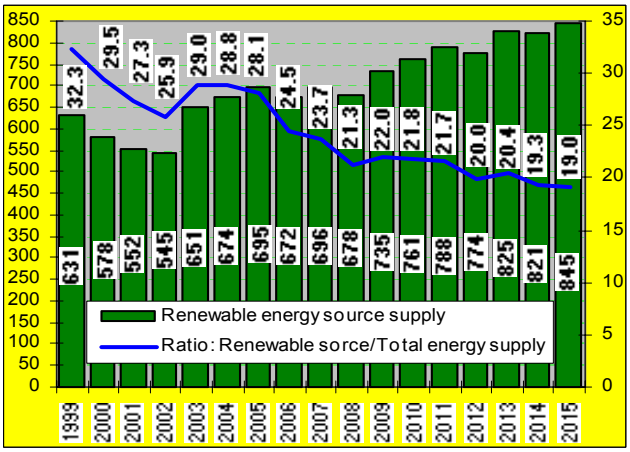

Figure II.82.: Total supply with renewable energy sources and its ratio with total supply based on LEAP (ktoe)

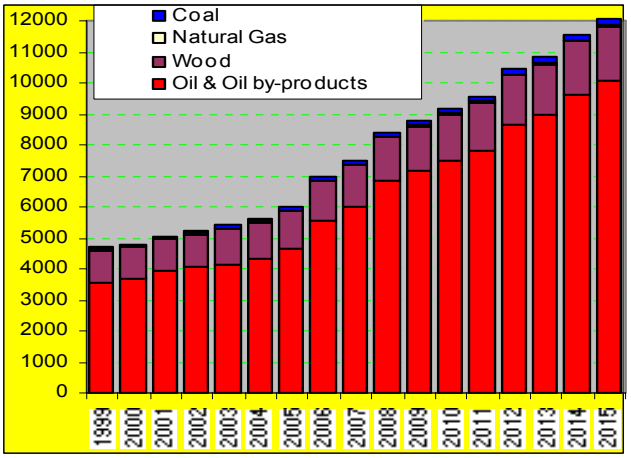

Figure II.83.: CO_2 emissions for each combustible fuel according to passive scenario based on LEAP (1000 tons)

Two other most important gases, which cause local pollution of the environment, are SO_2 and NO_x. These emissions are given in figures II.83 and II.84. Analysis indicates that the main emissions of both gases are caused from the combustion of oil by-products, fuel wood and coal.

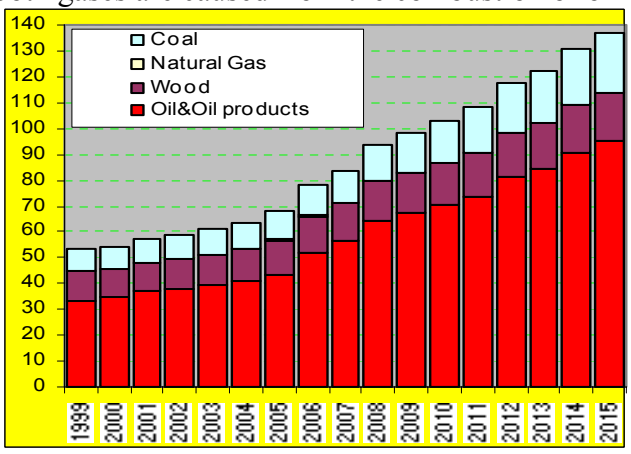

Figure II.84: SO_2 emissions for each combustible fuel according to passive scenario (1000 tons)

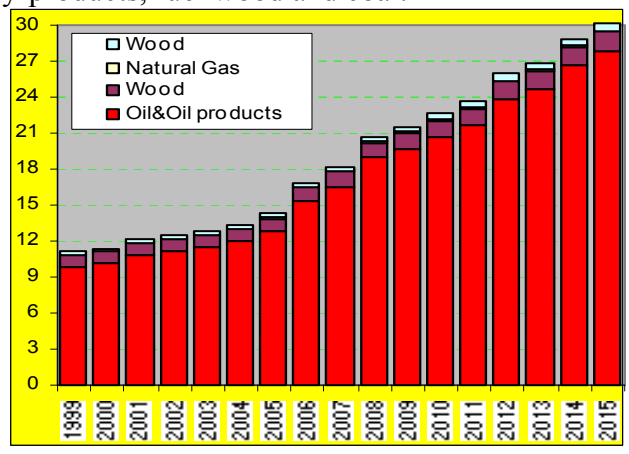

Figure II.85.: NO_x emissions for each combustible fuel according to passive scenario (1000 tons)

In the first chapter were widely analyzed the challenges of energy sector and two of most important were the development of two main indicators: the energy consumption per capita and the energy

intensity. Trend of both indicators according to the passive scenario is shown in figure II.86. Analysis demonstrates that the development of energy sector according to the passive scenario will lead to a growth of the energy consumption per capita (a positive sign), but in the same time will increase considerably the energy intensity. This means that the Albanian economy will consume more energy than in year 2000 to produce the same production unit. This will render our economy less competitive causing loss of the actual markets and increase of the trade deficit. Therefore, as it is emphasized several times, all measures should be taken in order that the Albanian energy system must not follow the passive scenario, but to be developed according to a scenario guaranteeing the growth of the energy consumption per capita and the decrease of energy intensity in the same time. This is the active scenario, as it is shown in figure below and it is analyzed in the following chapter of this document.

In figure II.87 are given the emissions of CO_2 per capita and for GDP. Analysis indicates that both those indicators are increased demonstrating that this scenario is unacceptable from environment point of view as well. The emissions per capita increase from 4.75 $kgCO_2$/capita (2000) to 6.00 $kgCO_2$/capita (2015). The emission intensity follows the same tendency, which's value increases from 3.7 $kgCO_2$/(US$) GDP in 2000 to 8.55 $kgCO_2$/(US$) GDP in 2015. The best scenario would be that scenario during which the CO_2 emissions per capita and GDP would be reduced as indicated in the figure. This seems to be a paradox but as it is analyzed below it isn't. Such a scenario may be achieved growing the domestic production with higher growth rate and consuming less energy for the same production and increasing the share of renewable energy resources compare to the passive scenario. The active scenario guarantees such a development as illustrated in the next chapter.

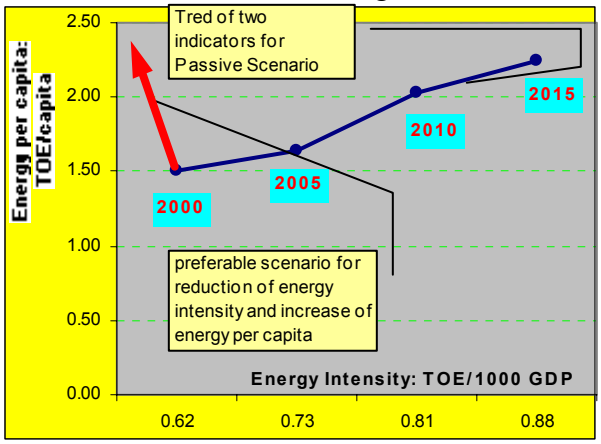

Figure II.86.: Trend of energy intensity and energy consumption per capita according to passive scenario.

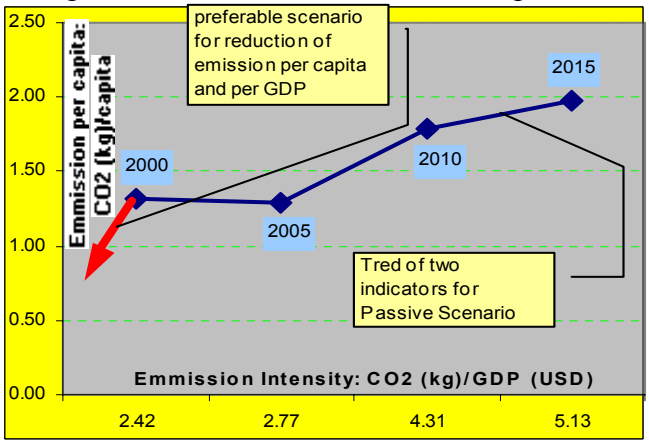

Figure II.87.: Trend of emission intensity and emissions per capita according to passive scenario.

II.18 Evaluation of investments needs and fuel cost for energy supply in all sectors

In this section is given a summary of total costs of the Albanian energy system if it is developed according to the passive scenario. In figure II.88 are given costs of the energy systems such as: oil extraction system, oil refining system and power system. As regarding the other two systems of the natural gas and coal production, they are not illustrated in figure II.88 because they are almost non-considerable compare to the other three above-mentioned systems. The total costs of natural gas and coal production systems are given in figures II.68 and II.76. Analysis of figure II.88 shows that a number of important investments are going to be done in the power generation system in order to

meet the electricity demand, while in the systems of oil extraction and refining, the investments will continue, but with a high risk due to well known reasons. On the other side, the fixed costs of systems of oil extraction and refining will be very high compare to those of the power generation system. This demonstrates once more that technologies applied in the system of oil extraction and refining are old and require very high investments.

In figure II.89 is shown the trend of total cost of energy system and contributions of power, oil, refining, natural gas and coal systems, which are respectively 43.77%, 23.52%, 32.33%, 0.18% and 0.41%. The total average annual costs of the energy system for three time periods are, respectively: US$ 98 million, US$ 172 million and US$ 249 million. In figure II.90 is shown the trend of total cost to guarantee the supply with energy sources, either domestically produced or imported. In the total cost are included investment cost, fixed and variable costs for O&M, fuel cost of imported marine diesel for new TPP supply, cost of imported power, cost of imported oil by-products to meet country's demand in all sectors (residential, services, industry, transport, agriculture and construction), and the cost of imported coal to supply service and industry sectors.

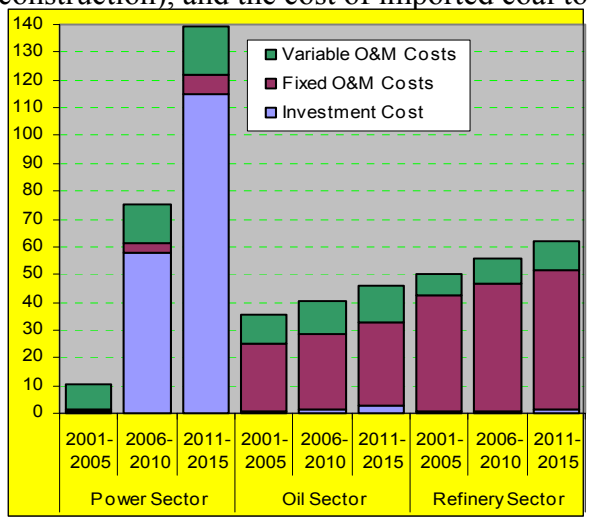

Figure II.88: Trend of total cost for three energy systems according to passive scenario (MUSD)

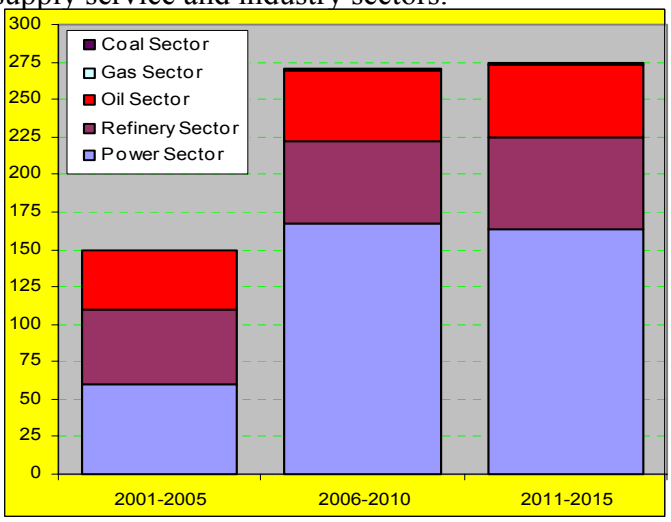

Figure II.89: Trend of total cost for three energy systems for each period according to passive scenario (MUSD)

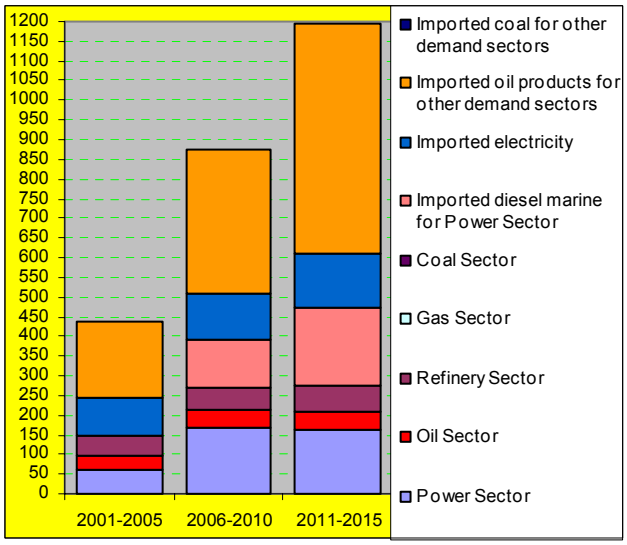

Figure II.90: Trend of total cost for all systems (electricity, oil, gas and coal extraction, and oil refining)

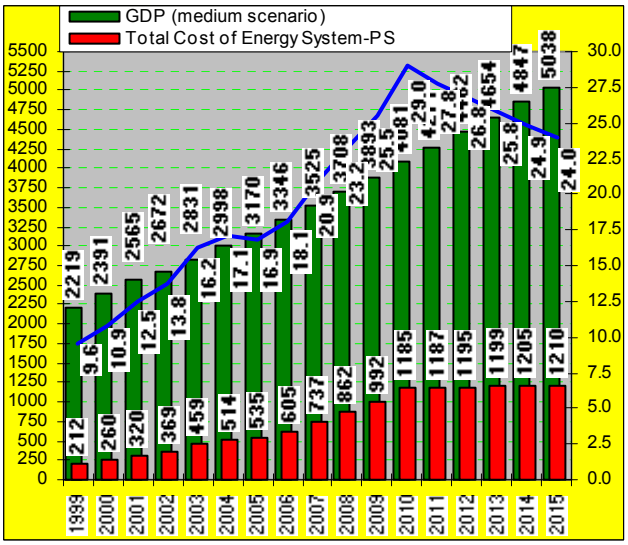

Figure II.91: Trend of total cost of energy system (MUSD), GDP, (MUSD) and their ratio (%)

including imports of energy commodities (MUSD)

Based on the above analysis, in figure II.91 are given three very important universal parameters for economic and energy systems according to forecasts of the passive scenario. As the figure indicates, the GDP value based on an average annual growth of 5% is expected to increase from US$ 2.219 billion in 1999 to US$ 5.038 billion in 2015. The total cost of energy system to support this economic and social development increases as well from US$ 211 million in 1999 to US$ 1210 million in year 2015. **What is very important is the fact that the ratio between the energy cost and GDP is expected to increase from 9.51% in year 1999 to 24.02% in 2015. If this comes true, it means that the cost of material goods (production and services) will increase considerably affecting the competitiveness of Albanian products with other countries products. As demonstrated in the above detailed analysis, the development of energy system according to the passive scenario will be accompanied with grave economic consequences such as increase of the energy trade deficit for the country and a heavy increase of emissions of polluters in the atmosphere.**

II.19 Conclusions on the trend of the energy demand and supply according to passive scenario

The forecast of energy demand for generalizing scenarios was accomplished using some of the driving factors of the economic and social development which are given below:

- The generalizing scenario, the passive scenario and active scenario (and all other scenarios) are based on the same economic average annual growth rate of 5% and the biggest share of GDP will be provided by the agriculture with a slight decrease from 48.7% in year 2002 to 39.2% in year 2015 followed by the construction sector and services, as their contribution will increase respectively, from 16.4% and 20% in 2002 to 17.8% and 23.4% in 2015. The industry and transport sector contributions are expected to be increase, respectively, from 11.2% and 3.7% in 1999 to 15.8% and 3.9% in 2015.

- The population growth for next years is forecasted to increase, averagely, by 1.1% per year. The population tendency of rural and urban areas is based on the expected internal migration from rural to urban areas, accompanied by the change of life quality, energy consumption and economic activities.

- On the other side, the number of dwellings is expected to increase by 35% from year 1999 (726000) to year 2015. Based on the forecasts, the transport indicator ton-km will increase by 85% from 1999 to year 2015, while the other indicator passenger-km will increase by 37%.

Some of the most important conclusions of the development of energy system according to the passive scenario are:

- **The main characteristic of the energy situation is the fact that self-sufficiency of Albania with primary energy sources in general and with oil in particular is declining quickly. The power system, also, is converted into a net importer to meet the demand. These factors will have a large effect on the energy trade balance, and consequently, on the country's general trade balance if the energy sector continues to be developed**

according to passive scenario. The need to import more fuels will increase the trade deficit beyond levels that the Albanian economy could afford.

- Analysis indicates that the energy demand for each sector grows respectively: for industry from 205 ktoe in 1999 to 539 ktoe in 2015; for residential from 385 ktoe in 1999 to 629 ktoe in 2015; for services from 187 ktoe in 1999 to 572 ktoe in 2015; for construction from 4.3 ktoe in 1999 to 16.4 ktoe in 2015; for transport from 515 ktoe in 1999 to 1001 ktoe in 2015.

- Despite there are seven primary energy sources, which contribute to meet the demand, only three of them, oil, hydro-energy (including power import) and fuel wood are the main contributors. In year 2015, their contributions are forecasted to be respectively; 74.95%, 14.00% and 8.51%.

- The forecast of energy demand for the residential sector indicates that in 2015 for space heating is expected to be consumed 33.50% of the total energy consumed in this sector, following by cooking with 24.27%, domestic hot water with 17.52%, electric appliances with 17.63%, lighting with 6.23% and air conditioning with 0.85%. As it was described in the above analysis, the greatest share of supply will be covered by electricity with 59.84%, following by fuel wood with 20.16%, LPG with 18.11% and others.

- Analysis showed that the energy demand from the service sector is expected to grow up quickly. In year 2015 the energy demand for this sector is expected to be 610 ktoe with the following supply pattern: 74 ktoe fuel wood, 285 ktoe oil by-products, 226 ktoe electricity, 7 ktoe coal, 15 ktoe heat and 3.3 ktoe solar energy.

- Based on the forecasts for each industry sub-sector, the main contributor of GDP will be industry of Food/Beverages/Tobacco, followed by the industry of Wood Processing/Paper/Publishing and other industries. Analysis of energy forecasts showed that the industries expected to consume more energy are the industry of metallurgy, followed by construction materials, food and textile industries.

- Analysis of the transport sector showed that the energy demand from passengers transport will dominate by around 2/3 of total energy demand during all period. The total energy demand in transport sector is forecasted to be 1000 ktoe increasing in 2015 by two times compare to year 1999.

- The forecasted demand for energy commodities in agriculture sector will grow quickly to support the fast development of this important sector for the Albanian economy. Diesel consumption is expected to grow significantly in future to keep up the increase of the agriculture production and to minimize the manual work of the Albanian farmers.

- Actually, only US$ 230 million are guaranteed (for transmission and distribution rehabilitation) through a number of projects, which are under implementation or pending to start. For this reason, as elaborating the passive scenario, is assumed that the level of losses is expected to be 14% in 2015, while the electricity supply to meet the demand and cover above losses is expected to be 12600 GWh.

- Analysis based on the unit cost of power generation demonstrated that the combined cycle TPP operating with marine diesel covering base load and gas turbine TPP operating with

marine diesel are the best alternatives. The best hydropower plant schemes resulted Bratila and Kalivaci HPP.

- As it analyzed in the active scenario, the natural gas penetration in the Albanian energy sector isn't likely to become reality before 2008. If natural gas will be available, it will be cheaper to use it for power generation instead of marine diesel. However, the new TPP to be built will operate with both, marine diesel and natural gas.

- The total investments required to cover needs in power generation are estimated to reach a value of US$ 915. This will put KESH in a very difficult economic and financial situation to find new investments for installment of new capacities.

- According to the passive scenario, oil production is expected to grow slowly reaching in year 2015 a value of 400 000 tons, while in the active scenario are given different options according to investment possibilities in the sector of oil and gas extraction.

- Total unit cost of the refinery output, which varies from 140-180 US$/ton, is considered very high, therefore the rehabilitation of our refineries is necessary to be competitive with imported by-products.

- Natural gas demand for power generation is forecasted to be some of 1.12 billion m^3N, while the total demand is expected to be 2.1 billion m^3N. Nevertheless, in the first glance, it appears we have a big natural gas market; it should be keep in mind that the passive scenario isn't that scenario that our energy sector should follow. The active scenario, which our energy sector should follow, demonstrates that the natural gas market will be half of that of the passive scenario, as it is shown in the analysis.

- Analysis shows that CO_2 emissions per capita and per GDP increase, demonstrating that this scenario is unacceptable from the environment standpoint. CO_2 emissions per capita are expected to grow from 4.25 kg/capita in year 2000 to 6.00kg/capita in year 2015. The same trend will experience the indicator of emission intensity, which grows from 3.7 kg/US$ GDP in 2000 to 8.55 kg/US$ GDP in 2015.

- Analysis demonstrates that the development of energy sector according to the passive scenario will increase the energy consumption per capita, and in the same time the energy intensity will go up significantly. This will make the Albanian economy less competitive, consequently, it will lose the current markets, and a growth of trade deficit will occur.

- Trend of the total cost of energy systems and results showed that contributions of electric system, oil, refining, natural gas and coal towards the total cost are respectively 43.77%, 23.52%, 32.33%, 0.18% and 0.41%. The average annual total costs of energy systems for three time periods 2001-'05, '06-'10, '11-'15 are estimated to be respectively: US$ 98 million, US$ 172 million and US$ 249 million, respectively. Analysis showed also that the ratio of total energy cost with GDP value of the Albanian economy could be increase from 9.51% in year 1999 to 19.6% in year 2015. As it is indicated in the detailed analysis done earlier, the development of energy system according to the passive scenario will have grave huge economic consequences, growth of country's trade deficit and increase of emission of polluters in the atmosphere. Therefore, all possible actions should be taken in order that the

energy sector must be developed according to the active scenario as it is prescribed in the following chapter.