Energy Resources and Supply Reliability in Albania
Energy Balance and Infrastructure Development

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Establishment of the Hydropower System in Albania

- The power supply for residential and industrial users in Albania started in 1923, with a diesel facility that operated at 0.4, 3.6 and 16 kV tension.
- In 1951, power facilities operated in Albania at a tension of 35 kV.
- In 1957, the Hydropower System was established and operated at a tension up to 110 kV.
- The current Albanian Hydropower System operates at high tension lines of 220kV and 400 kV.
- Until 1990, Albania had up to 20 generation units with an installed capacity of 1,670 MW.
  - 11 Hydro plants (1446 MW)
  - 9 Thermal plants (224 MW)
- The generation capacity of Hydropower Plants varies from 3.5 - 4.8 billion kWh to 7 billion kWh respectively for years with 90%, 50%, and 25% reliability on Hydro.
- The generation capacity of Thermal Plants was estimated at 1.2 billion kWh but currently all Thermal plants are closed.
- Theoretically, annual generation of 83 small Thermal Plants was estimated to be about 55 million kWh. Currently, the contribution of these plants in domestic power generation is insignificant, as they serve only the locations in which they are installed.
- Maximum generation was recorded in 1986, which was 5.027 billion kWh, of which 2.138 billion kWh was exported.

Energy Resources
Generation by Hydropower Plants

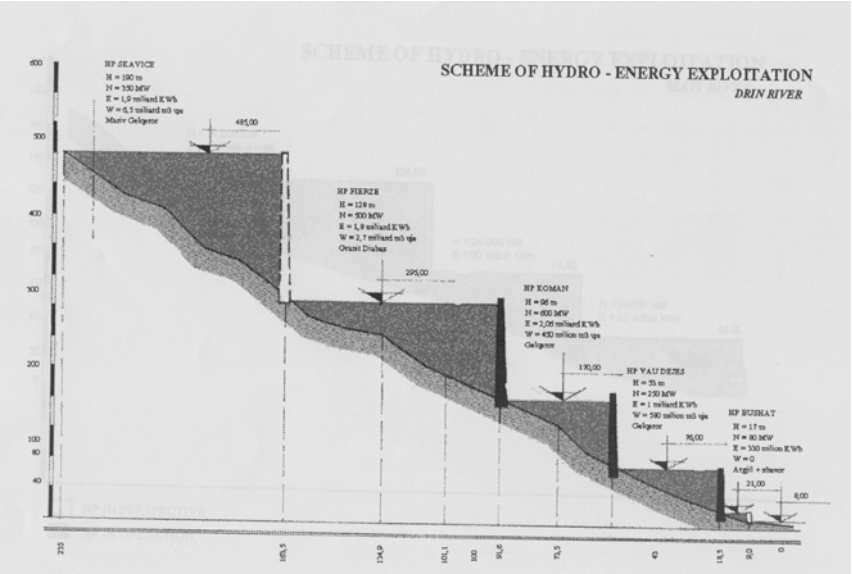
- The Albanian Electric System is unable to provide customers with quality service without outages.
- Hydropower Plants provide about 99% of annual production. Three of them are built on the cascade of the Drini river, and account for 86% of total generation.
- In a normal year, power generation in Albania is 4,160 GWh, but this amount is not sufficient to meet customer demand.

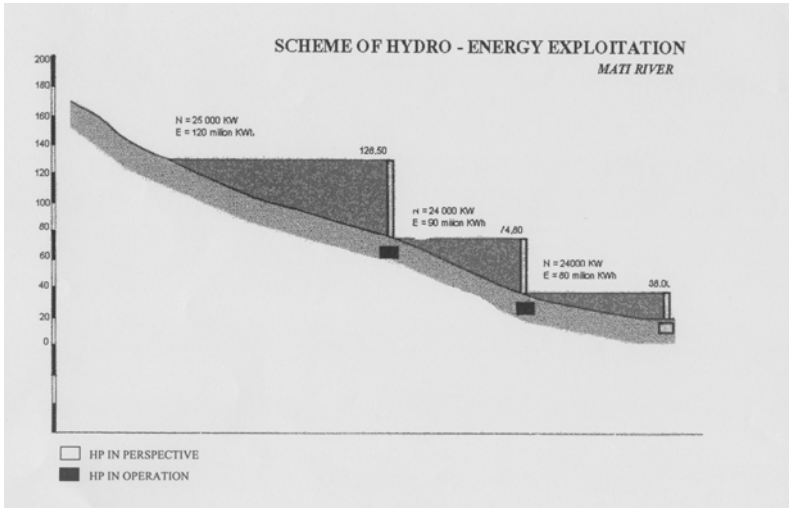
Plant	Installed capacity (MW)	Effective capacity (MW)	Average generation (GWh/a)
Fierza Hydro power plant	500.0	152	1,328
Koman hydropower plant	600.0	171	1,500
Vau i Dejes hydropower plant	250.0	100	880
Drini cascad	1,350.0	423	3,708
Ulza hydropower plant	27.0	14	120
Shkopet hydropower plant	25.0	10	90
Mati cascade	52.0	24	210
Bistrica hydropower plant 1	23.0	19	165
HP Bistrica 2	5.5	4	35
Bistrica Cascade	28.5	23	200
Small hydro power plants	20.0	2	20
Fier Thermal plant	159.0	10	76
Total	**1,609.5**	**482**	**4,214**

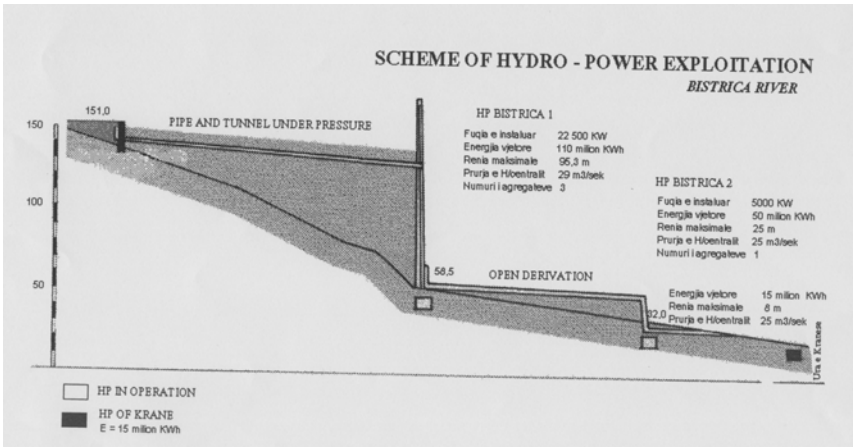
Energy Sources
Generation, Hydro Power Reserves

- Although about 98% of electric power is generated by Hydropower Plants, only 35% of Hydro resources is exploited.
- Total Hydropower reserves are estimated at 3,000 MW, and additional annual generation may reach up to 10—12 TWh.
- As 95% of Hydropower Plants are located in the northern part of Albania, it is preferable to build new generation facilities in the southern part of the country (i.e. Vjose and Devoll).
- Studies carried out by national and international institutions as well as common practice identified that:
  - The available generation capacity is not sufficient to meet growing domestic demand, even in favorable Hydro conditions.
  - The available generation capacity is not sufficient to satisfy peak demands at different times of the day or year.
  - For better management of Hydro resources, it is necessary to improve power generation infrastructure, and diversify resources.

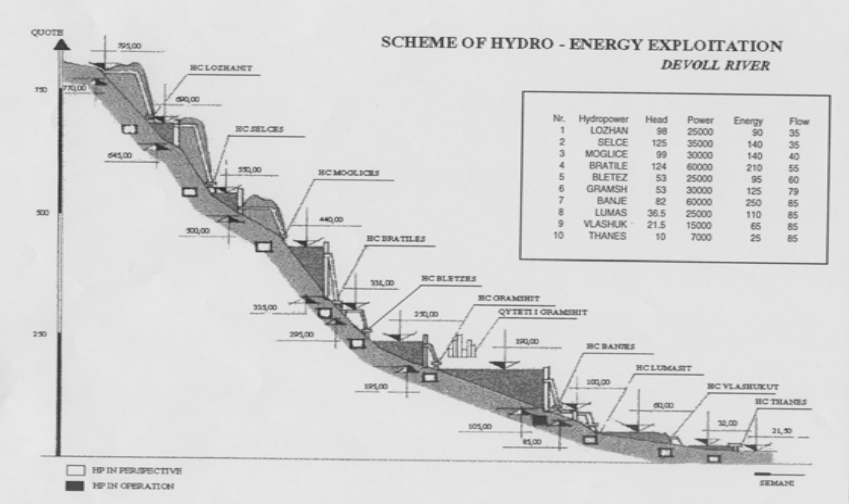
Energy Sources
Generation, Hydropower Reserves



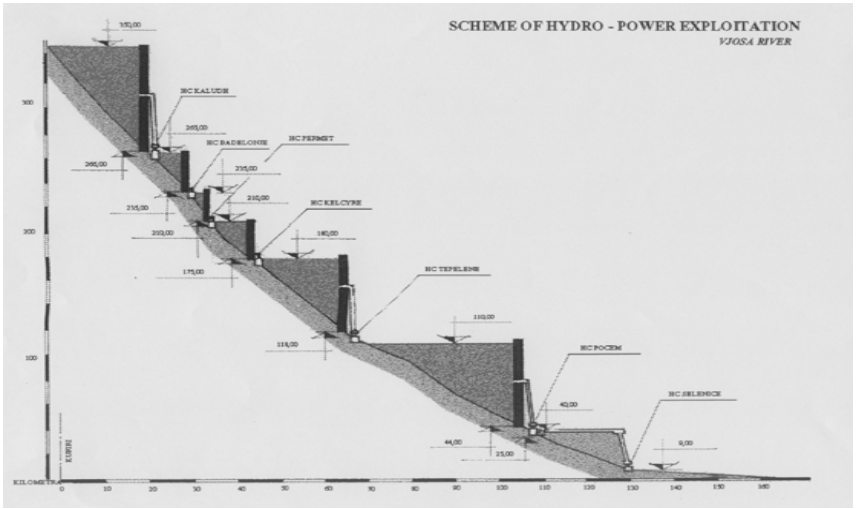




Energy Sources
Generation, Hydro Power Reserves



Nr.	Hydropower	Head	Power	Energy	Flow
1	LOZHAN	98	25000	90	35
2	SELCE	125	35000	140	35
3	MOGLICE	99	30000	140	40
4	BRATILE	124	60000	210	55
5	BLETEZ	53	25000	95	60
6	GRAMSH	53	30000	125	79
7	BANJE	82	60000	250	85
8	LUMAS	36.5	25000	110	85
9	VLASHUK	21.5	15000	65	85
10	THANES	10	7000	25	85



Energy Sources
Generation, Hydro Power Reserves of Small Hydropower Plants

- 83 Hydropower Plants were built until 1988 with a capacity from 30 to 5,000 kW.
- The installed capacity of these plants is 14 MW and it is possible to increase their capacity to 25 MW through a better exploitation of river flows.
- Work is continuing to identify the potential of new Hydropower Plants, and to increase the capacities in existing plants by avoiding the shortcomings reflected mainly in:
  - Partial exploitation of the total hydro power capacity.
  - Lack of frequency and tension stability, while changing the load.
  - Frequent disconnection of plants from the network due to the incapability of the management system.
  - Relatively high costs of repairing the equipment of small Hydropower Plants
- An assessment also shows the possibility to build 41 new Hydropower Plants with a capacity from 0.5 to 10 MW.
- The total capacity of these Hydropower Plants is estimated at 140-150 MW, with an annual generation at about 600 - 680 GWh
- All Hydropower Plants planned for construction are with deviations, without dams or water collectors.
- In regard to territorial distribution of power plants, 28 Hydro Plants may be built in the north at a capacity of 100 MW, which account for 65% of the total power. 13 at a capacity of 40 MW, may be built in the south and would account for 35 % of the total capacity.

Energy Sources
Generation, Alternative Energy Reserves

- **Broad exploitation of solar energy.**

  If Albania developed a solar panel system, hot water production will be equal to 1,000 $GWh_{Thermal}$ (or 125 $MW_{Thermal}$ of installed capacity)

- **Wind power.**

  Preliminary assessment shows that coastal areas are more affected by long lasting, strong winds, and that 20 Wind Mills may be built near the 20 pumping stations set up for protection from floods. If this becomes a reality, it is projected that by 2020 wind resources will generate about 400 GWh/year.

- **Debris as a potential resource.**

  Debris energy reserves for year 2005 was 1,783Mtoe, and in 2020 it is projected to be 9,517 Mtoe (this cost is much higher than traditional fuels).

- **Geothermic resources.**

  The geothermic resource of Ardenica is temp. 32-38°C, flow 15-18 l/s.

  The Geothermic resource of Kruja with a reserve of $5.9x10^8$ - $5.1x10^9$GJ.

  The geothermic resources of Peshkopia at a temperature of 43.5°C and a flow at 14-17 l/s.

  Geothermic reserves are not economical when used for power generation because their Thermal potential is low (maximum 20-33^0C).

- **Biomass is an energy source that has expanded throughout the country. In addition to firewood that is still used inefficiently, of great interest are also shrubs and debris. Biomass from farm crops is used as food for animals. Biomass produced from livestock is used as fertilizer.**

Energy Resources
Hydropower Generation, Perspectives

- The first table reflects the construction schedule of new generation facilities, in compliance with demand projections for power, based on the Active Scenario for energy development.
- Based on projections to exploit up to 150 MW from small Hydropower plants, it is agreed to install 10.7 MW on average, every year until 2020.
- The second table below shows energy generation from year to year by annual investment projections of new facilities.

Plants	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
SHPP		10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	150
Devoll 1 HPP		Duration of concessions and construction					75									75
Vjosa HPP	Duration of concessions and construction					80										80
Drini1Hydropower plant		Duration of concessions and construction					84									84
Total		**10.7**	**10.7**	**10.7**	**10.7**	**90.7**	**169.7**	**10.7**	**10.7**	**10.7**	**10.7**	**10.7**	**10.7**	**10.7**	**10.7**	**389**

Generation GWh	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
SHPP	102	143	185	226	268	309	351	392	434	475	517	558	600
New HP Plants	0	0	0	350	966	966	966	966	966	966	966	966	966
Current HPP	4047	4115	4149	4149	4149	4149	4149	4149	4149	4149	4149	4149	4149
Total	**4149**	**4258**	**4334**	**4725**	**5383**	**5424**	**5466**	**5507**	**5549**	**5590**	**5632**	**5673**	**5715**

Investment (Million Euro)	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
SHPP	1.5	6.0	11.4	11.8	12.1	12.5	12.9	13.2	13.6	14.0	14.5	14.9	15.4	15.8	16.3	185.9
HPP Devolli 1		6.0	18.0	42.0	30.0	24.0										120
HPP Vjosa 1	3.0	24.0	61.0	40.0	32.0											160
HPP Drini 1			23.4	62.4	39.0	31.2										156
Total	**4.5**	**36**	**113.8**	**156.2**	**113.1**	**67.7**	**12.9**	**13.2**	**13.6**	**14.0**	**14.5**	**14.9**	**15.4**	**15.8**	**16.3**	**621.9**

Energy Resources
Generation, Thermal Power Plants

- As mentioned above, none of nine Thermal power stations are in service.
- The table contains the main data on these facilities.

TURBO GENERATORS ON THE TPP OF ENERGETIC SYSTEM OF THE REPUBLIC OF ALBANIA

Nr	Thermopower		Output per unit (Mw)	General output (%)	Number of unites (pcs)	Condensing turbines		Bleeding turbines		Back pressure turbines		Made in
						Number (pcs)	Output (Mw)	Number (pcs)	Output (Mw)	Number (pcs)	Output (Mw)	
1	Ballsh		24.0	10.7	2			1	12	1	12	China
2	Cerrik		8.5	3.2	3	2	7			1	1.5	Russia
3	Elbasan		6.0	2.7	1					1	6.0	China
4	Fier	Part 99 Mw	99.0	44.2	5	3	75	2	24			China
		Set 60 Mw	60.0	26.8	1	1	60					Czechoslovakia
		TPP	159.0	71.0	6	4	135	2	24			
5	Korce		6.0	2.7	1			1	6			China
6	Maliq		7.0	3.1	3			1	4	2	3	Russia
7	Kucove		5.6	2.5	2			2	5.6			Czechoslovakia
8	Tirane		4.9	2.2	2	1	2.4	1	2.5			Sweden
9	Vlore		3.0	1.3	2	2	3					Sweden
	TPP general output (Mw)		224	100	22	9	147.4	8	54.1	5	22.5	
	TPP with solid fuels (coal)		35.4	15.8	12	5	12.4	3	12.5	4	10.5	
	TPP with liquid and gaseous fuels		188.6	84.2	10	4	135	5	41.6	1	12	

Energy Resources
Generation, Thermal Power Plants, Perspectives

- The rehabilitation of Fier Thermal power Plant, ROT form, is expected to be carried out by concession by 2009 (the first stage 72 MW and second stage 128 MW after 2013).
- It is also forecasted that Vlora Thermal power plant, 97MW, will be built by 2010.
- Until 2020, it is necessary to install a total of 604MW by building Thermal power plants in order to meet the growing demand and to diversify energy resources.
- Initially, Thermal power plants will use liquid fuel (diesel), because it is expected that Albania will be connected to the international gas network only after 2010.

Thermal power plants	2007	2008	2009	2010	2011	2012	2013 - 2020	Total
Thermal power plant of Fierit (first stage)	Duration of concession and rehabilitation		72					72
Vlora Thermal power plant	Duration of concession and rehabilitation			97				97
Thermal power plant CCGT with distilled oil and natural gas	Design study and duration of concession						435	435
Total			72	169			435	604

Total Generation	2009	2010	2011	2012	2013 – 2020
Thermal power of Fierit	390	390	390	390	390
Thermal power plant CCGT with distilled oil and natural gas		675.3	675.3	675.3	3263
Total generation	390	1065.3	1065.3	1065.3	3653

Investment million Euro	2007	2008	2009	2010	2011	2012	Total
Rehabilitation of Fier Thermal power plant	5.5	10.6					16.1
TThermal power plant CCGT with distilled oil and natural gas	25	67	40	62.0	115.0	68.0	377
Total	30.5	77.6	40	62	115	68	393.1

Situation of the Transmission Network

The transmission network of the Electric System consists of:

- **Transmission lines 400 kv 120.2 km**
- **Transmission lines 220 kv 1102.3 km**
- **Transmission lines 150 kv 34.4 km**
- **Transmission lines 110 kv 1232.1 km**
- **Substation OST 220 kV 11**

- **Currently the main issues are:**
  - **Lack of options to operate in the best way, and the lack of reactive power balance.**
  - **Limited interconnection capability of energy to transmission systems of neighboring countries.**
  - **Worn out monitoring system and inefficient communication facilities that make the system unreliable.**

Situation of the Transmission Network

- Considering the need to improve and develop the main transmission equipment, in order to support the growing capacity of the network, and to import energy, the World Bank and other donors have funded the package for the Rehabilitation Project of the Transmission System.

- The objectives to be achieved in this package are as follows:

  - To improve all standards of quality and efficiency of the entire transmission system.

  - To optimize operation, reduce technical losses, and improve tension profile.

  - To support and develop all intermediary transmission facilities.

  - To establish a new Dispatch Center which will significantly improve the operation of High Tension (HV) lines, prevent emergency situations, improve service in emergency circumstances, and apply energy interruption procedures.

  - To improve efficiency and to expand mutual exchanges with neighboring countries, particularly when the growing demand of Albania for energy requires an increase in imports.

Transmission Network
Master Plan 2007 - 2020

- The master plan aims at satisfying needs with a minimum cost, providing quality service in compliance with the established criteria, making interventions that bring about economic benefit, and meeting technical requirements for a reliable system operation integrated to UCTE.

- The master plan intends to achieve the objective whereby 2% annual losses be 2%.

- Priority projects are as follows:

  - 400 kV Elbasan-Kashar-Podgorice line (2009)
  - National Dispatch Center (2009)
  - 400/220/110 kV substation in Kashar, equipped with two 300 MVA transformers (2009)
  - Double line of Vlora Thermal power plant – Babice (2009)
  - 400 kV Prishtine line (Kosova B (ose C which is expected to be built) Kashar (after the year 2010)
  - 400 kV Macedonia-Albania (Vlore) - Italy inter-system line (after 2011)

- In total, it is expected that:

  - During 2007-2020, 17 new 110kV lines, one 220 kV, and one 400 kV line will be built, and ten current 110kV lines will see upgrades.
  - During this period, four new substations, 220/110 kV will be built, and the installed capacity of four others will increase. As a result, the installed capacity in the Electric system will increase by 850 MVA.

Situation of the Distribution Network

- The following are some figures related to the distribution system:
  - Substation OSSH 110/35 kV 326
  - Distribution Lines TM 13502 km (of which cable line 6/10/20 kV 881km)
  - TM/TU Transformers' cabin 17879
  - Distribution Line TU 24393 km
  - Customers connected to network 971,500 (855,812 are residential)
- Transmission equipment is supplied primarily by the 110 kV line systems and only a small part of the distribution system is directly supplied by the 220 kV transmission system.
- Technology is mainly Russian or Chinese. It is outdated and technical losses are four to five times higher than the normal rate, due to overload.
- A significant number of customers have no meters and receive power illegally.
- Wide usage of power for heating and cooking damages the distribution system, particularly in main cities.

Distribution Network
Master Plan 2007 - 2020

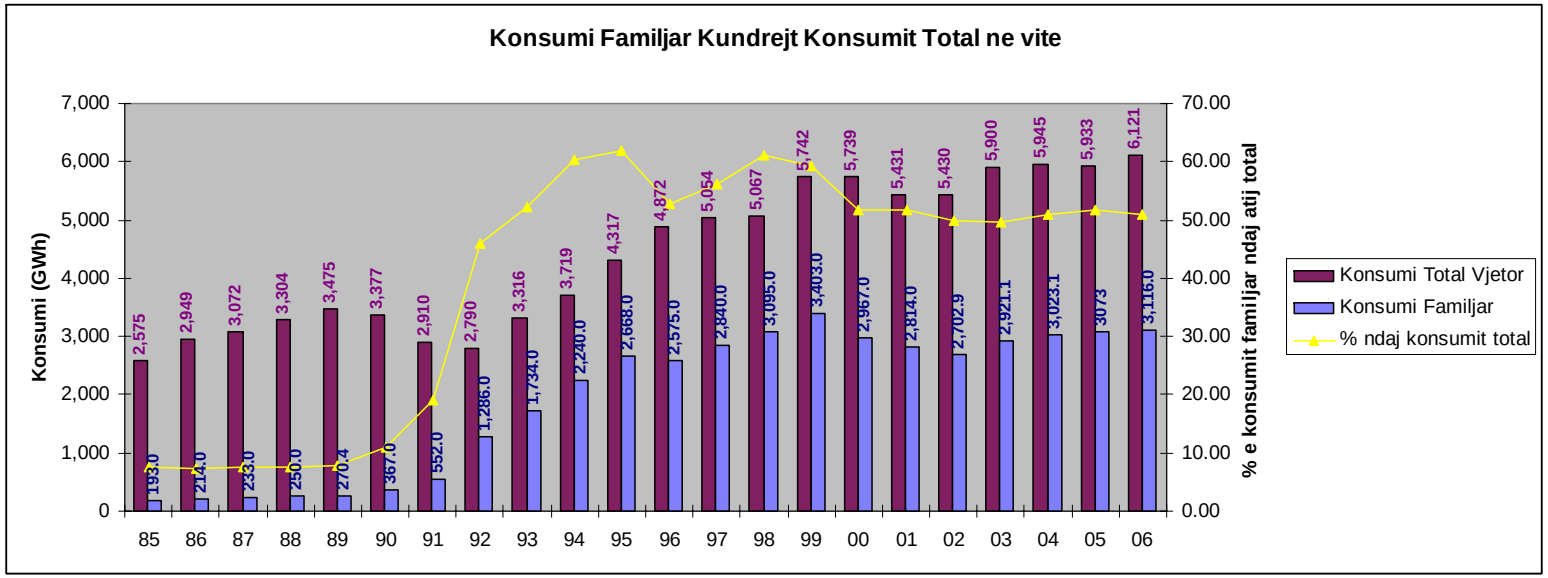
- The objectives of the program are:
- To provide all customers with meters by 2007.
- To minimize illegal connections where possible.
- To gradually replace the 35/10-6kV system with a 110/20 kV system, and establish 20 kV distribution lines in some of the main cities of Albania.
- To upgrade the current transformation centers from 6-10kV up to 20 kV. Build new underground standardized 20/0.4 kV cable centers, with 400 kVA capacity, which will reduce distribution losses from 7.3 to 6 %.
- To establish about 6,800 transformation centers in rural areas, place standardized poles, which will reduce technical losses from 9.8 to 7.3 percent, and to rehabilitate the TU rural network of 12,156km.
- To estimate maintenance cost, cost for new meters, as well as rehabilitation expenses.
- To reduce losses, which in 2020, are expected to be 6%.

Energy Balance and Supply Reliability

- Following are some of the problems encountered in the energy supply:
  - Increased demand for electric power is higher than any other energy resources.
  - Available generation capacity is not sufficient to meet growing domestic demand for electricity, particularly at peak times, even when hydro resources are favorable.
  - Overconsumption of electricity, particularly at low tension levels, has lead to great technical losses in transmission and distribution networks due to overload and other damage.
  - For a better management of Hydro reserves, it is necessary to improve the energy generation structure, i.e. to diversify resources.
  - Due to the current generation capacity and restrictions in available interconnection lines, it is impossible to satisfy the demand for 6.5 TWh/year (year 2006).
  - It has been difficult to guarantee energy imports from other countries of the region, as well as inter-connection capacities needed to transmit this energy to the Albanian border, not to mention that energy import rates have reached very high levels.

Energy Balance and Supply Reliability

- In 2006, 975,042 customers were supplied with energy, of which 860,469 were households and 104,963 were non-residential customers. The annual average increase of customers has been 5%, and in 2006, it was 8%.
- Residential consumption until 1991 accounted for about 8% of total consumption and it currently uses about 51% of total energy consumption.
- In 2006, the energy supply of KESH customers was 6.12 TW. This was the greatest amount ever supplied over the last 25 years.
- The average annual growth of energy supply since 1992 is 4.3%.



Energy Balance and Supply Reliability

- Growing demand for energy does not comply with energy billing as a result of the high level of non-technical losses generated through power theft.
- It is estimated that energy consumption that is not metered is very high compared to real consumption.
- According to estimates, total losses are about 40%. The same figure has been recorded since 2003.
- This implies that whenever KESH generates 1 kWh, the company is able to collect about 0.6 kWh.

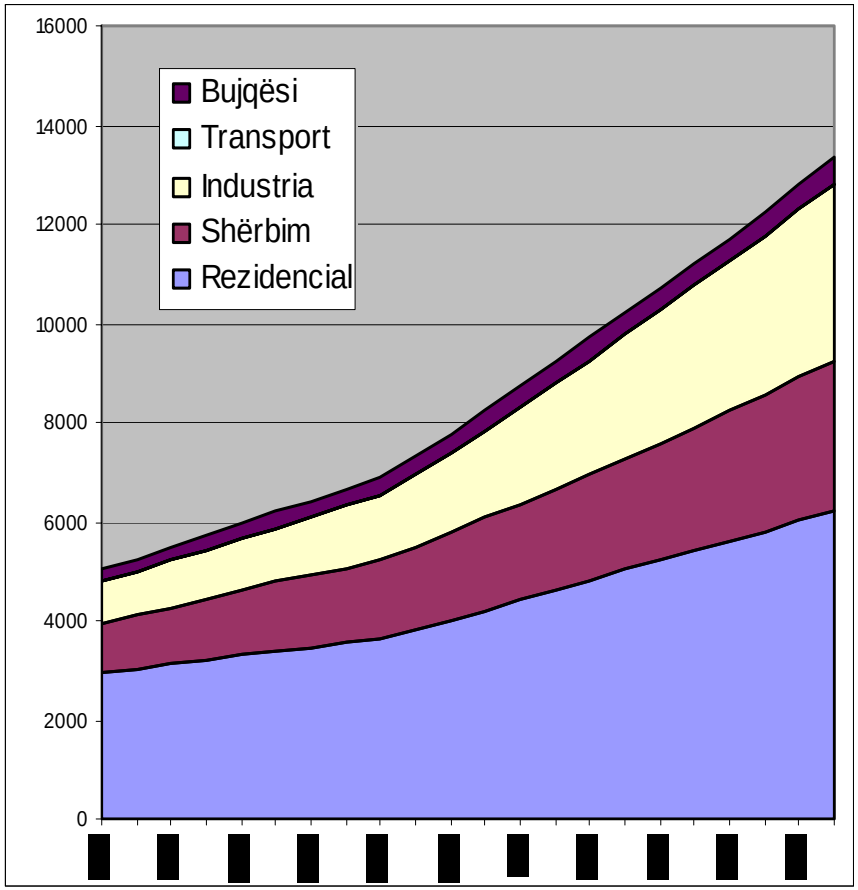
UNIT GWh	2002	2003	2004	2005	2006	2007	2008	2009
DEMAND FOR ENERGY	6200	6408	6428	6640	6465	6659	6855	7061
% INCREASE	--	3.24	0.31	3.19	-3	3	3	3
RESTRICTIONS	851	662	556	760	412	958	0	0
SUPPLIED ENERGY	5349	5746	5872	5881	6056	5701	6855	7061
GENERATION	3038	4748	5394	5357	5451	3813	4254	4867
IMPORTS	2226	916	478	524	2450	1888	2600	2194

Energy Balance and Supply Reliability Scenarios for the Sector Development

- The developed energy strategy is based on the hitherto development of the energy sector, to clearly determine steps to be taken as well as problems that all participants in the sector will encounter.
- The strategy is developed with the assistance of international organizations and the contribution of Albanian institutions.
- The strategy consists of two scenarios: passive and active.
- The scenarios are based on:
  - Both scenarios rely on the same rate of average economic growth of +5% a year.
  - The average annual population growth in the coming years is expected to be 1.1%.
  - The number of apartments from 726,000 in the baseline year (2003) will increase by 35% until 2020

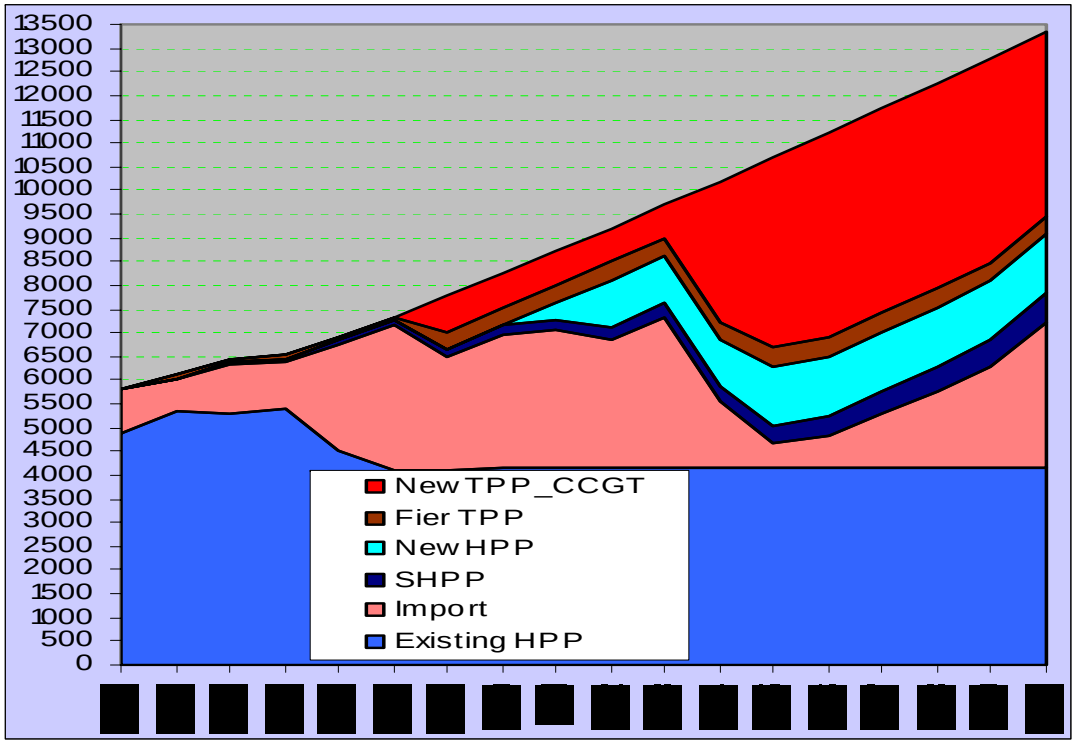
Energy Balance and Supply Reliability
Passive Scenario

- The passive scenario on energy demand reflects energy consumption in the event of outages.
- It does not take into consideration obstacles in implementation, as huge investment are needed. It also does not consider time needed to construct new generation, transmission, and distribution projects necessary to satisfy demand.
- The passive scenario makes energy sector participants aware of the indispensable need to take appropriate actions in order not to allow the energy sector develop spontaneously
- The energy demand estimated in the scenario for 2020 is 13.333 GWh and it is based on a high level of losses, which is 15%.



Energy Balance and Supply Reliability
Passive Scenario

- The figures show power provided by Hydro and Thermal power plants as well as imports
- In 2003, generation by Thermal power plants was 1,43%, and in 2020, it is projected to be 25%
- In 2003, the contribution of Hydropower plants was 98%, and in 2020, it is expected to drop to 75%
- The energy imports trend will keep increasing until 2020
- The import value for 2020 is expected to be 3.077 GWh



Energy Balance and Supply Reliability
Passive Scenario

- Some of the most important conclusions about energy development according to the passive scenario are:
  - The tendency to satisfy needs with our own primary energy resources tends to decrease because it is impossible to meet high demand for energy resources at a time when the primary resources have slightly increased. Furthermore, in order to satisfy needs for power, the electric system has become a net importer.
  - The development of the energy sector according to the passive scenario will lead to an increase of consumption per inhabitant. This will make the economy less competitive as it will increase and impact the cost of products and services.
  - The development of the electric system in compliance with the passive scenario has great economic effects: it increases energy deficiency of the country and brings about significant air pollution.
- In conclusion, this scenario assesses how problematic the development of the electric system is, and if it is implemented, wrong decisions will be made: unnecessary generation capacities will be installed in the energy sector and the national economy and environment will suffer damage.

Energy Balance and Supply Reliability
Active Scenario

- The active scenario supports and promotes the following objectives:
  - Enhances energy supply, reliability, and self sufficiency
  - Diversifies energy resources and uses renewable resources
  - Establishes true energy rates
  - Implements the regional energy market
  - Protects the environment

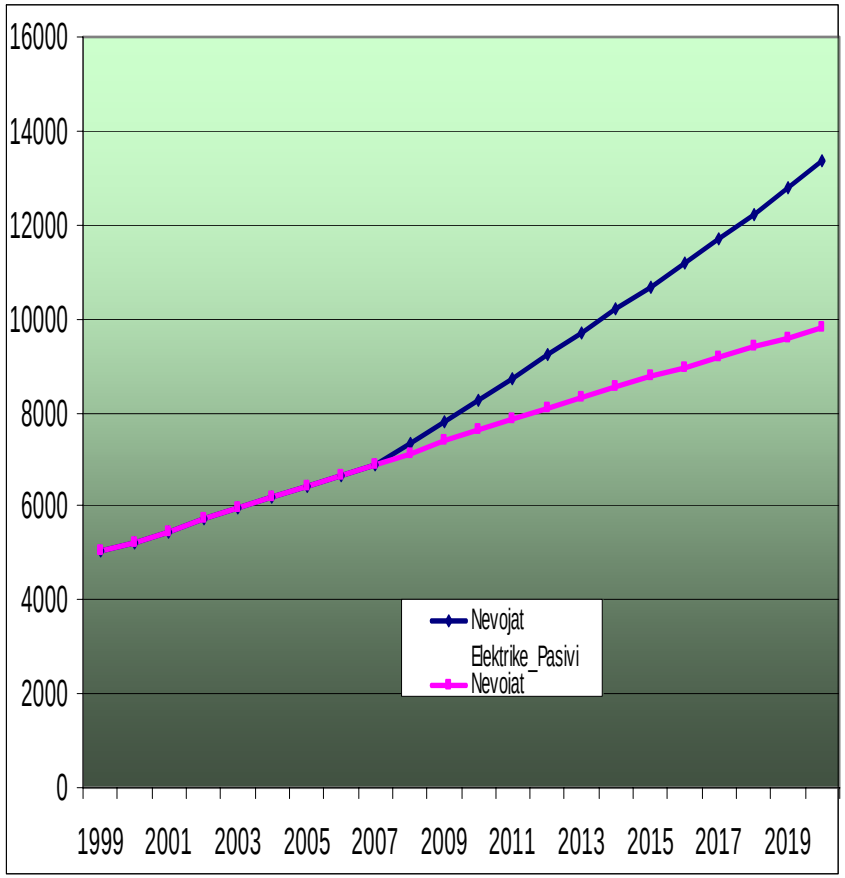
- The active scenario takes into consideration the effective methods for energy efficiency in households and service sector such as:
  - Thermal isolation of buildings that will lead to the reduction of energy needs for heating
  - USE of LPG, and reducing the amount of energy used for heating and cooking
  - Use central heating equipment as well as those for concentrated heating to provide hot water and for heating in skyscrapers
  - Use of solar panels for hot water, which reduces the amount of energy used to this end
  - Use energy efficient bulbs for lighting, which reduces the amount of energy for lighting
  - Gradually introduce co-generating equipment (diesel) and central heating, starting with big consumers (hospitals, dormitories, hotels, etc)
  - Increase efficiency of improved cos(Φ) equipment in pumps, refrigerators, etc.

Energy Balance and Supply Reliability
Active Scenario

- The Active Scenario foresees the implementation of efficient measures in the sector of industry such as:
  - Better energy management in all industrial sub sectors
  - Increase efficiency of existing boilers/furnaces in all industrial sub sectors
  - Substitute fuels such as coal and firewood with oil by-products
  - Improve factor (cosφ) in industrial plants
  - Introduce co-generation schemes in industry
  - Utilize efficient lighting in industry
  - Increase the level of raw materials processing, the quality and value of industrial products
  - Maintain and modernize techniques and technology in the industry
  - Present and implement new and cleaner technologies
- The Active Scenario envisages the implementation of efficient actions in the agricultural sector such as:
  - Apply schemes for using biomass and produce gas from crops and animal waste for heating houses, increase the contribution of renewable resources, reduce cost and pollution
  - Exploit solar collectors that produce hot air for drying different farm crops
  - Utilize existing irrigation reservoirs to install economical generation equipment when it is beneficial (it is possible to install in 20-25 MW)
  - Install 20 Windmills near the 20 water collectors located along the Adriatic coast which are used for protection from floods

Energy Balance and Supply Reliability
Active Scenario

- Excess energy will have a particular impact on reducing the demand for energy in the Active Scenario on sector basis. Energy spared is expected to be 9,796 GWh compared to 13,333 GWh envisaged in the Passive Scenario for 2020.
- Factors that reduce demand for energy will be:
  - Implementation of efficient actions in different sectors of the economy through investments to this end.
  - Introduction of alternatives and competitive energy resources that will reduce energy consumption.
  - Utilization of renewable resources.
- In 2020, excess energy is expected to be 3,537 GWh.



Energy Balance and Supply Reliability
Active Scenario

- Conclusions and Recommendations about the Active Scenario

- Reduce energy consumption according to the economic sectors, increase satisfaction of demand for power and reduce energy imports which is associated with economic savings
- The greatest contribution is expected to be made by the transportation sector (26.2%), the industry sector (22.5%), the housing sector (22.15%), the service sector (17.6%), and the agricultural sector (11.4%) compared to the total of energy resources for 2020.
- Reduced losses in the electric system from planned investments will be 7-10% in 2020.
- The analysis based on the per energy unit cost demonstrates that the best plants are Thermal plants with a combined cycle that cover the load schedule.
- It is necessary to carry out comprehensive studies on the cascades of Vjosa, Devoll, and Osum rivers.
- Total investments needed to satisfy generation demand amounts to 1.015 million Euros and in transmission/distribution to 671.55 million Euros.
- Usage of natural gas is more beneficial for energy generation rather than Thermal Plants that operate on diesel. However, new Thermal Plants that operate both on diesel and natural gas will be built .
- The final conclusion drawn by comparing the two scenarios, based on total investments for 2007 -2020, is that savings from the Active Scenario are valued at 720 million Euros, energy savings are 26.5%, guarantees the same economic development, as well as emits 20-25% less pollutants in the air.

THANK YOU FOR YOUR ATTENTION