This is simply explained by the fact of system output improvement (approximately twice) compared to traditional systems with industrial boilers. The reduction of environmental impact is also another advantage because be burned less fuel with normally a better quality and a higher price, is used. But, introduction of cogeneration plants requires:

First, relatively average and large consumers with simultaneous demand for heat and power energy.

Second, consumers should have a continuous demand, especially for thermal energy for more than 6 000 hours per year.

Third, each surplus quantity of electricity produced by CHP plant should be bought by electricity utility with the price established by ERE.

Four, CHP plants need serious investments that may be provided by fulfilling the precondition of necessary and continuous absorption of all heat and electricity. In addition, technical and economic analysis in every phase of the project should be efficient for all interested parties (financers, entrepreneurs, consumers).

Figures III.33 and III.34 show the heat demand in residential, service and industrial sectors. As shown by figures, the demand for heat according to the Active Scenario by 2015 is foreseen to be 800 $GWh_{thermal}$ while according to the Passive Scenario will be 180 $GWh_{thermal}$. The service sector is expected to have the greater share of demand for heat according to both scenarios.

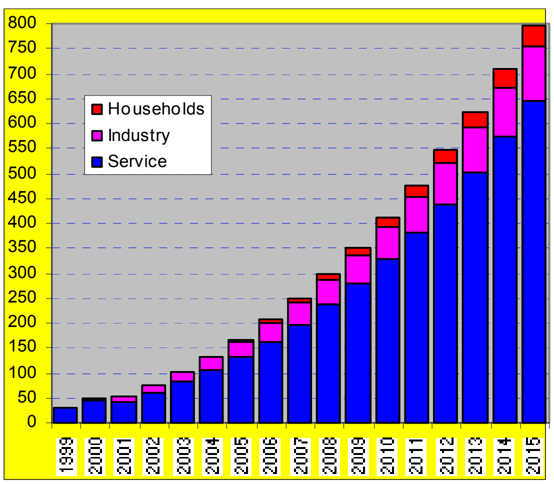

Figure III.33.: Demand for heat in residential, industry and service sectors according to active scenario ($GWH_{thermal}$)

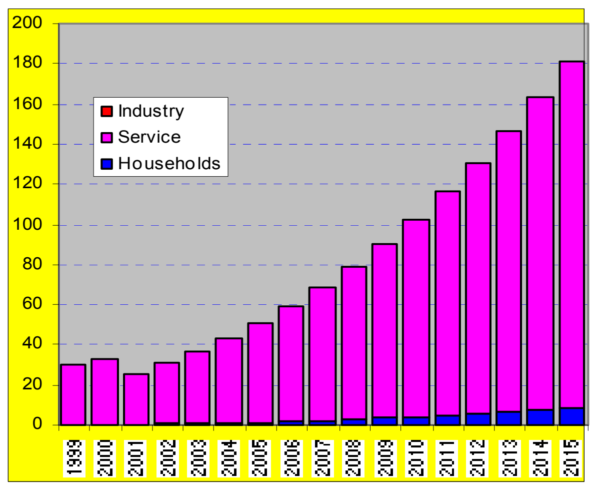

Figure III.34.: Demand for heat in residential, industry and service sectors according to passive scenario ($GWH_{thermal}$)

As underlined above, the required heat will be provided by central heating schemes and SSCHP. Figures III.35 and III.36 show the forecast for future heat production in respective plants according to the Active and Passive scenarios. The main role in the Active Scenario for heat production is foreseen to be played by CHP plants, while in the Passive Scenario by central heating plants. This is another advantage of the Active Scenario compared to the Passive one, because it makes possible to produce heat with a much higher efficiency (85-90% from SSCHP) compared to the production from central heating plants.

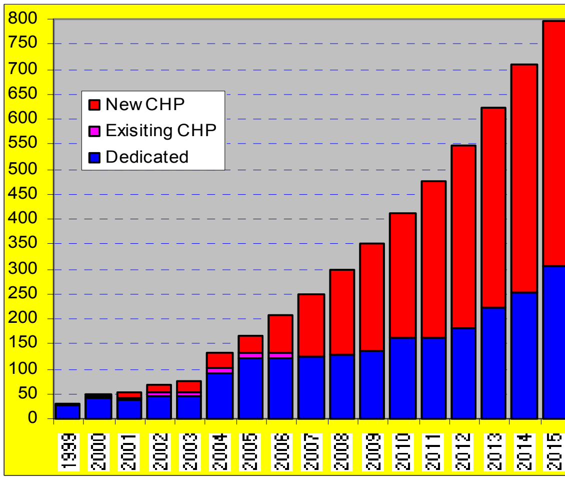

Figure III.35.: Forecast of heat production from respective plants according to active scenario (GWH$_{thermal}$)

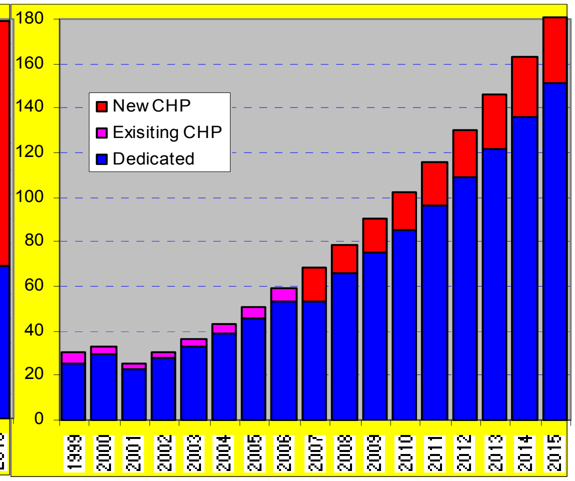

Figure III.36.: Forecast of heat production from respective plants according to passive scenario (GWH$_{thermal}$)

Figure III.37 shows the trend of heat production according to passive and active scenarios, while figure III.38 shows the trend of electricity generation from CHP plants.

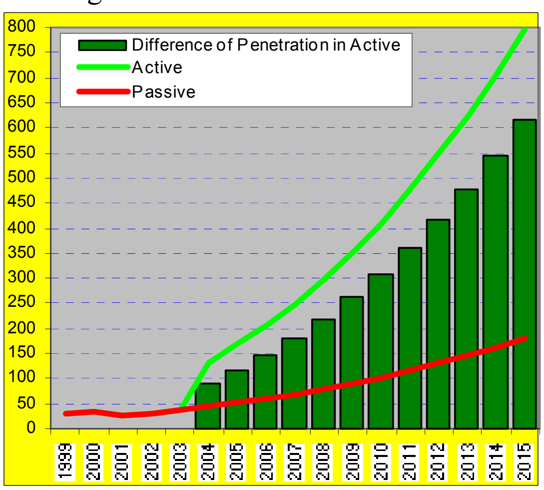

Figure III.37: Forecast of heat production from central heating plants and SSCHP according to active and passive scenarios, and the difference between them (GWH$_{thermal}$)

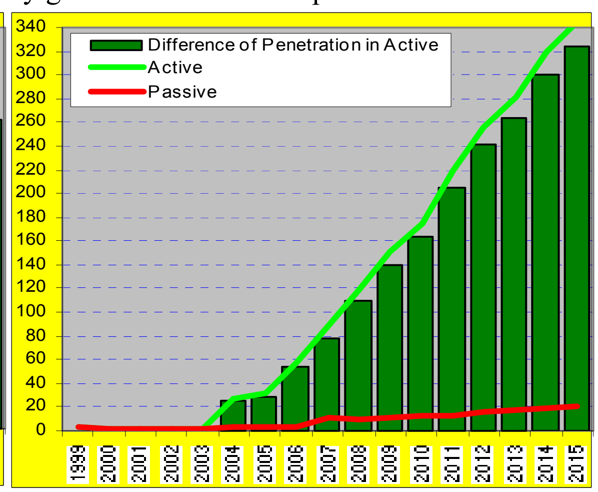

Figure III.38: Forecast of electricity production from central heating plants and SSCHP according to active and passive scenarios, and the difference between them (GWH$_{thermal}$)

Figure III.39 shows the heat production from central heating plants (that produce only heat) and the coproduction of heat and electricity from cogeneration plants. Figure III.40 shows the evaluation of necessary investments according to both scenarios for installation of central heating and CHP plants. The required value of investments by 2015 is expected to be US$ 14 million.

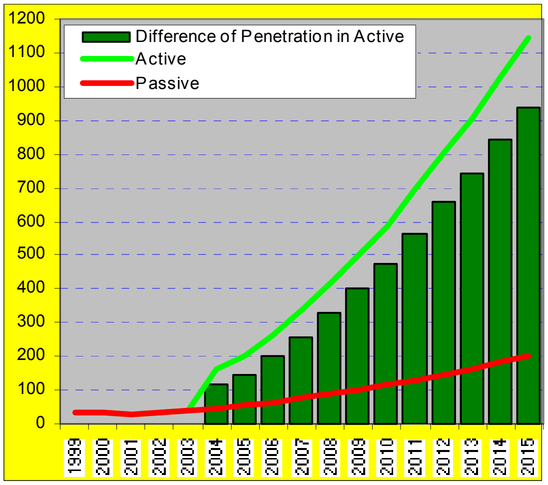

Figure III.39.: Forecast of heat and electricity production from central heating plants and SSCHP according to active and passive scenarios, and the difference between them ($GWH_{thermal}$)

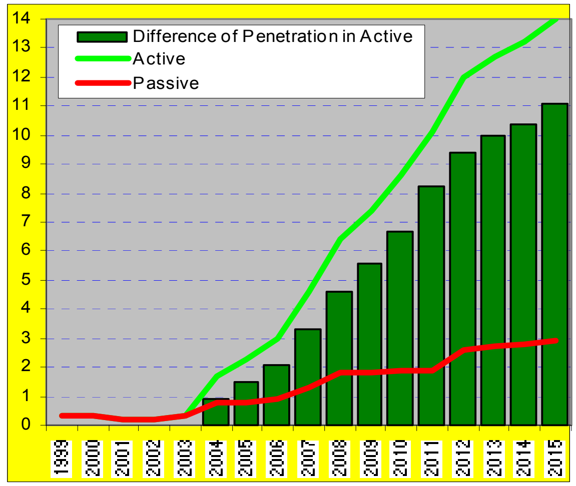

Figure III.40.: Forecast of necessary investments for central heating plants and SSCHP according to active and passive scenarios, and the difference between them (US$ million)

Penetration of efficient lighting in industry

A better lighting provides sufficient light in due place and time, facilitating activities and services. Lighting not only should be available when it is needed but it should be efficient as regards energy consumption avoiding energy losses due to its inefficient use.

The required power for a given quantity of lighting depends on the efficiency of lighting appliances (incandescent or fluorescents bulbs), the way the lighting system is designed and the proposed regimes for the maintenance of this system. In many buildings, lighting as a service, occupies the main part of the energy cost. In offices for example, lighting is calculated, as 50% of consumed electricity and in many cases may be equal to space heating cost.

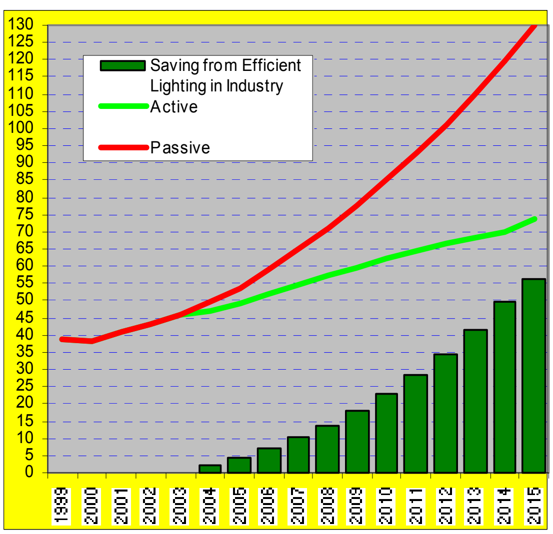

Figure III.41.: Forecast of electricity demand for lighting according to active and passive scenarios and respective savings (GWh)

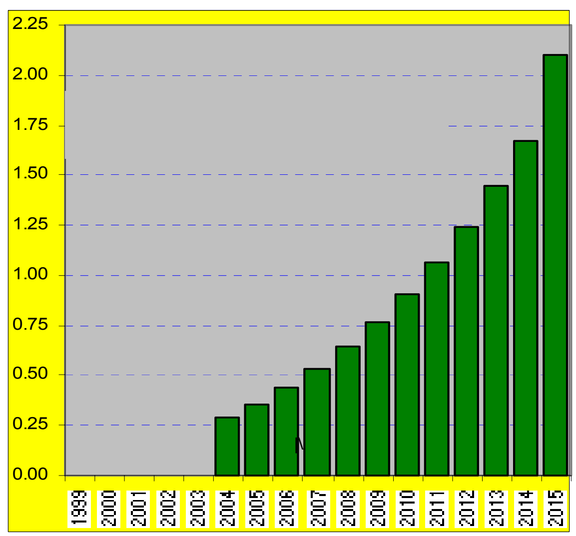

Figure III.42.: Forecast of necessary investments for lighting according to active and passive scenarios and respective savings due to introduction of efficient lighting (US$ million)

In hospitals, lighting cost is approximately 20-30% of the total electricity cost while in factories is 5-8% of consumed electricity. The application of best practices regarding the energy efficiency shows that the energy cost may be reduced up to 30% leading to a valuable saving in a shorter payback period. Figure III.41 shows the forecast of energy demand for lighting according to both scenarios and the respective saving of electricity in industry sector due to penetration of fluorescent bulbs.

Figure III.42 evaluates the necessary investments for an efficient lighting in the industry sector. The value of necessary investments by 2015 is estimated to be US$ 2.1 million. Figure III.43 gives a summary of saving from each measure as well as the energy demand according to the Active Scenario. As shown in figure, the energy demand according to the Active Scenario by 2015 is foreseen to be 580.6 ktoe. The total energy savings in the industry sector by 2015 are estimated to reach up to 225.2 ktoe. Figure III.44 shows the contribution of each energy source, evidencing that electricity, solar energy and oil coke will play the main role.

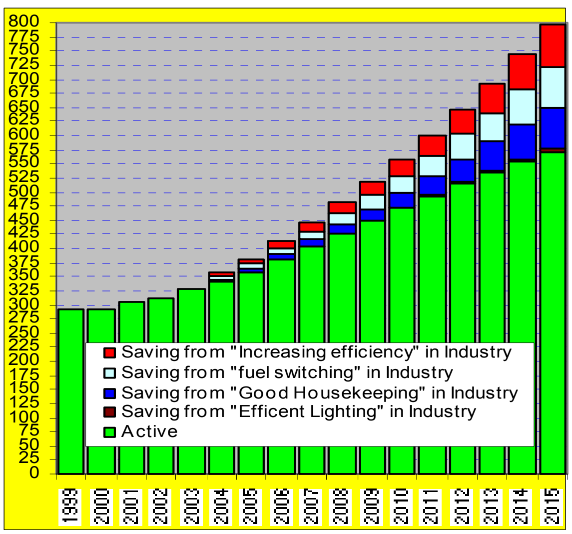

Figure III.43.: Forecast of energy demand according to active scenario and measures for energy saving in industry sector (ktoe)

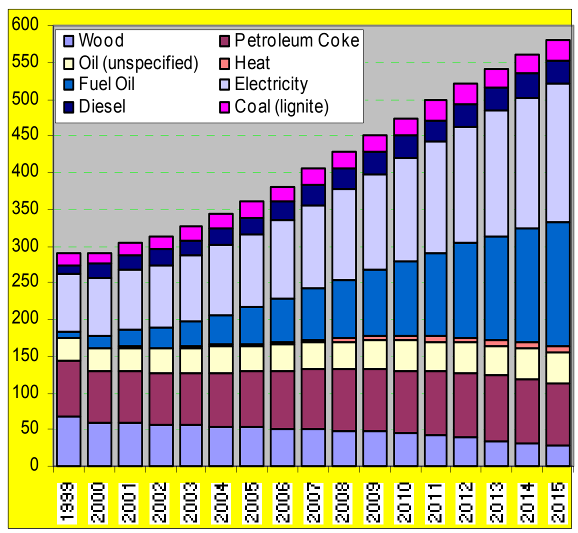

Figure III.44.: Demand forecast for each energy source in industry sector according to active scenario (ktoe)

Other important measures to increase the energy efficiency in all industrial sub sectors are:

- Recuperation of combustible gases in Ballsh refinery and Ferrochromium plant;
- Recuperation of secondary heat in Steel Industry;
- Coordination of TPP and Fier (Ballsh) Refinery to work under the efficient classical CHP scheme as well as for serious repair in both plants;
- Concentration of industries in industrial parks/zones where modern CHP schemes may be successfully applied; etc.

The analysis shows that economic-financial indicators for important activities of industrial sector, may considerably improve by applying the Active Scenario that means more attention paid to saving and efficient use of energy sources and selection of fuel types. The following measures should be undertaken in order to promote energy saving in the industrial sector:

- Power Sector Policy Statement aims the preparation of respective methodologies and schemes for energy audits in industrial enterprises. In addition, the draft law on Energy Policy proposes mandatory energy audits especially for large consumers. This is discussed more in details in the section of the legal framework.
- As regards the financing of different measures for energy saving, promotion of ESCO[1] type financial schemes is a priority. Such types of financial schemes that may be applied to introduce different energy saving measures in the industry and service sector (evidenced by respective energy audits) guarantee the respective investments and their payback through energy savings.

III.5 Forecast of energy demand in transport sector according to active scenario

III.5.1 Introduction

This section describes the energy demand in the transport sector according to the Active Scenario for the period 1999-2015. The transport sector includes the passenger and freights transport. The main indicators for these transports are respectively, passenger-km and ton-km. In total, they are not foreseen to change in both scenarios, except for changes in sub sectors. The Active Scenario foresees the decline of working volume of passengers' road transport and the increase of railway transport, while working volume in sea and air transport is not foreseen to change. Figure III.45 shows the trend of passenger-km indicator according to the Active Scenario for each sub-sector. The same situation is for freights transport where according to the Active Scenario a decline of working volume in road transport and the increase of railway transport is foreseen. The transporting volume of low tonnage trucks is foreseen to decline while the transporting volume of average and high tonnage trucks is foreseen to increase. Figure III.46 shows the trend of ton-km indicator according to the Active Scenario.

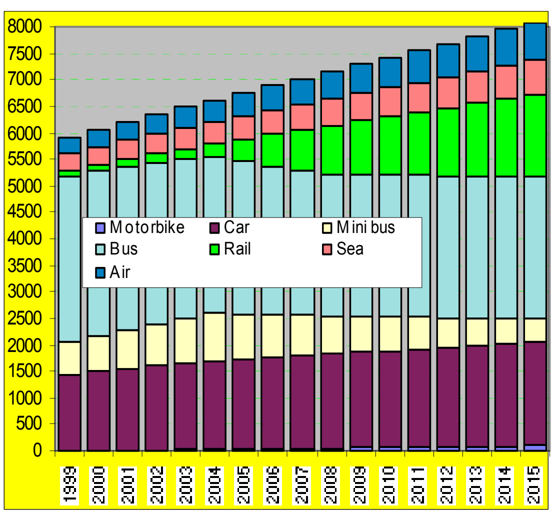

Figure III.45.: Forecast of passenger transport indicator according to active scenario, million passenger-km.

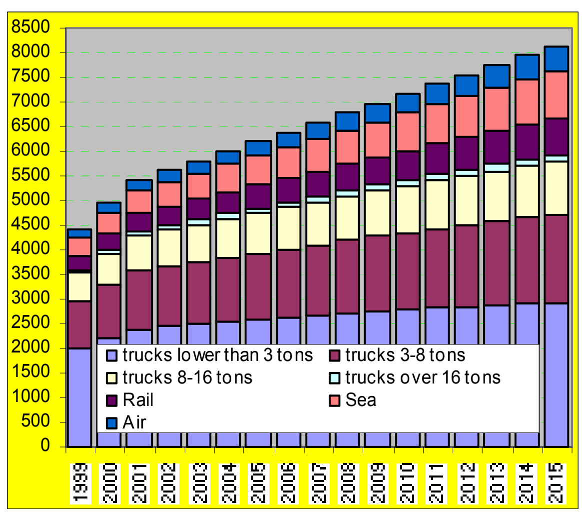

Figure III.46.: Forecast of freights transport indicator according to active scenario, million ton-km.

[1] **"ESCO"** abbreviation - **E**nergy **S**ervice **C**ompany

III.5.2 Energy saving measures in transport sector

The Active Scenario analyses a number of qualitative and quantitative energy efficiency measures to reduce the energy consumption and provide an economic efficiency. The following measures were analyzed for the passenger transport:

- Based on world and regional experiences, was estimated that energy intensities in transport sector will reduce to 10% due to a better management. This will be achieved through:
  - Road rehabilitation that has already started in a large scale;
  - Construction of new roads;
  - Better management of transport sector;
  - Use of efficient vehicles with lower engine power;
  - Increase of average speed of transportation vehicles.
- The Active Scenario foresees a decline of growing rates of private car number, and buses and trains in this case, will cover the difference created between the Active and Passive scenarios.
- The Active Scenario foresees the decline of minibuses contribution from 2004 till 2015, with 0-50%, taking into account the 2004 inventory of vehicles. This part of passenger transport will be covered with buses and trains.

Due to above measures, an increase of bus passengers number is foreseen.

- Another foreseen measure to be applied is the general reduction growth rate of passengers' number in car transport and covering of the difference with railway transport. This forecast that enhances the railway transport is based on the improvement of railway infrastructure, as well as in the substitution of part of the existing trains with low fuel consumption rapid trains.

Based on the world experience, such measures will promote the public transport of passengers that would reduce fuel consumption, decline the transport cost and reduce emissions in the atmosphere. This will be accompanied with economic savings that may be used to improve road and railway transport as well as encourage the citizens to use the public transport with lower tariffs.

The following measures were analyzed for the freights transport:

- Decline of 3 and 3-8 tons trucks contribution, for the period 2004-2015. The difference between two scenarios is foreseen to be covered by transport of 8-16 and over 16 tons trucks.
- Decline growth rate of contribution from road freights transport and the difference is foreseen to be covered by railway transport.

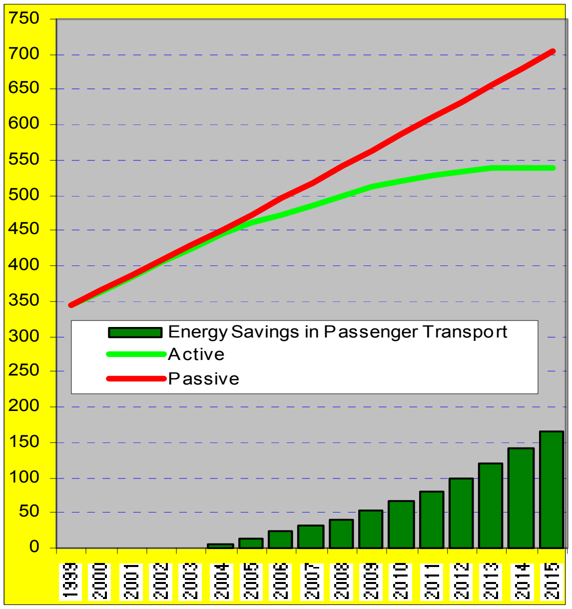

Figure III.47: Energy demand according to both scenarios and energy saving for passenger transport (ktoe)

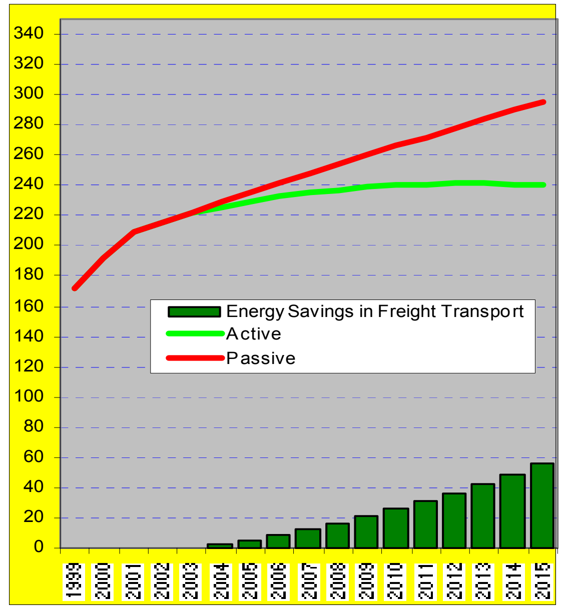

Figure III.48: Energy demand according to both scenarios and energy saving for goods transport (ktoe)

Figure III.47 shows the energy demand for passenger transport according to both scenarios. These values are respectively 704.8 ktoe and 538.4 ktoe, which mean a reduction with 24% by 2015.

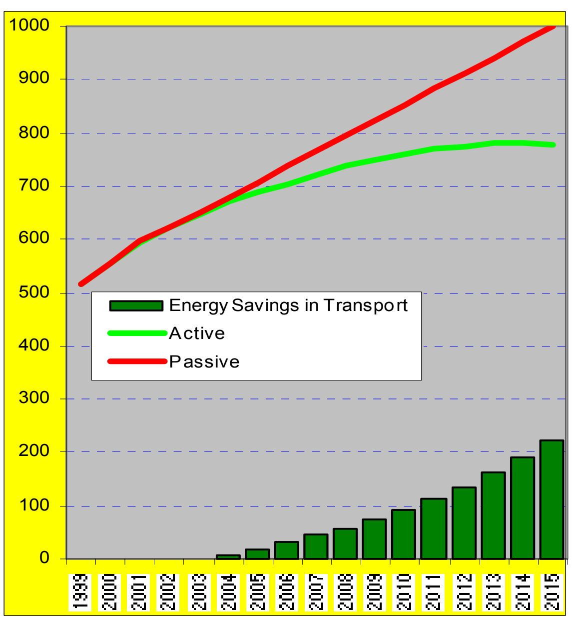

Figure III.49.: Energy demand according to both scenarios and energy saving for transport sector (ktoe)

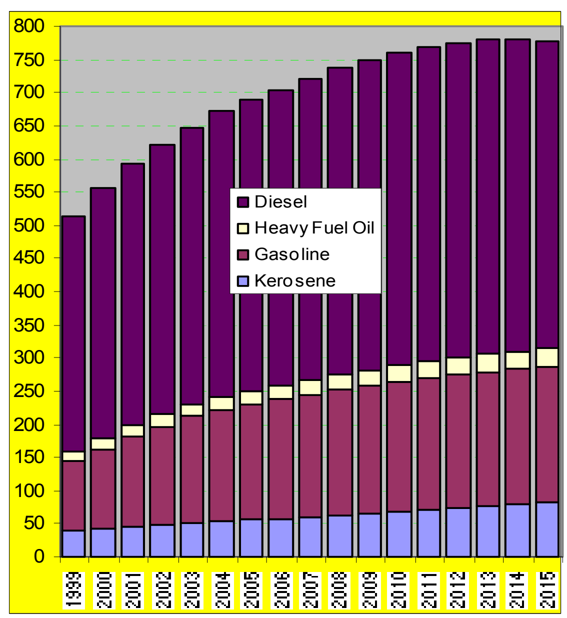

Figure III.50.: Forecast of demand for oil by-products according to active scenario (ktoe)

This is a sensitive saving with positive results to reduce import of oil by-products. Figure III.48 shows the energy demand for freights transport according to both scenarios and respective savings. The figure shows that according to the Passive Scenario, the energy demand will be 295.8 ktoe, while according to the Active Scenario it will be 239.9 ktoe. The energy savings by 2015 are expected to be at a level of 19%. Based on the above analysis, the total energy demand in transport sector by 2015 according to the Passive Scenario will be 1000.6 ktoe, while according to the Active Scenario, due to quantitative energy saving measures it will be reduced to 778.3 ktoe, which means a saving of 22% (see figure III.49). Figure III.50 shows the total demand for oil by-products in transport sector according to the Active Scenario.

The above analysis on energy savings and necessary investments was completed in co-operation with Ministry of Transports and Telecommunication. The Active Scenario shows the required investments for each measure as well as demand differences according to both scenarios for each type of transport for the period 2004-2015. Besides investments in transport modes, infrastructure investments were also taken into consideration. Such infrastructure investments will affect:

- Development of transport sector;
- Development of Albanian economy and society especially in less developed rural zones;
- Fuels saving;
- Environmental protection.

Based on different countries experience and studies prepared by Ministry of Transports and Telecommunication, was accepted that the specific weight of energy influence on infrastructure investments would be 10%. According to the Active Scenario additional investments are required besides investments.

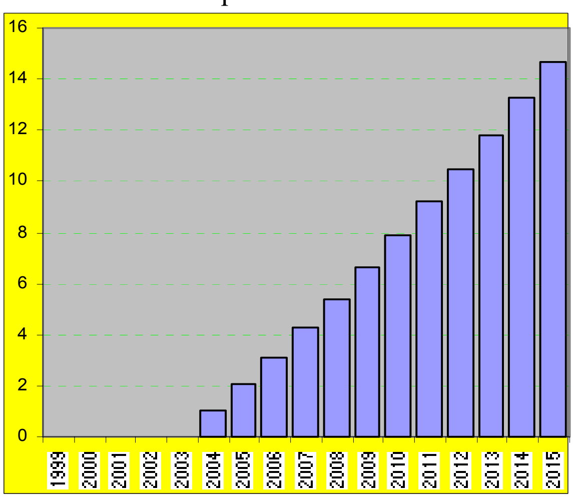

Figure III.51.: Investment for passenger railway transport (US$ million)

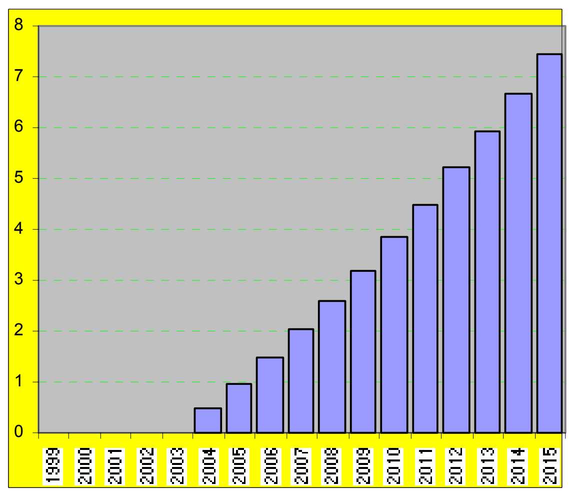

Figure III.52.: Investments for freights railway transport (US$ million)

Due to foreseen measures in the Active Scenario, road transport by buses and railway transports will have a significant increase. Application of such measures requires investments in passenger transport, as shown in Figure III.51. Due to qualitative measures undertaken in the Active Scenario, the transport with trucks of 8-16 tons and over 16 tons as well as railway transport will have the highest increase. Investments foreseen according to the Active Scenario till 2015 for freights railway transport are given in figure III.52, for transport with trucks of 8-16 tons in figure III.53, and for freights transport with trucks over 16 tons, in figure III.54.

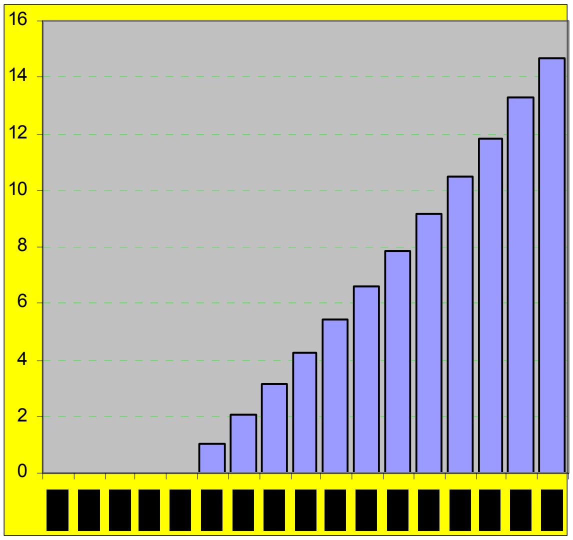

Figure III.53.: Investments for freights transport with trucks of 8-16 tons (US$ million)

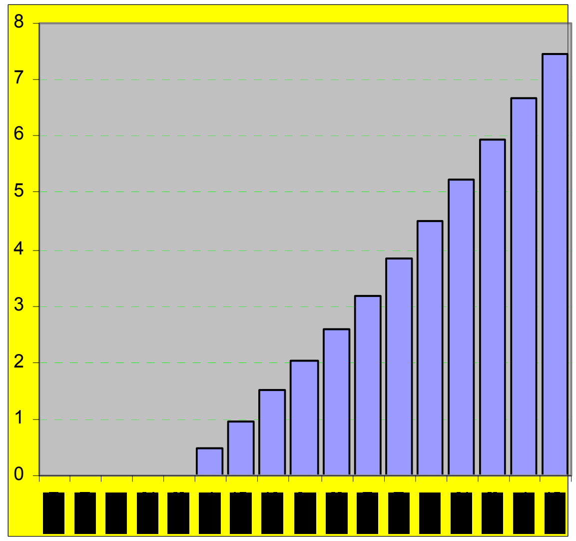

Figure III.54.: Investments for freights transport with trucks over 16 tons (US$ million)

The following measures are required for energy saving in transport sector:

- Continuing of the Government measures to improve road and railway infrastructure;
- Encourage of use of efficient cars with lower engine power;
- Imposing of higher custom taxes for used cars compared to new ones;
- Introduction and imposing of environmental taxes according to emissions in the atmosphere;
- Organization and performance of different awareness campaigns to promote and encourage public transport.

III.6 Forecast of energy demand in agriculture sector according to active scenario

III.6.1 Introduction

This section foresees the energy demand in agriculture sector for the period 1999-2015. Agriculture sector contribution in GDP (Gross Domestic Production), which is the main indicator, is assumed to equal to that in the Passive Scenario.

III.6.2 Analysis of energy saving measures in agriculture sector

With the objective of reducing the energy consumption according to the Active Scenario, the following quantitative and qualitative measures were taken into consideration and analyzed:

- First, a reduction of 10% of energy intensities due to a better management was foreseen. It will be achieved by restructuring the agriculture sector and establishing farmer groups with common interests that will enable the use of mechanized agricultural machineries. Such measures will double the profits, increase agriculture production and reduce, on the other side, the fuel specific consumption.
- Application of biomass schemes and production of biogas from plants and agriculture and animal farming wastes is an effective way to meet the growing demands in the agriculture sector. Biomass and biogas might be used for heating of green houses, thus meeting a part of their demand. This would increase the contribution of renewable energy sources, and reduce the cost and environmental pollution.

- The high potential of solar energy in our country makes it a preferred energy source, especially, if solar collectors that produce hot air for drying up of different agricultural cultures are used.
- Use of existing irrigation reservoirs to install electricity generation plants where economically efficient. Different analysis carried out by the Academy of Sciences and the Institution of Studies and Design of Hydro-technical Works show the existence of the potential to install a number of small HPPs with a total capacity of 20-25 MW.
- Installation of 20 wind energy power plants close to 20 pumping stations alongside Adriatic shore, to protect lands from flooding.

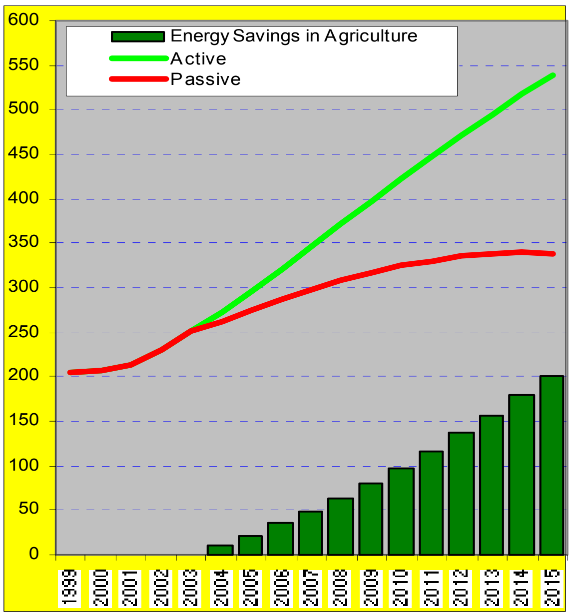

Figure III.55.: Trend of energy demand according to passive and active scenarios, and energy saving in agriculture sector (kote)

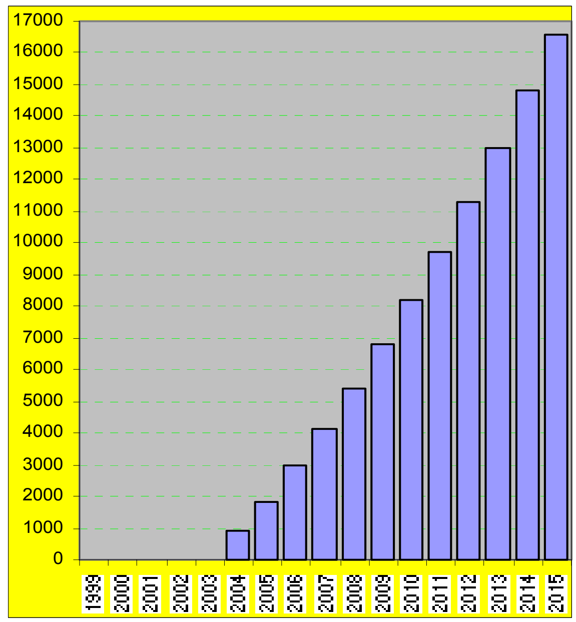

Figure III.56.: Necessary investments in agriculture sub sector (US$ million)

- Use of efficient irrigating schemes, which means that superficial irrigation with drills or flooding will be substituted with pressured irrigation in the form of rain or drops, is foreseen to reduce by 50% the energy consumption in agriculture sector.

Based on the above analysis, the total energy demand in agriculture sector by 2015 according to the Passive Scenario is forecasted to be 539.3 ktoe. According to the Active Scenario, due to quantitative measures, the energy demand is forecasted to reduce to a value of 338.3 ktoe that means a saving of 37%. This is shown in figure III.55.

According to the Passive Scenario, the energy demand in agriculture sub sector by 2015 is forecasted to be 376.4 ktoe, while according to the Active Scenario it is forecasted to be 218.5 ktoe, with an approximately saving of 42%. The energy demand by 2015 in livestock sub sector is forecasted to be 38.6 ktoe according to the Passive Scenario and 28.1 ktoe with a saving of 27%, according to the Active Scenario. The energy demand by 2015 in fish sub-sector, according to the Passive Scenario is forecasted to be 99.4 ktoe, while according to the Active Scenario it will be 72.5 ktoe with a saving of 27%. The energy demand by 2015 in forest sub-sector according to the Passive Scenario is forecasted to be 25 ktoe, while according to the Active Scenario it will be 9.3 ktoe with a saving of 23%.

In order to apply the foreseen measures in agriculture sub sector for the period 2004- 2015, the Active Scenario calculates in addition, the necessary investments as a difference between active and passive scenarios. Figure III.56 shows the necessary investments needed to apply efficient measures in agriculture sub sector, which are expected to be approximately US$ 16.6 million in 2015. The Government and farmers themselves will do these investments. The Government will invest in big irrigation works (and respective infrastructure), while farmers will invest in efficient irrigation means in rain form. In order to accomplish such investments and promote the penetration of efficient forms of irrigation, a working group with experts from Ministry of Agriculture and Food, Ministry of Industry and Energy, and National Agency of Energy will be established.

III.7 Forecast of energy demand for all consumption sectors according to active scenario

Based on the above analysis and LEAP software, the energy demand for each sector was calculated. Figures III.57 and III.58 show the forecast of energy demand for each sector and each energy source, according to the Active Scenario:

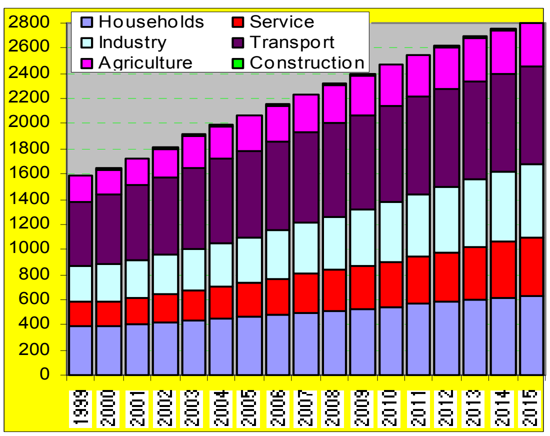

Figure III.57.: Forecast of energy demand for each sector according to passive scenario based on LEAP software (ktoe)

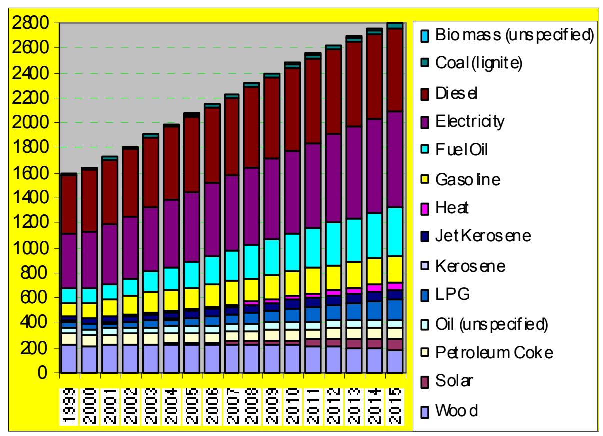

Figure III.58.: Forecast of energy demand for each energy source according to passive scenario based on LEAP software (ktoe)

The analysis of figure III.57 shows that the energy demand for each sector will increase: for agriculture sector from 205 ktoe in 1999 to 339.2 ktoe in 2015; for residential sector from 385 ktoe in 1999 to 618.8 ktoe in 2015; for service sector from 187 ktoe in 1999 to 439.7 ktoe in 2015; for construction sector from 4.3 ktoe in 1999 to 16.4 ktoe in 2015; and for transport sector from 515 ktoe in 1999 to 780.1 ktoe in 2015. The analysis of the energy resources shows that electricity, diesel, solar, fuel woods, kerosene and LPG will have the respective contributions in the total energy demand: 27.29%, 24.03%, 13.70%, 7.30%, 6.53% and 5.72% in 2015. Other energy resources, as shown in figure III.58, will contribute with only 15% of the total energy demand in 2015. Contrary to the Passive Scenario, two new energy sources appear in the Active Scenario, heat and solar energy that will increase considerably compared to the Passive Scenario forecasts. By 2015, they will contribute with respectively 2.44% and 3.31%.

Due to different measures mentioned in previous sections, the Active Scenario foresees a considerable saving of energy compared to the Passive Scenario. Figures III.9 and III.60 show the trend of both scenarios and energy savings.

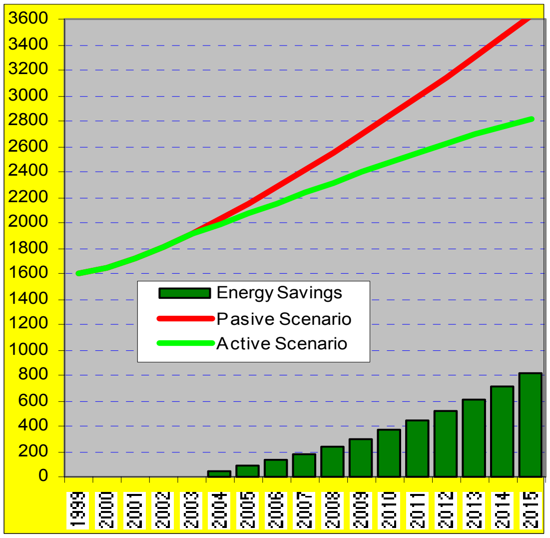

Figure III.59.: Forecast of energy demand according to each scenario and energy savings (ktoe)

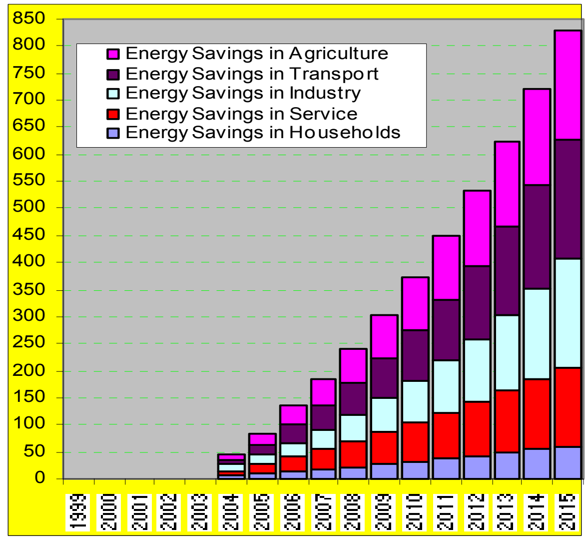

Figure III.60.: Energy savings for each sector according to active scenario compared to passive one (ktoe)

Figure III.59, shows that energy saving by 2015 according to the Passive Scenario will reach a value of 815 ktoe or 22.48% of the total consumption. The highest contribution in total savings in 2015, as shown in figure III.59, is expected to come from transport sector with 27.28%, industry with 24.58%, agriculture sector with 24.67%, service with 17.86% and residential sector with 7.4%. To achieve the above figures of energy saving in each sector there are necessary some investments, as analyzed in sub section III.2. Section III.16 summarizes the necessary investments for each sector in order to reduce energy consumption according to the Active Scenario.

III.8 Forecast of electricity demand according to active scenario

Figure III.61 shows an analysis of electricity demand forecast according to the Active Scenario, for each sector. The forecast of electricity demand in residential sector shows a growth of demand from 2954 GWh in 1999 to 4322 GWh in 2015. Figure III.62 shows the forecast of electricity demand in service sector for public and commercial services. Figures III.63 and III.64 show the forecast of electricity demand in industry and agriculture sectors.

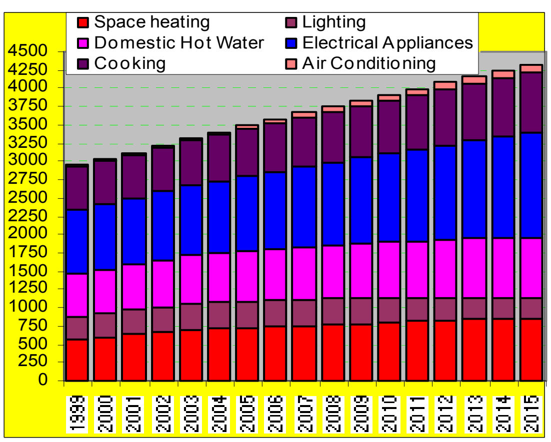

Figure III.61.: Forecast of electricity demand in residential sector to guarantee main services (GWh)

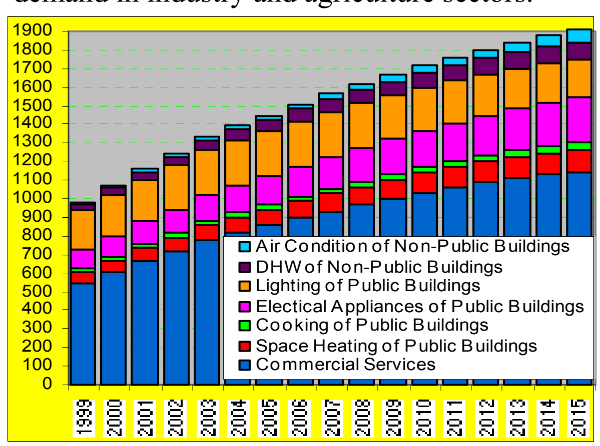

Figure III.62.: Forecast of electricity demand in public building and commercial sector to guarantee main services (GWh)

Figure III.65 shows the forecast of electricity demand for each sector. As is shown in the figure, the residential sector will be the main one during the whole analyzed period. The Active Scenario foresees a decline of the relative consumption in the residential sector from 57.69% in 1999 to 47.97% in 2015.

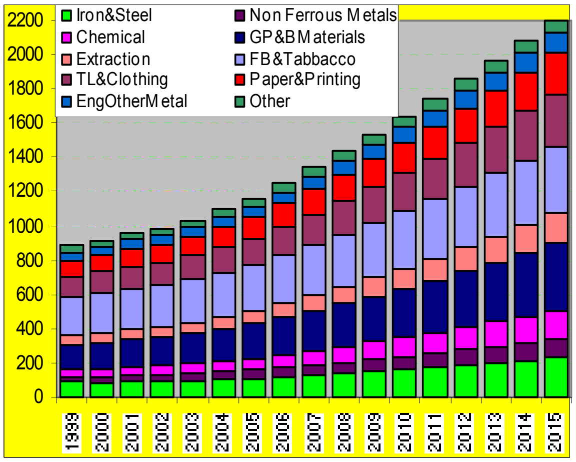

Figure III.63.: Forecast of electricity demand in industry sector (GWh)

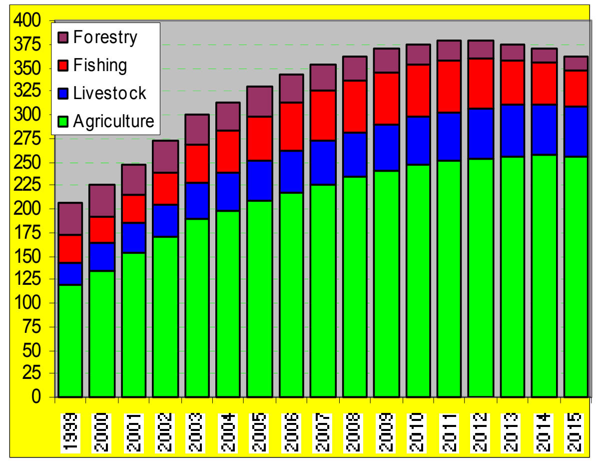

Figure III.64.: Forecast of electricity demand in agriculture sector (GWh)

On the other hand, industry and service sectors are foreseen to experience a relative increase from 18.05% and 18.86% in 1999 to 21.36% and 24.72% in 2015, respectively. Industry and service sectors contribution according to the Active Scenario is foreseen to be higher than in the Passive Scenario, evidencing once again that electricity will be used more for production, instead of comfort purposes.

Figure III.66 shows the electricity demand and forecasted losses for the period 1999-2015. Currently, losses in transmission and distribution systems are 25.5% and various measures are taken to reduce them. As emphasized in the description of power situation, the action plan has established a number of objectives to reduce the level of losses. **As analyzed by the World Bank study, the level of losses is foreseen to be reduced from 25.5% to 6%. Although such a level is likely to be achieved according to World Bank plan presented in the Module of Losses Reduction, the Active Scenario foresees a reduction of the losses level from 25.5% to 10% (which means it was accepted as a possible objective).**

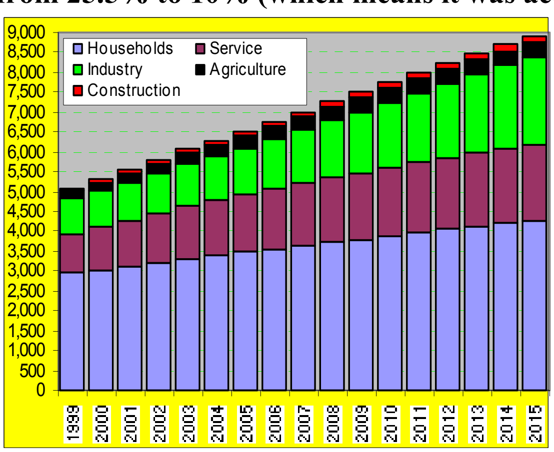

Figure III.65.: Forecast of electricity demand in all sectors (GWh)

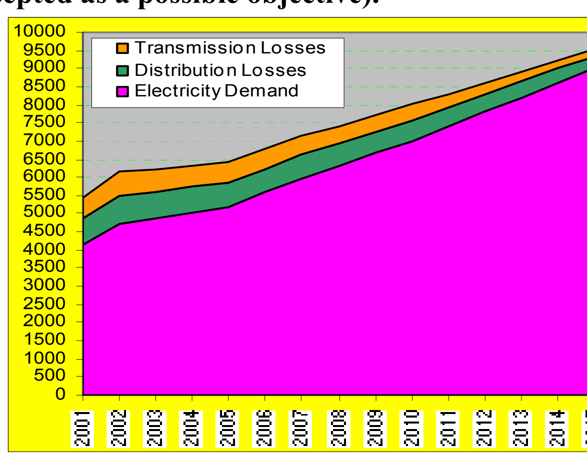

Figure III.66.: Forecast of electricity demand and technical losses in transmission and distribution sectors (GWh)

Figure III.67 shows the forecast of electricity demand according to both scenarios and electricity savings due to introduction of measures described in details in sections III.2-III.6 (figure III.68). Analysis shows a level of electricity savings of 3056 GWh in 2015, with the main contribution from reduction of technical losses followed by savings in service and residential sectors, etc.

As a conclusion, the electricity demand to meet the needs and reach the level of losses of 10% by 2015 is expected to be 9535 GWh. Both scenarios and the World Bank study, accepts that till 2008, 24 hours electricity supply is not guaranteed. In cooperation with American experts that have prepared LEAP software, unmeet electricity supply for the period 1999-2015 is modeled, as shown in figures III.69 and III.70.

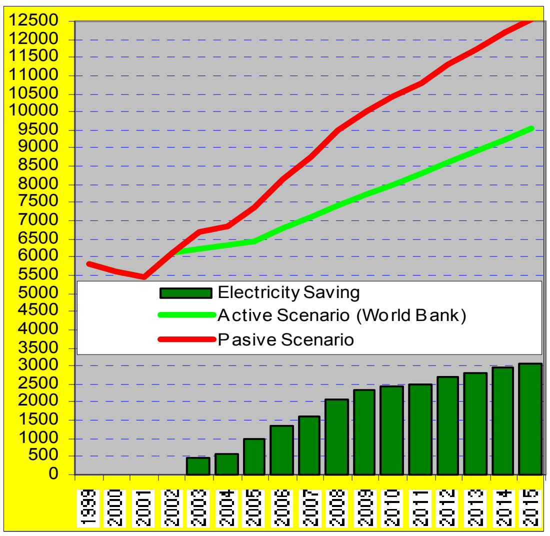

Figure III.67.: Forecast of electricity demand and energy saving for each sector (GWh)

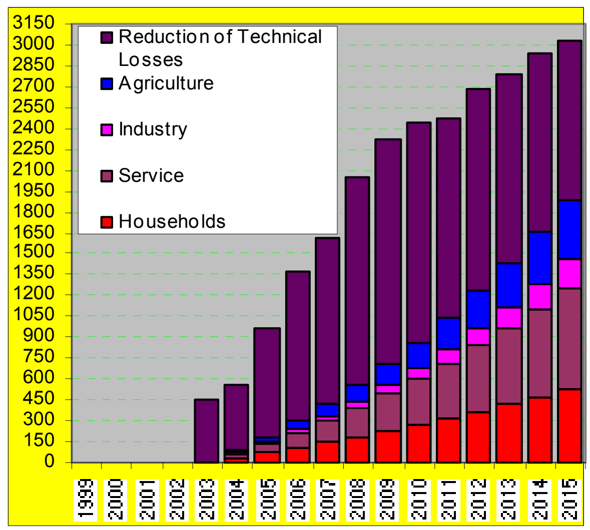

Figure III.68.: Electricity saving in each sector according to active scenario compared to passive scenario (GWh)

As already mentioned, the World Bank has prepared a number of scenarios to forecast the electricity demand. The main scenario for further analysis and preparation of respective master plans for Generation, Transmission and Distribution sectors was based on following modules of above mentioned study:

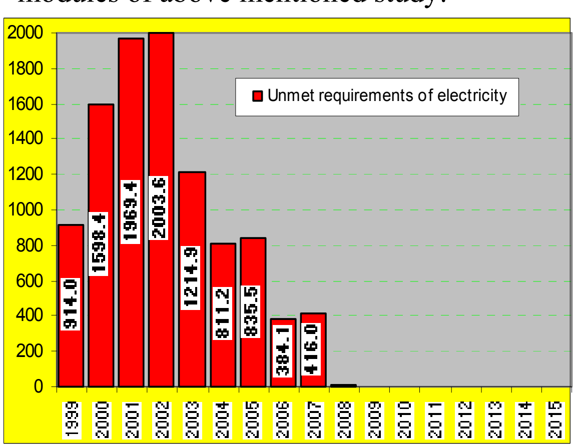

Figure III.69.: Forecast of nonsupplied electricity for all sectors (GWh)

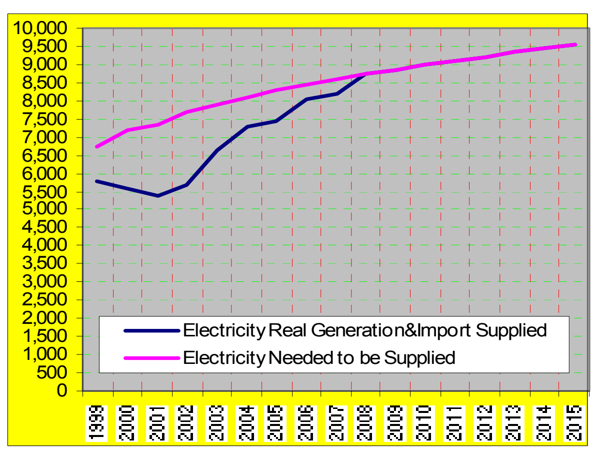

Figure III.70.: Electricity demand and real expected supply

Module A: forecasts electricity demand till 2015 (referring to the average scenario). The scenario reflects the unrestricted consumption after 2007 (as in the Passive Scenario) that may be guaranteed if there are no restrictions of supply on the generation, transmission and distribution side.

Module D:

- According to the analysis of this module, transmission[2] losses in 2001 were 602 GWh, which means 11.1% of electricity supplied to the network,
- According to the analysis of this module, distribution[3] losses in 2001 were 734 GWh, or 13.5% of the total energy supplied to the network or 16% of electricity supplied to the distribution level,
- Loss reduction plan till 2015 for transmission and distribution sectors is expected to be linear from 24.6% to 6%.

Module C:

According to the analysis of this module, the transmission losses by 2015 are expected to be reduced[4] to 2%.

Based on such assumptions, electricity demand during the period 2002-2015 is forecasted to increase with 55% (with an average increase of 3.4% per year). Figures III.71 and III.72 show the forecast of electricity generation and peak demand.

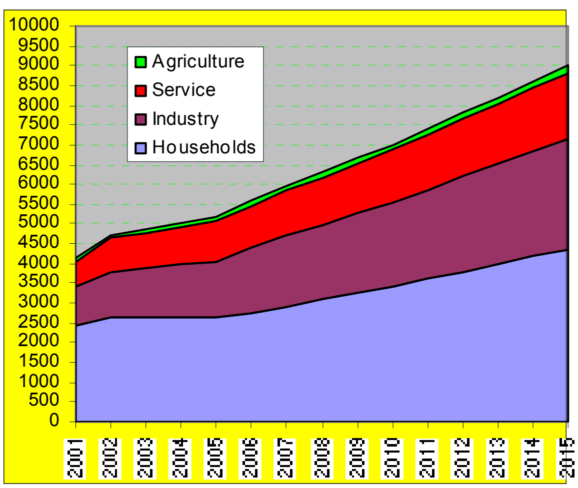

Figure III.71.: Forecast of electricity supply from HPPs, TPPs and import (GWh)

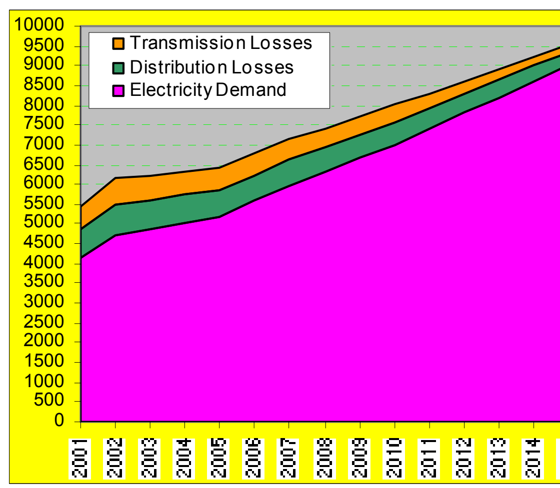

Figure III.72.: Forecast of total demand, and technical losses in transmission and distribution sectors (GWh)

III.9 Forecast of generation capacities and respective master plan

III.9.1 Selection of new plants to meet the demand according to the Active Scenario

In order to meet the additional demand for electricity and reduce the very high level of import, the Active Scenario considers the identification of new potential TPPs:

- Conventional steam turbines heavy fuel oil or coal fired TPPs;

[2] transmission system includes the following levels of voltage: 400 kv, 220kv, 110kv and 35 kv.
[3] distribution system includes 20 kv networks
[4] according to module D conclusions, 220 kV and 35 kV networks will not exist after 2015. As a consequence, the remaining transmission networks are those of 400 kV and 110 kV.

- Simple Cycle gas turbines natural gas or distillate oil SCGTs;
- Combined Cycle Gas – Steam Turbine fired with distillated oil or natural gas;
- TPPs with low speed diesel engine (SSD) and high speed diesel engine (MSD).

The most appropriate TPPs candidates with minimal cost (shown in the Passive Scenario analysis) would be:

- Combined Cycle Gas – Steam Turbine fired with diesel marine oil (distillate oil);
- Simple Cycle Gas Turbine fired with diesel marine;

If natural gas will be available, the best TPPs candidates would be:

- Gas fired CCGT for base load generation;
- Gas fired CCGT for peak-load generation.

World Bank study calculations evaluate as the most appropriate candidates for new HPPs, the followings:

- Bushati (84 MW) on Drin river cascade;
- Kaludha (75 MW), Dragot-Tepelena (130 MW) and Kalivaci (100 MW) on Vjosa River;
- Bratila (115 MW) and Banja (80 MW) on Devoll River.

Other HPPs such as Skavica (with two options) have been considered less attractive, especially based on economic analysis, and as a consequence they were not selected to compare with other HPPs.

Taking into account the situation of Albanian power system in the frame of Balkan region, Albania is not likely to become an exporting country in medium term future. As a consequence, three basic scenarios were analyzed to investigate the possibilities of meeting the domestic demand:

- Scenario 1: Albanian Power System is planed as isolated and self-sufficient;
- Scenario 2: Albanian Power System is planed to import a quantity of 1.7 TWh/year as base load (maintaining the import level of 2001);
- Scenario 3: Common optimization of both systems: Kosova and Albanian systems.

Analysis of three scenarios outcome shows the following conclusions for the period 2003-1015:

For the short term period (till 2005) taking into account the new plants construction period, the additional generation demand will be met only by increasing the import (used as base load) from 2.5-3 TWh. Meanwhile, taking into account the uncertainties of energy import, additional generation capacities are necessary to reduce dependence from import and hydrological conditions. New thermal capacities will make possible the efficient use of HPPs existing capacities to work in medium and peak load in order to meet the demand, facilitate the peak exchange (peak exporting) and importing in base load. As a consequence, it is recommended to plan the import level of 2001 (1.7 TWh/year) and install Vlora TPP CCGT (300 MW) that will start full operation by 2007 with three units.

For the medium – long term period (2006-2015), new additional capacities have been required to meet the continuously growing demand and allow the gradual reduction of import to the level of 2001 (1.7 TWh). The first CCGT plant with a capacity of 300 MW is expected to be commissioned by 2008, Bratila HPP (115 MW) by 2009, Kalivaci HPP (90 MW) by 2013, TPPs with an installed capacity of 200 MW, SCGT type with marine diesel fuels by 2013 and another CCGT plant with an installed capacity of 100 MW by 2014. The following table summarizes the main characteristics of master plan for the expansion of power generation:

Table III.6: Main caracteristics of plants selected for power generation according to Generation Master Plan, 2003-2015

Years	03	04	05	06	07	08	09	10	11	12	13	14	15
New capacities (MW)													
SCGT TPPs with oil distillates									105	210	210	210	210
Bratila HPP							115	115	115	115	115	115	115
Kalivaci HPP											90	90	90
CCGT TPPs with oil distillates				204	306	306	306	306	306	306	306	408	408
Total new capacitities				**204**	**306**	**306**	**421**	**421**	**526**	**631**	**721**	**823**	**823**
Generation (GWh)													
SCGT TPPs with oil distillates									58	124	132	107	178
New HPPs							461	461	461	461	855	855	855
Existing HPPs	3726	3799	3872	3945	3981	4115	4047	4137	4163	4246	4129	3984	4149
CCGT TPPs with oil distillates				1120	1445	1589	1496	1693	1917	2074	2099	2578	2638
Import as basic load	2477	2505	2527	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Generation	**6203**	**6304**	**6399**	**6765**	**7126**	**7404**	**7704**	**7991**	**8241**	**8481**	**8783**	**9117**	**9342**
Consumed Fuel (1000 ton)													
CCGT TPPs with oil distillates									14.6	31.1	33.1	26.8	44.7
SCGT TPPs with oil distillates				196	253	279	262.7	297.3	336.6	364.2	368.6	452.7	463.3
Total Fuel				**196**	**253**	**279**	**262.7**	**297.3**	**351.2**	**395.3**	**401.7**	**479.6**	**507.9**
Disbursement Time Period (MUSD)													
SCGT TPPs with oil distillates							13.4	26.8	13.4				
CCGT TPPs with oil distillates				45.0	45.0	45.0		43.3	43.3	43.3			
New HPPs		71.4	107	35.7						35.7	35.7		
TOTAL		**71.4**	**107**	**80.7**	**45.0**	**45.0**	**13.4**	**70.1**	**56.7**	**79.0**	**35.7**		

The following values presented in figure III.73 show the future diversified generation (HPPs and TPPs) for the period 2003-20015 maintaining an import level of 1.7 TWh/year.

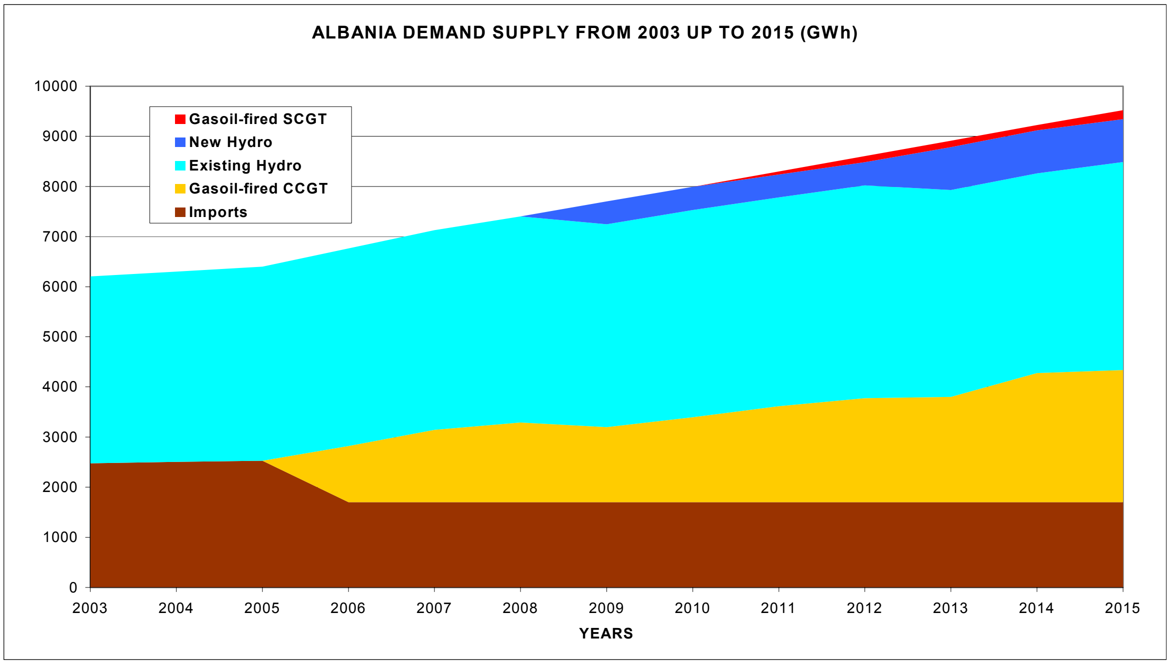

Figure III.72.: Master Plan of Electricity Generation Development

The analysis of three scenarios shows that due to differences between respective structures of energy production, there is a possibility to reduce the generation cost through a closer cooperation between Albanian and Kosova power systems. For example, the general profits for common system (Albania-Kosova) if there are no problems in transmission capacities, reaches a level of US$ 70 million/year by 2015 due to fuel cost reduction of Kosova cheaper coal (lignite). As a consequence, such cooperation forms between Kosova and Albania should be encouraged.

Although, electricity production in the medium term period till 2010 should not be totally based on the existing TPPs and new plants in Kosova, due to the difficulties and lack of a favorable investment climate in Kosova. For these reasons, cooperation should start with exchanges of power between Albania and Kosova using the existing capacities of both systems and their complimentary nature, exporting during peak period (towards Kosova) and importing from Kosova TPPs.

In order to identify a satisfactory level of cooperation between Albanian and Kosova systems and the type of cooperation, the following studies are recommended:

1. Interconnection study to analyze technical, economic, financial and organizational aspects and mitigation of the risks (study sponsored by WB, is expected to start soon);
2. Study on the selection of the most appropriate way of cooperation in a long term period (especially after 2010), including analysis of options to build new coal firing TPPs (lignite) in Kosova and installation of more SCGT and less CCGT units in Albania.

Following is a summary of the sensitivity analysis of main parameters that have a direct influence on power generation master plan.

III.9.2 Impact of Electricity Importing Price on Generation Master Plan

The proposed plan for the expansion of generation system is based on an import level expected to increase till 2006 and to remain constant further (equal with that of 2001 (1.7 TWh)). In general, selection between power inside generation and import depends from many factors such as national trade balance, import reliability in long term period, country's power policy, and impact on economic development, etc. Since these issues are strictly related to microeconomic development of the country, comparison between import price and long term marginal cost of electricity generation is determinative to cover the same graphic zone (which means the comparison between import and generation of plants that cover the graphic base load).

Based on study's outcomes, if import price to cover the base load were lower than 49 USD/MWh, import would be more efficient than building CCGT TPPs with marine diesel oil (oil distillate). Over such a value (nominated as a breakeven point) that corresponds to marginal cost of a 100 MW plant of combined cycle with oil distillate, TPPs are a better option than import to cover the base load.

Many electricity market studies in the Balkan region have concluded that after 2007-08 there will be no more free power (surplus) from Balkan countries. This is more emphasized after the assignment of a long term contract between Turkey and Bulgaria to import approx. 3.5 TWh/year. Although Southeastern European countries are working to establish an electricity market, the future demand should not be met by imports only. This would be very risky and the country would remain a passive player in the future market. In order to avoid such consequences, to participate in the market for having a mutual profit it is necessary not to depend totally on the imports. As a result, the forecasted value of future import of 1700 GWh/year, or 17% (1700 GWh/9600 GWh) is reasonable and economically feasible, especially in a short and medium term period where electricity market, although with low prices, is not able to guarantee the physical time for construction of new plants.

III.9.3 Impact of coal used as fuel in new plants

In the World Bank study a sensitivity analysis regarding coal use for power generation was done. The analysis aimed to evidence terms of direct cost due to lower fuel costs, but costs related to such factors as building of a sea terminal to process imported coal and investments for SO_2 and NO_x reduction plants, were not taken into consideration.

Based on the concept of long term marginal cost of electricity generation, the study underlined that STTP coal plants (steam turbines) have lower costs compared to combined cycle CCGT plants with marine diesel oil, (the construction of a sea terminal for imported coal processing and investments to reduce SO_2 and NO_x are not taken into consideration). Profits, taking in consideration only the direct cost, are in range of US$ 50-80 million for the period 2003-2015. Based on preliminary calculations and assessments of World Bank and Albanian experts, was concluded that the above range of profits does not balance the foreign cost of establishing the marine infrastructure for coal import and plants to reduce gases emitted in the atmosphere within allowed target. In addition, the profits are not high if compared with the damages they might cause to Albanian tourism development.

III.9.4 Impact of the demand increase on planning of future plants to meet that demand

The sensitivity analysis shows that the demand increase does not affect the peak load increase that should be generated in 2015, and that additional quantity should be met by three SCGT plants with an installed capacity of 3 x 100 MW. On the other side, the necessity to cover base load (when selecting coal plants or marine diesel oil plants) will increase the same with the demand as long as installed capacity of new HPPs does not change.

III.9.5 Impacts of possibility to use natural gas for power generation

Based on the natural gas penetration analysis given in respective section, was accepted that if natural gas would be available in 2008, CCGT and SCGT gas firing plants would be the lowest marginal cost options to cover the base and peak load. Marine diesel oil firing CCGT and SCGT plants should be designed with a double fuel use system, in order to operate with minimal additional investments when natural gas is available.

Profits from the use of natural gas for power generation after 2008 depends on the electricity demand:

- US$ 200-300 million (total value from 2003 till 2015), depends on the level of electricity import for high electricity demand scenario (12500 GWh in 2015),
- US$ 120-200 million (total value from 2003 till 2015), depends on the level of electricity imports for medium electricity demand scenario (9600 GWh in 2015).

The above values take into account the direct cost, initial investments costs for the construction of TPPs and the difference of fuels cost consumed due to use of natural gas instead of marine diesel oil. The general cost-benefit analysis on the use of natural gas is given in section III.14 and outcomes do not show high economic benefits (internal rate of return for natural gas interconnection is 10.9%).

III.9.6 Analysis of best HPPs projects

Economic ranking of different HPPs projects is almost unchangeable, analyzing different sensitivity situations such as the use or non use of imported gas in Albania, the change of demand or other factors. Bratila and Kalivaci HPPs projects have lower marginal cost than TPPs ones and provide economic benefits to the transmission network. Both projects have higher economic benefits compared to the construction of TPPs with the same power capacity of marine diesel oil. Both projects loose their economic advantage if natural gas is used in equivalent TPPs (comparable to HPPs). All studied situations show that other HPPs from the first group (Banja, Dragot-Tepelena, Bushati, Kaludha) cost more than the construction of marine diesel based TPPs. For example, Bushati and Dragoti HPPs would require a reduction of initial investments in a range of 10-15% to become competitive and be selected as more profitable candidates compared to equivalent TPPs.

III.10 Forecast of transmission capacities and transmission system master plan

III.10.1 Modeling of electricity transmission system

World Bank Albanian Power Sector Study has developed a minimal cost expansion plan for the transmission system for the period 2002-2015. This expansion plan contains the development of High Voltage (HV) system, including 400 kV, 220 kV and 110 kV networks. The respective analysis for the transmission sector is based on the following results:

- Forecast of electricity demand, according to section III.8,
- Master plan of power generation according to section III.9 that defines the minimal cost expansion plan for generation capacities,
- Reduction program of technical losses with the objective to reduce transmission and distribution losses from 27% in 1999 to a much lower value,
- Distribution master plan and definition of locations for new HV/MV substations.

The transmission system master plan for the period 2002-2015 was prepared based on following objectives:

- Supply the requested load according to consumers demand in the distribution system,
- Transmit electricity generated by power plants (HPPs and TPPs),
- Provide transmission capacity to facilitate electricity exchange with neighboring countries and integration of Albanian system into UCTE.
- Technical preparation of Albanian transmission system in order to participate actively in the Regional Electricity Market, based on Athens Memorandum of Understanding (November 15, 2002) and EU Directive 96/92 on Electricity,
- Meeting of planning criteria that determine the required security level,
- Meeting of economic criteria, providing that each component of the new transmission system be profitable for the power system, and
- Respect the programmed level of transmission losses according to targets (objectives) established by KESH Action Plan, taking into account that respective investments in the network are feasible.

For simulation purposes in the WB study the whole system of 400 kV, 220 kV, 110 kV has been modeled. The second synchronous zone of UCTE system that includes Montenegro, Serbia, Bosnia-Herzegovina, Kosova, Macedonia, Bulgaria, Romania and Greece power systems was represented by an equivalent system interconnected to Kardhia (Greece), Podgorica (Montenegro) and Prizren (Kosova).

The current situation of the Albanian power system is difficult. As mentioned in the first part of this document, the Albanian power system is not able to meet the peak demand and, as a consequence load sheddings are a necessity. This situation is caused by the high increase of demand (especially for space heating), lack of generation from hydro resources during dry periods and the insufficient capacity of transmission network due to lack of investments during the period 1989-1998.

The change of demand structure with a consumption growth for household use and the decline of industrial consumption, have also influenced negatively this situation. Neighboring countries in addition of facing a difficult situation, have limited transit capacities in their networks, which prevent Albania to import the needed quantity of electricity. Simulations done in the transmission system for 2002 show that:

- Voltage profile is broken, being very low especially in the 110 kV systems of Southern and Southeastern zones.
- Voltage decline in Korca zone goes up to 30%.
- 220/110kV transformers are overloaded especially in Vau Dejes, Fierza and Fier.
- 220/110 kV substations do not meet the “n-1”criterian.
- 110 kV lines that supply Korca and southern zone are overloaded with approximately 10-20%.

Kosova and Montenegro low voltage systems influence on the profile of the Albanian voltage system.

The 220 kV transmission system between Northern and Central Albania, connecting Drin cascade with main consumption centers operates under normal conditions. The lines of 220 kV southern ring supplying Rrashbull and Fier are overloaded and do not meet “n-1”criteria.

III.10.2 Transmission network expansion master plan for period 2005-2015

The Active Scenario for electricity demand forecast (equivalent to medium scenario prepared by WB) was used as a base scenario for the preparation of transmission system master plan. The scenario is characterized by a total increase of demand with approx. 91% during the period 2002-2015, corresponding to an average increase of 5% per year. The forecasted peak load to be covered by the transmission system by 2015 is 2127 MW. Peak load in 2005, 2010 and 2015 is forecasted to be respectively 1344 MW, 1729 MW and 2127 MW. Section III.9 of the master plan for the expansion of power generation capacities, assumes the introduction of new plants to the system, as shown in table III.7.

Table III.7: Generation expansion plan

Plant Name	Energy source/Fuel	Installed capacity MW	Commissioning date
Kalivaçi	Hydroenergy	90	2013
Bratila	Hydroenergy	115	2009
CCGT 1 Vlorë	Marine diesel oil	100	2006
CCGT 2 Vlorë	Marine diesel oil	100	2006
CCGT 3 Vlorë	Marine diesel oil	100	2007
CCGT 4 Vlorë	Marine diesel oil	100	2014
SCGT 1 Durrës	Marine diesel oil	105	2011
SCGT 2 Durrës	Marine diesel oil	105	2012
Total		**815**	

Two thermal power plants in Vlora and Durres were proposed to be built, composed by four units of 100 MW each with combined cycle (steam and gas turbine)and two units of 105 MW (each with simple cycle gas turbines respectively). The mixed placement of electric plants aims to minimize the development cost of transmission network. Strengthening of 220 kV ring connecting Fier and Rrashbull with Kashar and Elbasan substations, is not required in this case.

Table III.8: New HV/MV substations

Zone	Substation	Commissioning date	Zone	Substation	Commissioning date
Shkodër	Koplik	2008	Tiranë	Rrogozhinë	2009
Shkodër	Dobraç	2007	Elbasan	Peqin	2007

Shkodër	Pukë	2014	Elbasan	Gramsh	2007
Lezhë	Lezhë-2	2009	Fier	Patos	2009
Durrës	P. Romano	2005	Berat	Berat	2006
Durrës	Shijak	2008	Berat	Corovodë	2008
Tiranë	Rinas	2006	Gjirokastër	Gramsh	2010
Tiranë	Kinostudio	2006	Vlorë	TEC-Vlore	2005
Tiranë	TEC-Kombinat	2007	Vlorë	Sarandë	2005
			Vlorë	Himarë	2010

Connection of two SCGT and one CCGT unit directly to the 110 kV level allows the reduction of transformation capacity 220/110 kV and increase of system security in 110 kV voltage level. New proposed hydro power plants, Bratila and Kalivaci, will be connected to 110 kV level in 110 kV Gramshi and Krahes substations. Based on distribution sector master plans prepared by World Bank (described in section III.11) a list of new substations foreseen to be built during the period 2002-2015 in order meet the demands in each sector, was compiled, as shown in table III.8.

III.10.3 Main reinforcement of transmission system

High voltage networks of 110 and 35 kV operate close to their thermal limits with higher levels of losses in transmission system, as defined by KESH. Implementation of the first phase will reduce technical losses by intervening in HV and MV networks, taking into account the construction of 400/110 kV substations, substitution of 35/6 kV system and construction of new MV/HV substations. The final situation will further reduce technical losses with 10% in order to be within acceptable technical and economic levels. The transmission system proposed by the master plan will reach the objective of annual losses of 2% by 2015. Table III.9 shows the reduction of transmission losses for the period 2002-2015.

Table III.9: Reduction of transmission losses for the period 2002-2015

Year	Peak losses (MW)	Peak losses (%)	Annual losses (GWh)	Annual losses (%)	Load (in hours)
2002	91	7.4	206	4.2	2264
2005	47	3.4	142	2.4	3021
2010	51	2.9	164	2.1	3216
2015	52	2.4	186	2.0	3577

The master plan for the development of the transmission network was prepared to cover the demand with a minimal cost and, a qualitative service according to planning criteria. The master plan aims to reduce every year the shortages of supply and provide 24 hours of electricity supply after 2007. World Bank transmission master plan was based on the above forecasts taking into consideration the reinforcements of the network economically feasible for a safe operation of the transmission system and integration with UCTE system.

The analysis of the Albanian Power System behavior evidences the issue of voltage control in emergency situations, particularly when 400 kV line Zemlak-Kardhja is switched off. There is a lack of reactive power, especially in southern part of the system. Two options have been considered to solve the problem:

- Installation of 156 MVAR of compensators in medium voltage side of 110/220 kV substations, by improving the system's power factor (cos φ).
- Construction of a 400 kV interconnection line from Elbasan to Podgorica or Kosova B and a new 400/220 kV substation in Kashar for the discharge of 220 kV interconnection lines.

The first solution satisfies only the domestic demands of the Albanian system. The solution does not allow the transmission system to increase the import and exchange electricity with neighboring countries through the Albanian network. The new 400 kV line in the second solution allows the voltage control of the Albanian power system in extreme situations, increases the import within safe operation conditions and reinforces the Albanian transmission system integration into the common UCTE European system. This line will be feasible due to electricity transit among neighboring countries with the condition that exchanges remain within sustainable quantities, at least of 300 MW. Technical benefits are similar to those provided in the case of construction of 400 kV line with Montenegro (Podgorica) and Kosova (Kosova B). The interconnection with Montenegro will create a new corridor from north to southern part of UCTE system, with benefits for all Balkan countries.

In order to increase bilateral relations between Albania and Kosova (particularly as regards power exchange, the generation system master plan recommends a detailed feasibility study of Albania-Kosova line as well as a technical and economic comparison with Albania-Montenegro line. World Bank, the Albanian Government and UMNIK (Representatives of Kosova) have prepared the Terms of Reference for a feasibility study to be added to the feasibility study on Podgorica-Kashar line, already completed under German Bank kfw financing. Based on the analyses, the following reinforcements should be done to the 400 and 220kV system:

- Podgorica-Kashar-Elbasan 400 kV line or Kosova B-Kashar-400-Elbasan expected to be commissioned in 2005;
- 400/220 kV substation in Kashar, equipped with two 300 MVA transformers, expected to be commissioned in 2005;
- Double line (with two circuits) Vlora TPP-Fier, expected to be commissioned in 2005.

These reinforcements provide a satisfactory functioning of the Albanian system in synchrony with UCTE. They also provide a profitable participation of the country’s power system in the regional power market. In addition of these reinforcements, was proposed the construction of four 220/110kV new substations located in: Kucova (to be commissioned in 2005), Vlora TPP (to be commissioned in 2005), Koman (to be commissioned in 2013) and Lac (to be commissioned in 2014).

A total power of 700 MVA of VHV/110 kV transformers should be added to the transforming capacity. In order to connect new 110 kV substations and strengthen the 110 kV system, some 444 km lines of the 110 kV network will be constructed and added to the existing system. The proposed transmission network according to Master Plan complies with “n-1” criteria in all system interventions during the period 2010-2015. It allows supplying during the peak load and transmitting of plants generation under normal and breakdown situations. It also supports the country’s participation in the regional electricity market and UCTE system.

III.10.4 Establishing of new Dispatching Center

Currently, the whole activity of the Albanian power system control is manually done. Requirement to establish a new dispatching center according to following conditions is imperative:

- As a net importer of electricity, with main generating potentials from hydro resources, which makes difficult the forecast of optimal plans of production or import, Albania should pay first hand attention to the optimization of available reserves of electricity as well as to the continuous monitoring of electricity market conjunctures in the region.
- High volumes of electricity exchanges raise the need for analysis and precise technical and economic programming of flow distribution plan, their remote control in real time and post operational analysis.
- Last developments of our power system, and the increasing demand of country's economic and social development for a quantitative and qualitative electricity supply require a qualitative control of the optimal distribution of energy supplied to the network.

As discussed above, establishing of a new National Dispatching Center (NDC) and a modern and efficient telecommunication network is a vital request for the optimal technical and economic use of the system. NDC will be responsible to monitor and control the activity of main hydro and thermal generation resources and the optimal and safe functioning of national high voltage transmission network of 400 kV, 220 kV and main 110 kV voltage substations. NDC will cooperate with regional dispatching centers, monitor and control the energy exchanges with neighboring countries through 400 kV lines Elbasan-Kardhia, 220 kV Vau Dejes-Podgorice and 220 kV Fierze-Prizren. The WB study recommends the Dispatching Center to become effective before 2006 in order to precede from the technical aspects, introduction of Albanian power system in the SEE regional electricity market.

Total investments to establish the Dispatching Center are estimated to reach a value of approx. 19 million US$. The Italian Project, supporting the electric sector allocates an amount of approx. Euro 555 190 to study and design the new Dispatching Center. Attention should be paid while investing in the transmission system, to adapt the tele-information networks that are going to be used in the new Dispatcher Center to the modern telecommunication requirements.

III.10.5 Investments to support Transmission System Master Plan

World Bank study calculations show that the total investments that should be done in the transmission network are estimated US$ 204 million. Investments include the construction of 400 kV line Elbasan-Podgorice, including the 400/220/110 kV substation of Kashar. In addition, the total includes US$ 47.7 million for 400 kV interconnection line Podgorica-Kashar-Elbasan (23% of total cost). Approx. 62% of total investments will be commissioned during the period 2002-2005. Table III.10 shows the expenditure schedule.

Table III.10: Investments disbursing schedule for period 2002–2015 (US$ million)

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Foreign cost	4.11	22.96	39.73	22.58	5.53	8.64	8.07	7.56	5.62	2.75	3.63	3.84	3.61	1.43
Local cost	1.92	9.67	16.47	9.26	3.87	5.08	4.77	4.24	2.65	1.50	1.44	2.14	1.17	0.33
Total	6.03	32.63	56.20	31.84	9.40	13.72	12.84	11.80	8.27	4.24	5.06	5.98	4.78	1.76

The full intervention list to reinforce and expand the transmission system during the period 2002-20015, is as follows:

Year 2005

400 kV line Podgorice-Kashar- Elbasan 2.

400/220kV substation in Kashar, equipped with two 300 MVA transformes.
220/110 kV substation in Vlora TPP, equipped with one 100 MVA transformer.
220 kV two-circuits line, between Vlora TPP and Fier.
110 kV two-circuits line, between Vlora TPP and new 110 kV substation in Vlora.
Two-circuits line, between Vlora TPP and Vlora.
220/110 kV substation in Kuçova, equipped with one 100 MVA transformer, connected to 220 kV line Fier – Elbasan (enter – exit connection).
110 kV new line, between Saranda and Bistrica.

Year 2006
110 kV two-circuit line, between Tirana and Kinostudio.
Derivation of existing 110 kV line Kashar – Laç-1 in Rinas substation.
Two-circuits 110 kV new line Kuçova – Berat – Uznova instead of the existing one.

Year 2007
110 kV new line between Shkodra-1 and Dobraç.
Derivation of circuit of double line in Kashar 220 – Selita, in Kombinat TPP substation.
Derivation of existing 110 kV line Lushnje- Kavaje in Rrogozhina new substation.
New 110 kV line, between Rrogozhina and Peqin.
New two-circuits 110 kV line, between Cerrik and Gramsh.

Year 2008
New 110 kV line, between Dobraç and Koplik.
120 MVA third transformer in Vau Dejes.
New 110 kV line, Vau Dejes – Dobraç.
New 110 kV line, between Rrushbull and Shijak.
Connection of Shijak to the existing 110 kV line Rrushbull – Selite.
New 110 kV line between Uznova and Çorovoda.

Year 2009
Derivation of existing 110 kV line Bushat – Lezha in Lezha 2 substation.
Construction of 110 kV substation in Rrogozhina connected with Lushnja, Kavaja and Peqin.
A second 110 kV line, between Fier and Lushnja.
Derivation of existing 110 kV line Fier - Ballsh in Patos substation.

Year 2010
New 110 kV line, between Vlora TPP and Himara.
New 110 kV line between Himara and Saranda.
Derivation of existing line Gjirokastra – Bistrica in Gramsh substation.
A second transformer 150 MVA 400/110 kV in Zemlak.
New 110 kV line between Kashar 220 and Rinas.
Installation of 3 MVAR and 6 MVAR, respectively in Himara and Tepelena.

Year 2011:
Substitution of existing 110 kV line Fier–Kafaraj, equipped with 240 mm^2 sections lines.
110 kV third circuit, between P. Romano and Rrushbull.

Year 2012:
New two-circuits 110 kV line, between Kalivaç and Krahës
A second 110 kV line, between Krahës and Memaliaj.

Year 2013
60 MVA 220/110 kV transformer in Koman.
New 110 kV line, between Koman and F. Arrëz.
New 110 kV line, between Burrel and Suç.

Year 2014:
Construction of 220/110 kV substation in Laç-1, equipped with one 120 MVA transformer.
Derivation of 110 kV line Koman - F. Arrëz in Puka substation.

Year 2015:
A third 100 MVA 220/110 kV transformer in Kashar.
A second 100 MVA 220/110 kV transformer in Kuçova.

III.11 Forecast of distribution capacities and distribution system master plan

III.11.1 Modeling of electricity distribution system

First part of this section analyses in details the current situation of electricity distribution system. Based on the World Bank study, this section describes the Distribution System Master Plan. The objective of distribution system master plan is to define within a priority range, the demand for further rehabilitation and new investments for distribution capacities during the period 2002-2015, including the list of interventions and respective investments in each region. Distribution master plan is composed of two parts: Rehabilitation Plan, dealing with improvement of the existing distribution system to reduce technical losses and, future Expansion Plan of distribution system, focused on the necessary measures to meet the forecasted increase of electricity demand according to forecasted demand for each sector (residential, services, industry, etc.), given in section III.8. Distribution master plan uses a district zone (region) as central module that corresponds to a zone supplied by 1-2 110/20 kV substations. In addition, for each distribution region, a special master plan is presented, based on district's demand.

The World Bank study presents a clear vision for the strategy that should be followed to reduce the technical losses. The study emphasizes that main priority should be given to substitution of 35/10-6 kV system with a 110/20 kV system, as already done for Tirana network. The study also recommends avoiding any other investment as regards expanding of 35 kV network argued by assessments of technical and economic benefits. Rehabilitation plan was not feasible for several interventions to be implemented in a very short time period. Despite available funds, the necessary period from technical standpoint is less than 5 years. Rehabilitation plan should coordinate with distribution system expansion plan, and the analysis in this section show the need to establish basic structure of distribution system based on longterm developments for a domestic electricity market. Identification of zones and technical characteristics of new substations needs technical and economic assessments. Cost-benefit analysis is used as criteria to define the selection of least cost options that satisfy the technical requirements. New substations and 20 kV feeders will be added in integrating form to existing networks. On this basis was proved that it is possible to establish and develop a new distribution system that includes a number of lines supplied by existing and new substations according to respective regions.

III.11.2 Electricity Distribution Network Structure

Two IV (Intermediary Voltage) lines normally feed the HV (High Voltage) substations in order to allow alternative supply according to "n-1" criteria. In the future, KESH will consider as IV/HV substations only those with uniform voltage in 110 kV level. Investments in networks of 35 kV voltage levels are not foreseen since they are expected to be eliminated. Normally, the MV (Medium Voltage) network scheme has exiting feeders from one substation and directed to another one, aiming to increase of security supply. When no other substation exists within the respective zone, the feeder returns to the same substation. In the future KESH will consider as MV network only the uniform network with a level of 20 kV. Investments are not foreseen for 10 kV and 6 kV networks level, since they are expected to be eliminated. LV (Low Voltage) lines, especially in rural zones are expected to develop in radial form without reserve capacities. Each MV/LV substation supplies four or two LV feeders adjusted or reinforced in concreted poles. LV network will have only one uniform voltage level of 0.4 kV.

The feasibility study of possible technical solution is guaranteed through calculating models that analyze and compare options. The algorithm used, is a simplified algebra model that may be easily deviated by current conditions. The existing electric network is normally calculated according to its remained value, but the fact that Albanian network normally has an insignificant remained value (in most cases distribution system elements have a lifetime of more than 25 years), simplifies the model structure. The indicator used to adjust the model in the current conditions, was the density of required power expressed in kW/km^2.

III.11.3 Necessary measures for rehabilitation of distribution system

Based on the strategy for reduction of technical losses, the distribution system master plan aims to identify and evaluate the best strategy to expand the network in order to fulfill the growing demand for all consumers' categories. Networks and the distribution master plan are designed for each district and region. According to the methodology presented by the WB study, the rehabilitation master plan was prepared for four distribution divisions as proposed in the new organizational scheme of the electric sector (more details in the respective section).

The rehabilitation and expansion plan was prepared on case-by-case basis in order to analyze the required measures to reduce the technical losses and meet the demand till 2015. In the framework of KESH action plan 2003-2005, a number of measures started in 2001 are under implementation. In the following list there are same important measures undertaken by KESH Distribution Division for the short term investment program for the period 2003-2005:

- Installation of electric meters for all consumers categories,
- Construction of 20 kV voltage distribution lines in some of the main cities of the country,
- Implementation of "March 2000" Project, financed by Italian Cooperation,
- Implementation of Distribution-Transmission Rehabilitation project, financed by a donor group,
- Elimination of illegal connections in zones close to big cities.

Since evaluations are in a preliminary feasibility phase, the reserve factor used to calculate the investments is 15%. It should be underlined that the detailed action plan should include maintenance, new meters and rehabilitation costs of LV rural network of 12 156 km with an estimated cost of US$ 111 million, according to KESH annual plan. Table III.11 shows the summary of investments required to implement the distribution system master plan and expected loss reduction.

The strategy for Distribution Network development consists in planning the priorities, capacities and investment requirements of distribution network for the period 2003-2015. According to the WB study, the strategy of investments for distribution network development is divided into two phases:

First Phase: Deals with the complete rehabilitation of the network to reduce technical distribution losses from a current level of 15.8% to 5%.

Second Phase: Deals with further expansion and strengthening of the network according to Albanian economic and social development requirements.

The objective of investment projects in distribution sector includes the gradual substitution of 35/10-6 kV system with 110/20 kV system largely used in Europe, aiming the substitution of all 110/20 kV transformers at the end of the rehabilitation phase. This will reduce technical losses from 15.8% to 9.8%. In the same time, approx. 6800 transformers with standardized characteristics 20/04 kV, 100 kVA will be constructed and placed in pillars in rural zones to reduce technical losses from 9.8 to 7.3%. Existing transformers in urban zones will be modified from 10-6 kV to 20 kV and new standardized 20/04 kV ones will be adjusted with underground cables, with a capacity of 400 kVA, in order to reduce technical losses from 7.3 to 5%.

Table III.11: Investments in distribution system according to Master Plan and reduction of annual losses in national level[5]

Action Plan	Total investments	Reduction of losses	
	Million US$	**Million US$**	**GWh**
2002 - 2005	60.93	11.06	221
2006 - 2010	290.14	47.50	950
- Distribution Region 1	**59.95**	**15.21**	
- Distribution Region 2	**108.64**	**14.08**	
- Distribution Region 3	**53.90**	**8.30**	
- Distribution Region 4	**67.65**	**9.91**	
2011 – 2015	51.95	3.96	79
- Distribution Region 1	**5.21**	-	

[5] Note: Four distribution regions (1. Tirana-Durres, 2. North, 3. Southeast, 4. Southwest) will include the following districts:
Tirana-Durres: Durres, Kavaja, Kruja, Tirana;
North: Bulqiza, Diber, Has, Kukes, Kurbin, Lezha, Malesi e Madhe, Mat, Mirdite, Puke, Shkoder, Tropoja;
Southeast: Berat, Devoll, Elbasan, Gramsh, Kolonja, Korca, Kucova, Librazhd, Peqin, Pogradec, Skrapar;
Southwest: Delvina, Fier, Gjirokastra, Lushnja, Mallakaster, Permet, Saranda, Tepelena, Vlora.

- Distribution Region 2	**17.18**	**2.41**	
- Distribution Region 3	**21.99**	**1.55**	
- Distribution Region 4	**7.57**	-	
Total	403.02	62.52	1250

Table III.12: List of new substations to be constructed according to Distribution System Master Plan

REGION	ZONE	Substation	Construction Year
I	Shkodër	Dobrac	2007
	Shkodër	Koplik	2008
	Lezhe	Lezhe2	2009
	Shkodër	Puke	2014
II	Durrës	P.Rom	2005
	Tiranë	Rinas	2006
	Tiranë	Kinostudio	2006
	Tiranë	Kombinat TPP	2007
	Durrës	Shijak	2008
III	Berat	Berat	2006
	Elbasan	Gramsh	2007
	Elbasan	Peqin	2007
	Berat	Corovode	2008
IV	Vlorë	TEC-Vlore	2005
	Fier	Patos	2009
	Vlorë	Sarande	2010
	Vlorë	Himare	2010
	Gjirokastër	Gramsh	2010

As shown in table III.12, the Distribution System Master Plan foresees the construction of 20 new 110/20 kv substations, new 110 kV lines and 400/110 kV or 220/100 kV substations.

III.12 Electricity tariff structure

III.12.1 Current situation of electricity tariffs

The main objective of this section is to define the electricity tariff structure in order to reflect the cost and to recommend the strategy for a new tariff structure. Tariff setting process is based on a number of important documents:

(a) Existing structure of electricity tariffs;
(b) Action Plan Period 2003-2005 for average electricity tariffs;
(c) Analysis of year 2002 on costs and average tariffs;
(d) Evaluation of long term marginal cost by the World Bank study;
(e) Financial analysis and required revenue by the World Bank study;
(f) World Bank study recommendations on the tariff level for different consumer groups.

The existing electricity tariff structure takes into consideration five consumer categories:
- Industrial and commercial consumers in three voltage levels;
- Residential consumers supplied in low voltage;
- Public sector supplied in three voltage levels;
- Other consumers with subsidized tariffs (favorized consumers) and three pilot distribution companies;

- Large industrial consumers in oil, refinery, copper, chromium and cement production sectors as well as flour and bread production factories and religious institutions supplied by high and medium voltage which are connected to LV distribution network.

In general, consumers pay for electricity consumed in kWh (no other charges are paid). For consumers supplied in MV, the tariff structure was evaluated in relation to metering installation. Although important steps have been done during the last three years to improve the tariff system, it should be emphasized that electricity tariff system is more oriented toward social policies and supporting of large industries than toward actual electricity cost in generation, transmission and distribution levels.

III.12.2 Action Plan 2003-2005 on electricity tariffs

Since December 2000, a number of steps have been undertaken as regards electricity price policy. During the period 2000-2003, three individual action plans (based in yearly period) have been prepared and implemented for the power sector in order to fulfill a number of important objectives such as: reduction of non-technical and technical losses, reduction of illegal connections, increase of energy billed and of collections. In addition, the Power Sector Policy Statement strongly underlines that future billing system should cover the generation/transmission/distribution long term cost and provide an acceptable profit rate for KESH, remove direct government subsidies for KESH by 2005, and cross subsidies in medium terms after year 2007. KESH has currently prepared an Action Plan for the period 2003-2005, approved by Donors Group and by the Government with the Decree No.27 of January 16, 2003.

Figure III.74: Real cost structure of electric sector in year 2002 [6]

As mentioned above, after the approval of the plan, the Government is seriously engaged to adopt prices that cover the marginal cost of electricity including G/T/D. The approval from the parliament of the Law “On the Power Sector” gave to ERE the possibility to define the electricity tariff system. Action Plan 2003-2005 submits several important proposals on electricity prices, as follows:

- Increase of average tariff every year by 8% for all consumers categories (10% for residential consumers and 5% for other consumers);
- There will be no more favorable consumers in year 2005, except for water main enterprises, that will last until year 2007.

Figure III.74 shows the structure of the real cost for each Generation /Transmission/Distribution division, having an average cost of 6.44 lek/kWh. Contribution of generation, transmission and distribution sectors in the total cost is 40.52%, 10.4%, and 49.06%, respectively.

Table III.13 shows the structure of electricity sales for year 2002 and an average value of electricity tariff of 5.65 lek/kWh.

[6] KESH analysis

Table III.13.: Electricity Sale Structure for year 2002[7]				
Type of consumer/Unit	GWh	Lek million	lek/kWh	%
In HV	35	281	7.79	1.14
In MV	592	3,881	6.55	19.13
In LV	2,467	13,315	5.40	79.73
Household in LV	2,021	9,378	4.64	65.31
< than 300 kwh/month	1,698	6,792	4.00	54.88
> than 300 kwh/month	323	2,585	8	10.44
According to divisions				
Transmition	270	1,753	6.49	8.74
Distribution	2,824	15,724	5.57	91.26

Another important issue related to tariffs (especially residential ones) is the two-block division and low limit level of monthly electricity consumption. New tariff system should contribute to reduce electricity consumption particularly for space heating, promoting electricity efficient use, establishing conditions for the use of other alternative energy sources (particularly for space heating), improving KESH financial aspects in order to meet new investments and reduce Government's subsidies for electricity import, and attract foreign investments.

NAE studies propose a value of 230 kWh/month (instead of 300 kWh/month) for the first block of necessary electricity consumption, because this figure reflects better the necessary consumption for lighting, cooking and, electric appliances (radio, TV, tape recorder, washing machines). The above value was also based on World Bank study on the real electricity consumption in three main cities: Tirana, Shkodra, Korca and three villages Gosa, Maqellara, Borsh. Table III.14 shows the values of average electricity consumption [kWh] in three zones based on the data of the survey. According to the following table, the average electricity consumption per family (without space heating and domestic hot water) is 218 kWh/month in urban zones, 163 kWh/month in rural zones and 187 kWh/month in the whole country. Based on above figures, in addition to the increase of average electricity tariffs for all sectors (as described more in details following) a reduction of the first block level to 230 kWh/month in year 2004 was recommended. A further reduction up to 180 kWh/month is foreseen in year 2005 (government subsidies) for lighting, cooking, radio, TV, recorder and washing machines.

Table III.14.: Annual and monthly average consumption according to zones [kWh].									
Zones	**Urban zones**				**Rural zones**				**Republic**
Services	**Tirana**	**Shkoder**	**Korce**	**Aver.**	**Maqellare**	**Gose**	**Borsh**	**Aver.**	**Aver.**
Lighting	384	364	320	365	306	326	316	314	337
Radio, TV, tape recorder, washing machines	893	825	792	852	612	690	665	646	739
Cooking	1385	1392	1414	1393	1002	997	965	993	1173
Hot sanitary water	1111	1090	970	1077	760	889	829	813	931
Space heating	1087	1424	2043	1379	1923	1206	988	1521	1457
Annual Total	**4860**	**5095**	**5539**	**5066**	**4603**	**4108**	**3763**	**4287**	**4637**
Monthly average	**405**	**425**	**462**	**422**	**384**	**342**	**314**	**357**	**386**
Annual total without space heating and hot water preparation	**2662**	**2581**	**2526**	**2611**	**1920**	**2013**	**1946**	**1953**	**2249**
Monthly average without space heating and hot water preparation	**222**	**215**	**211**	**218**	**160**	**168**	**162**	**163**	**187**

[7] KESH analysis

Ministry of Labor and Social Affairs, MIE, ERE, KESH and NAE should complete a study on the number of families that need government subsidies, which are the only families to pay lower tariff of the first block. Structural changes of the tariff system for families will rapidly and efficiently improve the increase of general average tariff. Other alternative energy sources (LPG, fuel woods and solar panels) should provided electricity for space heating and domestic hot water, otherwise families would pay with second block tariff for the consumed electricity.

III.12.3 Long term marginal cost evaluation of Generation/Transmission/ Distribution sectors

The Power Sector Policy Statement emphasizes setting of electricity tariffs based on long-term marginal cost of electricity G/T/D sectors. Analysis of Generation, Transmission and Distribution Master Plan evaluates the necessary investments to implement these master plans. Based on G/T/D investments, their respective interests, fixed operation and maintenance costs, the long term marginal cost was calculated. Table III.14 shows the investment plan according to respective master plans given in sections III.9, III.10, and III.11. Based on above investments and respective methodology, the generation, transmission and distribution marginal costs, were calculated as showed in table III.15. Analysis shows that the level of G/T/D long-term marginal cost is 8.63 cent/kWh.

Table III.15.: Partial and cummulative marginal costs according to electric sector divisions

Total [lek/kWh]	Generation Marginal Cost	Development cost of Transmission system	Development cost of Distribution system
Generation Level (47.2 ose 53.53%)	47.2		
Transmission Level (59.8 ose 15.75%)	50.8	9.0	
Distribution Level (86.3 ose 30.70%)	56.8	10.0	19.5

III.12.4 Average Financial Tariff Evaluation

As analyzed above, calculation of long-term marginal costs takes into consideration the investment package and sources needed to expand, strengthen and operate the power system according to a defined development plan. Evaluation of average tariffs should be based on marginal cost of existing and new objects in generation, transmission and distribution sectors. In general, a required revenue was calculated according to procedures proposed by ERE. With this scope, the Albanian Parliament approved in May 2003, the Law "On the Power Sector" that will start to be applied for tariff purposes in December 2003. The analysis requires the calculation of required revenues based on the cash flow calculations.

Table III.16.: Requirement investments for the electric system based on respective master plans [US$ million]

	2003-2006			2007-2010			2011-2015			Totale Planning Period			
	Loan	Local	Total	Loan	Local	Total	Loan	Local	Total	Loan	Local	Total	%
Generation	174.15	63.3	259.2	70.12	99.36	173.5	88.02	73.07	169.35	332.29	236.06	602.05	54.05
Transmission System	57.21	25.15	82.36	29.89	16.74	46.63	15.26	6.57	21.82	102.36	48.45	150.81	13.54
Distribution System	51.8	19.98	71.78	154.36	64.01	218.36	36.59	15.28	51.88	242.75	99.27	342.02	30.71
Dispatching System	18.05		18.05	0.95		0.95				19		19	1.71
Total	301.12	108.76	431.39	255.32	180.1	439.44	139.86	94.92	243.06	696.39	383.78	1113.88	100.00

Since KESH is still a monopoly state-owned company, it is clear that it will not be expected to get the same rate of return the other private companies that they may have. For new required investments, KESH should have a reasonable internal rate of return on capital invested in respective assets. For this reason ERE will allow the company to have a sufficient profit of 2% by the end of year 2006. The rate of return should increase from 2% to 8% in 2009 and will remain constant until the end of analyzed period (8%). KESH current loans portfolio is as follows:

- Portfolio of loans from Donors = US$ 228 millions;
- Disbursements till December 2002 = US$ 118 million;
- Promised additional concessionary financing: US$ 200-250 million;
- General loan terms: low interests (soft loans) with maturity period from 4 to 30 years.

World Bank study on preparation of the Financial Plan for future investments in the power sector assumes, as follows:

- Future investments will be achieved 30% from self-financing through equities and 70% from loans.
- Until year 2006, loans will be financed through concessionaries loans with sovereign guarantee with these terms: 2% interest rate, 24 years maturity period, 6 years grace period.
- Commercial loans are foreseen to start by year 2006. Initially, the loan cost is assumed to be higher (12% interest rate, 8 years maturity period); softer terms have been assumed after 2007 (8% interest rate, 10 years maturity period);
- The Financial Plan has taken into consideration the tariff development according to "required revenues" model. As preparing the strategy of the average financial tariff, were taken into consideration the average tariffs suggested by Action Plan 2003-2005 that foresees an average tariff of 7.76 Lek/kWh to be effective by year 2005. The average tariff is foreseen to increase to 8.40 Lek/kWh by year 2009, and expected to reach a value of 9.33 Lek/kWh by year 2012.
- Setting of tariffs based on "required revenues" model assumes that assets payback rate will be 8% in 2009, aiming to improve KESH financial situation and cover the equity part in the amount of US$ 1.3 milliard of required investments for the whole period.

Figure III.74 shows the average financial tariff, G/T/D marginal long term running cost and average tariff based on the action plan (third phase).

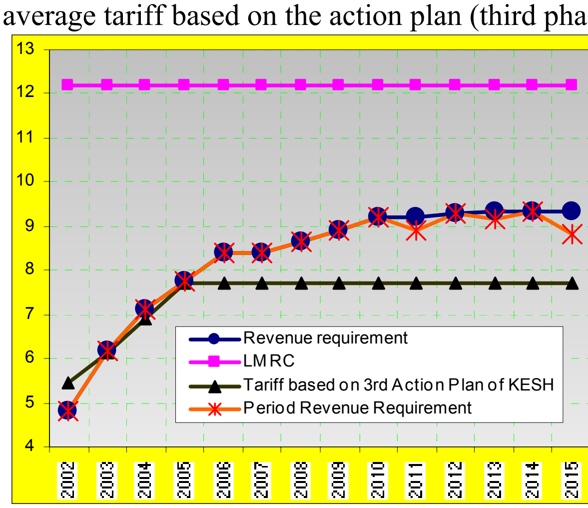

Figure III.74.: Average financial tariff, long term marginal cost, and average tariff based on action plan (lek/kWh)

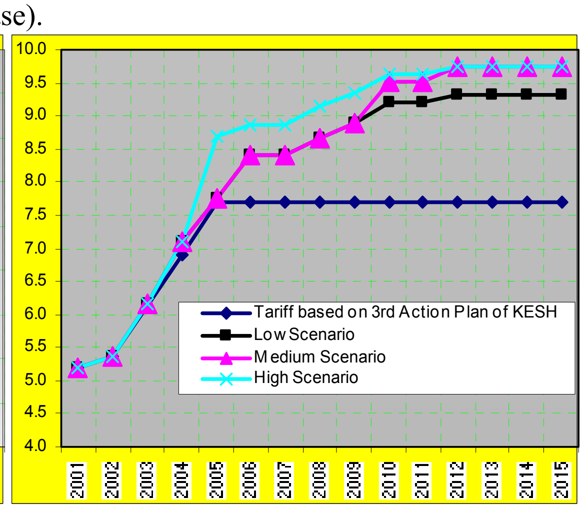

Figure III.75.: Average financial tariff and dependence from electricity import price (lek/kWh).

Figure III.74 shows an almost total matching between electricity average tariff according to Action Plan (third phase) and average financial tariff, till 2005. The figure shows a considerable difference between long term marginal cost (G/T/D) of 12.18 lek/kWh and average financial tariff of 9.33 lek/kWh. This difference is due to the fact that objects constructed during previous periods (before 1990), for which no investment payback was required (constructed with government budget funds). Based on the above average financial tariff and World Bank study on electricity demand in different sectors, table III.16 shows the average tariffs to be applied for different consumer groups:

Table III.17: Structure of average tariffs recommended for different consumer categories (Lek/kWh)

Category	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Cons. in HV	3.40	4.37	5.05	5.52	6.00	6.01	6.18	6.35	6.55	6.54	6.63	6.63	6.62	6.61
Residential	4.94	6.36	7.34	8.03	8.73	8.75	8.99	9.23	9.53	9.52	9.65	9.64	9.63	9.62
Industry	4.64	5.98	6.90	7.55	8.20	8.22	8.45	8.67	8.96	8.95	9.07	9.06	9.05	9.04
Commercial & Services	5.25	6.75	7.79	8.53	9.27	9.29	9.54	9.80	10.12	10.11	10.24	10.23	10.22	10.21
Water main enterprises	4.30	5.54	6.39	6.99	7.60	7.62	7.83	8.03	8.30	8.29	8.40	8.39	8.38	8.37

III.12.5 Sensitivity analysis of average financial tariff

In order to evaluate the impact of different parameters on the development of revenue requirement and average financial tariff level compared to accepted parameters of financial plan, the sensitivity analysis studied the following cases:

1. Import price sensitivity analysis

Basic case: Import price in year 2005 is 37.9 US$/MWh.
Analyzed cases: Impact of highest import price.

The analysis of figure III.73 and World Bank study, conclude that importing up to a level of 1 700 GWh/year during the analyzed period, is economically feasible. Current values of electricity import price, varies within an interval of 2.8-3.3 cent/kWh. The level of import price is foreseen to be increase in the future according to scenarios given in table III.18.

Basic case: Import price by year 2005 is expected to be 37.9 US$/MWh.
Analyzed cases: Sensitivity analysis for three cases presented in table III.18, show that loan conditions will be soften ones during the period 2007-2015, and foreseen interest rate will be 8% (10 years maturity period). Concessionary loans are foreseen to start by year 2006 with an interest rate of 2% (8 years maturity period).

Table III.18.: Three possible scenarios of electricity import price trend.

Unit (USc/kWh)	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Low scenario	3.21	3.18	3.43	3.61	3.79	3.79	3.79	3.79	3.79	3.79	3.79	3.79	3.79	3.79	3.79
Average scenario	3.21	3.18	3.43	3.61	3.79	3.79	3.79	3.79	3.79	4.90	4.90	4.90	4.90	4.90	4.90
High scenario	3.21	3.18	3.43	3.61	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90

Average financial tariffs are calculated based on the above scenarios of electricity import price. The analysis shows that although the import price will increase with 30%, the average financial tariff will increase with only 4.5%.

2. Sensitivity analysis of loan terms (interest rate)

As emphasized above, new investments are foreseen to be done for the generation, transmission and distribution systems, in the period 2003-2015, are US$ 1.3 billion. In addition, the financial model for the calculation of average financial tariff assumes 70% of investments from loans and 30% from equities (companies internal capital). Since the loan share is high (70%) a sensitivity analysis were prepared for the loan interest rate and its effect on the average financial tariff.

The loan terms for Base and Alternative cases are:

Base case: assumes new concessionary loans in a quantity of 130 MUSD/year with an interest rate of 2% (24 years maturity period, 6 years grace period).
The sensitivity case assumes that until year 2006 the loan interest rate will be 4% (6 years grace period), while during the period 2007-2015, loans are foreseen to have more unfavorable conditions and an interest rate of 12% (2 years grace period). The sensitivity analysis shows that due to changes of loan interest rates, the average tariff will increase with 4.78%.

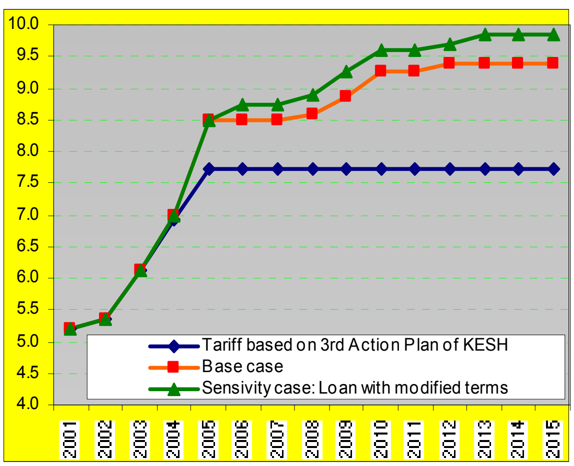

Figure III.76.: Impact of loan terms change on average financial tariff (lek/kWh)

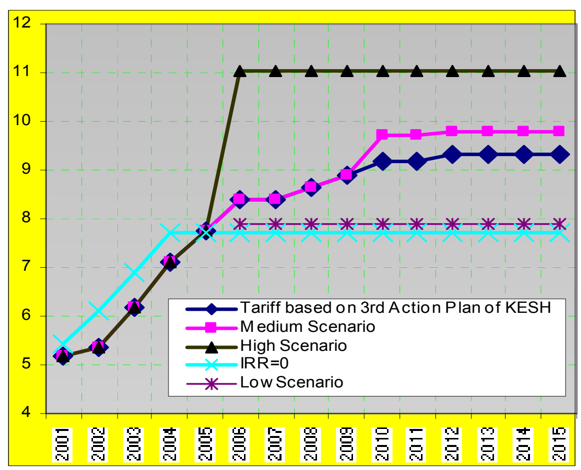

Figure III.77.: Average financial tariff and dependence from Internal Rate of Return (IRR) (lek/kWh)

3. Sensitivity analysis of internal rate of return

Another important parameter that influences on the average financial tariff is the internal rate of return of the power company. As emphasized in Power Sector Study, one of the basic objectives of power sector is to become efficient and have an internal rate of return within allowed values. As a consequence, following sensitivity analysis addresses four cases with the internal rate of return, according to table III.19.

Base case: in order to improve KESH financial situation, internal rate of return of investments was assumed to increase from a negative value in 2002 to 2% in year 2006 and 8% in 2009, remaining within these levels till 2015.
Analyzed cases: Other cases of sensitivity analysis are given in table III.19.

Table III.19.: Sensitivity analysis for different internal rates of return (%).															
Sensitivity cases	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**
No investment payback required						0	0	0	0	0	0	0	0	0	0
Investments payback (low scenario)						2	4	6	8	8	8	8	8	8	8
Investments payback (average scenario)						2	4	6	8	10	10	10	10	10	10
Investments payback (high scenario)						12	12	12	12	12	12	12	12	12	12

Average financial tariffs were calculated based on the above description and the financial model. As shown in figure III.77, with the increase of the internal rate of return (0-12%), average financial tariff is expected to increase from 7.71 lek/kWh to 11.09 lek/kWh. As a conclusion, it should be underlined that the change of internal rate of return has the highest impact on the average tariff.

4. Electricity purchase from IPP (Independent Power Producers)

Base case: World Bank financial plan does not take into consideration the option of building IPP plants due to difficulties to provide investments with acceptable conditions. In the base case, electricity purchase from IPP was not assumed.
Analyzed cases: IPP option was also taken into consideration in the sensitivity analysis.

IPP has the advantage of preventing KESH from bearing the cost and the risk of investment. Assuming that TPP will be constructed as IPP, the cost of one kWh is calculated to be 51.39 US$/MWh. The sensitivity analysis shows that if electricity was purchased from IPP, the impact on the average financial tariff would be low.

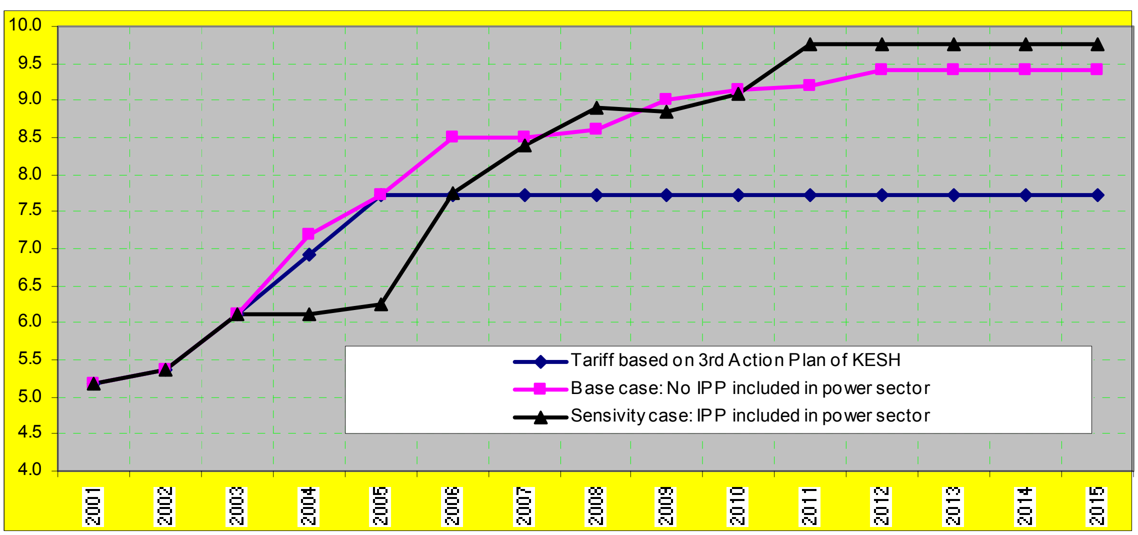

Figure III.78: Impact on average financial tariff of purchasing electricity from IPP (lek/kWh).

As a final conclusion of sensitivity analysis, the accepted internal rate of return has the highest impact on the average tariff.

III.13 Forecast of producing and importing capacities of oil by-products (including storage capacities) according to active scenario

III.13.1 Oil production trend of existing fields

The Active Scenario has analyzed three scenario to determine the trend of oil production existing fields while taking also into consideration foreign companies development plan for Patos-Marinza sandstone oil field. The plan is based on information from Albpetrol Company as well as on the trend of domestic oil fiels in years. Figure III.79 presents three scenarios of oil production trend for the period 1999-2015. Figure III.80 shows trend of oil produced by Albpetrol and by new wells with new technology, according to the Active Scenario.

Figure III.79.: Scenarios of oil production trend (ktoe)

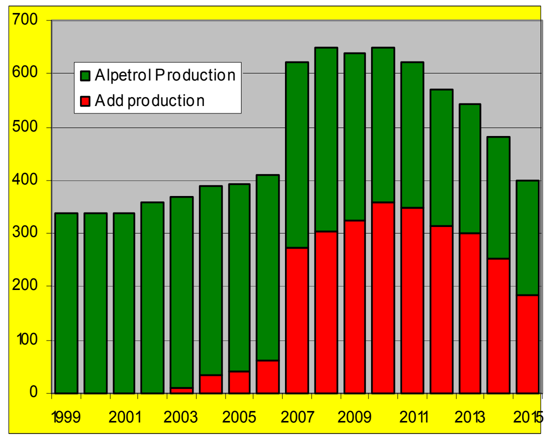

Figure III.80.: Contribution of Albpetrol and new technology in Patos-Marinez existing oil fields (ktoe)

Optimistic scenario foresees successful results from the technology of intensive extraction of fluids from sandstone oil field in Patos Marinza, with groups of concentrated wells used by new technology. Referring to the graphic, the results of this method have started to show in 2003 when oil production is expected to reach up to 480 000 ton per year. This value will not change till 2006, when the new method is foreseen to be applied in the whole zone of Patos Marinza oil field. Investments according to this scenario have a value of US$ 220 million. Production will increase in 2006 reaching a peak of 1.93 million ton per year during the period 2008-2013 followed by a decline in 2015, up to 968 000 ton. Scenario results correspond to the peak production of our domestic oil fields. Scenario peak is related to the period 1974-1978, where endigenous oil production reached a value of 1.9-2.4 million ton per year.

Passive scenario foresees the failure of the new method, contributing till 2006 with an oil production of approx. 413 000 ton per year, followed by a natural decline of 5%, and reaching a production value of 215 000 ton per year by 2015. According to this scenario, investments to develop new exploitation technology of wells are expected to be around US$ 65 million, while Albpetrol investments in existing oil fields are expected to be 7-9 million per year.

Active scenario recommended by the National Strategy of Energy, foresees the same trend for oil production as optimistic scenario till 2006, followed with a production increase of not more than 650 000 ton per year till 2012, declining to 400 000 ton by 2015. This alternative is taken into consideration in the analysis of the Active Scenario, because it maintains a normal oil production trend. Investments according to this scenario are expected to be US$ 73 million.

III.13.2 Oil cost in existing resources

The Active Scenario is based on the normal alternative of oil exploitation from existing oil fields that foresees a maximum of 650 000 ton per year. Investments according to this scenario will cover the period 2002-2005, starting from the experimental phase of work till a stage of average development of Patos-Marinza oil field. Foreseen investments according to the Active Scenario are US$ 73 million. Investments in 2002 and 2003 were US$12 million, and US$ 2.4 million, respectively. Year 2003 offers experimental results, followed by an investment of US$ 25.4 million in 2004-2005 and US$ 5 million in 2009-2010. Figure III.76 shows the investments, and average fixed and variable costs for five years. Investments in existing oil fields will intensify during the period 2001-2006, reaching an average value of US$ 13 million with a fixed cost of US$ 25 million and a variable cost of US$ 25 million. During the periods 2006-2010 and 2011-2015, investments, and fixed and variable costs maintain a constant value, due to production stability. Comparison of expenses between scenarios shows higher values in the Active Scenario due to a total of 1.4 million ton production more than in the Passive Scenario.

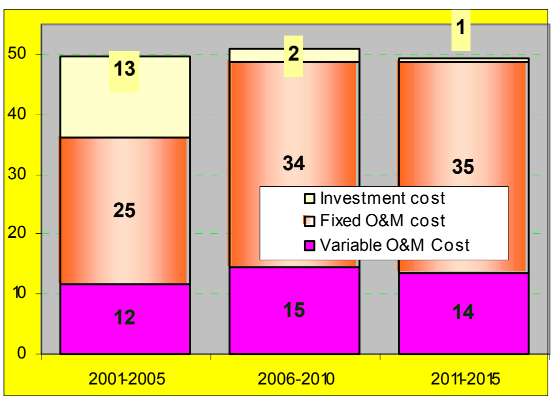

Figure III.81.: Table of investments, and average fixed and variable costs according to active scenario (US$ million)

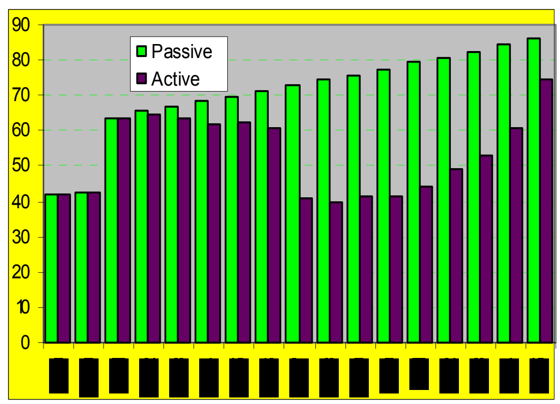

Figure III.82.: Comparison of fixed costs for both scenarios in existing oil fields 1999-2015 ($/ton)

Figure III.81 shows the trend of fixed cost for both scenarios, clearly evidencing that due to production increase after 2004, fixed cost according to the Active Scenario will decline to 3 US$/ton less than in the Passive Scenario, reaching to 36 US$/ton in 2011, thereafter increasing in 2015 due to production decline. In any case it is foreseen to be 16 US$/ton lower than in the Passive Scenario. Figure III.82 compares variable costs for both scenarios, showing a decline of 3 US$/ton after 2004, 12 US$/ton in 2013, and 3 US$/ton in 2015, due to production increase.

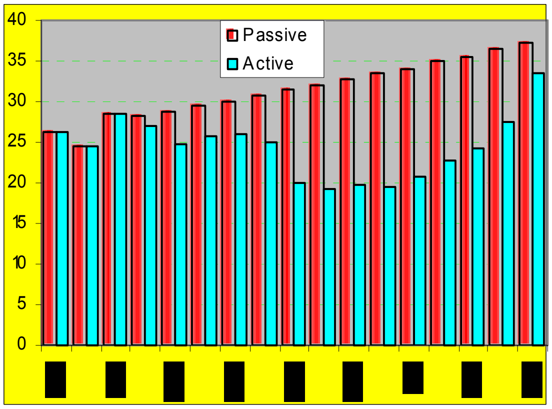

Figure III.83.: Comparison of variable costs for both scenarios in existing oil fields 1999-2015 (US$/ton)

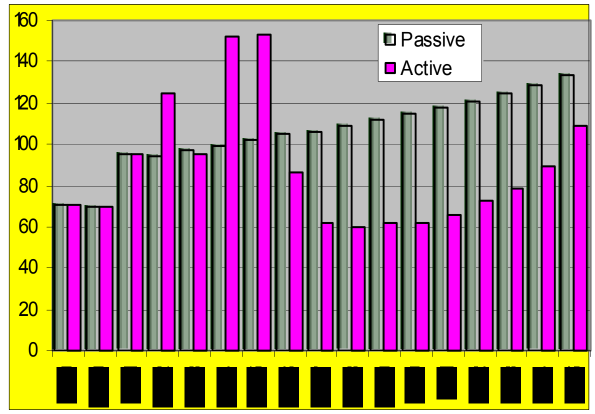

Figure III.84.: Comparison of oil extraction costs for both scenarios in existing oil fields1999-2015 (US$/ton)

Figure III.84 shows oil exploitation cost in existing oil fields, according to the Active Scenario. The figure clearly evidences an increase of exploitation cost in 2002 and 2004-2005, with 129 US$/ton and 156 US$/ton respectively, recuperated soon after 2005 when exploitation cost declines to 50 $/ton till 2014, to reach to 28 US$/ton by 2015. Diminution of the difference after 2014 is explained with the decline of investments efficiency, which is still high compared to the Passive Scenario.

III.13.3 Oil and gas reserves in new searching zones

Foreign companies have been exploring in Albania since 12 years ago drilling 10 exploration wells during this period (6 offshore and 4 onshore areas). Although, no new oil and gas fields are discovered, the wells have contributed in the evolution of geological concepts and evidenced a number of potential aspects for oil and gas reserves, currently under study.

Forecast of reserves

The panorama of reserves presentation in the endogenous exploratiion zones is important for the National Strategy of Energy, which shows their quantitative aspects and precedes the preparation of studies on future oil and gas sector development. Reserves are listed following, based on their discovering chronology, starting with onshore blocks for the first and second rounds, Albpetrol blocks and offshore blocks. In the first round, the oil geological reserves are calculated to be in the range of 70 million m^3 and those extracted only 7 million m^3, while gas geological reserves are estimated to be 76 billion N m^3, those extracted 30 billion N m^3. Their economic evaluation is under process in the zones of this round, although actual results show low economic figures. Figures III.85 and III.86 show the reserves.

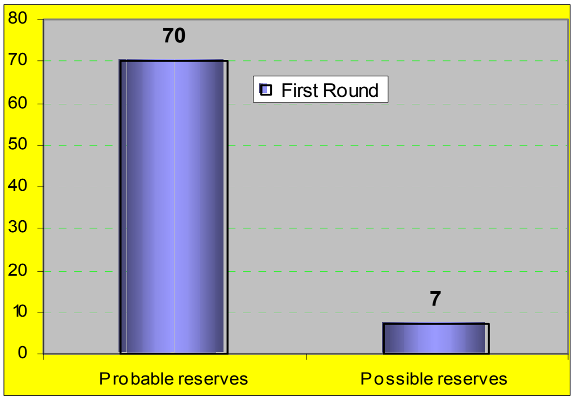

Figure III.85.: Oil reserves according to first round (million m^3)

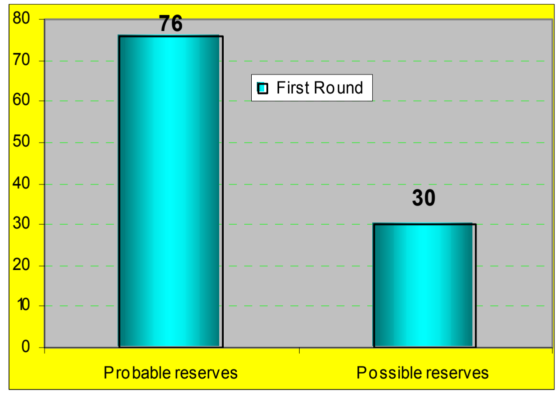

Figure III.86.: Natural gas reserves according to first round (million N m^3)

Oil reserves in the second round are higher compared to the first round, while gas reserves are lower. This is due to the fact that the zone where the round operates has a more attractive oil-field structure. From figures III.87 and III.88 it may be calculated that oil geological reserves are 130 million m^3, oil possible reserves 40 million m^3, gas reserves 20 billion N m^3 and possible gas reserves 10 billion N m^3.

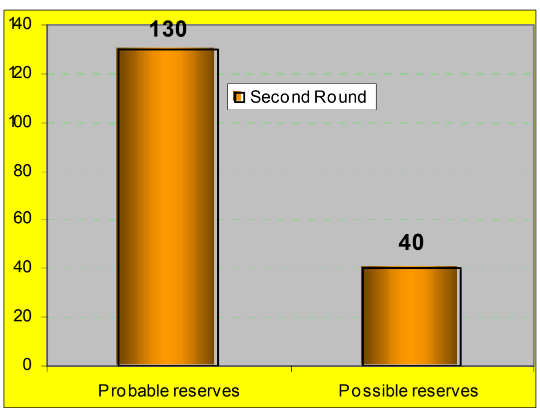

Figure III.87.: Oil reserves according to second round (million m^3)

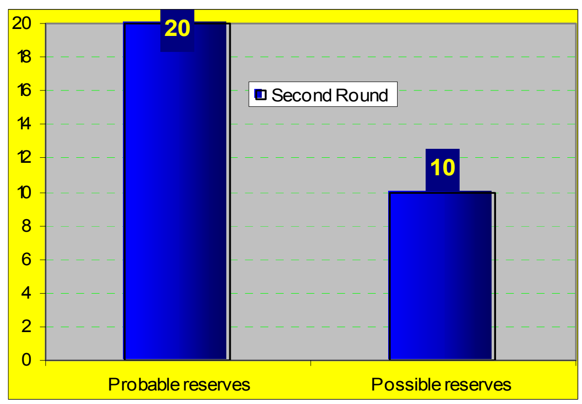

Figure III.88.: Natural gas reserves according to second round (billion N m^3)

The Albpetrol block zone has potential oil and gas reserves, where the oil geological reserves are estimated to be 60 million m^3 and those expected 7.4 million m^3. Gas reserves in this zone are lower, estimated to be within a range of 270 million N m^3, while expected reserves 100 million N m^3. Figures III.89 and III.90 show reserves in the Albpetrol zone.

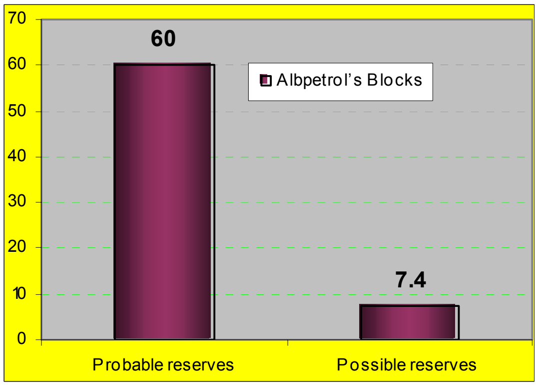

Figure III.89.: Oil reserves in Albpetrol Blocks (million m^3)

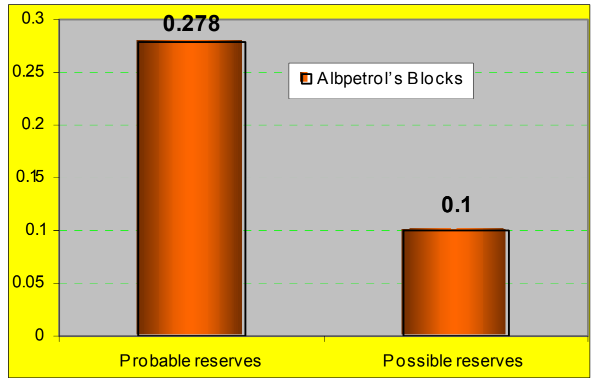

Figure III.90: Natural gas reserves in Albpetrol Blocks (billion N m^3)

The offshore exploration activities show that oil geological reserves are estimated to be 200 million m^3 and possible oil reserves 50 million m^3, while gas geological reserves are estimated to be 100 billion N m^3 and gas possible reserves 25 billion N m^3. According to evaluations these reserves are not economically feasible and future plans of the National Petroleum Agency foresee a review of some parts of the zone (Figures III.91 and III.92).

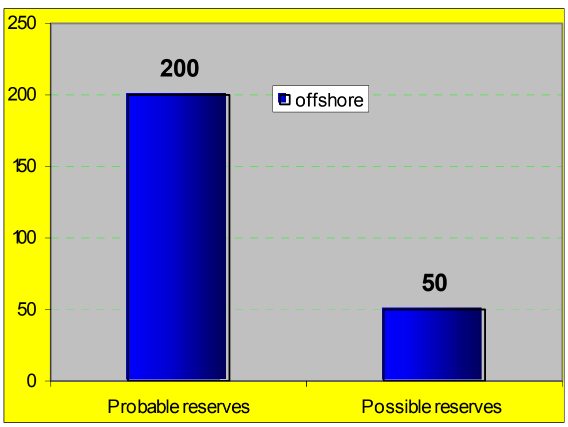

Figure III.91: Oil offshore reserves (million m^3)

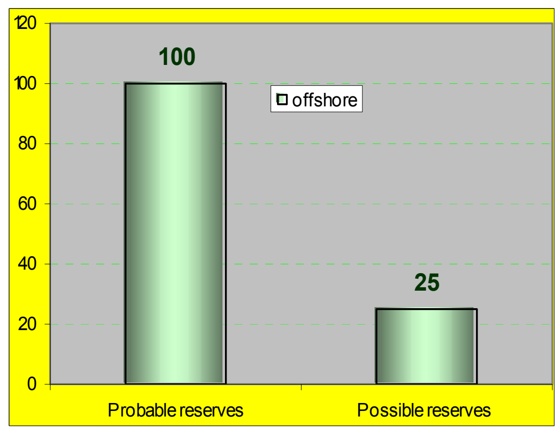

Figure III.92: Natural gas offshore reserves (billion N m^3)

Most probable zones for oil and gas discovering are:

- Shpiragu (Sqepuri) region where the evaluation of oil concentration capacity in drilled wells is under process.
- Palokastra and Vlora region, where drilling of two wells to certify optimistic outcomes of seismic studies is being prepared.
- South Tirana region, where the drilling of well is foreseen to start by the end of 2003, expecting possible results by the end of 2004.
- Offshore Durres-Kepi Palles region, interesting for gas researches.

As mentioned above, the oil geological reserves onshore are estimated to be 260 million m^3, from which 54 million m^3 are possible reserves. Currently, economic aspects of reserves are being studied, and results are expected within the next three years. Similar outcomes may be expected for the natural gas reserves in the same zone, estimated to be 96 billion N m^3. The offshore geological oil reserves are estimated to be 200 million m^3 and possible reserves 50 million m^3, while the gas reserves are estimated to be 100 billion N m^3. The reserves have not been economically feasible so far, thus offshore zones are going to be studied during the coming years in order to reach a final conclusion on economic feasibility of the reserves.

III.13.4 Oil by-products demand

Meeting the oil by-products demand in our country depends more and more on the import, which is playing a dominant role in our internal market. Under these conditions, the Active Scenario analysis the related problems and development ways for the future.

Despite measures to increase the oil domestic production, the Active Scenario foresees that imported oil by-products will continue to dominate the market. The oil by-products such as diesel, gasoline and LPG are foreseen to occupy approx. 88% of import of oil by-products and gas. Differently from the Passive Scenario, the Active Scenario foresees that the trend of domestic oil products dependence from import will remain constant at a level of 30% until 2011, declining to 17% by 2015. Improvement is related to the increase of oil domestic production, due to the use of modern technologies from foreign companies operating in Patos-Marinza oil field. Figure III.93 shows the dependence trend of domestic oil products from import according to the Active Scenario, while figure III.94 shows the comparison of oil by-products demand for each sector in years, according to both scenarios.

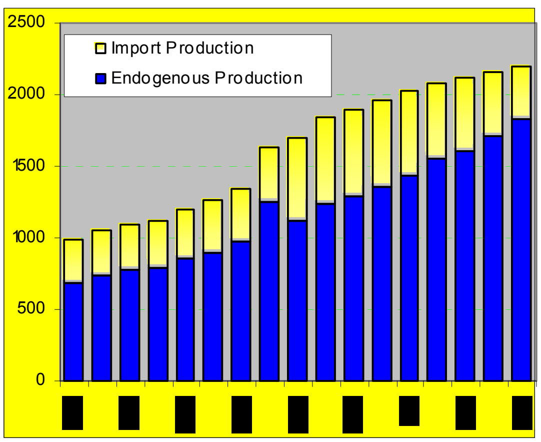

Figure III.93: Rate of dependence of domestic products from import, according to the Active Scenario (ktoe)

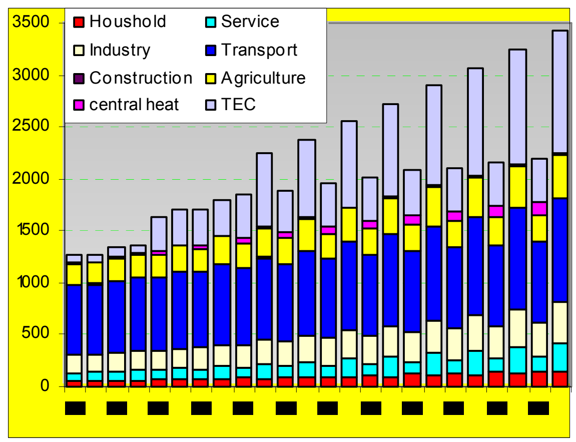

Figure III.94: Comparison of oil products demand according to the Passive Scenario (ktoe)

The Active Scenario differentiates the final demand for oil by-products and gas for all economic sectors (industry, transport, service, residential, construction and agriculture). Analysis and forecast of oil by-products demand according to the Active Scenario were based on measures aiming an efficient consumption of oil by-products and gas in all economic sectors. Referring to figures III.95 and III.96, the first results of measures undertaken according to the Active Scenario, will start in 2004.

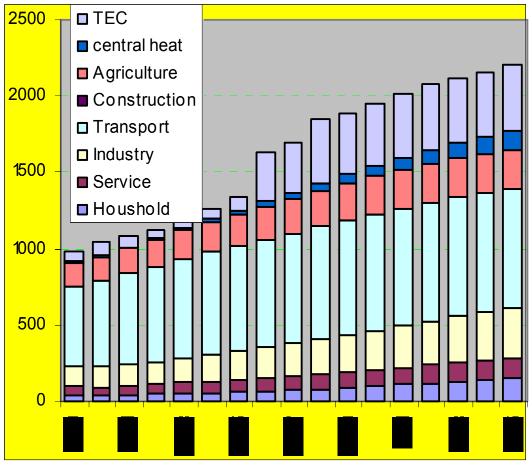

Figure II.95.: Consumption of oil-by products according to sectors, Active Scenario (ktoe)

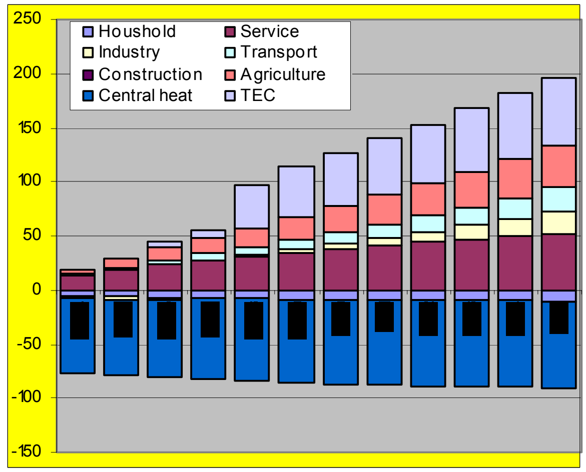

Figure III.96.: Trend of the Active Scenario according to sectors, with saving sectors in positive directions and increased consumption sectors in negative directions (%).

According to the Active Scenario, oil by-products demand in the residential sector by 2004 is expected to be 56.7 ktoe, reaching up to 152.4 ktoe by 2015. Compared to the Passive Scenario, the electricity consumption according to the Active Scenario is expected to decline, while oil products consumption will increase. The increase will start with 4% in 2004, reaching up to 10% in 2015. Oil by-products demand in service sector will decline due to increase of efficiency, while oil by-products consumption is foreseen to be 75.9 ktoe and 133.9 ktoe, respectively by 2004 and 2015. Compared to the Passive Scenario, the oil by-products' saving is estimated to be 14% and 52%, respectively by 2004 and 2015. According to the Active Scenario, the industrial sector final consumption will be 172.2 ktoe by 2004, and 326.6 ktoe by 2015. Improvements in this sector aim the use of efficient technologies with positive effects on the Active Scenario. Saving effects in the sector will start in 2008 reaching up to 20% by 2015.

According to the Active Scenario, the transport sector will continue to be the main consumer of oil by-products, especially of two of them, diesel and gasoline. Impact of undertaken measures in this sector will start in 2004, where consumption is foreseen to be 671 ktoe, reaching up to 778 ktoe by 2015. Compared to the Passive Scenario, the savings in this sector will reach a level of 22% by 2015. The fuel consumption in construction sector is foreseen to develop with the same trend as in the Passive Scenario, due to the small role of these products in the sector. Saving in oil by-products consumption in agriculture sector will be approx. 4% by 2004, and 38% by 2015. According to the Active Scenario, the central heating and small cogeneration plants working with diesel no.2 will have a considerable development compared to the Passive Scenario. Consumption of oil by-products according to the Active Scenario is expected to be 19.7 ktoe by 2004 and 125 ktoe by 2015. Compared to the Passive Scenario, the increase is foreseen to be 68% in 2004 and 80% in 2015. Oil by-products consumption for power generation will decline with 2% in 2005 and 36% in 2015. The consumption decline is dedicated to the priority the Active Scenarios give to the electricity demand reduction.

The consumption of oil by-products according to the Active Scenario will occupy approx. 62% of the total fuel consumption due to the fact that fuel woods, coal and natural gas consumption will not have an important development. Domestic market will continue to be dominated by consumption of light oil by-products with a trend that goes from 68% to 72%, in the total consumption of oil products. Growing rates of average consumption are foreseen to be 5% for diesel, 4% for kerosene, 5.9% for heavy fuel oil and 9.3% for LPG. Although LPG has a high average growth compared to other by-products, it will occupy approx. 4-7% of oil by-products total consumption. Consumption trend of oil by-products is foreseen to grow from 1118 ktoe in 2002 to 2200 ktoe in 2015, but still being 36% lower than in the Passive Scenario due to efficient measures. Figure III.97 show the oil by-products consumption for the period 1999-2015, and figure III.98 show the trend of consumption according to both scenarios.

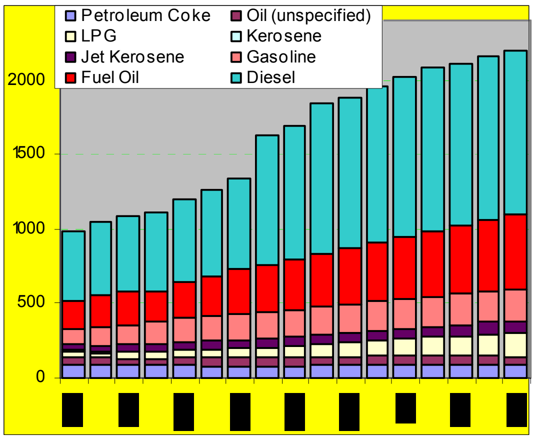

Figure III.97: Oil by-products consumption, Active Scenario (ktoe)

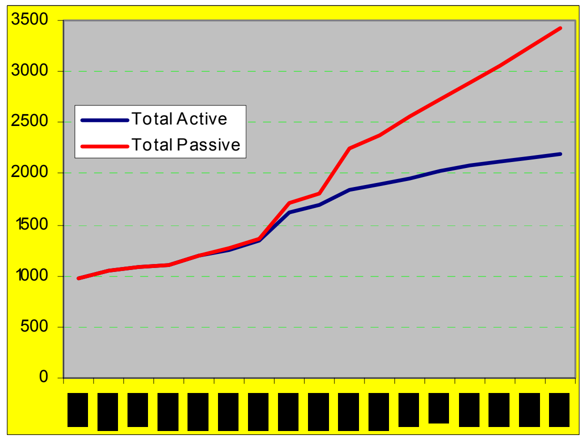

Figure III.98: Comparison of Active and Passive Scenarios for oil by-products saving (ktoe)

The above results of the Active Scenario show a decline of demand for oil by-products, foreseen to reach to 1225 ktoe by 2015. If the demand is expressed in costs, savings according to the Active Scenario are expected to start by 2006 with a value of US$ 18 million, reaching a value of US$ 410 million by 2015. 50% of contribution in savings comes from power generation sector due to demand decline. Figures III.99 and III.100 represent oil by-products importing cost according to the Active Scenario and the difference with that of the Passive Scenario.

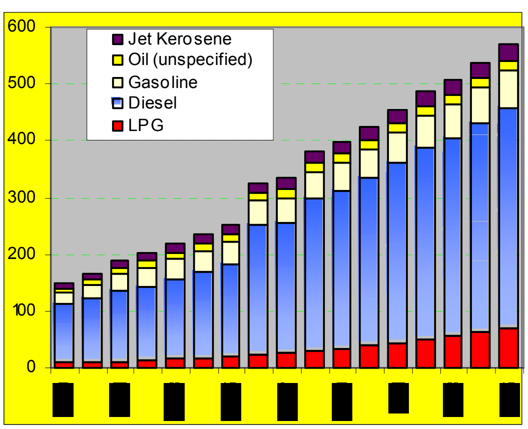

Figure III.99: Cost of imported products, Active Scenario (US$ million)

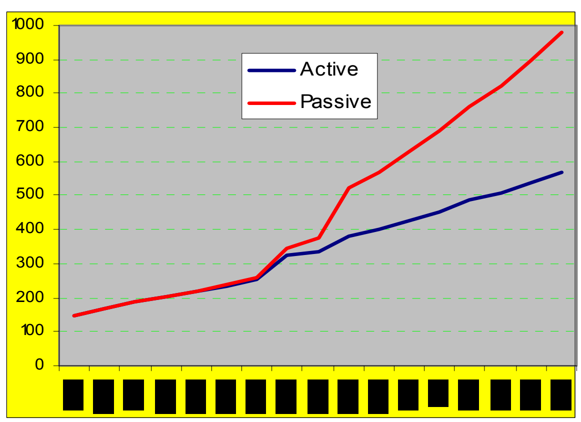

Figure III.100: Comparison between Active and Passive Scenarios (US$ million)