REHABILITATION OF THE DOLNA ARDA HYDROPOWER CASCADE

JOINT IMPLEMENTATION PROJECT

BASELINE STUDY

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Abbreviations

EEEA	Energy and Energy Efficiency Act
EPS	Electric Power System
ER	Emission Reduction
ERU	Emission Reduction Unit
EU	European Union
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GTCC	Gas Turbine Combined Cycle
GWh	Gigawatt hours
HPP	Hydro Power Plant
IRP	Integrated Resource Planning
JI	Joint Implementation
kV	Kilovolt
kWh	Kilowatt hours
MEER	Bulgarian Ministry of Energy and Energy Resources
mln.	Million
MOEW	Bulgarian Ministry of Environment and Water
MW	Megawatt
MWh	Megawatt hours
NEK EAD	Natsionalna Elektricheska Kompania EAD
NDC	National Dispatch Center
NPP	Nuclear Power Plant
PDD	Project Design Document
PIN	Project Idea Note
PSHPP	Pump Storage Hydro Power Plant
TPP	Thermal Power Plant
TWh	Terrawatt hours
UCTE	Union for the Co-ordination of Transmission of Electricity
UNFCCC	United Nations Framework Convention on Climate Change

1 Introduction

The first section of this Baseline Study includes a description of the Dolna Arda Joint Implementation Project and the Bulgarian electricity power sector. This is followed by an elaboration of the baseline methodology and a description of the baseline and project scenarios. The study is based on the Integrated Resource Planning (IRP) manager model and the Bulgarian Least Cost Development Plan, which has been prepared by Natsionalna Elektricheska Kompania EAD (NEK EAD).

Although the Republic of Bulgaria's population of 7.8 million people is slightly less than of Austria, it's about 33% larger in size. Located in south-eastern Europe, Bulgaria borders the Black Sea to the east, Greece and Turkey to the south, Macedonia and Serbia-Montenegro to the west, and Romania to the north.

The following four main tasks have been identified as essential for the determination of the baseline and project scenarios for the Baseline Study:

1. Scenario analysis of the electricity demand forecast based on Bulgarian macro economic data forecast.
2. Working out of a Least Cost Plan for the development of the whole EPS by using a software program called "Integrated Resource Planning Manager".
3. Preparing a forecast of the electricity generation that will result from the implementation of the Dolna Arda JI Project.
4. Computation of the CO_2 emissions on the basis of the Least Cost Plan for the electricity generation of the energy capacities (IRP model) in the baseline and project scenarios.

2 Project Information

2.1 Project Abstract

The Dolna Arda Hydropower Cascade Rehabilitation Joint Implementation project consists of four parts:

1. Refurbishment of HPP Kardjali (units 1 to 4)
2. Refurbishment of HPP Ivailovgrad (units 1 to 3)
3. Refurbishment of HPP Studen Kladenets (units 1 to 4)
4. Installation of one additional generating unit in HPP Studen Kladenets (unit 5)

The Dolna Arda project is situated in the regions of Kardjali and Haskovo, which lie in the south-eastern part of Bulgaria. The reservoirs and the power plants within the Dolna Arda Cascade are located close to the town of Kardjali, the village of Madjarovo and Ivailovgrad community. The valley of the Arda River is in the south-eastern part of Bulgaria. The Arda River springs from the middle part of the Rhodopi Mountains, collects the waters coming from several smaller rivers and flows into Maritsa River at the town of Odrin in Turkey.

The Dolna Arda hydropower cascade is situated in the middle and lower part of the Arda River. The cascade consists of 3 reservoirs and HPPs, built in the period from 1958-1971. These are: HPP Kardjali, HPP Studen Kladenets and HPP Ivailovgrad, which are located below reservoirs that have the same names.

The following table gives an overview of the main project parameters.

Dolna Arda Cascade JI Project		
Dolna Arda Cascade capacity before project	MW	259,1
Increase in capacity due to rehabilitation of 3 HPPs	MW	10,6
Increase in capacity due to installation of new unit 5	MW	19,75
Total increase in capacity due to project	MW	30,35
Total increase in power generation due to project	GWh/a	63,6
Construction period		2005-2010

Table 1: Dolna Arda Cascade - main project parameters

The ultimate goal of this project is to increase the performance of an existing hydropower cascade and thus also increase energy production from renewable energy sources. The rehabilitation of three existing hydropower plants (HPP Studen Kladenets, HPP Kardjali, HPP Ivailovgrad) will achieve an increase in the energy generation by approx. **20,9 GWh/a**, and the installation of an additional generating unit in HPP Studen Kladnets will increase the annual power generation by approx. **42,7 GWh/a**. As a result of this project, the total increase in power generation by renewable energy sources in the Dolna Arda Cascade will be **63,6 GWh/a.** Hence, the additional electricity generated by the Dolna Arda Cascade project will replace electricity generated by other power plants in the Bulgarian electric power system.

A detailed description of the Dolna Arda JI Project is included in the Project Design Document chapter A 2.1 and A 6.

2.1.1 Time Schedule

The time schedule for the Dolna Arda JI Project is shown in the following table.

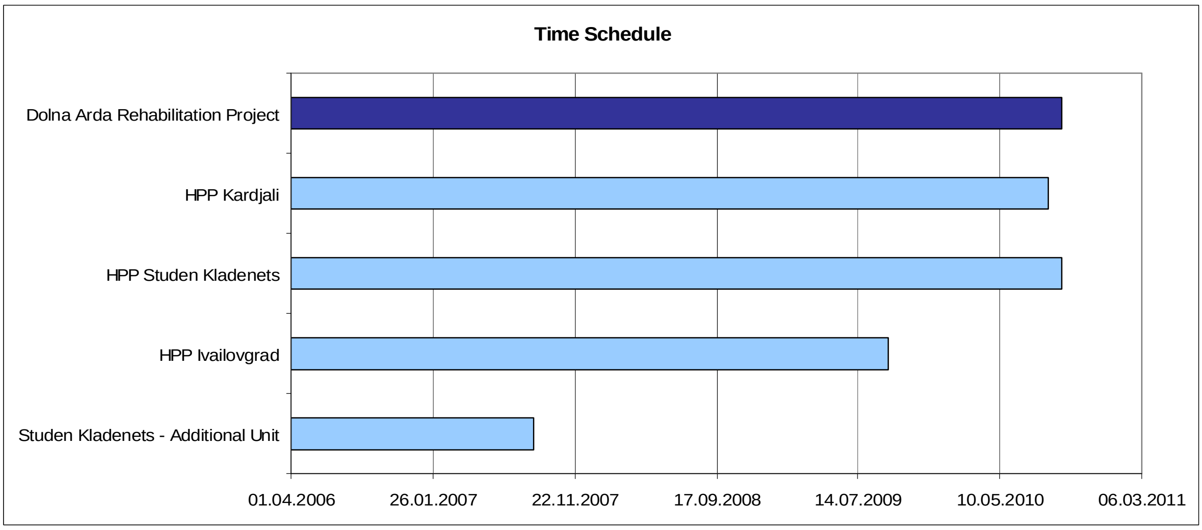


Table 2: Time Schedule Dolna Arda Project

2.2 Project Participants

2.2.1 Project developer

NEK EAD Natsionalna Elektricheska Kompania EAD, Bulgaria
Contact: Mr. Lubomir Velkov - Executive Director
tel.: + 359 2 9879154
fax: + 359 2 9263437

Natsionalna Elektricheska Kompania EAD (NEK EAD) is a sole-owner joint-stock company, which is held 100% by the State and has its headquarters in Sofia. The managing bodies of the joint-stock company are the General Assembly, a five-member Board of Directors and a Procurator. The sole-owner rights are exercised by the Minister of Energy and Energy Resources. One of the main functions of NEK as commercial company is to purchase, transport and sell to high-voltage customers and power distribution companies the electricity generated not only by the company itself, but also by power generation companies (NPP and TPP) within the system of the Ministry of Energy and Energy Resources, private HPP, district heating plants and industrial auto-producers.

The NEK activities are described as follows:
- Generation and transmission of electric power;
- Centralized purchase and sale of electric power;
- Supply of electric power to customers connected to the transmission network;
- Import, export of electric power and energy resources;
- Construction and maintenance of power generation and transmission facilities;
- Investment activities;
- Introduction and promotion of energy efficiency in the generation and transmission of electric power;
- On-line control and coordination of the operation of the National Power System through the National Dispatch Center.

In the beginning of 2003, NEK EAD was the owner of 51 hydro power plants with a total installed capacity of 2.615 MW. In the same year, twelve small power plants with a total capacity of 26 MW were privatized. Therefore, at the end of 2003, NEK EAD was running 39 hydro power plants with a total installed capacity of 2.589 MW.

Transmission of electricity is carried out through the high-voltage power transmission network all over the territory of Bulgaria. It is owned by NEK EAD which is responsible for the technical policy, operation, maintenance and development of the power transmission facilities encompassed by the national energy ring.

Another task of national importance that the company performs through the National Dispatch Center is to act as the operator of the power transmission system of the Republic of Bulgaria. In this respect the National Dispatch Center (NDC), in its capacity as a specialized unit of NEK EAD, performs the functions of real time dispatching of the Electric Power System (EPS) of the Republic of Bulgaria and ensuring the reliable power supply.

For further information please see PDD chapter A.3.1 and http://www.nek.bg.

2.2.2 Project Partners

- **VA TECH HYDRO** GmbH & Co, Vienna
  Responsibility: electrical and mechanical part of the project
  Contact: Mr. Herbert Holzinger
  Tel.: +43 1 89100 2671
  Fax: +43 1 89100 3757
  http://www.vatech.at

The project team comprises environmental, technical, economic and legal experts, and very successful cooperation between NEK EAD and VA TECH HYDRO was experienced in the past during similar projects, such as the Tsankov Kamak Vacha Cascade project in Bulgaria.

3 Baseline Determination Methodology

3.1 The Bulgarian Experience with JI and Baselines

Bulgaria has complied with the requirements of the UNFCCC, and the government ratified the Kyoto Protocol on 17 July 2002. During the First Commitment Period (2008-2012), Bulgaria's total greenhouse gas emissions are expected to be below the agreed target of 92% compared to the base year. A national action plan on climate change was adopted in 2000, which promotes the participation in the Kyoto Flexible Mechanisms, namely Joint Implementation and Emissions Trading. Participation in the Kyoto mechanisms has been given high priority.

In 2002, the Republic of Bulgaria and the Republic of Austria signed a Memorandum of Understanding (MoU) regarding bilateral co-operation for the realisation of Joint Implementation projects to reduce GHG emissions under Article 6 of the Kyoto Protocol (see Annex 10.1).

In Bulgaria, JI is seen as an economically feasible method for reducing GHG emissions while simultaneously receiving economic, technical and expert assistance. The potential for emission reduction in Bulgaria is large; however, the Dolna Arda Cascade Joint Implementation Project is regarded as a pilot project that will assist in gaining valuable experience in the field of Joint Implementation.

The Ministry of Environment and Water (MOEW) plays a leading role in the development and enforcement of the climate change policy. The Bulgarian Joint Implementation Unit was established on 1 July 2000 and is part of the MOEW. The staff of the JI Unit Bulgaria assists in JI policy development, co-ordinates the JI activities, performs negotiations on the transfer of ERUs, and maintains close communication with the project developers. The unit includes a senior expert, who is the national contact point for the UNFCCC, as well as several supporting experts.

Ministry of Environment and Water
Contact: Ms. Daniela Stoycheva (State expert, National Focal Point on UNFCCC)
67, W. Gladstone Str.
BG-1000 Sofia, Bulgaria

Ms. Ivona Grozeva (Senior Expert)
Ms. Milia Dimitrova (Junior Expert)

The activities of the unit are complemented with the support of experts from other relevant institutions.

The decision process for JI projects in Bulgaria is as follows:

1. Request from the project developer for issuance of Letter of No Objection by the Ministry of Environment and Water
2. Endorsement of the project as a JI project on the basis of Project Idea Note (PIN)

Procedures for issuance of a Letter of No Objection:
- general project evaluation and internal endorsement
- issuance of Letter of No Objection

3. Request from the project developer for issuance of Letter of Approval from the Ministry of Environment and Water
4. Approval of the JI project on the basis of validated Project Design Document (PDD) (Letter of Approval)
   Procedures for issuance of Letter of Approval by the host country:
   - Project evaluation according to the national criteria by the Steering Committee[1] for JI projects
   - Recommendation to the Minister of the Environment and Water for approval/rejection of the project
5. Issuance of Letter of Approval by the host country. The project has to be approved by the investor country as well.
6. Signing an Agreement about the purchase of the emission reduction.
   This agreement should be signed between the project developer and the "buyer". It should contain the exact amount of emission reductions that will be transferred and the price.
7. Start of the project

3.2 Baseline Methodology Review

The baseline for this project is the scenario that reasonably represents the anthropogenic emissions by sources that would occur in the absence of the project (business-as-usual-scenario). The baseline, which is calculated in a methodological way, is compared to the project's emissions, and thus the generated ERUs can be calculated.

3.2.1 General options

The most important question to be answered when asking for the most probable baseline scenario for the proposed project is: How would the electricity produced by the proposed hydropower project be produced in absence of this project and which are the main determinants for answering this question?

Baseline methodologies fall into two broad categories, project specific and multi-project approaches. The following list provides an overview on the most commonly used methods. Many more are mentioned in literature[2], but they can be considered to be adequately covered by the list below.

The following basic options of baseline methodologies have been dealt with:

- project-specific baselines:
  - control group
  - investment analyses
  - scenario analyses
- standard oriented/ multi-project baselines

[1] The Steering Committee consists of 12 members – representatives of relevant Ministries and institutions.
[2] Sources among others: PCF, Ministry of Spatial Planning, Housing and Environment/NL, IEA, OECD

Project-specific baselines

When regarding project-specific baselines, it is often argued that project type, project size and data availability are the main factors determining the choice of the baseline methodology.

The **control group** approach asks for finding a similar country/region/project with circumstances comparable to the project area in order to monitor developments without a JI project. A control group defining a very similar situation of electricity generation in another country would be hard to find due to historically different circumstances regarding natural resources, technology, economical aspects, status and policy of market liberalization, etc.

The **investment approach** identifies all conceivable and realistic development alternatives taking into consideration technical, economic, political, social and environmental aspects and ranks them according to their economic benefit, e.g. through determining the Internal Rate of Return. The alternative with the highest return is defined as the baseline alternative. Due to the fact that economic aspects are the key determinants for this aspect, this approach asks for a decision model driven mainly by economic forces and the clear comparability of different options.

The potential for using the investment analysis in the electricity sector is very limited, as generally new projects are competing against a mix of production units in the electricity sector. Only very rarely a new project is directly competing against an existing unit. So the investment approach is not considered to be suitable for the electricity sector.

(Risk-based) **scenario analyses** investigate possible development scenarios without the project taking into consideration various influencing factors such as technology, policy or market constraints. Options leading to a too high risk are ruled out and the most probable scenario is chosen as the baseline. The main challenge of this approach is to select the most important influencing factors and to identify the best/most reliable data sources for the investigation.

Multi-project approaches

There are a number of different approaches for multi-sector baselines. They may range from average emissions rates for a sector to technology standards to comprehensive modeling within a particular sector (e.g. a least cost dispatch analysis of the electricity sector). Despite the variety of approaches the outcome remains the same, which is to provide a set of standard figures to be used as a baseline for a number of different projects. These can also be benchmarks and – like for the project-specific baselines – would be expressed in the form of an emissions rate per unit of activity (e.g. tonnes CO_2 /GWh).

The multi-project approach is advocated because using such methods will significantly reduce transaction costs for JI projects. That is, the costs of developing baselines for JI projects will be much lower when developed in countries that already have multi-project baselines and therefore the costs to project developers and investors are lowered considerably. This approach will therefore also promote the number of projects that are implemented through these mechanisms as well as promote the implementation of the smaller sustainable energy projects. Additionally there will be more predictability for the project developer on the number of ERUs that will be acquired from a project.

Especially for hydropower plants, a multi-project approach for the baseline seems to be a viable and efficient solution.

3.2.2 Multi-project baselines for the electricity sector

For the electricity sector, multi-project baselines have been widely used in JI and CDM projects. The reason for this is that the implementation of one project has (marginal) implications on the entire electricity sector. Hence, project-specific baselines are not adequate and multi-project approaches are preferred.

In the following section, the different baseline methodologies based on multi-project approaches are analysed and their adequacy for the proposed project is investigated. Institutional conditions, the data availability, and the specific feature of the Bulgarian electricity sector have to be taken into account when finally selecting the most appropriate baseline methodology.

Average emissions rate (all plants)
This is by far the simplest methodology for determining the baseline. It assumes that the project will displace a part of the overall electricity generation mix. The problem with this method is that it will include all plants with low operating costs that would normally operate as a base load, including hydro or nuclear. However, it is unlikely that a new investment would displace generation from these plants and far more likely that an investment would displace the plants with higher operating costs such as oil and gas plants. This methodology may therefore not be accepted by investor countries, particularly when there is a large proportion of hydro and nuclear in the host country’s generation mix.

Average emissions rate (excluding nuclear and hydro)
Certain technologies will continue to operate despite the introduction of a JI project. The best example is storage hydro, which is extremely flexible and tends to operate at periods of high load. This is not because of high operating costs, but rather due to the ability to shift the hours of generation.

There is a trend in baseline determination to eliminate generation from all hydro and nuclear because the low operating costs mean that their generation will not be influenced by new plants in the grid. If hydro and nuclear are excluded from the baseline, the assumption needs to be clearly documented and justified.

This approach attempts to deal with the issues associated with just taking an average of the system; nevertheless, the accuracy is still questionable. The benefit of this approach is that it will give a mix of all loads which the project will displace; however, it will not give a weighted average according to the running costs.

Average emissions for each load category
This method involves grouping the load profile into different load categories, such as seasonal, peak, shoulder and base loads. Having identified the load profile of the project, a direct comparison can be made with the same load category in the baseline projections.

Marginal plant only (Least cost dispatch analysis)
The least cost method assumes that the plants running at the margin (with the highest cost) will be the first to be replaced. The method should show the generation by each plant for each hour (or group of hours) in the year. The assumption is that the introduction of the new capacity will push out plants that are currently operating at the margin in the load duration curve. This analysis would require an evaluation of the last unit(s) to be switched on for each hour (or group of hours) in the year and thus the hourly marginal emissions rate. This type of approach is thought to be the most accurate in terms of which unit will actually stop generating. The negative aspect is the relatively high quality and quantity of data necessary for this method.

Operating margin/build margin (UNFCCC – ACM0002)
The approved consolidated baseline methodology ACM0002 of the UNFCCC for grid-connected electricity generation from renewable sources foresees the calculation of a combined margin which consists of the operating margin and build margin. This is based on the assumption that electricity generated by the project would have otherwise been generated by the operation of grid-connected power plants (operating margin) and by the addition of new generation sources (build margin). The baseline emission factor is then calculated as a weighted average of the operating margin emission factor and the build margin emission factor.

3.2.3 Conclusion

Average emissions rate (all plants)
The average emissions rate is the simplest to define. For the proposed project this approach is too inaccurate for the purpose of determining the CO_2 emission reductions and is therefore eliminated.

Average emissions rate (excluding nuclear and hydro)
This methodology is the same as the first but simply excludes nuclear and hydro from the baseline emissions as they have low running costs and thus are unlikely to be displaced. This methodology has been used quite widely for projects, but it is still a relatively rough methodology and is only recommended if there is a relatively small volume of emission reductions to be issued in the sector. Due to the character of the Dolna Arda Cascade, a more detailed analysis is considered to be useful.

Average emissions for each load category
This approach does not provide additional benefits compared to the previous two methodologies and is again a rough approach and does not go much further in defining what would actually be displaced by the new capacity.

Marginal plant only (Least cost dispatch analysis)
The least cost dispatch analysis for the electricity sector sets out in economic terms which technologies or specific generating units are likely to be displaced by new generation in the grid. This may provide a realistic picture of what is actually displaced, particularly in opening electricity markets.

This method requires detailed information regarding the applied dispatch model in Bulgaria i.e. an evaluation of the last units to be switched on for each hour in the year. Power stations with a guaranteed supply agreement have to be taken into consideration. As discussed with NEK and the National Dispatch Center the current data made available show that there is enough level of detail to perform this least cost dispatch analysis.

Operating margin/build margin (UNFCCC – ACM0002)
This approach is a combination of the operating margin with the build margin. It can be applied to countries where the capacity in the electricity system is extended. This leaves however the difficulty of defining the weight between the operating and the build margin. As capacity extensions will only have a limited role in the Bulgarian electricity sector, the operating/build margin is not recommended for an evaluation of the proposed project.

3.3 Selection of the Baseline Methodology

Following the argumentation above and the conclusions of the discussion with NEK EAD and National Dispatch Center, the proposed baseline methodology should elaborate the **‘Marginal plant only (Least cost dispatch analysis)’**. This type of approach is seen to be the most accurate when analyzing which unit will be replaced by a new capacity.

The least cost dispatch approach analyses the electricity sector on the basis of electricity demand, price and cost estimations and gives the marginal plant in each hour of the year. For the analyses required for the Dolna Arda Cascade Joint Implementation Project, the computer model ‘Integrated Resource Planning Manager Model’ (IRP Manager Model) is available at NEK EAD. The IRP model provides and co-ordinates an expansive „Tool Box“ of integrated resource planning capabilities, including chronological simulation of demands and resources, automated resource strategy development, decision analysis, and complete forecasts of impacts from all perspectives. A detailed description of the IRP model is shown in chapter 10.3

Annex: The IRP Manager Model.

3.4 Project boundary

The baseline methodology determines the baseline scenario for the project within the following boundaries. The electricity generated by the Dolna Arda Cascade JI Project will be delivered to the Bulgarian Electric Power System. The National Dispatch Center (NDC), in its capacity of system operator, performs the function of real time dispatching in the EPS of the Republic of Bulgaria.

The project boundary is defined by emissions sources directly affected by the project operation of the Dolna Arda Cascade project. Since all power plants at the Bulgarian EPS are potentially affected by the operation of the Dolna Arda Cascade Project, the project boundary comprises the whole Bulgarian Electric Power System. Therefore, the project boundary is defined as the Bulgarian EPS.

3.5 Indirect Emissions Effects (leakage)

Indirect emission effects are changes in emission levels that are caused by the project but occur outside of the baseline and project boundaries. Indirect effects can be positive or negative. If indirect effects are significant, calculated emission reductions within the project boundaries must be corrected for leakage. In the case of the Dolna Arda Cascade JI Project, no identifiable leakage will occur, and thus the expected result would imply no leakage.

4 The Bulgarian Electricity Sector

4.1 Short History of the Bulgarian Electricity Sector

The Bulgarian electricity sector was dominated by the vertically integrated state-owned Natsionalna Elektricheska Kompania (NEK) until its unbundling in 2000. NEK has been converted to a transmission company with a single buyer division, transmission system maintenance division, hydro power plants enterprise, and dispatch center (Operator of the power transmission system: National Dispatch Center NDC). The NDC, in its capacity as a specialized unit of NEK EAD, performs the functions of real time dispatching of the electric power system of Bulgaria. Its main assignment is to guarantee reliable and economic operation of the Bulgarian electric power system.

The following figure gives an overview on the Electric Power Sector in the Republic of Bulgaria.

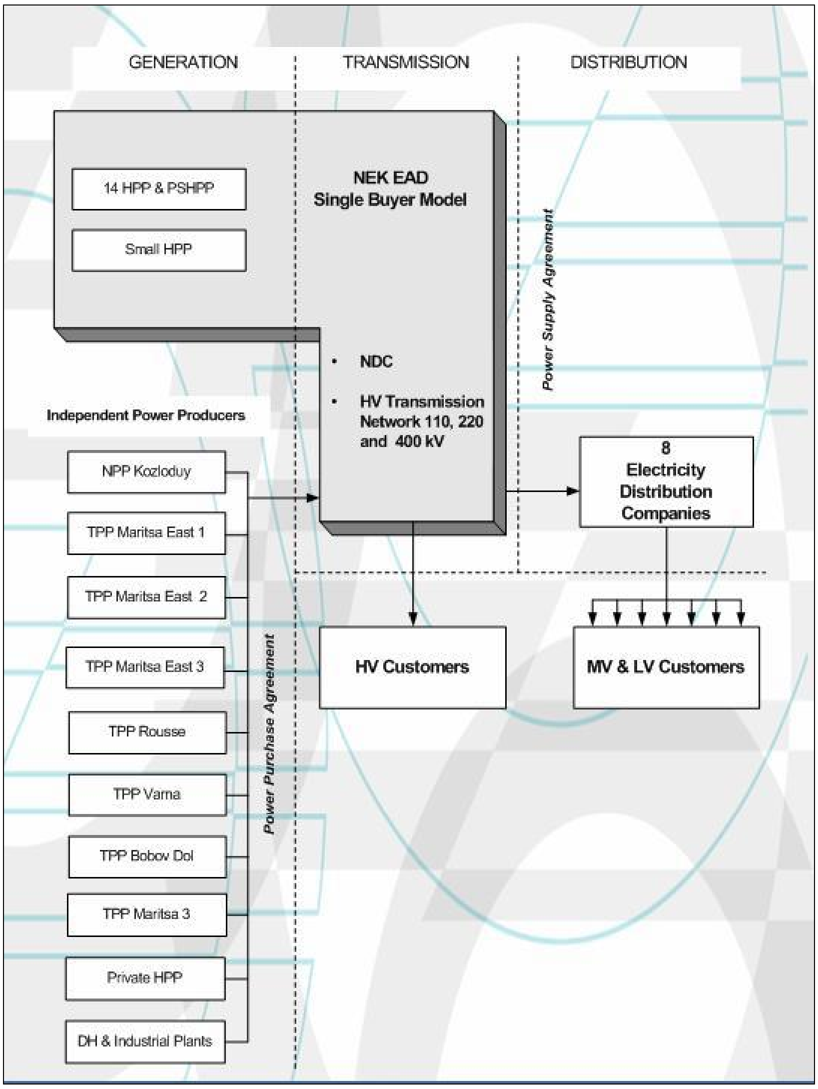


Figure 1: Bulgarian Electric Power Sector

Bulgaria is dependent on imports for 70% of its energy supplies. With virtually no supplies of oil and small reserves of gas, Bulgaria has had to pay for energy in hard currency at world market prices, resulting in less reliable supplies or price fluctuations.

The installed capacity of the Bulgarian power system in 2004 was 12.331 MW. A historical summary of installed electricity generating capacity in the Bulgarian EPS is shown in the following table.

Installed Electricity Generation Capacity							
	Unit	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Hydroelectric	MW	2.839	2.839	2.839	2.839	2.838	2.838
Nuclear	MW	3.760	3.760	3.760	3.760	2.880	2.880
Geothermal/Solar/Wind/Biomass	MW	0	0	0	0	0	0
Conventional thermal	MW	6.487	6.477	6.412	6.477	6.613	6.613
Total Capacity Installed	**MW**	**13.086**	**13.076**	**13.011**	**13.076**	**12.331**	**12.331**

Table 3: Installed Capacities 1999-2004

An historical summary of Bulgarian electricity net generation and net consumption is shown in the following table.

Bulgarian Electricity Generation and Consumption							
	Unit	1999	2000	2001	2002	2003	2004
Net Generation	**GWh**	**34.298**	**36.887**	**39.618**	**38.595**	**38.428**	**37.598**
hydroelectric	GWh	2.934	2.881	2.021	2.708	3.276	3.246
nuclear	GWh	14.529	18.449	18.237	18.949	16.040	15.596
geo/solar/wind/biomass	GWh	0	0	0	0	0	0
conventional thermal	GWh	16.835	15.557	19.360	16.938	19.112	18.756
Net Consumption*	**GWh**	**25.522**	**25.486**	**25.800**	**25.312**	**26.430**	**26.359**
Imports	GWh	1.670	964	1.092	2.040	1.283	741
Exports	GWh	3.627	5.584	8.017	8.335	6.772	6.620
Net Exports	GWh	1.957	4.620	6.925	6.295	5.489	5.879

*Final consumption in the country

Table 4: Electricity Generation and Consumption

Over the past 6 years, the Bulgarian electricity net generation has increased by 10%, with a peak in 2001. In accordance with the Bulgarian government's commitments to the European Union and as confirmed by a decision of the Bulgarian Council of Ministers, units 1 + 2 of Kozloduy NPP were disconnected from the Bulgarian EPS at the end of 2002. As a result the net generation from nuclear sources decreased in 2003.

Bulgaria is a major exporter of electricity, supplying power to Turkey, Greece, Yugoslavia, Macedonia, and Albania. In 2004 Bulgaria exported about 6.620 GWh, with the majority of the exported electricity going to Turkey.

4.2 Current status of the Bulgarian Electricity Sector

4.2.1 Generating Capacities

In 2004, the Bulgarian EPS had a total of 12.331 MW installed generating capacities consisting of:

	Installed Capacities 2004		*Available Capacities 2004*	
Category	**MW**	**%**	**MW**	**%**
Thermal Power Plants	6613	53,6%	5015	52,7%
Nuclear Power Plants	2880	23,4%	2700	28,4%
Hydro Power Plants and Pumped-Storage HPPs	2838	23,0%	1800	18,9%
Total	**12331**	**100%**	**9515**	**100%**

Table 5: Installed and Available Generation Capacities 2004

4740 MW of the thermal power plants are public utilities, 880 MW are co-generation plants which have the main purpose of supplying heat to towns, and 993 MW are co-generation plants that belong to large industrial enterprises.

Thermal power plants (52,7%) and nuclear generation (28,4%) dominated the available generation capacities.

The **available capacity** of the existing power generating resources, however, is considerably lower than their installed capacity and amounts to about 9515 MW. This difference compared to the installed capacity is mainly caused by the following factors:

- Due to economic reasons, district heating plants do not operate at their total installed capacity, but only at the level corresponding to the heat load in combined electricity and heat generation, which amounts to **about 460 MW.**

- After privatization, the existing industrial co-generation plants considerably decreased their available capacity due to closure of companies and decrease of the heat load. Thus, out of 993 MW installed capacity in the large industrial plants, currently their available capacity is **about 400 MW**.

- HPP and PSHPP together participate in covering the maximum load in the system during a moderately humid year with **1800 MW** total capacity.

- Part of the installed capacity of the existing thermal power plants cannot be reached due to wear of their facilities. Thus, of 4740 MW of installed capacity in large thermal power plants, the available capacity is **about 4155 MW** (or 12,3% less).

The age structure of thermal power plants and nuclear units shown in the table below is very similar to that of other European countries and demonstrates the need for rehabilitation. Investments in rehabilitation will also take place in the Bulgarian energy sector in the coming years (see Chapter 6).

Age Structure of Power Plants						
	over 35 yrs.	31-35 yrs.	26-30 yrs.	21-25 yrs.	16-20 yrs.	below 15 yrs.
TPPs	24,8%	17,4%	12,7%	25,5%	10,9%	8,7%
District heating TPPs	59,0%	0,7%	19,2%	6,0%	15,2%	0,0%
On-site TPPs	41,2%	33,0%	1,0%	12,4%	5,0%	7,4%
NPPs	0,0%	0,0%	0,0%	30,6%	34,7%	34,7%

Table 6: Age Structure of Bulgarian Power Plants

4.2.2 Transmission Infrastructure

Bulgaria's high-voltage power transmission network consists of transmission lines of 750 kilovolt (kV), 400 kV, 220 kV, and 110 kV; step-down substations; one 400 kV switching station; and medium and low voltage distribution networks that supply the industrial, public and residential customers. The system of 400, 220 and 110 kV lines, which has a total length of about 14.427 km, operates in a ring mode. The 750 kV-line runs along a total distance of 235.4 km from Varna in Bulgaria to Isaccea in Romania (85 km on Bulgarian territory), and it is operated at 400 kV.

An overview of Bulgaria's high-voltage electricity grid system is shown in Figure 2.

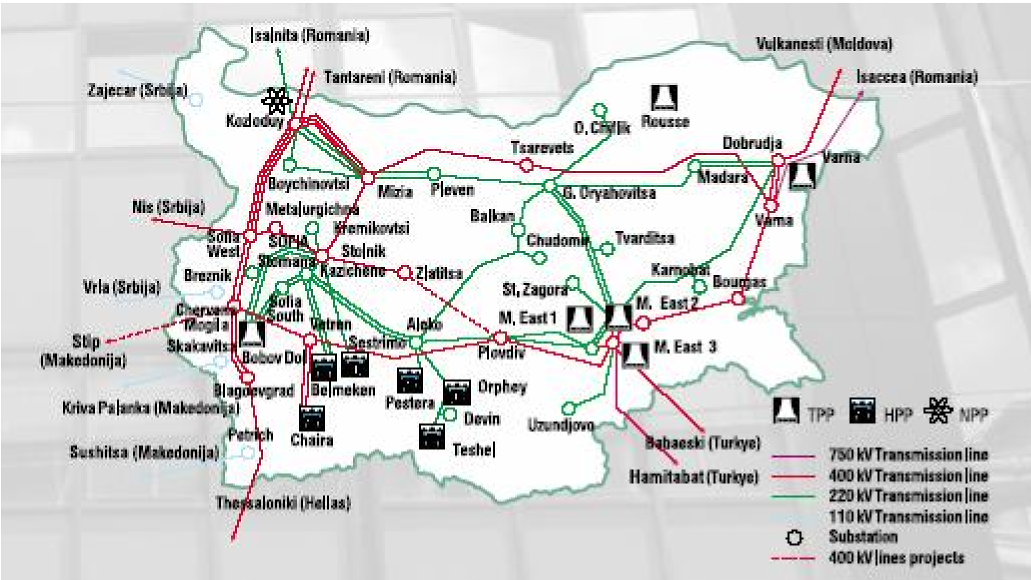


Figure 2: Bulgaria’s High-Voltage Electricity Transmission System

5 Bulgarian Electricity Demand Forecast

5.1 Background

Pursuant to the provisions of the existing Energy and Energy Efficiency Act (EEEA) in Bulgaria, NEK EAD prepares short-term and long-term forecasts of the electricity demand in the country as well as short-term and long-term least cost development plans for the development of the electric power system. The latest Least Cost Development Plan of the Bulgarian power sector for the period 2004-2020 was published in April 2004, and it is used as a reference in this baseline study. It reflects the latest forecast macro-economic data for the Republic of Bulgaria, developed by the Economic Analyses and Forecasts Agency (EAFA) in 2004, as well as the considerable changes that have occurred in the structure of the electricity sector in the recent years. The plan is based on the national priorities and principles of market integration. It implies the requirements for a stable economic growth and adequate way of living under the expected conditions of national economy growth.

The Bulgarian forecast of generation requirements for the power system is prepared by NEK. A number of scenarios have been worked out for the electricity sector development in the country until 2020. All scenarios are developed by taking into account the same energy fuel price forecast, which are based on the forecasts from the study by the International Energy Agency - *World Energy Outlook 2000*. Out of these scenarios, 2 scenarios have been identified as most likely to represent the future development of electricity demand in Bulgaria. These scenarios have been named “Minimum” and “Maximum” and are described in the following chapter.

5.2 Minimum and Maximum Scenarios

NEK’s forecasts involve the so-called “maximum” and “minimum” scenarios. The main difference is the assumption on the rate of improvement of energy efficiency that the Bulgarian economy would achieve over time.

5.2.1 Macro-economic Determinants

The forecasts of **electricity demand** in the country directly and indirectly imply the macro-economic growth forecast for Bulgaria. The most frequently investigated macro-economic indicators influencing electricity demands are:

- Gross Domestic Product (GDP) and its structure
- Development of the GDP structure by major branches: industry, agriculture, services
- Inflation rate
- Population
- Electric power price
- Per capita income by current and comparable prices

The envisaged rates of GDP growth in the period under consideration are as follows:

GDP 2003-2020	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rate of GDP Growth	4,3%	5,6%	5,3%	5,5%	5,5%	5,5%	5,5%	5,5%	5,5%	5,5%	5,5%	5,5%	5,5%	5,5%	5,0%	5,0%	4,5%	4,0%

Table 7: GDP 2003 - 2020

5.2.2 Electricity Demand

The total electricity demand forecast for Bulgaria consists of the following forecasts:

- public sector demand
- household sector demand
- house consumption of power plants
- transmission and distribution losses
- electric power export

Public sector demand
For the public sector electricity demand forecast, the macro-economic development data for Bulgaria as well as forecasts of electricity intensity by sectors of the economy (Industry, Services, and Agriculture and Forestry) are used.

All assessments made by local and foreign macro-economists show that the GDP electricity intensity in Bulgaria is several times higher compared to West European countries. So, a policy that improves this factor will be a major priority in the economic development in the forthcoming years.

The following table shows a forecast of electricity intensity for electric power consumed in the public sector with respect to the GDP.

Electricity Intensity per GDP		
Phases	**Minimum Scenario kWh/BGL**	**Maximum Scenario kWh/BGL**
2002 - 2005	from 1,27 to 0,99	from 1,27 to 1,01
2006 - 2010	0,83	0,84
2011 - 2015	0,69	0,73
2016 - 2020	0,63	0,69

Table 8: Electricity Intensity 2002 – 2020

Household sector demand
For the household sector electricity demand forecast, the input data are: population forecast, household income forecast, electricity price forecast, and the forecast of electric power saving in the households.

In order to forecast the electricity demand of the households, the following function is applied:

$E = \alpha + \beta I + \gamma P + \delta N$, with a multiple correlation factor R = 0.9987.

E – average household electricity demand;
I – average household income;
P – average household electricity price;
N – number of households.

The sum of the public sector and household sector electricity demand forecasts forms the end-consumer electricity demand forecast.

House consumption by power plants; Transmission and distribution losses
In the next step, a forecast of house consumption by power plants as well as the transmission and distribution losses is made. For this purpose, the period 1990-2003 was analysed and it was found that electric power consumption for the house load of power plants will be 10-10,5% of the gross electricity production. Furthermore, the transmission and distribution losses were found to be very high, reaching 18% of distributable electric power. The decrease of process losses in the future is one of the main methods of reducing electricity intensiveness in Bulgaria.

Electric power exports
The final element in the electricity demand forecast is the export of electricity. In the Least Cost Development Plan, an annual export of 5000 GWh is assumed until the end of 2006. At the end of 2006, two units in the Kozloduy NPP will be decommissioned in order to comply with EU recommendations. Hence, it is assumed that 1500 GWh of electricity will be exported annually after 2006.

Electricity demand forecast
Thus, the electricity demand forecast for Bulgaria is equal to the sum of the following forecasts: public sector, household sector, house consumption by power plants, transmission and distribution losses, and exports.

The following table shows the electricity demand forecast:

Electricity Demand						
		2000	**2005**	**2010**	**2015**	**2020**
Minimum scenario growth	GWh/a	41307	42190	41760	45250	50370
Maximum scenario growth	GWh/a	41307	42850	42490	47940	55690

Table 9: Electricity Demand Forecast 2000 - 2020

These analyses demonstrate the increasing trend of electricity demand in Bulgaria, except for a decrease after the year 2006 due to the decommissioning of Kozloduy NPP. Furthermore, the assumptions lead to different electricity demands in the different scenarios. This forecast is illustrated by the following figure.

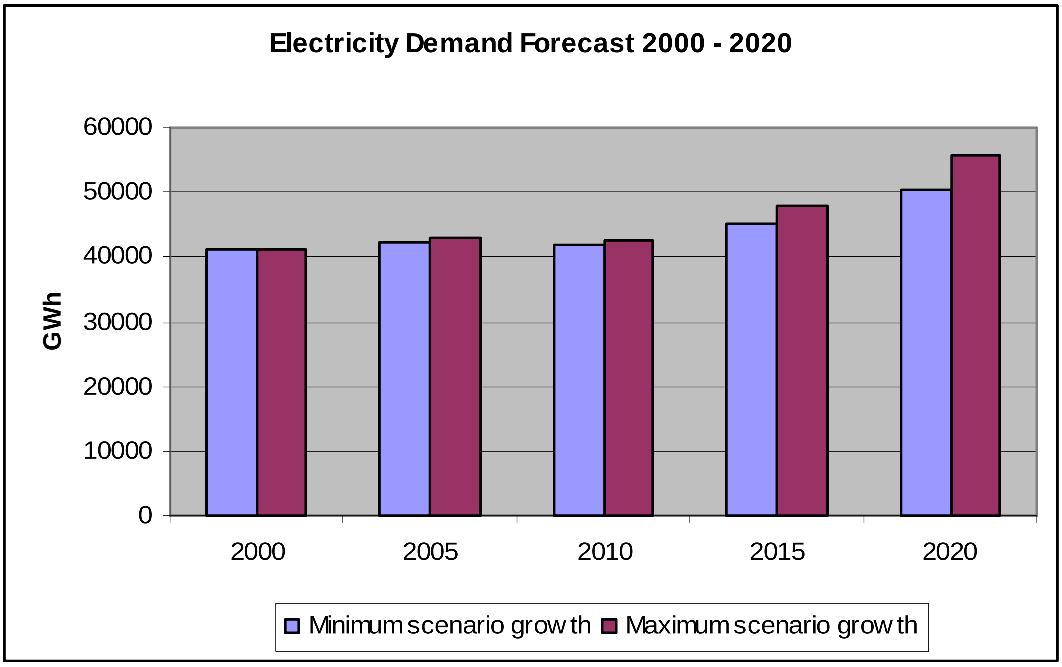


Figure 3: Bulgarian Electricity Demand 2000 – 2020

The Minimum scenario reports an electricity demand of 41.307 GWh in 2000 and 50.370 GWh in 2020, which means an increase of about 21,9%. During the same period, the Maximum scenario shows an increase of the electricity demand from 41.307 GWh to 55.690 GWh (34,8%).

5.2.3 Electricity Imports / Exports

The Bulgarian Electric Power System has established stable connections with the electricity systems of the neighbouring countries. The Government Energy Policy envisages development of Bulgaria as a regional electricity supplier. The Bulgarian EPS is already part of the UCTE, which will result in expansion of the export possibilities of the system. For the period up to 2006, annual exports of 5.000 GWh have been assumed. After 2006, the annual exports will be decreased to 1.500 GWh due to the decommissioning of the nuclear power plant Kozloduy (units 3 and 4).

The analysis of the electric power systems development in the **Balkan countries** and the possibilities for electricity import from countries outside the Region after the year 2005 shows the following exports and imports in the Balkan region:

Exports / Imports		
Country	**Import GWh**	**Export GWh**
Albania	1000	-
Bosnia & Herzegovina	-	2000
Serbia	-	1000
Montenegro	4000	-
Macedonia	1000	-
Croatia	8000	-
Romania	-	5000
Greece	3000	-
Turkey	6000	-
Non-Balkan countries	-	6000
Total	**23000**	**14000**

Table 10: Balkan Countries Export and Import

The expected shortage of electricity is 9000 GWh. Over the next decade, electricity demand in the Balkan region is expected to increase by approx. 130 TWh. In conclusion, if Bulgaria manages to rehabilitate its capacities soon and completes its investment program in the electricity sector, it could establish itself significantly in the region with the expected energy deficiencies after 2010.

5.3 Decision on the scenario for the baseline study

The analysis of the future electricity demand shows that there is quite a difference in the additional electricity consumption in the 2 scenarios. While in the Minimum scenario there will be an increase in demand of about 9.063 GWh between 2000 and 2020, the increase demand will be about 14.383 GWh in the Maximum scenario for the same time period.

This difference between the 2 scenarios will of course have an influence on the marginal load and most probably also on the Least Cost Development Plan. So a decision has to be made as to which scenario will be used for the further analyses in this baseline study.

The demand increase in the Minimum scenario between 2000 and 2020 is about 21,9%, whereas in the Maximum scenario the demand increase in this time period is estimated to be 34,8%, thus requiring more electric capacity.

Power plants currently on the margin are mainly coal-fired power plants with rather low efficiencies. When demand is increased, the following developments are possible:

- Existing plants will have a higher load factor, which increases overall efficiency of the plants and therefore also decreases the specific CO_2 emission factor per MWh.
- New plants will be built to cover additional demand. Options for new plants will mainly include coal- and gas-fired units, which have lower specific CO_2 emission factors than the existing coal fired power plants.

These potential developments show the tendency that a higher demand will lead to lower specific CO_2 emission factors for the marginal plants. In order to be conservative in the assumptions in this baseline study, the Maximum scenario is taken as a basis for the further calculations.

In the Monitoring Plan for the Dolna Arda Cascade Project, the marginal plant in each hour of the year will be analyzed based on the actual dispatch order. Therefore, any change between the electricity demand assumed in the baseline study and real electricity demand and the corresponding changes in the marginal load will be taken into account in the Monitoring Plan.

6 Development prospects of generating capacity extension

6.1 Decommissioning of capacities

The integration of Bulgaria into the European Union is a high priority in the program of the Bulgarian government. A key issue in Bulgaria's accession to the EU is the requirement for the early closure of Kozloduy units 3 and 4. Based on the negotiations between Bulgaria and the EU, the decommissioning of Kozloduy units 3 and 4 (commissioned in 1980 and 1982, respectively) are expected by the end of 2006.

Due to the expiry of the service life of some facilities and the restrictions posed by the Directive 2001/80/EC that sets Permission Emission Standards, the following TPP generating capacities will be decommissioned:

1. Maritsa 3 TPP – in the end of 2010
2. Brikel TPP – in the end of 2010
3. Bobov Dol TPP – Unit 1 in 2008, Unit 2 in 2011 and Unit 3 in 2014

6.2 Commissioning of capacities

The period 2007-2010 is crucial to the Bulgarian EPS, especially if Kozloduy units 3 and 4 are decommissioned before a new nuclear unit is commissioned. About 1700 MW of new capacities will be constructed during this time, and the Least-Cost Development Plan 2004-2020 includes the commissioning of the following projects:

1. New TPP burning indigenous lignites – 600 MW, 2008/2009
2. Tsankov Kamak HPP – 80 MW, 2009
3. Belene NPP – 1000MW, 2012.

Furthermore, following measures are listed in the Least-Cost Plan for preserving the level of electricity supply security and creating new generating capacities:

- Increased share of electricity output from renewable energy sources
- Rehabilitation of TPPs that will continue to operate after 2010
- Preservation of the share of nuclear energy in the overall energy balance through construction of new nuclear capacities
- Increased share of co-generation plants
- Reduction of transmission and distribution losses
- Gasification of households to replace consumption of electric power, fuel oil and coal for heating by natural gas

The Plan also mentions that from 2010-2015 the need for commissioning of new nuclear capacities between 1000 MW and 2000 MW will arise.

Other options for generating capacities are combined-cycle thermal power plants fired with natural gas, and a thermal power plant fired with imported coal.

6.3 Rehabilitation

Instead of constructing new capacities, rehabilitation of existing power plants is one way to provide electric capacity for the future. The rehabilitation of large TPPs in Bulgaria should fulfil the following general requirements:

1. Facilities and machines operational life extension by at least 15 years.
2. Energy cycle efficiency improvement.
3. Increase of the energy units' gross electric power.
4. Increase of the availability and the manoeuvrability of the energy units.
5. Meeting the technical requirements for the units operation within the UCTE Electric Power System.
6. Meeting of all legislative requirements for environmental safety and operation of the energy capacities.

The TPP rehabilitation projects differ by scope and envisaged refurbishment and take into account the condition and the operational life of the machines and the equipment in the different power plants. The following table gives an overview on the rehabilitation program in the Bulgarian electricity sector.

Electricity Sector	
Rehabilitation Program	**Fuel**
TPP Varna	steam coal
TPP Maritsa Iztok #2 part (150 MW)	lignite
TPP Maritsa Iztok #2 part (210 MW)	lignite
TPP Maritsa Iztok #3	lignite
TPP Rousse (condensate plant)	steam coal
PSHPP Chaira	hydro

Table 11: Rehabilitation Program

7 Baseline Scenario (Least Cost Development Plan)

7.1 Electricity supply in the baseline scenario

When combining electricity demand, current structure of electricity supply and options for capacity extension/rehabilitation, the IRP Manager Model delivers as an output the Least-Cost Development Plan for the Bulgarian electricity system.

The following list summarizes the main assumptions for the Least-Cost Development Plan:

Electricity demand:
- Electricity demand will increase from 42.850 GWh in 2005 to about 44.465 GWh in 2012 (+3,8%).

Decommissioning:
- Units No. 3 & 4 of Kozloduy NPP by end of 2006;
- TPP Brikel by the end of 2010;
- TPP Maritsa 3 by the end of 2010;
- In Bobov Dol TPP, one coal-fired unit will be decommissioned in 2008, a second one in 2011, and a third one in 2014.

Commissioning:
- HPP Tsankov Kamak, 80 MW, in 2009;
- New TPP burning indigenous lignites, 600 MW, in 2008/2009;
- Expansion of cogeneration PPs, 130 MW, in 2009;
- New NPP Belene, 1000 MW, 2012.

Rehabilitation:
- TPP Varna
- TPP Maritsa Iztok #2 part (150MW)
- TPP Maritsa Iztok #2 part (210MW)
- TPP Maritsa Iztok #3
- TPP Rousse
- The power generation of the pumped storage hydro power plant Chaira will increase due to the Yadenitsa reservoir project, which foresees the construction of an additional lower compensation basin by 2010.

The computations of the IRP Manager Model report the following productions per power plant in the years 2005 to 2012:

Baseline Scenario			**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
	Power Plant Unit	Fuel	Total Electricity Generation GWh	Total Electricity Generation GWh	Total Electricity Generation GWh	Total Electricity Generation GWh	Total Electricity Generation GWh	Total Electricity Generation GWh	Total Electricity Generation GWh	Total Electricity Generation GWh
1.	TPP Bobov dol	brown coal	3.138	3.104	3.157	2.162	1.667	889	1.002	320
2.	TPP Varna	steam coal	3.648	3.580	3.752	4.366	1.909	2.478	3.482	1.965
3.	TPP Brikel (Maritsa Iztok #1)	lignite	881	878	893	923	895	925	0	0
4.1.	TPP Maritsa Iztok #2 part (150MW)	lignite	3.077	3.581	4.727	4.760	4.624	4.692	4.772	4.485
4.2.	TPP Maritsa Iztok #2 part (210MW)	lignite	4.112	4.026	3.513	4.418	4.781	4.851	5.054	4.572
5.	TPP Maritsa Iztok #3	lignite	4.227	5.214	5.840	5.932	5.809	5.900	6.008	5.640
6.	TPP Maritsa 3	lignite	205	202	202	205	202	156	0	0
6.1.	TPP Rousse (condensate plant)	steam coal	614	258	1.235	1.258	815	967	1.052	356
6.2.	TPP Rousse (cogeneration)	steam coal	184	183	188	190	169	173	163	161
7.1.	NPP Kozlodui # I and # II Unit	nuclear	0	0	0	0	0	0	0	0
7.2.	NPP Kozlodui # III and # IV Unit	nuclear	5.494	5.490	0	0	0	0	0	0
7.3.	NPP Kozlodui # V and # VI Unit	nuclear	11.350	11.290	12.003	12.066	11.921	12.019	12.129	11.647
8.	Cogeneration PP - Sofia	natural gas	269	269	269	269	269	269	269	269
9.	Cogeneration PP - Sofia-Iztok	natural gas	537	537	537	537	537	537	537	537
10.	Cogeneration PP Plovdiv	natural gas	180	180	180	180	180	180	180	180
11.	Cogeneration PPs others	natural gas	517	517	517	517	517	517	517	517
12.	Industrial PP Bourgas	heavy oil/gases	419	418	422	425	425	429	430	424
13.	Industrial PP Deven	steam coal	367	366	367	369	367	369	370	364
14.	Industrial PP Himko	natural gas	156	153	153	153	153	153	153	151
15.	Industrial PP Sviloza	steam coal	204	204	204	204	202	201	204	200
16.	Industrial PPs others	heavy oil	610	608	614	618	599	600	607	593
17.	Existing Hydro Power Plants	hydro	2.694	2.695	2.695	2.695	2.702	2.702	2.702	2.703
18.	Cascade HPPs Dolna Arda	hydro	0	0	0	0	0	0	0	0
19.	HPP Tsankov Kamak	hydro	0	0	0	0	198	198	198	198
20.	Expansion of Cogeneration PPs	natural gas	0	0	0	0	483	483	502	477
21.	New TPP burning imported coal	sub-bitum. coal	0	0	0	0	0	0	0	0
22.	New Combined Cycle PP	natural gas	0	0	0	0	0	0	0	0
23.	New TPP burning indigenous lignites	lignite	0	0	0	437	1.964	2.818	3.237	2.251
24.	New NPP	nuclear	0	0	0	0	0	0	0	6.538
25.	Pump Storage HPP Chaira - pumping mode		-416	-348	-345	-325	-168	-155	-252	-334
	- generation mode	hydro	312	261	259	274	126	116	189	251
	Power not delivered		71	16	78	5	24	24	95	0
	Total		**42.850**	**43.682**	**41.460**	**42.638**	**41.370**	**42.491**	**43.600**	**44.465**

Table 12: Baseline Scenario – Electricity Generation

Calculations for Table 12 are detailed in a spreadsheet attached in Annex 10.9. The Excel spreadsheet shows the available capacities, generation, heat rates, carbon contents and the emission factors on an annual basis. The gross heat rate and net calorific values are based on average figures for the years 2000-2004.

The Bulgarian Least-Cost Development Plan reports the following new power plants in the period 2005 to 2012.

Electricity Sector			
New Capacities 2005-2012	**Fuel**	**Year of Commissioning**	**Capacity MW**
Expansion of cogeneration PPs	nat. gas	2008	130
New TPP burning indigenous lignite	lignite	2008-2009	600
New NPP	nuclear	2010-2012	1.000
HPP Tsankov Kamak	hydro	2009	80
Total			**1.810**

Table 13: Commissioning of New Capacities – 2005-2012

The TPP rehabilitation projects differ by scope and envisaged refurbishment. The following table gives an overview on the rehabilitation program in the Bulgarian electricity sector, which results from the computations of the IRP Manager model:

Electricity Sector				
Rehabilitation Program	**Fuel**	**Period**	**Available Capacity old MW**	**Available Capacity new MW**
TPP Varna	steam coal	2007-2013	1200	1260
TPP Maritsa Iztok #2 part (150 MW)	lignite	2005-2007	540	610
TPP Maritsa Iztok #2 part (210 MW)	lignite	2009-2012	800	840
TPP Maritsa Iztok #3	lignite	2003-2006	800	840
TPP Rousse (condensate plant)	steam coal	2005-2006	100	200
PSHPP Chaira	hydro	2007-2009	420	630

Table 14: Rehabilitation Program - Baseline Scenario

7.2 CO_2 emissions in the baseline scenario

The following table gives the CO_2 emissions in the Baseline scenario per plant and year for the time span 2005-2012.

Baseline Scenario			**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
	Power Plant Unit	Fuel	Total CO2 Emissions kt/a	Total CO2 Emissions kt/a	Total CO2 Emissions kt/a	Total CO2 Emissions kt/a	Total CO2 Emissions kt/a	Total CO2 Emissions kt/a	Total CO2 Emissions kt/a	Total CO2 Emissions kt/a
1.	TPP Bobov dol	brown coal	3.790	3.749	3.813	2.611	2.013	1.074	1.210	386
2.	TPP Varna	steam coal	3.687	3.618	3.792	4.413	1.929	2.453	3.375	1.864
3.	TPP Brikel (Maritsa Iztok #1)	lignite	687	685	696	720	698	721	0	0
4.1.	TPP Maritsa Iztok #2 part (150MW)	lignite	4.085	4.398	5.615	5.442	5.218	5.295	5.385	5.061
4.2.	TPP Maritsa Iztok #2 part (210MW)	lignite	4.670	4.573	3.990	4.890	5.153	5.229	5.447	4.928
5.	TPP Maritsa Iztok #3	lignite	5.108	5.990	6.535	6.240	5.980	6.074	6.185	5.806
6.	TPP Maritsa 3	lignite	195	192	192	195	192	148	0	0
6.1.	TPP Rousse (condensate plant)	steam coal	622	262	1.225	1.215	791	939	1.021	346
6.2.	TPP Rousse (cogeneration)	steam coal	196	194	200	202	180	184	173	171
7.1.	NPP Kozlodui # I and # II Unit	nuclear	0	0	0	0	0	0	0	0
7.2.	NPP Kozlodui # III and # IV Unit	nuclear	0	0	0	0	0	0	0	0
7.3.	NPP Kozlodui # V and # VI Unit	nuclear	0	0	0	0	0	0	0	0
8.	Cogeneration PP - Sofia	natural gas	108	108	108	108	108	108	108	108
9.	Cogeneration PP - Sofia-Iztok	natural gas	198	198	198	198	198	198	198	198
10.	Cogeneration PP Plovdiv	natural gas	67	67	67	67	67	67	67	67
11.	Cogeneration PPs others	natural gas	210	210	210	210	210	210	210	210
12.	Industrial PP Bourgas	heavy oil/gases	297	296	299	301	301	304	305	301
13.	Industrial PP Deven	steam coal	232	232	232	234	232	234	234	230
14.	Industrial PP Himko	natural gas	90	88	88	88	88	88	88	87
15.	Industrial PP Sviloza	steam coal	228	228	228	228	225	224	228	223
16.	Industrial PPs others	heavy oil	763	760	768	773	749	750	759	742
17.	Existing Hydro Power Plants	hydro	0	0	0	0	0	0	0	0
18.	Cascade HPPs Dolna Arda	hydro	0	0	0	0	0	0	0	0
19.	HPP Tsankov Kamak	hydro	0	0	0	0	0	0	0	0
20.	Expansion of Cogeneration PPs	natural gas	0	0	0	0	159	159	165	157
21.	New TPP burning imported coal	sub-bitum. coal	0	0	0	0	0	0	0	0
22.	New Combined Cycle PP	natural gas	0	0	0	0	0	0	0	0
23.	New TPP burning indigenous lignites	lignite	0	0	0	459	2.062	2.959	3.399	2.363
24.	New NPP	nuclear	0	0	0	0	0	0	0	0
25.	Pump Storage HPP Chaira - pumping mode		0	0	0	0	0	0	0	0
	- generation mode	hydro	0	0	0	0	0	0	0	0
	Power not delivered		0	0	0	0	0	0	0	0
	Total		**25.234**	**25.849**	**28.258**	**28.595**	**26.556**	**27.418**	**28.558**	**23.249**

Table 15: Baseline Scenario – CO_2 Emissions of Power Stations

Total baseline emissions are calculated by multiplying the annual plant specific power generation with corresponding specific emission factors. In the period 2008 to 2012, total baseline CO_2 emissions caused by the Bulgarian electricity sector are around 134.376 kilotons CO_2. The significant CO_2 emission reductions in 2009 are the result of the decommissioning of Unit 1 of TPP Bobov dol, the rehabilitation works on TPP Varna decreasing power generation, and the commissioning of HPP Tsankov Kamak in 2009. The CO_2 emission reductions in 2012 are due to the commissioning of a 1000 MW nuclear power plant in 2012. Plant specific emission factors and detailed computations are shown in Annex 10.9.

8 Project Scenario

8.1 JI Project electricity generation forecast

The project scenario in the Dolna Arda Cascade Joint Implementation Project includes the rehabilitation of three existing hydropower plants (HPP Studen Kladenets, HPP Kardjali, and HPP Ivailovgrad) and the installation of an additional generating unit in HPP Studen Kladnets (unit 5). The project scenario considers the improved efficiencies of the refurbished plants and the associated energy generation increase as well as the additional generation due to the installation of the new unit in HPP Studen Kladenets. The Dolna Arda Hydropower Cascade Rehabilitation project is considered as an energy capacity that will be part of the Bulgarian Electric Power System (EPS).

The signing of the bilateral Memorandum of Understanding between the Bulgarian Ministry of Environment and Water and the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management on 2 September 2002 and the subsequent ratification by the Bulgarian Parliament facilitated the realisation of Joint Implementation projects between Bulgaria and Austria.

The transfer of Emission Reduction Units (ERUs) that would result from the implementation of the proposed JI project for the Dolna Arda Cascade plays a substantial role in the financial set-up of the project.

The Austrian Export Promotion Authority understands that a realisation as a JI Project is a precondition for a cover by OeKB. Therefore, the JI approach is considered a pre-condition for the realization of the Dolna Arda project.

It is intended that earnings from NEK out of the sale of ERUs to the Austrian JI/CDM Programme will serve as cash basis on an escrow account for the repayment of interest and principal from 2008 on. This instrument is essential collateral for the whole project set-up and, therefore, serves as a crucial leverage for the entire realization of Dolna Arda Cascade JI Project.

Due to the unfavourable relationship between investment costs for renewing the mechanical/electrical parts and the increase in capacity and output, rehabilitation projects did not receive a high priority in the investment plan of NEK EAD.

- Dolna Arda Hydropower Cascade JI Project Electricity Generation Forecast:

Dolna Arda Cascade JI Project		
Dolna Arda Cascade capacity before project	MW	259,1
Increase in capacity due to rehabilitation of 3 HPPs	MW	10,6
Increase in capacity due to installation of new unit 5	MW	19,75
Total increase in capacity due to project	MW	30,35
Total increase in power generation due to project	GWh/a	63,6
Construction period		2005-2010

Table 16: Dolna Arda Parameters

Table 16 summarizes the main Dolna Arda parameters.

A total increase of **63,6 GWh** in the annual electricity generation of the Dolna Arda Hydropower Cascade is expected due to the proposed project.

- Forecast of the electricity generation of the rehabilitated HPPs in the Dolna Arda Cascade

The following table shows the expected generation of Studen Kladenets, Kardjali, and Ivailovgrad before and after rehabilitation and the resulting additional generation due to rehabilitation.

Dolna Arda Cascade - electricity generation forecast due to rehabilitation					
Rehabilitation Program	**Efficiency coefficient before %**	**Efficiency coefficient after %**	**Electricity output w/o project GWh/a**	**Electricity output w/ project GWh/a**	**Additional generation GWh/a**
HPP Studen Kladenets	86,2	91,5	154,97	164,5	9,53
HPP Kardjali	88,8	91,9	111,61	115,5	3,89
HPP Ivailovgrad	88,3	92,7	149,14	156,57	7,43
TOTAL					**20,85**

Table 17: Studen Kladenets, Kardjali, and Ivailovgrad - Generation

Due to the increased production efficiencies of the existing hydropower plants, an additional **20,9 GWh** per year will be generated.

The forecast for the electricity generation of the Dolna Arda JI Project consists of an additional annual electricity generation of **42,7 GWh** from the new unit at HPP Studen Kladenets, plus the **20,9 GWh** from the rehabilitation of Studen Kladenets, Kardjali, and Ivailovgrad hydropower plants, thus resulting in a total increase in the Dolna Arda Cascade electricity generation of **63,6 GWh** per year.

A summary of the power generation due to the entire Dolna Arda JI project is shown in Annex 10.4. A description of the method used to analyze the energy effects due to the rehabilitation of the three power plants as well as the installation of unit 5 in Studen Kladenets is included in Annex 10.5. The tables in Annex 10.6 and Annex 10.7 illustrate the energy effects due to the rehabilitation of the three power plants and the increase of installed capacity in HPP Studen Kladenets, respectively. Finally, Annex 10.8 summarizes the total increase in power generation due to the entire Dolna Arda JI Project, broken down into months for the years 2008-2012.

As reported by the IRP model the following table shows the electricity generation in the Project Scenario.

Project Scenario			**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
	Parameter Power Plant Unit	Fuel	Total Electricity Generation GWh	Total Electricity Generation GWh	Total Electricity Generation GWh	Total Electricity Generation GWh	Total Electricity Generation GWh	Total Electricity Generation GWh	Total Electricity Generation GWh	Total Electricity Generation GWh
1.	TPP Bobov dol	brown coal	3.138	3.104	3.157	2.149	1.660	878	984	309
2.	TPP Varna	steam coal	3.648	3.580	3.752	4.358	1.901	2.464	3.475	1.944
3.	TPP Brikel (Maritsa Iztok #1)	lignite	881	878	893	924	894	924	0	0
4.1.	TPP Maritsa Iztok #2 part (150MW)	lignite	3.077	3.581	4.727	4.762	4.625	4.692	4.771	4.485
4.2.	TPP Maritsa Iztok #2 part (210MW)	lignite	4.112	4.026	3.513	4.418	4.781	4.850	5.053	4.572
5.	TPP Maritsa Iztok #3	lignite	4.227	5.214	5.840	5.921	5.790	5.888	5.986	5.624
6.	TPP Maritsa 3	lignite	205	202	202	204	204	156	0	0
6.1.	TPP Rousse (condensate plant)	steam coal	614	258	1.235	1.250	801	953	1.044	339
6.2.	TPP Rousse (cogeneration)	steam coal	184	183	188	191	168	173	163	161
7.1.	NPP Kozlodui # I and # II Unit	nuclear	0	0	0	0	0	0	0	0
7.2.	NPP Kozlodui # III and # IV Unit	nuclear	5.494	5.490	0	0	0	0	0	0
7.3.	NPP Kozlodui # V and # VI Unit	nuclear	11.350	11.290	12.003	12.066	11.921	12.019	12.129	11.647
8.	Cogeneration PP - Sofia	natural gas	269	269	269	269	269	269	269	269
9.	Cogeneration PP - Sofia-Iztok	natural gas	537	537	537	537	537	537	537	537
10.	Cogeneration PP Plovdiv	natural gas	180	180	180	180	180	180	180	180
11.	Cogeneration PPs others	natural gas	517	517	517	517	517	517	517	517
12.	Industrial PP Bourgas	heavy oil/gases	419	418	422	426	425	428	430	425
13.	Industrial PP Deven	steam coal	367	366	367	369	366	368	370	364
14.	Industrial PP Himko	natural gas	156	153	153	153	153	153	153	151
15.	Industrial PP Sviloza	steam coal	204	204	204	205	200	201	204	200
16.	Industrial PPs others	heavy oil	610	608	614	617	599	599	607	595
17.	Existing Hydro Power Plants	hydro	2.694	2.695	2.695	2.695	2.702	2.702	2.702	2.703
18.	Cascade HPPs Dolna Arda	hydro	0	0	0	49	54	60	64	64
19.	HPP Tsankov Kamak	hydro	0	0	0	0	198	198	198	198
20.	Expansion of Cogeneration PPs	natural gas	0	0	0	0	482	483	501	477
21.	New TPP burning imported coal	sub-bitum. coal	0	0	0	0	0	0	0	0
22.	New Combined Cycle PP	natural gas	0	0	0	0	0	0	0	0
23.	New TPP burning indigenous lignites	lignite	0	0	0	438	1.964	2.819	3.235	2.251
24.	New NPP	nuclear	0	0	0	0	0	0	0	6.538
25.	Pump Storage HPP Chaira - pumping mode		-416	-348	-345	-355	-200	-174	-267	-352
	- generation mode	hydro	312	261	259	292	150	132	200	264
	Power not delivered		71	16	78	3	29	22	95	3
	Total		**42.850**	**43.682**	**41.460**	**42.638**	**41.370**	**42.491**	**43.600**	**44.465**

Table 18: Project Scenario – Electricity Generation

Calculations for Table 18 are detailed in a spreadsheet attached in Annex 10.10. The annual power generation from the Dolna Arda JI Project increases every year from 2008 until 2011 corresponding to the completion of rehabilitation works and the installation of the new unit in HPP Studen Kladenets.

8.2 Project Emissions

Project emissions are the emissions that occur in the Bulgarian EPS after implementation of the Dolna Arda Cascade JI Project. The following table gives the CO_2 emissions in the project scenario per plant and year. Applied plant specific emission factors are presented in Annex 10.10.

Project Scenario			**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
	Parameter Power Plant Unit	Fuel	Total CO2 Emissions kt/a	Total CO2 Emissions kt/a	Total CO2 Emissions kt/a	Total CO2 Emissions kt/a	Total CO2 Emissions kt/a	Total CO2 Emissions kt/a	Total CO2 Emissions kt/a	Total CO2 Emissions kt/a
1.	TPP Bobov dol	brown coal	3.790	3.749	3.813	2.596	2.005	1.060	1.188	373
2.	TPP Varna	steam coal	3.687	3.618	3.792	4.405	1.921	2.439	3.368	1.844
3.	TPP Brikel (Maritsa Iztok #1)	lignite	687	685	696	721	697	721	0	0
4.1.	TPP Maritsa Iztok #2 part (150MW)	lignite	4.085	4.398	5.615	5.445	5.219	5.295	5.384	5.061
4.2.	TPP Maritsa Iztok #2 part (210MW)	lignite	4.670	4.573	3.990	4.890	5.159	5.228	5.446	4.928
5.	TPP Maritsa Iztok #3	lignite	5.108	5.990	6.535	6.228	5.961	6.062	6.163	5.790
6.	TPP Maritsa 3	lignite	195	192	192	194	194	148	0	0
6.1.	TPP Rousse (condensate plant)	steam coal	622	262	1.225	1.208	778	925	1.014	329
6.2.	TPP Rousse (cogeneration)	steam coal	196	194	200	203	179	184	173	171
7.1.	NPP Kozlodui # I and # II Unit	nuclear	0	0	0	0	0	0	0	0
7.2.	NPP Kozlodui # III and # IV Unit	nuclear	0	0	0	0	0	0	0	0
7.3.	NPP Kozlodui # V and # VI Unit	nuclear	0	0	0	0	0	0	0	0
8.	Cogeneration PP - Sofia	natural gas	108	108	108	108	108	108	108	108
9.	Cogeneration PP - Sofia-Iztok	natural gas	198	198	198	198	198	198	198	198
10.	Cogeneration PP Plovdiv	natural gas	67	67	67	67	67	67	67	67
11.	Cogeneration PPs others	natural gas	210	210	210	210	210	210	210	210
12.	Industrial PP Bourgas	heavy oil/gases	297	296	299	302	301	304	305	301
13.	Industrial PP Deven	steam coal	232	232	232	234	232	233	234	230
14.	Industrial PP Himko	natural gas	90	88	88	88	88	88	88	87
15.	Industrial PP Sviloza	steam coal	228	228	228	229	223	224	228	223
16.	Industrial PPs others	heavy oil	763	760	768	772	749	749	759	744
17.	Existing Hydro Power Plants	hydro	0	0	0	0	0	0	0	0
18.	Cascade HPPs Dolna Arda	hydro	0	0	0	0	0	0	0	0
19.	HPP Tsankov Kamak	hydro	0	0	0	0	0	0	0	0
20.	Expansion of Cogeneration PPs	natural gas	0	0	0	0	158	159	165	157
21.	New TPP burning imported coal	sub-bitum. coal	0	0	0	0	0	0	0	0
22.	New Combined Cycle PP	natural gas	0	0	0	0	0	0	0	0
23.	New TPP burning indigenous lignites	lignite	0	0	0	460	2.062	2.960	3.396	2.363
24.	New NPP	nuclear	0	0	0	0	0	0	0	0
25.	Pump Storage HPP Chaira - pumping mode		0	0	0	0	0	0	0	0
	- generation mode	hydro	0	0	0	0	0	0	0	0
	Power not delivered		0	0	0	0	0	0	0	0
	Total		**25.234**	**25.849**	**28.258**	**28.556**	**26.510**	**27.362**	**28.495**	**23.186**

Table 19: Project Scenario – CO_2 Emissions of Power Stations

Details of Table 19 are shown in Annex 10.10. In the period 2008 to 2012, total CO_2 emissions of the Bulgarian electric power system in the project scenario are 134.109 kilotons CO_2.

9 Calculation of estimated Emission Reduction

The calculation of emission reductions requires the identification of the power plants whose electricity generation would be displaced by the Dolna Arda Cascade JI Project. The following chapter is based on the results of the IRP model for the Baseline and Project scenarios as shown in chapter 7 and chapter 8.

9.1 Computations and results

Table 20 summarizes the difference of the baseline and project electricity generation as reported by the IRP model and presented in Table 12 (Baseline scenario) and Table 18 (Project scenario).

Project - Baseline: Generation			**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
	Parameter Power Plant Unit	Fuel	Total Electricity Generation GWh	Total Electricity Generation GWh	Total Electricity Generation GWh	Total Electricity Generation GWh	Total Electricity Generation GWh	Total Electricity Generation GWh	Total Electricity Generation GWh	Total Electricity Generation GWh
1.	TPP Bobov dol	brown coal	0	0	0	-13	-7	-11	-18	-11
2.	TPP Varna	steam coal	0	0	0	-8	-8	-14	-7	-21
3.	TPP Brikel (Maritsa Iztok #1)	lignite	0	0	0	1	-1	-1	0	0
4.1.	TPP Maritsa Iztok #2 part (150MW)	lignite	0	0	0	2	1	0	-1	0
4.2.	TPP Maritsa Iztok #2 part (210MW)	lignite	0	0	0	0	0	-1	-1	0
5.	TPP Maritsa Iztok #3	lignite	0	0	0	-11	-19	-12	-22	-16
6.	TPP Maritsa 3	lignite	0	0	0	-1	2	0	0	0
6.1.	TPP Rousse (condensate plant)	steam coal	0	0	0	-8	-14	-14	-8	-17
6.2.	TPP Rousse (cogeneration)	steam coal	0	0	0	1	-1	0	0	0
7.1.	NPP Kozlodui # I and # II Unit	nuclear	0	0	0	0	0	0	0	0
7.2.	NPP Kozlodui # III and # IV Unit	nuclear	0	0	0	0	0	0	0	0
7.3.	NPP Kozlodui # V and # VI Unit	nuclear	0	0	0	0	0	0	0	0
8.	Cogeneration PP - Sofia	natural gas	0	0	0	0	0	0	0	0
9.	Cogeneration PP - Sofia-Iztok	natural gas	0	0	0	0	0	0	0	0
10.	Cogeneration PP Plovdiv	natural gas	0	0	0	0	0	0	0	0
11.	Cogeneration PPs others	natural gas	0	0	0	0	0	0	0	0
12.	Industrial PP Bourgas	heavy oil/gases	0	0	0	1	0	-1	0	1
13.	Industrial PP Deven	steam coal	0	0	0	0	-1	-1	0	0
14.	Industrial PP Himko	natural gas	0	0	0	0	0	0	0	0
15.	Industrial PP Sviloza	steam coal	0	0	0	1	-2	0	0	0
16.	Industrial PPs others	heavy oil	0	0	0	-1	0	-1	0	2
17.	Existing Hydro Power Plants	hydro	0	0	0	0	0	0	0	0
18.	Cascade HPPs Dolna Arda	hydro	0	0	0	49	54	60	64	64
19.	HPP Tsankov Kamak	hydro	0	0	0	0	0	0	0	0
20.	Expansion of Cogeneration PPs	natural gas	0	0	0	0	-1	0	-1	0
21.	New TPP burning imported coal	sub-bitum. coal	0	0	0	0	0	0	0	0
22.	New Combined Cycle PP	natural gas	0	0	0	0	0	0	0	0
23.	New TPP burning indigenous lignites	lignite	0	0	0	1	0	1	-2	0
24.	New NPP	nuclear	0	0	0	0	0	0	0	0
25.	Pump Storage HPP Chaira - pumping mode		0	0	0	-30	-32	-19	-15	-18
	- generation mode	hydro	0	0	0	18	24	16	11	13
	Power not delivered		0	0	0	-2	5	-2	0	3
	Total		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Table 20: Project – Baseline Electricity Generation

The output of the IRP model reports 4 main marginal power plants in the period under consideration – TPP Bobov dol, TPP Varna, TPP Maritsa Iztok # 3 and TPP Rousse (condensation plant). Usually within one working hour the EPS has one marginal power plant. However, from an annual perspective, the IRP model reports 4 marginal power plants, and that is due to their varied load schedules as well as differing maintenance programs with regard to their duration, scope of repair works and time of year that they are carried out.

Table 21 shows the electricity generation of the 4 main marginal power plants in the baseline and project scenario. The reduction of electricity generation shows how long the respective power plant will be marginal when the Dolna Arda Cascade JI Project HPPs are in operation.

Generation (GWh)		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Total 2005-2007**	**Total 2008-2012**
		GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh
TPP Bobov dol	Baseline	3.138	3.104	3.157	2.162	1.667	889	1.002	320	**9.399**	**6.040**
	Project	3.138	3.104	3.157	2.149	1.660	878	984	309	**9.399**	**5.980**
	Reduction	0	0	0	13	7	11	18	11	**0**	**60**
TPP Varna	Baseline	3.648	3.580	3.752	4.366	1.909	2.478	3.482	1.965	**10.980**	**14.200**
	Project	3.648	3.580	3.752	4.358	1.901	2.464	3.475	1.944	**10.980**	**14.142**
	Reduction	0	0	0	8	8	14	7	21	**0**	**58**
TPP Maritsa Iztok #3	Baseline	4.227	5.214	5.840	5.932	5.809	5.900	6.008	5.640	**15.281**	**29.289**
	Project	4.227	5.214	5.840	5.921	5.790	5.888	5.986	5.624	**15.281**	**29.209**
	Reduction	0	0	0	11	19	12	22	16	**0**	**80**
TPP Rousse	Baseline	614	258	1.235	1.258	815	967	1.052	356	**2.107**	**4.448**
	Project	614	258	1.235	1.250	801	953	1.044	339	**2.107**	**4.387**
	Reduction	0	0	0	8	14	14	8	17	**0**	**61**

Table 21: Generation Marginal Plants

The difference in electricity generation between the baseline and project scenarios leads to emission reductions in the Bulgarian EPS. The following table is based on the results of the IRP model.

Plant specific emission factors and calculations are shown in Annexes 10.9 and 10.10.

Project - Baseline: Emission Reduction			2005	2006	2007	2008	2009	2010	2011	2012
	Parameter Power Plant Unit	Fuel	Total CO2 Emissions kt/a	Total CO2 Emissions kt/a	Total CO2 Emissions kt/a	Total CO2 Emissions kt/a	Total CO2 Emissions kt/a	Total CO2 Emissions kt/a	Total CO2 Emissions kt/a	Total CO2 Emissions kt/a
1.	TPP Bobov dol	brown coal	0	0	0	-16	-8	-13	-22	-13
2.	TPP Varna	steam coal	0	0	0	-8	-8	-14	-7	-20
3.	TPP Brikel (Maritsa Iztok #1)	lignite	0	0	0	1	-1	-1	0	0
4.1.	TPP Maritsa Iztok #2 part (150MW)	lignite	0	0	0	2	1	0	-1	0
4.2.	TPP Maritsa Iztok #2 part (210MW)	lignite	0	0	0	0	6	-1	-1	0
5.	TPP Maritsa Iztok #3	lignite	0	0	0	-12	-20	-12	-23	-16
6.	TPP Maritsa 3	lignite	0	0	0	-1	2	0	0	0
6.1.	TPP Rousse (condensate plant)	steam coal	0	0	0	-8	-14	-14	-8	-17
6.2.	TPP Rousse (cogeneration)	steam coal	0	0	0	1	-1	0	0	0
7.1.	NPP Kozlodui # I and # II Unit	nuclear	0	0	0	0	0	0	0	0
7.2.	NPP Kozlodui # III and # IV Unit	nuclear	0	0	0	0	0	0	0	0
7.3.	NPP Kozlodui # V and # VI Unit	nuclear	0	0	0	0	0	0	0	0
8.	Cogeneration PP - Sofia	natural gas	0	0	0	0	0	0	0	0
9.	Cogeneration PP - Sofia-Iztok	natural gas	0	0	0	0	0	0	0	0
10.	Cogeneration PP Plovdiv	natural gas	0	0	0	0	0	0	0	0
11.	Cogeneration PPs others	natural gas	0	0	0	0	0	0	0	0
12.	Industrial PP Bourgas	heavy oil/gases	0	0	0	1	0	-1	0	1
13.	Industrial PP Deven	steam coal	0	0	0	0	-1	-1	0	0
14.	Industrial PP Himko	natural gas	0	0	0	0	0	0	0	0
15.	Industrial PP Sviloza	steam coal	0	0	0	1	-2	0	0	0
16.	Industrial PPs others	heavy oil	0	0	0	-1	0	-1	0	3
17.	Existing Hydro Power Plants	hydro	0	0	0	0	0	0	0	0
18.	Cascade HPPs Dolna Arda	hydro	0	0	0	0	0	0	0	0
19.	HPP Tsankov Kamak	hydro	0	0	0	0	0	0	0	0
20.	Expansion of Cogeneration PPs	natural gas	0	0	0	0	0	0	0	0
21.	New TPP burning imported coal	sub-bitum. coal	0	0	0	0	0	0	0	0
22.	New Combined Cycle PP	natural gas	0	0	0	0	0	0	0	0
23.	New TPP burning indigenous lignites	lignite	0	0	0	1	0	1	-2	0
24.	New NPP	nuclear	0	0	0	0	0	0	0	0
25.	Pump Storage HPP Chaira - pumping mode		0	0	0	0	0	0	0	0
	- generation mode	hydro	0	0	0	0	0	0	0	0
	Power not delivered		0	0	0	0	0	0	0	0
	Total		**0**	**0**	**0**	**-38**	**-46**	**-56**	**-64**	**-63**

Table 22: Project – Baseline: Emission Reductions

The implementation of the Dolna Arda Cascade JI Project leads to CO_2 emission reductions as listed in Table 22. The total emission reductions in the period 2008-2012 achieved due to the implementation of the Dolna Arda Cascade JI Project amount to **267.465 tons CO_2**. The emission reductions achieved increase every year from 2008 until 2011 corresponding to the completion of rehabilitation works and the installation of the new unit.

Finally, Figure 4 summarizes the forecasted annual electricity generation and the emissions in the baseline and the project scenarios.

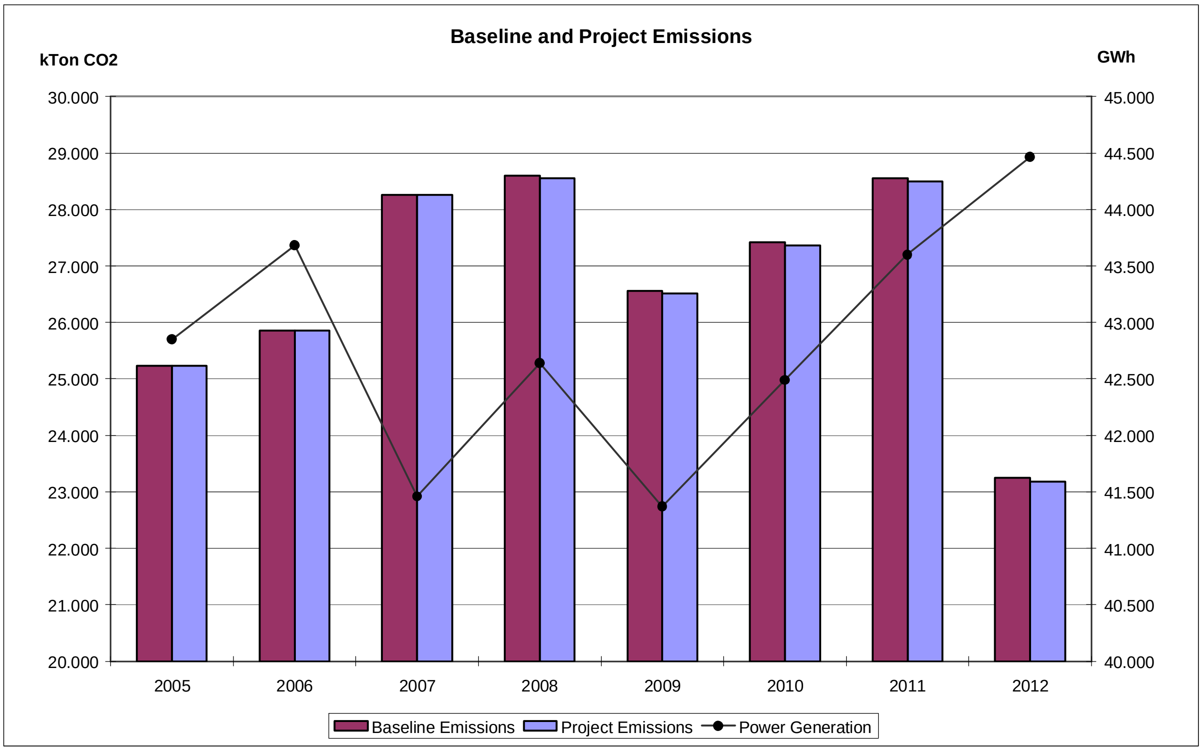


Figure 4: Baseline and Project Emissions 2005-2012

The significant decrease in power generation in 2007 can be explained by the decommissioning of Units 3 & 4 of the Kozloduy NPP at the end of 2006. In the following years the power generation fluctuates due to rehabilitation works on thermal power plants. In the years 2011 and 2012, a significant increase in power generation is expected as a result of the commissioning of the new TPP burning indigenous lignite in 2008-2010 and the commissioning of a new nuclear power plant in 2012.

9.2 Summary

The results can be summarized as follows:

- The results for the time period 2008-2012 indicate that 4 power plants will reduce their electricity generation as marginal power plants after commissioning of the Dolna Arda Cascade JI Project. These power plants are TPP Bobov dol, TPP Varna, TPP Maritsa Iztok # 3 and TPP Rousse (condensation plant).

- These 4 power plants are not equal with regard to covering the load schedule. Due to the differences in the load schedule between summer and winter working days, mid-load schedule also in the weekends, these four power plants are marginal plants in the Bulgarian EPS.

- These 4 power plants have the highest cost for coal leading to the highest production costs and are therefore the marginal units.

- In connection with the forced decommissioning of units 3 & 4 in Kozloduy NPP by the end of 2006, the IRP model shows that a new TPP burning indigenous lignite with a total capacity of 600 MW will be commissioned in 2008/2009.

- According to the results of the IRP model computations, a new NPP with a capacity of 1000 MW will be commissioned in 2012.

- Between 2008 and 2012 the total emission reduction due to this project is **267.465 t CO_2**.

However, the actual emission reductions will be calculated by monitoring the hourly system operations and using actual dispatch data, as detailed in the Monitoring Plan.

9.3 Reliability and assessment of the results

The computations made for the CO_2 emissions have 3 indicators that may vary within some limits in their future consideration. These indicators mostly depend on the type of fuel used and the actual operation conditions of the units.

- Gross Heat Rate (kJ/kWh) – this indicator is specific for each thermal unit and is influenced by the operation conditions of the facilities. Also due to refurbishments, the gross heat rate may vary by calendar month. The average annual values for 2002 have been taken into consideration for the calculations.

- Net Calorific Value (GJ/Mg) – this indicator depends on the type of coal used and has a certain value for each coal delivery. Changes in this indicator are possible due to two reasons:

  1. Coal from different sources is used and blended in various proportions.
  2. Changes are possible in the fuel bases – in the sense that after the rehabilitation fuel from another source can be used.

  Changes in the net calorific value will be monitored in real time on a monthly basis.

- Fuel Carbon Content (%) – this indicator shows the carbon content of the fuel used. It will be defined for each month based on a coal components analysis.

As mentioned throughout the Baseline Study, changes in these indicators will be taken into account in the Monitoring Plan. Therefore, any change between the assumptions made in the Baseline Study and the real development will be considered by the Monitoring Plan.

10 Annexes

10.1 Annex: Memorandum of Understanding Bulgaria – Austria

MEMORANDUM OF UNDERSTANDING

REGARDING

BILATERAL CO-OPERATION

FOR THE REALISATION OF

JOINT IMPLEMENTATION PROJECTS

BETWEEN THE REPUBLIC OF AUSTRIA AND

THE REPUBLIC OF BULGARIA

The Federal Minister of Agriculture, Forestry, Environment and Water Management of the Republic of Austria and the Minister of Environment and Water, the Minister of Finance and the Minister of Energy and Energy Resources of the Republic of Bulgaria,

- Recalling that the Republic of Austria has ratified the Kyoto Protocol in May 2002 and that the Republic of Bulgaria has signed the Kyoto Protocol and is currently preparing its ratification
- Taking into account in particular Article 6 of the Kyoto Protocol including Decision 15/CP.7 and 16/CP.7 adopted at the Marrakesh Conference as well as future decisions of the Conference of the Parties of the UNFCCC concerning the implementation of this Article
- Affirming the intention of the Republic of Austria and the Republic of Bulgaria, hereafter referred to as the Partner States, to undertake all efforts to promote the development of a sustainable and environmentally friendly energy policy
- Recalling existing co-operation in the fields of environment and energy and stressing the importance of enhanced co-operation within the framework of the energy partnership

have reached the following understanding:

I. Scope and Objective

The co-operation in the framework of this Memorandum will facilitate the realization of Joint Implementation projects in accordance with Article 6 of the Kyoto Protocol in the Republic of Bulgaria through joint activities and the transfer to the Republic of Austria of emission reduction units resulting from the implementation of such projects.

II. Project Types and Categories

1. The provisions of this Memorandum will apply in any case to the following priority project categories in so far as the technical implementation of the projects corresponds to the current state of technical development:

- Construction (or retrofitting) of CHP installations;
- Fuel switch in energy conversion installations to renewable or from fuels with high carbon content to fuels with lower carbon content, in particular in existing district-heating systems;
- Construction (or retrofitting) of power generation installations operated with renewables (in particular hydropower, wind power, biogas or biomass CHP);
- Projects leading to avoidance or (energetic) recovery of landfill gas;
- Waste management measures contributing to avoidance of greenhouse gas emissions in particular through energy recovery and use;
- Projects leading to reduction of final energy consumption in residential buildings, public and private services buildings as well as in industrial applications and processes (including waste heat potentials).

2. Concerning projects not listed under paragraph 1 above, the Partner States will decide jointly in how far provisions of this Memorandum can be applied to support their realization.

3. Projects will have overall positive impacts on the environment and social development of the Republic of Bulgaria.

4. Projects aiming at the construction or retrofitting of nuclear power plants will be excluded under this Memorandum.

III. Energy Partnership

1. The Partner States agree on setting up joint activities (“Energy Partnership”) with the aim to support project identification and project development in the early project phase mainly with respect to the energy-related project categories mentioned in Article II. Activities under the “Energy Partnership” will be realized with joint contributions from the Partner States and aim at a steady pipeline of high-quality Joint Implementation projects for implementation under the provisions of this Memorandum. The realization of the following activities is agreed:

a. providing information and know-how exchange, mainly by organizing joint conferences and meetings with involved experts and companies;

b. setting up a steady platform for co-operation between experts, companies, utilities and other involved actors;

c. training of project developers, companies, utilities and other involved actors, where relevant;

d. technical and organizational support for the identification of potential Joint Implementation projects and in the first steps of project definition and development.

2. The Partner States nominate the Executive Agency for Energy Efficiency (EAEE) and the Austrian Energy Agency (E.V.A.) to prepare the final work programme of the Energy Partnership.

IV. Project Cycle

1. The project cycle will be based on the provisions of the Kyoto Protocol and all relevant COP and COP/MOP decisions and will follow any additional requirements or national guidelines of both Partner States.

2. The Partner States agree to elaborate standardized procedures for certain project categories.

V. Principles for baseline setting and calculation of ERUs

1. A baseline will be established in accordance with the relevant COP and COP/MOP decisions.

2. ERUs attributable to a project will be calculated by subtracting the monitored and verified data on actual emissions from the baseline after realization of the project.

3. The elaboration of the baseline study and the detailed calculation of ERUs will follow primarily an existing methodology accepted by both Partner States. Unless otherwise agreed between the Partner States for specific projects, a baseline, which has been validated in accordance with the provisions of this Memorandum, will have to be re-assessed and re-validated at the earliest 5 years, but at the latest 10 years after the original validation.

4. The Partner States strive to co-operate on the elaboration and further development of methodologies for baseline setting and ERU calculation.

VI. Approval by the Republic of Bulgaria and Transfer of Emission Reduction Units to the Republic of Austria

1. The ERUs to be transferred to the Republic of Austria will be determined between the Partner States by mutual agreement in accordance with the provisions under Art. VII and approved by the Republic of Bulgaria in written form. Such written approval will contain a legally binding confirmation of the Republic of Bulgaria that such ERUs attributable to a project under Art. II will be transferred to the Republic of Austria upon verification.

2. Such transfer may occur as long as ERUs can be attributed to a project in accordance with the provisions under Art. V. As a matter of principle, ERUs may only be transferred after their actual occurrence and corresponding to the extent of their actual occurrence in the year concerned.

3. The Bulgarian authorities will furthermore facilitate the development and fulfillment of projects through assistance to the interested companies involved, e.g. by providing relevant information.

VII. Co-ordination between the Partner States

1. Concerning the management of projects with regard to the support measures granted by the Republic of Austria and with regard to the transfer of ERUs attributable to a project from the Republic of Bulgaria to the Republic of Austria, the Partner States agree upon the following process:

a. Both Partner States will designate Secretariats to be responsible for the operative representation of the respective Partner State and to function as direct contact points in all matters concerning the implementation of this Memorandum.

b. The Austrian Secretariat and the Secretariat of the Republic of Bulgaria will have to reach agreement on the eligibility of a selected project for transfer of ERUs in accordance with the provisions of this Memorandum. On this basis, in accordance with Art. V the ERUs resulting from the project, which will be transferred after project realization from the Republic of Bulgaria to the Republic of Austria, will have to be determined by mutual agreement. The above-mentioned agreements may be linked to conditions in relation to actual implementation of the projects.

2. The Secretariats of the Partner States will jointly define requirements for independent entities which may be charged with baseline validation and verification of ERUs that have actually occurred. On the basis of this definition of requirements the Secretariats will jointly select the appropriate entities and grant written authorization to such entities to perform the above-mentioned verification functions. It is agreed that independence of such entities from representatives of the Republic of Austria, of the Republic of Bulgaria, and from interests of prospective project participants will constitute an indispensable requirement.

3. The Secretariats of the Partner States will jointly develop standardized procedures for certain project categories.

VIII. Adjustment of the Memorandum to future international agreements

In case a specific provision of this Memorandum contradicts a provision from a treaty to be concluded in the future and to which one of the Partner States becomes a Party, the Memorandum will be adjusted accordingly based on the agreement of both Partner States.

IX. Final Provisions

This Memorandum will take effect after finalization of internal procedures by both Partner States and mutual notification thereof. Amendments and supplements require written form.

The Memorandum is executed in two originals in the English language.

SIGNED in Vienna, on

Wilhelm MOLTERER

Federal Minister for Agriculture, Forestry, Environment and Water Management of the Republic of Austria

SIGNED in Sofia, on

Dolores ARSSENOVA

Minister of Environment and Water

Milen VELTCHEV

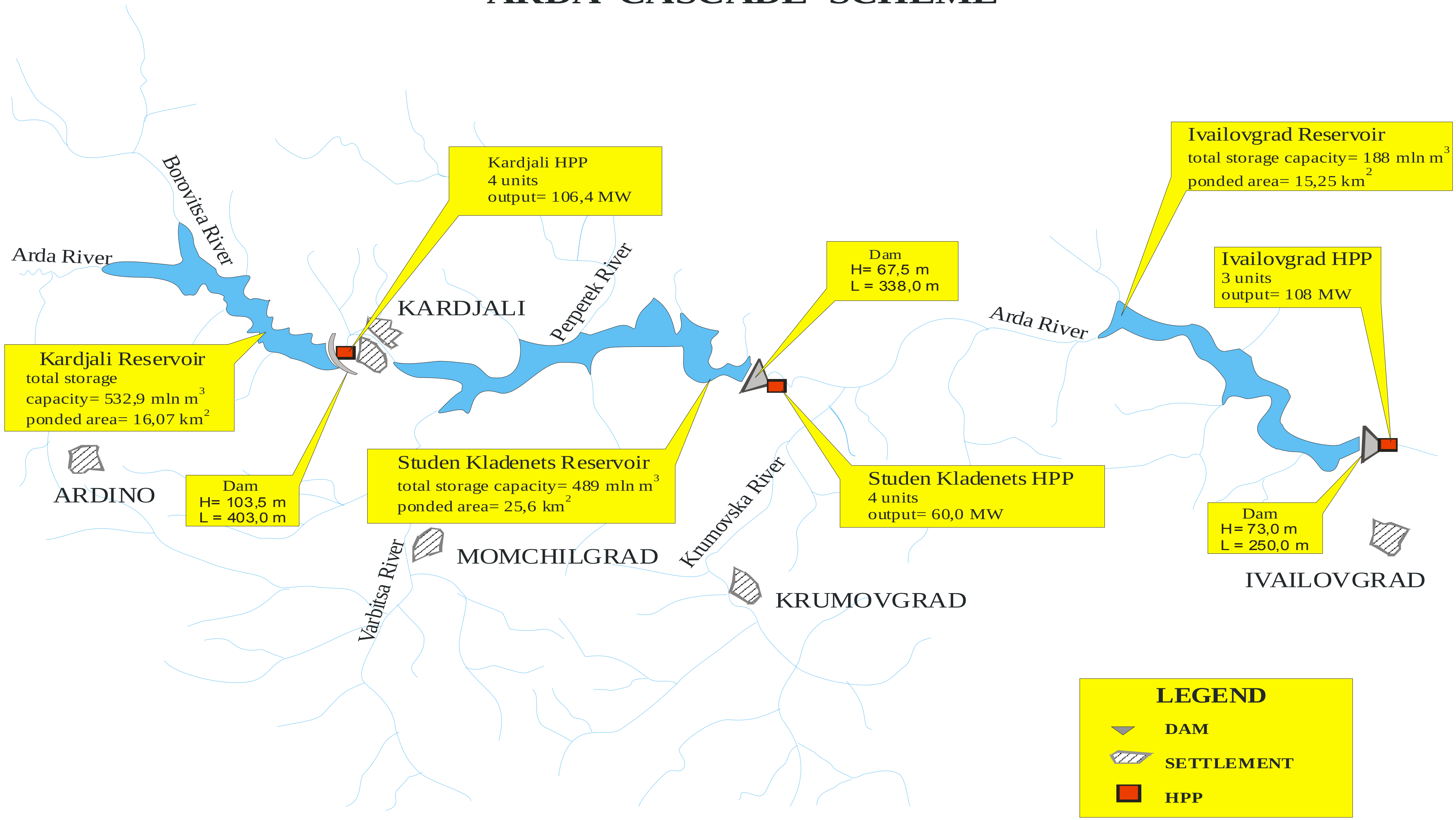
Minister of Finance

Milko KOVACHEV

Minister of Energy and Energy Resources

10.2 Annex: Schematic Layout Dolna Arda Cascade

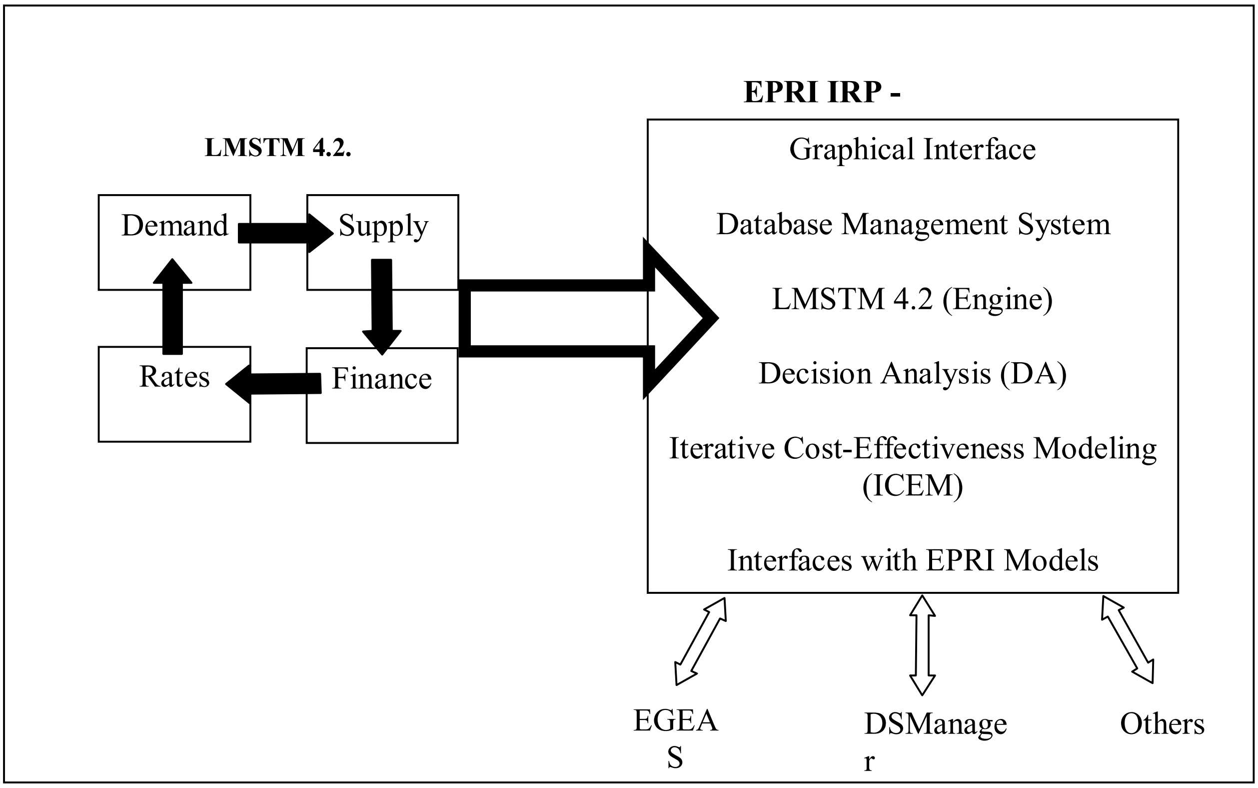
ARDA CASCADE SCHEME



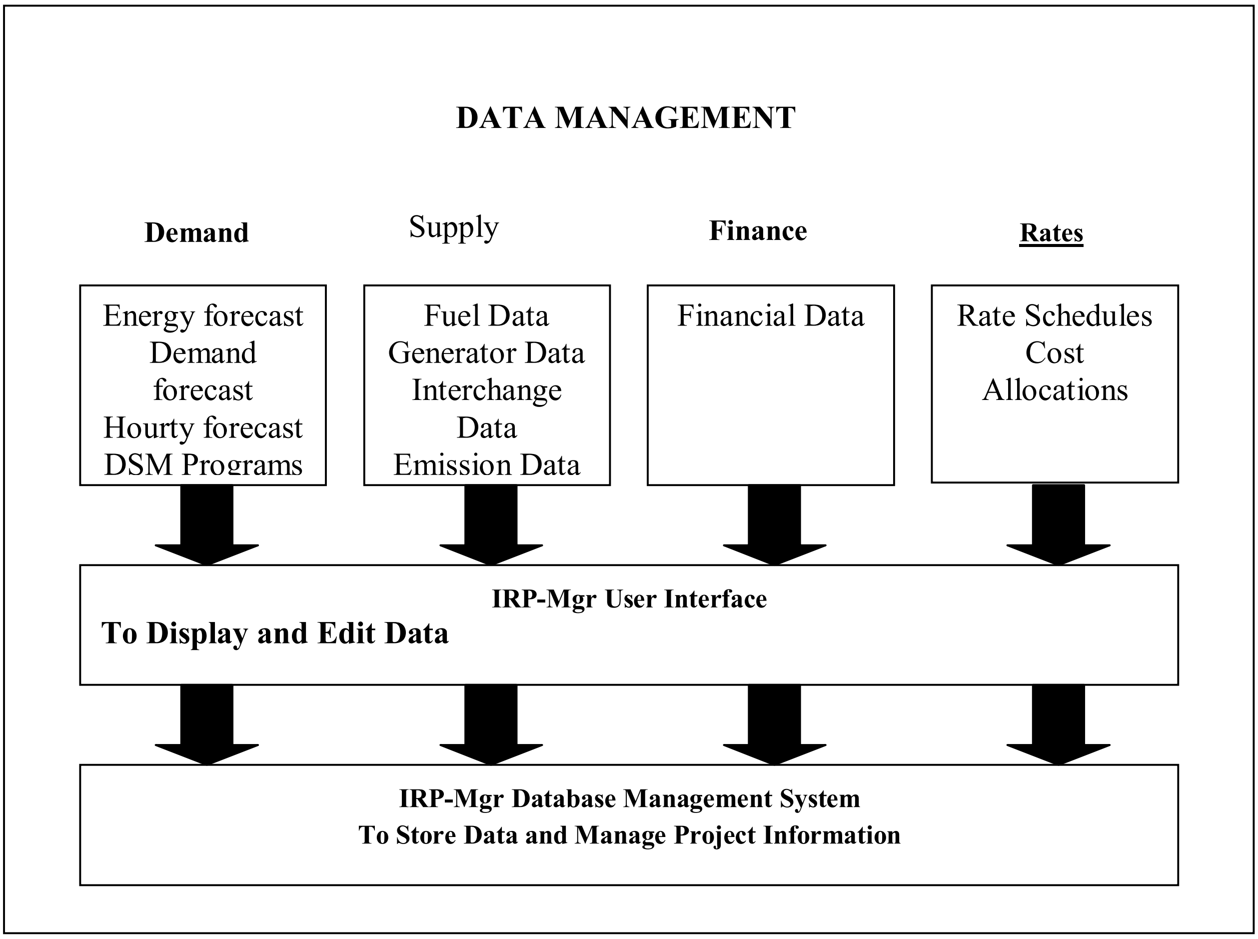
10.3 Annex: The IRP Manager Model

Description: The IRP Manager Model Overview

EPRI IRP-Manager provides and co-ordinates an expansive „Tool Box“ of integrated resource planning (IRP) capabilities, including chronological simulation of demands and resources, automated resource strategy development, decision analysis, and complete forecasts of impacts from all perspectives. IRP-Manager’s graphical user interface and database management system envelop the proven analytical engine of EPRI LMSTM, and offer seamless interfaces with EPRI DS Manager and EPRI EGEAS.



EPRI IRP-Manager provides comprehensive management of the demand, supply, financial and rate data needed for integrated planning, as illustrated below. IRP-Manager’s graphical user interface (GUI) includes a user-friendly, menu/mouse-driven process of data entry and project analysis, with instant graphic display of key input and output variables. The database management system offers quick and space-efficient data storage and management of project information.



IRP-Manager provides a **„Tool-Box"** of the full range of analytic capabilities needed for integrated planning. Case analysis of demand, supply, financial and rate alternatives can be performed by using the IRP-Manager Scenario Builder to assemble the data, the IRP-Manager Engine to perform detailed chronological simulation for all perspectives, and IRP-Manager Results Viewer to provide graphical and tabular cross-scenario comparisons of results.

Planners can define and preview demand-side alternatives using EPRI DS Manager Version 2.0, and its companion planning models. IRP-Manager directly extracts these programs from DS Manager data files for evaluation with supply alternatives in a "level-field" integrated analysis. IRP Manger provides hourly marginal costs, avoided capital costs and rate escalation inputs to DS Manager, assuring planners of consistency in the screening and integrated planning evaluations.

Planners can perform a detailed evaluation of resource strategies across various features using the IRP-Manager Decision Analysis (DA) Module. This module rapidly constructs a decision analysis scenario "tree" based on user definition of decision paths uncertainty variables, and associated probabilities. IRP-Manager automatically applies data "overlays" to create each endpoint scenario of the decision tree, and undertake sequential simulation of each scenario. Instant tabular and graphic results can be defined and reviewed for various objective/results functions and stakeholder perspectives.

For each resource plan, IRP-Manager provides a complete forecast of utility system characteristics. This includes chronological marginal cost forecasts (needed by screening models such as EPRI DS Manager), electric rates at the system or rate class level, monthly fuel usage, emissions output of utility power plants, capital requirements, and hourly load shape projections including demand-side program impacts.

Scenario Management System

IRP-Manager includes a Scenario Builder, allowing rapid set-up and organization of data sets for the resource planning scenarios to be evaluated. The Scenario Builder automatically modifies parent “data sets” when simulation each scenario defined by the User. A batch run process automatically executes multiple scenarios, as well as saves key output data for each scenario in the on-line database.

A space-efficient process of applying “overlays” to base scenario data sets dramatically reduces storage requirements in comparison to conventional data management approaches. Scenario/output and project-level data archiving further reduces disk storage requirements.

The Scenario Management System includes scenario and project-level validation of completeness and consistency prior to initiation of the simulation process. On-screen documentation is included for individual data items, as well as scenarios and projects.

Decision Analysis (DA) Module

The scenario building concept is extended within IRP-Manager to allow rapid definition and construction of decision analyses. IRP-Manager rapidly constructs a decision analysis “tree”, based on user definition of decision paths, uncertainty variables, and associated probabilities.

The DA module automatically constructs and applies data overlays to build the end-point scenarios for the decision tree, and verifies consistency and completeness of data. IRP-Manager the sequentially simulates each end-point case.

End-point scenario results are stored in the database for analysis by the User. Expected and probability-weighted results are available for any of several key output variables. Both tabular and graphic results formats are available on-screen.

Iterative Cost-Effectiveness Modeling (ICEM) Module

Iterative cost-effectiveness modeling (ICEM) is a process of evaluating and selecting resource options to obtain a desired combination as defined by an objective function specified by the User. This process can be applied to develop a range of strategies based on various objective functions such as societal costs, price growth, benefit/cost tests and emission levels.

Available time windows are defined for various resource options, chosen by the User from earlier demand and supply screening analysis. For each year of the resource evaluation period, each resource option is evaluated separately, and the resource option best meeting the objective function option is chosen and added to the resource plan. The remaining resource options are each evaluated once again, and additional options iteratively selected by IRP-Manager, to the extent that options meet the objective function. This iterative process is repeated for each year, to construct a multi-year resource plan.

The ICEM process differs from other “optimization” techniques in that ICEM allows a relatively large number of unique demand and supply resource options to be evaluated on a consistent basis with acceptable model run times, and with a broad range of decision rules. As such, there is no need for application of oversimplifying “short-cut” methods, such as single year production simulation or screening curves, in constructing a resource plan at this stage of the planning process.

ICEM as applied within IRP-Manager includes production cost simulation of each resource option for the entire study period – up to 45 years. An end-effects adjustment can be applied to estimate economic impacts beyond the study period. IRP-Manager allows the User to define a single-variable or multi-variable decision rule for application within the ICEM module. Clear explanation and documentation of the selected options is provided by IRP-Manager.

10.4 Annex: Summary of Power Generation due to Project

Dolna Arda Cascade - Breakdown of Power Generation due to Project		HPP Studen Kladenets	HPP Kardjali	HPP Ivailovgrad	HPP Dolna Arda Cascade
Total power output before rehabilitation	MW	60	106,4	103,5	**269,9**
Coefficient of electrical power efficiency of generators	-	0,96	0,96	0,96	
Net power output before rehabilitation	MW	57,6	102,144	99,36	**259,104**
Efficiency growth after rehabilitation	%	5,30	3,10	4,40	
Net power output after rehabilitation	MW	60,65	105,31	103,73	**269,70**
New unit 5 maximum power output	MW	19,75	-	-	
New unit 5 net power output	MW	16,00	-	-	
HPP maximum total output after rehabilitation	MW	80,40	105,31	103,73	**289,45**
Average annual power generation before project	GWh/a	154,975	111,61	149,14	**415,725**
Additional power generation due to rehabilitation	GWh/a	9,53	3,9	7,43	**20,86**
Additional power generation due to new unit 5	GWh/a	42,728	-	-	
Total additional power generation due to project	GWh/a	52,258	3,9	7,43	**63,588**
Average annual power generation after project	GWh/a	207,233	115,51	156,57	**479,313**

10.5 Annex: Analysis of Power Generation Part 1

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Rehabilitation of the Hydro Mechanical Equipment of Kardjali HPP, Studen Kladenets HPP and Ivailovgrad HPP in Dolna Arda Cascade

1. Introduction.

The purpose of the current study is to define the effect (the additional energy generation) as a result of the rehabilitation of the hydro-mechanical equipment in the power plants “Kardjali”, “Studen Kladenets” and “Ivailovgrad” in Arda Cascade.

2. Assumptions and prerequisites.

The study has been carried out on the grounds of the following basic data, assumptions and prerequisites:

- Real data about the monthly energy generation from the operation of the three power plants mentioned above in the period 1975-2004;
- Parameters of the turbine equipment in the power plants before the rehabilitation;
- Parameters of the turbine equipment in the power plants after the rehabilitation, submitted by VA TECH HYDRO;
- Weighted average values of the turbine efficiency in a function of N_i/N_o (**before** and **after** the rehabilitation) in the different turbine operation modes, based on the VA TECH HYDRO offer.

On the grounds of the basic data and prerequisites, the additional energy generation is defined as a result of the increased weighted average efficiency of the hydro-mechanical equipment after the rehabilitation, with the same regimes of water flows out of the reservoirs located above the three power plants in the period 1975-2002.

3. Energy effect resulting from the rehabilitation.

Tables 1-6 are made according to the assumptions and prerequisites defined above. Table 7 below shows the final energy indicators of the three power plants in Arda Cascade as a result of the hydro-mechanical equipment rehabilitation.

Table No7

Indicator	Measure	Before rehabilitation	After rehabilitation	Effect resulting from the rehabilitation
Kardjali HPP				
η_w	%	88,8	91,9	3,1
E_{annual}	$GWh/_{annual}$	111,61	115,50	3,90
Studen Kladenets HPP				
η_w	%	86,2	91,5	5,30
E_{annual}	$GWh/_{annual}$	154,97	164,50	9,53
Ivailovgrad HPP				
η_w	%	88,3	92,7	4,4
E_{annual}	$GWh/_{annual}$	149,14	156,57	7,43
Total for the three HPPs (GWh/a)				**20,86**

Increase of the installed capacity in Studen Kladenets HPP

1. Introduction

The goal of this study is to define the effect (the additional energy generation) as a result of increasing the installed capacity of Studen Kladenets HPP by the installation of one additional hydro unit (unit 5).

2. Assumptions and prerequisites.

The study has been carried out on the grounds of the following basic data, assumptions and prerequisites:

- Real data about the water balance (by months) of Studen Kladenets Reservoir for the period 1980-2004, received from Dams & Cascades Enterprise;
- Curve of the ponded volumes of Studen Kladeents Reservoir ;
- Parameters of the four hydro units in the power plant after their rehabilitation submitted by VA TECH HYDRO ;
- Parameters of the additional hydro unit (unit 5) in the power plant, submitted by VA TECH HYDRO.

The analysis is made on the grounds of a simulation of the power plant operation under conditions of **four** and **five** hydro units in the period 1980-2004, with the same water balance in Studen Kladenets Reservoir. Keeping this condition, the effect of increasing the power plant installed capacity results from two main factors:

- Additional energy generation resulting from the increased total capacity (flexibility) of the units, which allows operation at a higher water level of the reservoir.
- Additional energy generation from unit 5 during operation in the cases of high waters spilling.

The water levels of Studen Kladenets Reservoir have been defined for each month of the 25-year period under consideration, according to the first of the two factors mentioned above, as the water balance in the period 1980-2004 has been taken into account. For each of the reservoir water levels defined so, higher water levels are determined, which correspond to the monthly volume which can be additionally turbined by unit 5. it is aimed by that to have operation of the power plant at the higher water levels (at unchanged water balance), and the availability of unit 5 will allow passing to operation at the lower levels of the reservoir when that is needed.

According to the second of the above factors, additional energy generation is achieved during the operation of unit 5 when Studen Kladenets reservoir spills. Within the 25-year operational period under consideration the total time of reservoir spillage amounts to 36 day-and-nights (864 hours).

3. Energy effect resulting from increasing the capacity of Studen Kladenets HPP.

Table 8 (lists 1-13) is prepared on the grounds of the assumptions and prerequisites defined above. Table 9 presents the final energy indicators for additional energy generation from Studen Kladenets HPP as a result of its operation at higher water levels of Studen Kladenets Reservoir. Table 10 shows the additional energy generation from unit 5 when the reservoir spills, as well as the total effect from increasing the capacity of Studen Kladenets HPP.

10.6 Annex: Analysis of Power Generation Part 2 - Rehabilitation Effects

Табл. 6

Generation of Ivailovgrad HPP before rehabilitation (thousand kWh)													
Years	Months												Amount
	1	2	3	4	5	6	7	8	9	10	11	12	
1975	21.244	13.379	7.555	5.291	15.722	13.347	15.281	23.373	11.489	8.525	9.821	12.675	157702
1976	12.571	11.045	11.717	10.972	6.364	4.119	5.876	2.066	453	5.948	20.356	43.314	134801
1977	29.936	39.449	23.768	16.360	5.572	18.698	13.611	5.655	1.596	4.243	5.912	10.808	175608
1978	5.179	12.464	16.615	7.215	6.789	5.680	8.989	6.387	16.253	5.756	16.722	23.981	132030
1979	35.790	40.279	10.019	14.508	14.744	6.091	6.297	10.628	5.195	10.551	25.259	23.324	202685
1980	44.000	28.000	24.000	18.000	22.000	21.000	17.000	4.000	5.000	6.000	6.000	30.000	225000
1981	51.670	50.977	28.689	16.818	10.651	6.975	16.713	7.750	9.122	11.570	10.792	11.790	233517
1982	20.200	15.000	20.800	17.400	11.300	10.200	6.800	3.000	1.300	3.900	8.000	21.700	139600
1983	26.000	36.000	17.000	14.000	14.000	24.807	22.678	19.730	5.126	7.376	10.225	12.014	208956
1984	18.810	22.497	52.011	33.062	6.191	10.691	7.838	4.289	7.992	10.669	19.718	10.794	204562
1985	23.887	20.937	15.512	9.295	4.850	6.336	2.471	715	66	63	52	385	84569
1986	103	23.517	19.457	3.171	11.765	5.596	8.914	5.025	1.950	14.709	9.742	15.548	119497
1987	12.093	13.055	14.297	26.475	11.680	6.715	7.507	5.750	7.315	10.678	10.547	14.268	140380
1988	10.165	7.856	31.064	20.352	7.180	11.544	13.439	8.756	2.117	4.988	9.159	13.826	140446
1989	7.409	3.448	16.666	8.873	11.960	6.535	9.140	14.795	7.520	13.138	16.003	11.103	126590
1990	9.693	7.373	8.091	11.215	11.811	5.247	6.316	2.905	1.646	2.523	1.200	7.648	75668
1991	4.955	26.390	17.001	8.756	10.687	7.905	7.438	6.969	3.962	8.723	10.859	15.444	129089
1992	11.779	2.777	795	4.491	3.099	4.315	5.443	4.488	1.699	6.255	5.149	8.544	58834
1993	8.182	8.141	7.885	5.895	7.330	4.094	5.157	4.968	5.108	1.472	14.020	5.930	78182
1994	3.627	6.454	5.696	5.423	2.694	5.863	5.481	4.952	1.711	5.409	6.899	8.807	63016
1995	29.368	12.486	24.522	24.834	7.325	9.178	6.238	5.818	3.916	5.694	14.960	12.248	156587
1996	17.248	23.783	29.400	29.926	15.357	5.870	6.515	6.526	6.144	2.938	5.517	43.629	192853
1997	25.805	6.066	23.278	44.170	6.554	5.008	4.998	5.492	7.056	6.761	13.706	34.923	183817
1998	32.082	43.864	26.911	10.159	38.819	26.308	9.315	5.168	2.425	510	26.311	39.588	261460
1999	19.959	36.018	40.414	25.674	8.205	5.685	6.414	6.647	3.804	5.560	8.885	10.218	177483
2000	13.126	14.313	12.121	8.548	12.031	6.020	5.553	6.767	6.027	7.197	6.789	6.184	104676
2001	7.235	8.587	5.676	9.751	9.632	4.775	5.650	4.829	3.690	5.497	4.553	11.563	81438
2002	10.110	4.144	12.040	3.821	2.862	5.519	5.209	5.878	10.319	13.702	19.678	32.696	125978
2003	47.082	43.762	16.345	19.998	14.378	11.140	6.765	6.661	2.280	771	1.543	24.183	194908
2004	45.998	28.293	9.380	6.187	2.725	12.380	7.569	10.928	8.363	5.685	8.174	18.641	164323
Average	**20177**	**20345**	**18291**	**14688**	**10476**	**9255**	**8554**	**7031**	**5021**	**6560**	**10885**	**17859**	**149142**
p (%)	13,53	13,64	12,26	9,85	7,02	6,21	5,74	4,71	3,37	4,40	7,30	11,97	100,00
Generation of Ivailovgrad HPP after rehabilitation (thousand kWh)													
Average	**21182**	**21359**	**19202**	**15420**	**10998**	**9716**	**8980**	**7381**	**5272**	**6887**	**11427**	**18749**	**156572**

before rehabilitation			**After rehabiltiation**			**Effect resulting from rehabilitation**		
ηw	%	88,30	ηw	%	92,7	Δ ηw	%	4,40
E	GWh/annum	149,14	E	GWh/annum	156,57	Δ E	GWh/annum	7,43

Table 5

Generation of Studen Kladenets HPP before rehabilitation (thousand kWh)													
Years	Months												Amount
	1	2	3	4	5	6	7	8	9	10	11	12	
1975	18450	14447	10640	7834	13323	14108	20876	21217	14516	12289	9538	10570	167808
1976	14471	11452	13714	12338	7066	5420	6487	2021	501	9662	21365	42175	146672
1977	38166	33751	23658	17247	11783	24230	16589	2442	1056	8199	4906	11571	193598
1978	6347	13485	17462	14256	6348	5908	10772	9042	16509	5268	14405	24815	144617
1979	31717	27610	15746	16024	14499	7967	8009	13812	6619	11921	23317	24629	201870
1980	45000	33000	31000	20000	23000	24000	22000	6000	13000	5000	6000	25000	253000
1981	39000	44000	35000	21000	12000	9000	17800	12100	13400	14100	8200	11000	236600
1982	24400	17000	17700	16300	16700	11600	5700	1260	1000	6000	9700	22800	150160
1983	29000	32000	23000	15000	20000	25214	23327	19431	6435	9843	11361	11210	225821
1984	20215	26713	43119	32321	7994	10122	9274	7531	9049	12565	18158	11417	208478
1985	26176	22760	16455	10911	5699	6350	3400	693	261	0	78	1707	94490
1986	940	12936	23581	4491	15820	5359	11971	5202	3936	16946	12893	15606	129681
1987	11636	12084	13994	24480	14520	6616	8844	8992	10892	10896	11753	18864	153571
1988	10902	6886	24544	29353	9405	15477	12969	9145	7775	9118	12681	9640	157895
1989	5663	2814	10642	9735	14826	7233	10956	17917	12397	11628	11993	11285	127089
1990	12227	7664	5501	10007	5407	10134	5715	4786	3683	2223	987	3257	71591
1991	4551	22869	18674	10164	9846	9457	8163	11348	3812	9900	15382	18134	142300
1992	10424	3213	549	1893	1608	5658	4682	3969	8237	5952	2751	8602	57538
1993	9317	8723	5290	4990	4830	3337	6558	4331	5223	7548	15402	4353	79902
1994	1857	4797	2397	2232	4755	6591	5373	5418	4914	8030	5445	5364	57173
1995	19515	12430	20615	28478	9563	7773	8269	8422	5991	8013	17988	13508	160565
1996	14641	14811	27425	27854	18776	7212	9614	6526	6528	3705	3366	39505	179963
1997	26483	5514	15255	43551	6972	1401	9000	7052	4323	12750	13151	25959	171411
1998	33260	35868	27165	9615	31499	30222	11413	0	0	507	23760	36972	240281
1999	17727	30414	36576	26486	9567	6054	10908	6361	7658	6399	10239	9860	178249
2000	12657	9024	13566	10490	15789	6930	7758	8417	7316	9024	7047	5145	113163
2001	4560	6600	6387	8742	12735	4983	6720	8028	7050	5715	7794	9070	88384
2002	10078	6072	4227	4791	2886	5519	6351	7200	6453	12825	22158	38850	127410
2003	41682	37419	21291	20101	16467	14856	8379	3300	1395	2002	11852	20971	199715
2004	43719	33084	10683	8943	4551	17283	6768	16900	11327	7428	9258	20310	190254
Average	**19493**	**18315**	**17862**	**15654**	**11608**	**10534**	**10155**	**7962**	**6709**	**8182**	**11431**	**17072**	**154975**
p (%)	12,58	11,82	11,53	10,10	7,49	6,80	6,55	5,14	4,33	5,28	7,38	11,02	100,00
Generation of Studen Kladenets HPP after rehabilitation (thousand kWh)													
Average	**20691**	**19441**	**18960**	**16617**	**12322**	**11182**	**10779**	**8452**	**7121**	**8685**	**12134**	**18121**	**164505**

before rehabiltiation			**after rehabilitation**			**effect of rehabilitation**		
ηw	%	86,20	ηw	%	91,50	Δ ηw	%	5,30
E	GWh/annum	154,97	E	GWh/annum	164,50	Δ E	GWh/annum	9,53

Table 4

Generation of Kardjali HPP before rehabilitation (thousand kWh)													
Years	Months												Amount
	1	2	3	4	5	6	7	8	9	10	11	12	
1975	7958	3974	9378	4731	10089	10385	18395	1385	0	9037	4071	7738	87141
1976	4207	5521	9147	10970	2715	3905	5796	2707	0	14089	33566	29482	122105
1977	12939	14431	15344	6680	5178	17868	5084	662	3365	5323	2767	8227	97868
1978	5219	13660	8398	6888	3702	6555	5386	4062	11101	4277	8748	25683	103679
1979	14281	3604	2045	14810	19989	6773	6333	11798	5750	13230	8393	18373	125379
1980	28000	26000	19000	7000	14000	7000	24000	6000	4000	3000	4000	11000	153000
1981	26000	15000	29000	20000	12000	1000	29600	7600	3600	1200	3700	14700	163400
1982	22800	2000	12600	16700	11400	4900	5000	300	2100	5700	11800	23200	118500
1983	27000	16000	15000	7000	7000	17854	17689	18837	6597	8925	2510	10361	154773
1984	19096	21613	18271	29840	811	1895	8961	7208	4519	13129	11161	1362	137866
1985	24393	8589	9178	10386	5660	6879	2758	683	160	126	97	2326	71235
1986	399	9010	7392	8031	15565	10850	12240	4175	3347	20144	6447	8034	105634
1987	4826	4660	9217	34368	12187	7087	9869	7519	13583	11265	6122	8809	129512
1988	1001	578	22984	22753	5882	16071	14290	7785	2594	6166	5940	3540	109584
1989	1074	2764	9708	6736	14586	3006	8779	23154	9969	5546	8379	3415	97116
1990	1149	3404	5501	6112	15847	1066	1399	375	191	703	838	1946	38531
1991	1405	20824	12408	11954	12214	4941	5578	7551	4531	16750	12961	5937	117054
1992	2996	1893	360	800	367	5286	7466	5910	13755	9211	2422	1359	51825
1993	5092	2960	1952	911	1647	1498	4124	2907	3395	5066	14378	2742	46672
1994	492	1768	2479	1378	2443	3282	4025	4692	3690	6269	5257	4128	39903
1995	8129	9320	17238	16270	8167	10035	10332	12027	2603	5458	11942	4080	115601
1996	6499	7790	18171	22552	17082	4488	7809	6054	5925	2972	1288	26782	127412
1997	18360	2134	13973	38159	2999	3987	8708	6607	3658	11849	10960	18314	139708
1998	18361	30615	18919	8255	34707	16013	2064	8811	10343	3478	9659	21517	182742
1999	11972	24504	31727	21096	7922	6499	17244	6866	3627	5124	5572	7508	149661
2000	7991	4019	10167	9076	10878	9127	7265	8065	6386	6835	2985	440	83234
2001	1208	1615	2212	3529	10103	4378	7005	6218	7501	7301	4353	4806	60229
2002	3773	2356	1110	1454	1145	3881	4803	6977	8330	10530	19148	35057	98564
2003	25924	29324	12222	17909	22438	13164	3611	2073	1461	4667	11364	14524	158681
2004	34517	22198	9236	6459	6384	20686	7368	19966	13948	1697	3746	15379	161584
Average	**11569**	**10404**	**11811**	**12427**	**9837**	**7679**	**9099**	**6966**	**5334**	**7302**	**7819**	**11359**	**111606**
p (%)	10,37	9,32	10,58	11,13	8,81	6,88	8,15	6,24	4,78	6,54	7,01	10,18	100,00
Generation of Kardajli HPP after the rehabilitation													
Average	**11973**	**10768**	**12224**	**12861**	**10181**	**7947**	**9417**	**7209**	**5521**	**7557**	**8092**	**11756**	**115506**

before rehabiltiation			**after rehabilitation**			**effect of rehabilitation**		
ηw	%	88,80	ηw	%	91,9	Δ ηw	%	3,10
E	GWh/annum	111,61	E	GWh/annum	115,50	Δ E	GWh/annum	3,90

Table No1

Kurjali HPP - Tests 1996				
Ni/No	**N**	**η_T**	**Weighting Factor (w)**	**η_T x w**
33,20	30,8	0,875	0,10	0,088
30,94	28,7	0,894	0,15	0,134
29,86	27,7	0,899	0,20	0,180
28,78	26,7	0,895	0,25	0,224
26,52	24,6	0,885	0,15	0,133
24,36	22,6	0,869	0,10	0,087
22,10	20,5	0,854	0,05	0,043
		Test measurements 1996:	**1,000**	**0,888**
Kurjali HPP - after Rehabiliattion				
Ni/No	**N**	**η_T**	**Weighting Factor (w)**	**η_T x w**
1,0	39,05	0,9193	0,20	0,184
0,9	35,15	0,9355	0,20	0,187
0,8	31,24	0,9310	0,25	0,233
0,7	27,34	0,9255	0,15	0,139
0,6	23,43	0,9095	0,10	0,091
0,5	19,53	0,8810	0,05	0,044
0,4	15,62	0,8290	0,05	0,041
		Sum total:	**1,000**	**0,919**

Table No2

Studen Kladenets HPP - Manufacture Data				
Ni/No	**N**	**η_T**	**Weighting Factor (w)**	**η_T x w**
1,00	35,821	0,8181	0,20	0,164
0,90	31,866	0,8584	0,20	0,172
0,80	28,844	0,8845	0,25	0,221
0,70	24,644	0,8956	0,15	0,134
0,60	22,803	0,8899	0,10	0,089
0,50	19,463	0,8660	0,05	0,043
0,40	16,224	0,8306	0,05	0,042
		Manufacture Data:	**1,000**	**0,865**
		Test measurements 2000:		**0,862**
Studen Kladenets HPP - after Rehabilitation				
Ni/No	**N**	**η_T**	**Weighting Factor (w)**	**η_T x w**
1,00	33,740	0,9155	0,20	0,183
0,90	30,366	0,9320	0,20	0,186
0,80	26,992	0,9285	0,25	0,232
0,70	23,618	0,9205	0,15	0,138
0,60	20,244	0,9060	0,10	0,091
0,50	16,870	0,8760	0,05	0,044
0,40	13,496	0,8210	0,05	0,041
		Sum total:	**1,000**	**0,915**

Table No3

Ivailovgrad HPP - Manufacture data				
Ni/No	**N**	**η_T**	**Weighting Factor (w)**	**η_T x w**
1,00	33,50	0,9140	0,25	0,229
0,85	30,00	0,9150	0,40	0,366
0,60	27,00	0,9095	0,25	0,227
0,40	24,00	0,8880	0,10	0,089
		Manufacture Data:	**1,00**	**0,911**
		Test measurements 2000:		**0,883**
Ivailovgrad HPP - after Rehabilitation				
Ni/No	**N**	**η_T**	**Weighting Factor (w)**	**η_T x w**
1,00	91,580	0,9248	0,20	0,1850
0,90	82,422	0,9277	0,20	0,1855
0,80	73,264	0,9302	0,25	0,2326
0,70	64,106	0,9310	0,15	0,1397
0,60	54,948	0,9282	0,10	0,0928
0,50	45,790	0,9194	0,05	0,0460
0,40	36,632	0,9027	0,05	0,0451
		Sum total:	**1,000**	**0,9266**

Years	Months												Amount
	1	2	3	4	5	6	7	8	9	10	11	12	
Generation of Studen Kladenets HPP before the rehabilitation (thousand kWh)													
Average	19493	18315	17862	15654	11608	10534	10155	7962	6709	8182	11431	17072	**154975**
p (%)	12,58	11,82	11,53	10,10	7,49	6,80	6,55	5,14	4,33	5,28	7,38	11,02	100,00
Additional generation of Studen Kladents after rehabilitation (thousand kWh)													
Average	1199	1126	1098	963	714	648	624	490	413	503	703	1050	**9530**
Additional generation of Studen Kladenets HPP after installation of unit 5 (thousand kWh)													
Average	1448	1383	1358	860	638	579	558	438	369	450	628	938	**9647**
Generation of Studen Kladenets HPP after rehabilitation and installation of unit 5 (thousand kWh)													
Average	**22139**	**20824**	**20319**	**17477**	**12960**	**11760**	**11337**	**8889**	**7490**	**9135**	**12762**	**19060**	**174152**

10.7 Annex: Analysis of Power Generation Part 3 - Studen Kladenets Effects

Studen Kladenets HPP (Table 8 - list 1)

mln m^3

Years	Months	Inflow	Consumption				Inflow-Cons.	Vreservoir		Water Level		Δh
			Total	HPP		Other						
				4 units	unit 5		4 units	4 units	5 units	4 units	5 units	
	1	347,646	322,248	321,15	54,701	1,098	25,398	434,299	489,000	223,18	225,01	1,83
	2	233,491	241,948	240,575	63,158	1,373	-8,457	425,842	489,000	222,87	225,01	2,14
	3	191,843	229,876	227,905	80,352	1,971	-38,033	387,809	468,161	221,40	224,35	2,95
	4	172,153	152,666	150,27	77,760	2,396	19,487	407,296	485,056	222,17	224,89	2,72
	5	214,182	169,811	166,648	37,333	3,163	44,371	451,667	489,000	223,79	225,01	1,22
	6	121,295	184,646	180,82	77,760	3,826	-63,351	388,316	466,076	221,42	224,28	2,86
1980	7	138,931	169,901	165,09	77,760	4,811	-30,970	357,346	435,106	220,11	223,21	3,10
	8	50,787	48,705	43,923	80,352	4,782	2,082	359,428	439,780	220,21	223,38	3,17
	9	30,176	108,973	105,496	77,760	3,477	-78,797	280,631	358,391	216,40	220,16	3,76
	10	41,665	47,755	44,549	80,352	3,206	-6,090	274,541	354,893	216,08	220,01	3,93
	11	78,537	57,271	54,602	77,760	2,669	21,266	295,807	373,567	217,19	220,81	3,62
	12	347,726	185,929	183,864	31,396	2,065	161,797	457,604	489,000	223,99	225,01	1,02
	Total	**1968,43**	**1919,73**	**1884,89**		**34,84**			**Mean**	**220,74**	**223,43**	**2,69**
	1	374,303	359,146	284,300	16,239	74,846	15,157	472,761	489,000	224,50	225,01	0,52
	2	350,403	349,789	315,279	15,625	34,510	0,614	473,375	489,000	224,52	225,01	0,50
	3	252,718	257,621	256,049	20,528	1,572	-4,903	468,472	489,000	224,36	225,01	0,66
	4	125,374	156,706	153,890	51,860	2,816	-31,332	437,140	489,000	223,28	225,01	1,73
	5	97,677	98,809	95,12	52,992	3,689	-1,132	436,008	489,000	223,24	225,01	1,77
	6	17,691	71,914	67,1	77,760	4,814	-54,223	381,785	459,545	221,15	224,06	2,91
1981	7	176,641	139,223	134,08	52,992	5,143	37,418	419,203	489,000	222,63	225,01	2,39
	8	54,203	93,356	88,361	80,352	4,995	-39,153	380,050	460,402	221,08	224,09	3,01
	9	32,968	109,101	105,905	77,760	3,196	-76,133	303,917	381,677	217,60	221,15	3,55
	10	17,779	130,199	127,992	80,352	2,207	-112,420	191,497	271,849	211,14	215,93	4,79
	11	47,124	109,065	107,698	77,760	1,367	-61,941	129,556	207,316	206,81	212,16	5,35
	12	275,000	106,180	104,718	80,352	1,462	168,820	298,376	378,728	217,32	221,03	3,70
	Total	**1821,881**	**1981,109**	**1840,492**		**140,617**			**Mean**	**219,80**	**222,37**	**2,57**

Studen Kladenets HPP (Table 8 - list 2)

mln m^3

Years	Months	Inflow	Consumption				Inflow-Cons.	Vreservoir		Water Level		Δh
			Total	HPP		Other						
				4 units	unit 5		4 units	4 units	5 units	4 units	5 units	
	1	170,51	195,13	193,724	80,352	1,406	-24,620	273,756	354,108	216,03	219,97	3,94
	2	105,762	174,662	173,75	72,576	0,912	-68,900	204,856	277,432	212,00	216,23	4,23
	3	176,772	162,337	160,98	80,352	1,357	14,435	219,291	299,643	212,90	217,39	4,49
	4	196,855	140,034	138,62	77,760	1,414	56,821	276,112	353,872	216,16	219,96	3,80
	5	113,947	145,006	142,755	80,352	2,251	-31,059	245,053	325,405	214,43	218,65	4,22
	6	40,643	112,455	109,22	77,760	3,235	-71,812	173,241	251,001	209,92	214,77	4,85
1982	7	55,095	61,907	58,835	77,760	3,072	-6,812	166,429	244,189	209,46	214,38	4,92
	8	10,261	15,79	12,905	80,352	2,885	-5,529	160,900	241,252	209,07	214,21	5,14
	9	16,333	12,041	9,59	77,760	2,451	4,292	165,192	242,952	209,37	214,31	4,94
	10	48,982	60,557	58,77	80,352	1,787	-11,575	153,617	233,969	208,56	213,78	5,22
	11	170,585	94,909	93,826	77,760	1,083	75,676	229,293	307,053	213,51	217,76	4,26
	12	423,139	177,821	176,695	14,389	1,126	245,318	474,611	489,000	224,56	225,01	0,46
	Total	**1528,884**	**1352,649**	**1329,67**		**22,979**			**Mean**	**213,00**	**217,20**	**4,21**
	1	204,679	213,86	212,800	23,570	1,060	-9,181	465,430	489,000	224,26	225,01	0,76
	2	207,073	231,052	230,195	47,549	0,857	-23,979	441,451	489,000	223,44	225,01	1,58
	3	163,977	177,348	176,04	60,920	1,308	-13,371	428,080	489,000	222,96	225,01	2,06
	4	93,993	112,637	110,785	77,760	1,852	-18,644	409,436	487,196	222,26	224,96	2,70
	5	74,806	139,874	137,28	80,352	2,594	-65,068	344,368	424,720	219,53	222,83	3,30
	6	215,214	196,183	193,665	77,760	2,518	19,031	363,399	441,159	220,38	223,43	3,05
1983	7	119,27	185,281	181,435	77,760	3,846	-66,011	297,388	375,148	217,27	220,88	3,60
	8	117,221	158,073	154,61	80,352	3,463	-40,852	256,536	336,888	215,09	219,19	4,11
	9	59,808	61,174	58,06	77,760	3,114	-1,366	255,170	332,930	215,01	219,01	4,00
	10	76,194	85,627	83,57	80,352	2,057	-9,433	245,737	326,089	214,47	218,69	4,21
	11	16,999	132,949	131,35	77,760	1,599	-115,950	129,787	207,547	206,83	212,17	5,34
	12	206,036	111,213	109,545	80,352	1,668	94,823	224,610	304,962	213,22	217,66	4,43
	Total	**1555,27**	**1805,271**	**1779,335**		**25,936**			**Mean**	**217,89**	**221,15**	**3,26**

Studen Kladenets HPP (Table 8 - list 3)

mln m^3

Years	Months	Inflow	Consumption				Inflow-Cons.	Vreservoir		Water Level		Δh
			Total	HPP		Other						
				4 units	unit 5		4 units	4 units	5 units	4 units	5 units	
1984	1	230,072	166,767	165,055	80,352	1,712	63,305	287,915	368,267	216,79	220,59	3,80
	2	259,733	206,086	204,835	72,576	1,251	53,647	341,562	414,138	219,41	222,44	3,03
	3	409,269	313,12	311,953	51,289	1,167	96,149	437,711	489,000	223,30	225,01	1,71
	4	267,328	234,121	231,97	18,082	2,151	33,207	470,918	489,000	224,44	225,01	0,58
	5	47,294	68,901	64,45	39,689	4,451	-21,607	449,311	489,000	223,71	225,01	1,30
	6	28,794	80,028	75,3	77,760	4,728	-51,234	398,077	475,837	221,81	224,60	2,78
	7	54,271	70,064	64,994	77,760	5,070	-15,793	382,284	460,044	221,18	224,08	2,90
	8	50,545	63,975	59,535	80,352	4,440	-13,430	368,854	449,206	220,61	223,71	3,09
	9	30,114	73,791	70,346	77,760	3,445	-43,677	325,177	402,937	218,64	222,00	3,36
	10	78,769	102,405	99,802	80,352	2,603	-23,636	301,541	381,893	217,48	221,16	3,67
	11	84,029	152,577	151,03	77,760	1,547	-68,548	232,993	310,753	213,73	217,94	4,22
	12	15,915	139,69	138,365	80,352	1,325	-123,775	109,218	189,570	205,26	211,01	5,76
	Total	**1556,133**	**1671,525**	**1637,635**		**33,89**			**Mean**	**218,86**	**221,88**	**3,02**
1985	1	370,282	215,735	214,400	80,352	1,335	154,547	263,765	344,117	215,49	219,52	4,03
	2	136,686	200,129	198,925	72,576	1,204	-63,443	200,322	272,898	211,71	215,99	4,28
	3	109,991	166,379	165,19	80,352	1,189	-56,388	143,934	224,286	207,87	213,20	5,34
	4	96,524	113,203	111,725	77,760	1,478	-16,679	127,255	205,015	206,64	212,01	5,37
	5	65,309	60,465	58,227	80,352	2,238	4,844	132,099	212,451	207,00	212,48	5,48
	6	64,176	70,51	68,24	77,760	2,270	-6,334	125,765	203,525	206,52	211,92	5,39
	7	28,42	46,391	44,185	77,760	2,206	-17,971	107,794	185,554	205,14	210,75	5,61
	8	11,078	12,813	9,995	80,352	2,818	-1,735	106,059	186,411	205,01	210,81	5,80
	9	50,47	6,869	4,8	77,760	2,069	43,601	104,237	181,997	204,86	210,51	5,65
	10	8,177	1,871	0,11	80,352	1,761	6,306	110,543	190,895	205,36	211,10	5,74
	11	26,005	2,824	0,91	77,760	1,914	23,181	133,724	211,484	207,12	212,42	5,30
	12	31,876	17,980	16,269	80,352	1,711	13,896	147,620	227,972	208,13	213,43	5,29
	Total	**998,994**	**915,169**	**892,976**		**22,193**			**Mean**	**207,57**	**212,84**	**5,27**

Studen Kladenets HPP (Table 8 - list 4)

mln m^3

Години	Months	Inflow	Consumption				Inflow-Cons.	Vreservoir		Water Level		Δh
			Total	HPP		Other						
				4 units	unit 5		4 units	4 units	5 units	4 units	5 units	
1986	1	41,851	11,898	10,06	80,352	1,838	29,953	177,603	257,955	210,22	215,17	4,95
	2	388,341	100,211	98,434	23,267	1,777	288,130	465,733	489,000	224,27	225,01	0,75
	3	118,637	184,467	182,715	80,352	1,752	-65,830	399,903	480,255	221,89	224,74	2,85
	4	60,919	36,649	33,915	64,827	2,734	24,270	424,173	489,000	222,81	225,01	2,20
	5	100,267	119,27	116,433	80,352	2,837	-19,003	405,170	485,522	222,09	224,91	2,81
	6	72,107	44,407	40,32	56,130	4,087	27,700	432,87	489,000	223,13	225,01	1,88
	7	73,206	91,243	86,92	74,167	4,323	-18,037	414,833	489,000	222,46	225,01	2,55
	8	27,828	43,282	38,085	80,352	5,197	-15,454	399,379	479,731	221,86	224,72	2,86
	9	19,896	32,731	28,44	77,760	4,291	-12,835	386,544	464,304	221,35	224,22	2,87
	10	107,131	125,776	122,705	80,352	3,071	-18,645	367,899	448,251	220,57	223,67	3,10
	11	51,563	101,254	98,67	77,760	2,584	-49,691	318,208	395,968	218,31	221,73	3,42
	12	60,371	132,67	130,7	80,352	1,970	-72,299	245,909	326,261	214,48	218,69	4,21
	Total	**1122,117**	**1023,858**	**987,397**		**36,461**			**Mean**	**220,29**	**223,16**	**2,87**
1987	1	128,847	97,073	94,765	80,352	2,308	31,774	277,683	358,035	216,25	220,14	3,90
	2	142,389	101,866	99,675	72,576	2,191	40,523	318,206	390,782	218,31	221,52	3,21
	3	127,171	115,612	113,185	80,352	2,427	11,559	329,765	410,117	218,86	222,28	3,42
	4	330,27	181,396	178,493	10,361	2,903	148,874	478,639	489,000	224,69	225,01	0,33
	5	101,968	109,076	104,855	17,469	4,221	-7,108	471,531	489,000	224,46	225,01	0,56
	6	57,503	56,58	51,705	16,546	4,875	0,923	472,454	489,000	224,49	225,01	0,53
	7	65,299	71,413	64,64	22,660	6,773	-6,114	466,340	489,000	224,29	225,01	0,73
	8	44,526	72,58	66,575	50,714	6,005	-28,054	438,286	489,000	223,32	225,01	1,69
	9	82,369	89,764	84,556	58,109	5,208	-7,395	430,891	489,000	223,06	225,01	1,96
	10	79,52	90,384	86,635	68,973	3,749	-10,864	420,027	489,000	222,66	225,01	2,36
	11	81,599	89,501	86,215	76,875	3,286	-7,902	412,125	489,000	222,36	225,01	2,66
	12	97,897	135,619	133,07	80,352	2,549	-37,722	374,403	454,755	220,85	223,90	3,05
	Total	**1339,358**	**1210,864**	**1164,369**		**46,495**			**Mean**	**221,96**	**224,00**	**2,03**

Studen Kladenets HPP (Table 8 - list 5)

mln m^3

Years	Months	Inflow	Consumption				Inflow-Cons.	Vreservoir		Water Level		Δh
			Total	HPP		Other						
				4 units	unit 5		4 units	4 units	5 units	4 units	5 units	
	1	22,09	80,671	77,98	80,352	2,691	-58,581	315,822	396,174	218,19	221,74	3,55
	2	142,413	58,594	55,92	72,576	2,674	83,819	399,641	472,217	221,87	224,48	2,60
	3	279,222	187,638	177,618	80,352	10,020	91,584	491,225	491,225	225,08	225,08	0,00
	4	183,15	217,069	213,935	31,694	3,134	-33,919	457,306	489,000	223,98	225,01	1,03
	5	78,6	75,607	71,38	28,701	4,227	2,993	460,299	489,000	224,09	225,01	0,93
	6	123,754	119,23	114,85	24,177	4,380	4,524	464,823	489,000	224,24	225,01	0,78
1988	7	89,546	105,954	100,06	40,567	5,894	-16,408	448,433	489,000	223,68	225,01	1,33
	8	51,619	72,813	67,09	61,761	5,723	-21,194	427,239	489,000	222,92	225,01	2,09
	9	21,178	63,632	59,47	77,760	4,162	-42,454	384,785	462,545	221,28	224,16	2,88
	10	39,132	68,179	65,22	80,352	2,959	-29,047	355,738	436,090	220,04	223,25	3,20
	11	68,608	101,162	98,36	77,760	2,802	-32,554	323,184	400,944	218,55	221,93	3,38
	12	103,248	75,441	72,882	80,352	2,559	27,807	350,991	431,343	219,83	223,07	3,24
	Total	**1202,56**	**1225,99**	**1174,765**		**51,225**			**Mean**	**221,98**	**224,06**	**2,08**
	1	41,191	47,012	44,520	80,352	2,492	-5,821	345,170	425,522	219,57	222,86	3,29
	2	53,045	12,324	21,02	72,576	-8,696	40,721	374,891	447,467	220,87	223,65	2,78
	3	166,31	80,302	78,05	28,101	2,252	86,008	460,899	489,000	224,11	225,01	0,91
	4	66,622	79,381	75,635	40,860	3,746	-12,759	448,140	489,000	223,67	225,01	1,34
	5	102,662	115,09	110,995	53,288	4,095	-12,428	435,712	489,000	223,23	225,01	1,78
	6	37,344	59,037	54,419	74,981	4,618	-21,693	414,019	489,000	222,43	225,01	2,58
1989	7	66,376	85,946	81,11	77,760	4,836	-19,570	394,449	472,209	221,67	224,48	2,81
	8	131,956	113,241	128,147	80,352	-14,906	18,715	393,164	473,516	221,62	224,52	2,90
	9	78,22	98,921	95,04	77,760	3,881	-20,701	372,463	450,223	220,77	223,74	2,98
	10	78,557	92,287	89,305	80,352	2,982	-13,730	358,733	439,085	220,17	223,35	3,18
	11	93,335	90,544	88,24	77,760	2,304	2,791	361,524	439,284	220,30	223,36	3,06
	12	68,159	120,414	118,591	80,352	1,823	-52,255	309,269	389,621	217,87	221,47	3,60
	Total	**983,777**	**994,499**	**985,072**		**9,427**			**Mean**	**221,36**	**223,96**	**2,60**

Studen Kladenets HPP (Table 8 - list 6)

mln m^3

Years	Months	Inflow	Consumption				Inflow-Cons.	Vreservoir		Water Level		Δh
			Total	HPP		Other						
				4 units	unit 5		4 units	4 маш.	5 units	4 units	5 units	
	1	58,483	103,987	102,131	80,352	1,856	-45,504	263,765	344,117	215,49	219,52	4,03
	2	60,024	66,863	64,91	72,576	1,953	-6,839	256,926	329,502	215,11	218,85	3,74
	3	68,098	59,89	57,645	80,352	2,245	8,208	265,134	345,486	215,56	219,59	4,02
	4	128,622	85,677	82,733	77,760	2,944	42,945	308,079	385,839	217,81	221,32	3,51
	5	76,926	51,845	48,645	80,352	3,200	25,081	333,160	413,512	219,02	222,41	3,39
	6	23,912	84,493	80,32	77,760	4,173	-60,581	272,579	350,339	215,97	219,80	3,83
1990	7	19,774	56,32	51,135	77,760	5,185	-36,546	236,000	313,760	213,90	218,09	4,19
	8	11,53	55,588	51,03	80,352	4,558	-44,058	191,975	272,327	211,17	215,96	4,79
	9	3,586	49,133	45,69	77,760	3,443	-45,547	146,428	224,188	208,05	213,20	5,15
	10	16,756	34,78	32,071	80,352	2,709	-18,024	128,404	208,756	206,72	212,25	5,52
	11	24,12	12,604	10,461	77,760	2,143	11,516	139,920	217,680	207,57	212,80	5,23
	12	291,172	27,773	25,413	80,352	2,360	263,399	403,319	483,671	222,02	224,85	2,83
	Total	**783,003**	**688,953**	**652,184**		**36,769**			**Mean**	**214,03**	**218,22**	**4,19**
	1	38,699	37,907	35,415	80,352	2,492	0,792	404,111	484,463	222,05	224,87	2,82
	2	369,163	310,868	163,765	26,594	147,103	58,295	462,406	489,000	224,16	225,01	0,86
	3	92,78	141,98	139,764	75,794	2,216	-49,200	413,206	489,000	222,40	225,01	2,61
	4	84,886	74,753	72,150	65,661	2,603	10,133	423,339	489,000	222,78	225,01	2,23
	5	102,712	77,033	73,194	39,982	3,839	25,679	449,018	489,000	223,70	225,01	1,31
	6	41,721	72,086	67,477	70,347	4,609	-30,365	418,653	489,000	222,61	225,01	2,41
1991	7	55,322	70,919	65,905	77,760	5,014	-15,597	403,056	480,816	222,01	224,76	2,75
	8	53,941	94,068	89,83	80,352	4,238	-40,127	362,929	443,281	220,36	223,50	3,14
	9	32,83	33,3	29,349	77,760	3,951	-0,470	362,459	440,219	220,34	223,39	3,06
	10	99,499	74,908	71,265	80,352	3,643	24,591	387,050	467,402	221,37	224,32	2,95
	11	105,447	116,629	114,394	77,760	2,235	-11,182	375,868	453,628	220,91	223,86	2,95
	12	57,477	136,747	134,785	80,352	1,962	-79,270	296,598	376,950	217,23	220,95	3,72
	Total	**1134,477**	**1241,198**	**1057,293**		**183,905**			**Mean**	**221,66**	**224,23**	**2,57**

Studen Kladenets HPP (Table 8 - list 7)

mln m^3

Years	Months	Приток	Consumption				Inflow-Cons.	Vreservoir		Water Level		Δh
			Total	HPP		Other						
				4 units	unit 5		4 units	4 units	5 units	4 units	5 units	
1992	1	33,146	98,098	96,16	80,352	1,938	-64,952	231,646	311,998	213,65	218,01	4,36
	2	21,159	31,191	29,12	72,576	2,071	-10,032	221,614	294,190	213,04	217,11	4,07
	3	37,178	7,9	5,29	80,352	2,610	29,278	250,892	331,244	214,77	218,93	4,16
	4	82,679	19,538	16,936	77,760	2,602	63,141	314,033	391,793	218,10	221,56	3,46
	5	20,41	15,639	12,255	80,352	3,384	4,771	318,804	399,156	218,34	221,86	3,52
	6	46,063	45,466	41,946	77,760	3,520	0,597	319,401	397,161	218,37	221,78	3,41
	7	45,199	38,626	33,99	77,760	4,636	6,573	325,974	403,734	218,68	222,04	3,35
	8	33,21	31,215	26,197	80,352	5,018	1,995	327,969	408,321	218,78	222,21	3,44
	9	78,565	66,373	62,172	77,760	4,201	12,192	340,161	417,921	219,34	222,58	3,24
	10	61,238	48,171	44,545	80,352	3,626	13,067	353,228	433,580	219,93	223,15	3,22
	11	49,604	22,287	19,563	77,760	2,724	27,317	380,545	458,305	221,10	224,02	2,91
	12	51,504	61,756	59,34	80,352	2,416	-10,252	370,293	450,645	220,67	223,76	3,08
	Total	**559,955**	**486,26**	**447,514**		**38,746**			**Mean**	**217,90**	**221,42**	**3,52**
1993	1	53,953	72,05	69,871	80,352	2,179	-18,097	352,196	432,548	219,89	223,12	3,23
	2	52,592	64,828	62,941	72,576	1,887	-12,236	339,960	412,536	219,33	222,37	3,04
	3	67,981	42,655	40,016	80,352	2,639	25,326	365,286	445,638	220,46	223,58	3,12
	4	46,212	40,003	37,008	77,760	2,995	6,209	371,495	449,255	220,72	223,71	2,98
	5	68,423	38,704	35,519	80,352	3,185	29,719	401,214	481,566	221,94	224,78	2,84
	6	25,565	29,743	24,6	77,760	5,143	-4,178	397,036	474,796	221,77	224,56	2,79
	7	26,386	53,37	47,725	77,760	5,645	-26,984	370,052	447,812	220,66	223,66	3,00
	8	20,382	36,75	31,085	80,352	5,665	-16,368	353,684	434,036	219,95	223,17	3,22
	9	22,246	40,372	36,135	77,760	4,237	-18,126	335,558	413,318	219,13	222,40	3,27
	10	31,39	58,076	55,288	80,352	2,788	-26,686	308,872	389,224	217,85	221,46	3,61
	11	102,23	131,257	129,365	77,760	1,892	-29,027	279,845	357,605	216,36	220,13	3,77
	12	53,800	37,640	35,525	80,352	2,115	16,160	296,005	376,357	217,20	220,93	3,73
	Total	**571,16**	**645,448**	**605,078**		**40,37**			**Mean**	**219,61**	**222,82**	**3,22**

Studen Kladenets HPP (Table 8 - list 8)

mln m^3

Years	Months	Inflow	Consumption				Inflow-Cons.	Vreservoir		Water Level		Δh
			Total	HPP		Other						
				4 units	unit 5		4 units	4 units	5 units	4 units	5 units	
1994	1	53,362	15,408	13,3	80,352	2,108	37,954	333,959	414,311	219,06	222,44	3,39
	2	45,057	39,856	38,1	72,576	1,756	5,201	339,160	411,736	219,30	222,34	3,05
	3	36,261	18,764	16,36	80,352	2,404	17,497	356,657	437,009	220,08	223,28	3,19
	4	62,564	18,532	14,983	77,760	3,549	44,032	400,689	478,449	221,92	224,68	2,76
	5	27,195	40,834	36,555	80,352	4,279	-13,639	387,050	467,402	221,37	224,32	2,95
	6	30,831	53,541	48,4	77,760	5,141	-22,710	364,340	442,100	220,42	223,46	3,04
	7	27,521	44,083	37,865	77,760	6,218	-16,562	347,778	425,538	219,69	222,86	3,17
	8	30,444	44,862	38,92	80,352	5,942	-14,418	333,360	413,712	219,03	222,42	3,39
	9	28,012	42,568	38,195	77,760	4,373	-14,556	318,804	396,564	218,34	221,75	3,42
	10	44,423	65,839	62,71	80,352	3,129	-21,416	297,388	377,740	217,27	220,99	3,71
	11	50,142	45,989	43,41	77,760	2,579	4,153	301,541	379,301	217,48	221,05	3,57
	12	111,967	45,609	43,115	80,352	2,494	66,358	367,899	448,251	220,57	223,67	3,10
	Total	**547,779**	**475,885**	**431,913**		**43,972**			**Mean**	**219,54**	**222,77**	**3,23**
1995	1	162,891	139,166	137,225	80,352	1,941	23,725	391,624	471,976	221,56	224,47	2,92
	2	126,289	91,514	89,62	62,601	1,894	34,775	426,399	489,000	222,89	225,01	2,12
	3	189,4	148,852	146,57	22,053	2,282	40,548	466,947	489,000	224,31	225,01	0,71
	4	159,448	208,837	206,296	71,442	2,541	-49,389	417,558	489,000	222,56	225,01	2,45
	5	65,385	73,24	69,519	79,297	3,721	-7,855	409,703	489,000	222,27	225,01	2,75
	6	63,734	61,581	57,16	77,144	4,421	2,153	411,856	489,000	222,35	225,01	2,67
	7	69,905	64,476	59,935	71,715	4,541	5,429	417,285	489,000	222,55	225,01	2,46
	8	69,811	64,31	59,6	66,214	4,710	5,501	422,786	489,000	222,76	225,01	2,25
	9	27,316	46,783	42,785	77,760	3,998	-19,467	403,319	481,079	222,02	224,76	2,75
	10	35,875	60,627	57,995	80,352	2,632	-24,752	378,567	458,919	221,02	224,04	3,02
	11	104,804	130,371	128,635	77,760	1,736	-25,567	353,000	430,760	219,92	223,05	3,13
	12	55,498	103,392	101,749	80,352	1,643	-47,894	305,106	385,458	217,66	221,31	3,64
	Total	**1130,356**	**1193,149**	**1157,089**		**36,06**			**Mean**	**221,82**	**224,39**	**2,57**

Studen Kladenets HPP (Table 8 - list 9)

mln m^3

Years	Months	Inflow	Consumption				Inflow-Cons.	Vreservoir		Water Level		Δh
			Total	HPP		Other						
				4 маш.	unit 5		4 маш.	4 маш.	5 маш.	4 маш.	5 маш.	
	1	134,702	106,848	105,325	80,352	1,523	27,854	332,960	413,312	219,01	222,40	3,39
	2	182,018	117,421	115,915	72,576	1,506	64,597	397,557	470,133	221,79	224,41	2,62
	3	201,099	204,207	202,395	80,352	1,812	-3,108	394,449	474,801	221,67	224,56	2,89
	4	220,463	200,621	198,82	77,760	1,801	19,842	414,291	492,051	222,44	225,11	2,67
	5	110,533	141,791	138,445	80,352	3,346	-31,258	383,033	463,385	221,21	224,19	2,98
	6	29,463	57,217	52,675	77,760	4,542	-27,754	355,279	433,039	220,02	223,14	3,11
1996	7	43,793	76,685	71,371	77,760	5,314	-32,892	322,387	400,147	218,51	221,89	3,39
	8	35,325	52,408	48,53	80,352	3,878	-17,083	305,304	385,656	217,67	221,31	3,64
	9	47,448	56,352	53,465	77,760	2,887	-8,904	296,400	374,160	217,22	220,84	3,61
	10	20,454	31,894	29,315	80,352	2,579	-11,440	284,960	365,312	216,63	220,46	3,83
	11	116,127	27,655	25,45	77,760	2,205	88,472	373,432	451,192	220,81	223,78	2,97
	12	437,41	429,801	286,535	80,352	143,266	7,609	381,041	461,393	221,12	224,12	3,00
	Total	**1578,835**	**1502,9**	**1328,241**		**174,659**			**Mean**	**219,84**	**223,02**	**3,18**
	1	169,167	192,401	191,270	80,352	1,131	-23,234	357,807	438,159	220,13	223,32	3,18
	2	38,929	44,138	42,285	72,576	1,853	-5,209	352,598	425,174	219,90	222,85	2,94
	3	185,888	107,595	105,835	58,109	1,760	78,293	430,891	489,000	223,06	225,01	1,96
	4	293,7	315,423	313,844	77,760	1,579	-21,723	409,168	486,928	222,25	224,95	2,70
	5	41,092	56,069	51,79	80,352	4,279	-14,977	394,191	474,543	221,66	224,56	2,90
	6	30,462	16,287	12,44	77,760	3,847	14,175	408,366	486,126	222,21	224,92	2,71
1997	7	52,571	70,333	65,34	77,760	4,993	-17,762	390,604	468,364	221,51	224,35	2,84
	8	39,837	52,612	48,229	80,352	4,383	-12,775	377,829	458,181	220,99	224,01	3,02
	9	20,896	36,968	33,265	77,760	3,703	-16,072	361,757	439,517	220,31	223,37	3,06
	10	72,952	93,347	90,555	80,352	2,792	-20,395	341,362	421,714	219,40	222,72	3,32
	11	83,225	97,616	95,98	77,760	1,636	-14,391	326,971	404,731	218,73	222,07	3,35
	12	272,265	185,488	184,48	75,252	1,008	86,777	413,748	489,000	222,42	225,01	2,59
	Total	**1300,984**	**1268,277**	**1235,313**		**32,964**			**Mean**	**221,05**	**223,93**	**2,88**

Studen Kladenets HPP (Table 8 - list 10)

mln m^3

Years	Months	Inflow	Consumption				Inflow-Cons.	Vreservoir		Water Level		Δh
			Total	HPP		Other						
				4 units	unit 5		4 units	4 units	5 маш.	4 units	5 units	
	1	211,11	242,324	241,67	80,352	0,654	-31,214	382,534	462,886	221,19	224,17	2,99
	2	322,703	260,889	260,38	44,652	0,509	61,814	444,348	489,000	223,54	225,01	1,48
	3	150,023	202,49	201,205	80,352	1,285	-52,467	391,881	472,233	221,57	224,48	2,91
	4	75,621	70,466	67,492	77,760	2,974	5,155	397,036	474,796	221,77	224,56	2,79
	5	312,516	250,152	225,27	29,600	24,882	62,364	459,400	489,000	224,06	225,01	0,96
	6	97,803	223,444	219,626	77,760	3,818	-125,641	333,759	411,519	219,05	222,34	3,29
1998	7	18,92	103,853	94,794	77,760	9,059	-84,933	248,826	326,586	214,65	218,71	4,06
	8	58,063	8,513	2,035	80,352	6,478	49,550	298,376	378,728	217,32	221,03	3,70
	9	63,011	6,564	0	77,760	6,564	56,447	354,823	432,583	220,00	223,12	3,12
	10	47,201	4,727	2,476	80,352	2,251	42,474	397,297	477,649	221,78	224,66	2,87
	11	168,513	171,619	170,045	77,760	1,574	-3,106	294,191	371,951	217,11	220,74	3,63
	12	237,004	267,796	266,61	80,352	1,186	-30,792	363,399	443,751	220,38	223,52	3,14
	Total	**1762,488**	**1812,837**	**1751,603**		**61,234**			**Mean**	**220,20**	**223,11**	**2,91**
	1	118,356	128,299	127,022	80,352	1,277	-9,943	354,456	434,808	219,99	223,20	3,21
	2	279,521	220,313	219,469	72,576	0,844	59,208	412,664	485,240	222,38	224,90	2,52
	3	281,598	262,525	261,493	57,263	1,032	19,073	431,737	489,000	223,09	225,01	1,93
	4	181,992	197,808	195,339	73,079	2,469	-15,816	415,921	489,000	222,50	225,01	2,51
	5	64,921	69,794	66,146	77,952	3,648	-4,873	411,048	489,000	222,32	225,01	2,70
	6	46,535	49,485	44,415	77,760	5,070	-2,950	408,098	485,858	222,20	224,92	2,71
1999	7	97,23	83,648	77,913	77,760	5,735	13,582	421,680	499,440	222,72	225,33	2,62
	8	45,651	53,04	47,08	80,352	5,960	-7,389	414,291	494,643	222,44	225,19	2,75
	9	24,581	58,575	54,944	77,760	3,631	-33,994	380,297	458,057	221,09	224,01	2,92
	10	33,979	48,28	45,193	80,352	3,087	-14,301	365,996	446,348	220,49	223,61	3,12
	11	41,144	75,578	73,588	77,760	1,990	-34,434	331,562	409,322	218,94	222,25	3,31
	12	80,251	76,255	74,508	80,352	1,747	3,996	335,558	415,910	219,13	222,50	3,37
	Total	**1295,759**	**1323,6**	**1287,11**		**36,49**			**Mean**	**221,44**	**224,25**	**2,80**

Studen Kladenets HPP (Table 8 - list 11)

mln m^3

Years	Months	Inflow	Consumption				Inflow-Cons.	Vreservoir		Water Level		Δh
			Total	HPP		Other						
				4 units	unit 5		4 units	4 units	5 units	4 units	5 units	
	1	72,239	92,572	91,306	80,352	1,266	-20,333	315,225	395,577	218,16	221,71	3,55
	2	146,116	64,824	64,022	72,576	0,802	81,292	396,517	469,093	221,75	224,38	2,63
	3	102,859	99,473	98,461	80,352	1,012	3,386	399,903	480,255	221,89	224,74	2,85
	4	97,893	79,965	77,606	77,760	2,359	17,928	417,831	495,591	222,58	225,22	2,64
	5	93,493	112,986	109,72	80,352	3,266	-19,493	398,338	478,690	221,82	224,69	2,87
	6	53,924	56,52	52,338	77,760	4,182	-2,596	395,742	473,502	221,72	224,52	2,80
2000	7	43,639	59,837	53,787	77,760	6,050	-16,198	379,544	457,304	221,06	223,98	2,92
	8	46,207	69,094	63,908	80,352	5,186	-22,887	356,657	437,009	220,08	223,28	3,19
	9	38,771	56,068	52,564	77,760	3,504	-17,297	339,360	417,120	219,31	222,55	3,24
	10	44,39	67,133	65,388	80,352	1,745	-22,743	316,617	396,969	218,23	221,77	3,54
	11	33,039	50,093	48,846	77,760	1,247	-17,054	299,563	377,323	217,38	220,97	3,59
	12	54,663	34,626	33,541	80,352	1,085	20,037	319,600	399,952	218,38	221,89	3,51
	Total	**827,233**	**843,191**	**811,487**		**31,704**			**Mean**	**220,20**	**223,31**	**3,11**
	1	101,96	35,77	33,718	80,352	2,052	66,190	385,790	466,142	221,32	224,28	2,96
	2	79,959	50,374	48,501	72,576	1,873	29,585	415,375	487,951	222,48	224,98	2,50
	3	43,741	49,948	47,861	79,832	2,087	-6,207	409,168	489,000	222,25	225,01	2,77
	4	93,999	66,884	63,931	52,717	2,953	27,115	436,283	489,000	223,25	225,01	1,76
	5	86,611	92,285	88,525	58,391	3,760	-5,674	430,609	489,000	223,05	225,01	1,97
	6	34,545	41,26	35,976	65,106	5,284	-6,715	423,894	489,000	222,80	225,01	2,21
2001	7	37,711	52,972	47,105	77,760	5,867	-15,261	408,633	486,393	222,23	224,93	2,71
	8	36,898	62,249	56,329	80,352	5,920	-25,351	383,282	463,634	221,22	224,20	2,98
	9	46,221	51,919	47,823	77,760	4,096	-5,698	377,584	455,344	220,98	223,92	2,94
	10	47,744	46,249	42,865	80,352	3,384	1,495	379,079	459,431	221,04	224,06	3,01
	11	30,759	58,446	55,875	77,760	2,571	-27,687	351,392	429,152	219,85	222,99	3,14
	12	44,731	65,560	63,634	80,352	1,926	-20,829	330,563	410,915	218,90	222,31	3,42
	Total	**684,879**	**673,916**	**632,143**		**41,773**			**Mean**	**221,61**	**224,31**	**2,70**

Studen Kladenets HPP (Table 8 - list 12)

mln m^3

Years	Months	Inflow	Consumption				Inflow-Cons.	Vreservoir		Water Level		Δh
			Total	HPP		Other						
				4 маш.	unit 5		4 units	4 units	5 units	4 units	5 units	
	1	62,701	75,81	74,146	80,352	1,664	-13,109	223,999	304,351	213,19	217,63	4,44
	2	34,493	49,943	48,357	72,576	1,586	-15,450	208,549	281,125	212,23	216,43	4,20
	3	106,614	35,582	33,299	80,352	2,283	71,032	279,581	359,933	216,35	220,23	3,88
	4	37,088	36,617	33,954	77,760	2,663	0,471	280,052	357,812	216,37	220,13	3,76
	5	19,553	23,773	19,486	80,352	4,287	-4,220	275,832	356,184	216,15	220,06	3,92
	6	23,872	44,499	39,872	77,760	4,627	-20,627	255,205	332,965	215,01	219,01	4,00
2002	7	49,956	49,517	44,59	77,760	4,927	0,439	255,644	333,404	215,04	219,03	3,99
	8	47,404	60,214	56,342	80,352	3,872	-12,810	242,834	323,186	214,30	218,55	4,24
	9	68,427	46,919	44,146	77,760	2,773	21,508	264,342	342,102	215,52	219,43	3,91
	10	140,733	94,302	91,78	80,352	2,522	46,431	310,773	391,125	217,94	221,54	3,59
	11	166,331	156,489	154,928	77,760	1,561	9,842	320,615	398,375	218,42	221,82	3,40
	12	302,482	273,12	271,564	80,352	1,556	29,362	349,977	430,329	219,79	223,04	3,25
	Total	**1059,654**	**946,785**	**912,464**		**34,321**			**Mean**	**215,86**	**219,74**	**3,88**
	1	375,896	378,676	311,108	80,352	67,568	-2,780	385,827	466,179	221,32	224,28	2,96
	2	173,193	235,857	234,79	72,576	1,067	-62,664	323,163	395,739	218,55	221,72	3,17
	3	92,515	76,237	74,667	80,352	1,570	16,278	339,441	419,793	219,31	222,65	3,34
	4	58,002	65,801	62,876	77,760	2,925	-7,799	331,642	409,402	218,95	222,25	3,31
	5	58,981	35,051	31,728	80,352	3,323	23,930	355,572	435,924	220,04	223,24	3,20
	6	142,788	127,117	123,682	77,760	3,435	15,671	371,243	449,003	220,71	223,70	2,99
2003	7	47,782	54,492	49,566	77,760	4,926	-6,710	365,533	443,293	220,47	223,50	3,03
	8	112,837	124,935	120,216	80,352	4,719	-12,098	353,435	433,787	219,94	223,16	3,22
	9	88,851	81,885	78,411	77,760	3,474	6,966	360,401	438,161	220,25	223,32	3,07
	10	25,042	54,317	52,34	80,352	1,977	-29,275	331,126	411,478	218,92	222,33	3,41
	11	47,086	66,186	64,308	77,760	1,878	-19,100	312,026	389,786	218,01	221,48	3,48
	12	242,724	178,307	138,787	80,352	39,520	64,417	376,443	456,795	220,93	223,97	3,03
	Total	**1465,697**	**1478,861**	**1342,479**		**136,382**			**Mean**	**219,78**	**222,97**	**3,18**

Studen Kladenets HPP (Table 8 - list 13)

mln m^3

Years	Months	Inflow	Consumption				Inflow-Cons.	$V_{reservoir}$		Water Level		∆h
			Total	HPP		Other						
				4 units	unit 5		4 units	4 units	5 units	4 units	5 units	
2004	1	319,872	328,052	296,262	80,352	31,790	-8,180	341,797	422,149	219,42	222,74	3,32
	2	305,154	316,084	263,588	72,576	52,496	-10,930	33,087	105,663	198,82	204,98	6,15
	3	97,339	150,035	148,16	80,352	1,875	-52,696	278,171	358,523	216,27	220,17	3,89
	4	161,851	141,899	139,401	77,760	2,498	19,952	298,123	375,883	217,31	220,91	3,60
	5	153,953	116,025	112,482	80,352	3,543	37,928	336,051	416,403	219,15	222,52	3,37
	6	90,958	109,944	104,621	77,760	5,323	-18,986	317,065	394,825	218,25	221,68	3,43
	7	26,803	64,993	58,965	77,760	6,028	-38,190	278,875	356,635	216,31	220,08	3,77
	8	16,915	28,495	23,271	80,352	5,224	-11,580	267,295	347,647	215,68	219,68	4,00
	9	11,999	13,364	9,065	77,760	4,299	-1,365	265,929	343,689	215,61	219,50	3,90
	10	37,427	17,603	14,398	80,352	3,205	19,824	285,753	366,105	216,67	220,49	3,82
	11	70,263	84,361	82,533	77,760	1,828	-14,098	271,655	349,415	215,92	219,76	3,84
	12	337,209	220,257	144,839	80,352	75,418	116,952	388,607	468,959	221,43	224,37	2,94
	Total	**1629,743**	**1591,112**	**1397,585**		**193,527**			**Mean**	**215,90**	**219,74**	**3,84**

∆haverage	**3,14**

Table 9

Year	W_{HPP}	Water Level		Δh	$N_{addit.}$	$E_{addit.}$
		4 units	5 units			
	mln m^3	m	m	m	kW	GWh
1980	1884,890	220,74	223,43	2,69	695	12,137
1981	1840,492	219,80	222,37	2,57	664	11,322
1982	1329,670	213,00	217,20	4,20	1086	13,368
1983	1779,335	217,89	221,15	3,26	843	13,885
1984	1637,635	218,86	221,88	3,02	781	11,838
1985	892,976	207,57	212,84	5,27	1362	11,265
1986	987,397	220,29	223,16	2,87	742	6,783
1987	1164,369	221,96	224,00	2,04	527	5,686
1988	1174,765	221,98	224,06	2,08	538	5,849
1989	985,072	221,36	223,96	2,60	672	6,131
1990	652,184	214,03	218,22	4,19	1083	6,541
1991	1057,293	221,66	224,23	2,57	664	6,504
1992	447,514	217,90	221,42	3,52	910	3,771
1993	605,078	219,61	222,82	3,21	830	4,649
1994	431,913	219,54	222,77	3,23	835	3,339
1995	1157,089	221,82	224,39	2,57	664	7,118
1996	1502,900	219,84	223,02	3,18	822	11,440
1997	1268,277	221,05	223,93	2,88	745	8,743
1998	1751,060	220,20	223,11	2,91	752	12,197
1999	1287,110	221,44	224,25	2,81	726	8,657
2000	811,487	220,20	223,31	3,11	804	6,041
2001	632,143	221,61	224,31	2,70	698	4,085
2002	912,464	215,86	219,74	3,88	1003	8,474
2003	1342,479	219,78	222,97	3,19	825	10,251
2004	1397,585	215,90	219,74	3,84	993	12,846
Mean:	**1157,327**	**218,956**	**222,091**	**3,14**	**811**	**8,517**

Табл. 10

Total days with spillage of St.Kladenets Reservoir in the period 1980 - 2004	days	36
	hours	864
Additional el. generation of unit 5 from spilled waters 1980 - 2004	kWh	28,253
Mean annual energy generation from unit 5 from spilled waters	kWh	**1,130**
Total additional mean annual energy generation from St. Kladenets HPP after the installation of unit 5	kWh	**9,647**

10.8 Annex: Monthly Power Generation Dolna Arda 2008 – 2012

Energy Effects of Dolna Arda HPProject Rehabilitation

2008 Stage	Months												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Kurdjali HPP													
Power Generation before Rehabilitation	11.569	10.404	11.811	12.427	9.837	7.679	9.099	6.966	5.334	7.302	7.819	11.359	111.606
Additional Power Generation after Rehabilitation	101	91	103	109	86	67	79	61	47	64	68	99	975
Power Generation after Rehabilitation	11.670	10.495	11.914	12.536	9.923	7.746	9.178	7.027	5.381	7.366	7.887	11.458	112.581
Studen Kladenets HPP													
Power Generation before Rehabilitation	19.493	18.315	17.862	15.654	11.608	10.534	10.155	7.962	6.709	8.182	11.431	17.072	154.975
Additional Power Generation after Rehabilitation	300	282	275	241	179	162	156	123	103	126	176	263	2.383
Additional Power Generation of the new Unit No5	1.448	1.383	1.358	860	638	579	558	438	369	450	628	938	9.647
Power Generation of Unit No5	4.161	3.909	3.813	3.341	2.478	2.249	2.168	1.700	1.432	1.747	2.440	3.644	33.081
Power Generation after Rehabilitation	21.240	19.980	19.495	16.755	12.425	11.275	10.869	8.523	7.181	8.758	12.235	18.273	167.005
Ivailovgrad HPP													
Power Generation before Rehabilitation	20.177	20.345	18.291	14.688	10.476	9.255	8.554	7.031	5.021	6.560	10.885	17.859	149.142
Additional Power Generation after Rehabilitation	335	338	304	244	174	154	142	117	83	109	181	296	2.477
Power Generation after Rehabilitation	20.512	20.683	18.595	14.932	10.650	9.409	8.696	7.148	5.104	6.669	11.066	18.155	151.619
Dolna Arda HP Cascade													
Power Generation before Rehabilitation	51.238	49.064	47.964	42.769	31.921	27.468	27.808	21.959	17.064	22.044	30.135	46.290	415.723
Additional Power Generation after Rehabilitation	2.184	2.093	2.039	1.453	1.076	962	936	738	602	749	1.053	1.596	15.481
Power Generation after Rehabilitation	53.422	51.157	50.003	44.222	32.997	28.430	28.744	22.697	17.666	22.793	31.188	47.886	431.206
Difference in Power Generation before and after Rehabilitation	2.184	2.093	2.039	1.453	1.076	962	936	738	602	749	1.053	1.596	15.481
Power Generation of Dolna Arda HPProject	6.345	6.003	5.852	4.795	3.554	3.210	3.103	2.438	2.034	2.495	3.493	5.240	48.563
Total Power Generation of Dolna Arda HPProject	**6.345**	**6.003**	**5.852**	**4.795**	**3.554**	**3.210**	**3.103**	**2.438**	**2.034**	**2.495**	**3.493**	**5.240**	**48.563**

2009 Stage	Months												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Kurdjali HPP													
Power Generation before Rehabilitation	11.569	10.404	11.811	12.427	9.837	7.679	9.099	6.966	5.334	7.302	7.819	11.359	111.606
Additional Power Generation after Rehabilitation	202	182	206	217	172	134	159	122	93	128	137	198	1.950
Power Generation after Rehabilitation	11.771	10.586	12.017	12.644	10.009	7.813	9.258	7.088	5.427	7.430	7.956	11.557	113.556
Studen Kladenets HPP													
Power Generation before Rehabilitation	19.493	18.315	17.862	15.654	11.608	10.534	10.155	7.962	6.709	8.182	11.431	17.072	154.975
Additional Power Generation after Rehabilitation	600	563	549	482	357	324	312	245	207	252	352	525	4.766
Additional Power Generation of the new Unit No5	1.448	1.383	1.358	860	638	579	558	438	369	450	628	938	9.647
Power Generation of Unit No5	4.161	3.909	3.813	3.341	2.478	2.249	2.168	1.700	1.432	1.747	2.440	3.644	33.081
Power Generation after Rehabilitation	21.540	20.261	19.769	16.996	12.603	11.437	11.025	8.645	7.285	8.884	12.411	18.535	169.388
Ivailovgrad HPP													
Power Generation before Rehabilitation	20.177	20.345	18.291	14.688	10.476	9.255	8.554	7.031	5.021	6.560	10.885	17.859	149.142
Additional Power Generation after Rehabilitation	670	676	607	488	348	308	284	233	167	218	362	593	4.953
Power Generation after Rehabilitation	20.847	21.021	18.898	15.176	10.824	9.563	8.838	7.264	5.188	6.778	11.247	18.452	154.095
Dolna Arda HP Cascade													
Power Generation before Rehabilitation	51.238	49.064	47.964	42.769	31.921	27.468	27.808	21.959	17.064	22.044	30.135	46.290	415.723
Additional Power Generation after Rehabilitation	2.920	2.803	2.721	2.047	1.515	1.345	1.313	1.038	836	1.047	1.478	2.254	21.316
Power Generation after Rehabilitation	54.158	51.867	50.685	44.816	33.436	28.813	29.121	22.997	17.900	23.091	31.613	48.544	437.040
Difference in Power Generation before and after Rehabilitation	2.920	2.803	2.721	2.047	1.515	1.345	1.313	1.038	836	1.047	1.478	2.254	21.316
Power Generation of Dolna Arda HPProject	7.081	6.713	6.533	5.388	3.992	3.593	3.481	2.738	2.268	2.794	3.918	5.899	54.397
Total Power Generation of Dolna Arda HPProject	**7.081**	**6.713**	**6.533**	**5.388**	**3.992**	**3.593**	**3.481**	**2.738**	**2.268**	**2.794**	**3.918**	**5.899**	**54.397**

2010 Stage	Months												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Kurdjali HPP													
Power Generation before Rehabilitation	11.569	10.404	11.811	12.427	9.837	7.679	9.099	6.966	5.334	7.302	7.819	11.359	111.606
Additional Power Generation after Rehabilitation	303	273	310	326	258	201	238	183	140	191	205	298	2.925
Power Generation after Rehabilitation	11.872	10.677	12.121	12.753	10.095	7.880	9.337	7.149	5.474	7.493	8.024	11.657	114.531
Studen Kladenets HPP													
Power Generation before Rehabilitation	19.493	18.315	17.862	15.654	11.608	10.534	10.155	7.962	6.709	8.182	11.431	17.072	154.975
Additional Power Generation after Rehabilitation	899	845	824	722	536	486	468	368	310	377	527	788	7.148
Additional Power Generation of the new Unit No5	1.448	1.383	1.358	860	638	579	558	438	369	450	628	938	9.647
Power Generation of Unit No5	4.161	3.909	3.813	3.341	2.478	2.249	2.168	1.700	1.432	1.747	2.440	3.644	33.081
Power Generation after Rehabilitation	21.840	20.543	20.044	17.236	12.782	11.599	11.181	8.768	7.388	9.009	12.586	18.798	171.770
Ivailovgrad HPP													
Power Generation before Rehabilitation	20.177	20.345	18.291	14.688	10.476	9.255	8.554	7.031	5.021	6.560	10.885	17.859	149.142
Additional Power Generation after Rehabilitation	1005	1013	911	732	522	461	426	350	250	327	542	889	7.430
Power Generation after Rehabilitation	21.182	21.358	19.202	15.420	10.998	9.716	8.980	7.381	5.271	6.887	11.427	18.748	156.572
Dolna Arda HP Cascade													
Power Generation before Rehabilitation	51.238	49.064	47.964	42.769	31.921	27.468	27.808	21.959	17.064	22.044	30.135	46.290	415.723
Additional Power Generation after Rehabilitation	3.656	3.514	3.402	2.640	1.953	1.728	1.691	1.338	1.069	1.346	1.903	2.913	27.150
Power Generation after Rehabilitation	54.894	52.578	51.366	45.409	33.874	29.196	29.499	23.297	18.133	23.390	32.038	49.203	442.875
Difference in Power Generation before and after Rehabilitation	3.656	3.514	3.402	2.640	1.953	1.728	1.691	1.338	1.069	1.346	1.903	2.913	27.150
Power Generation of Dolna Arda HPProject	7.817	7.423	7.215	5.981	4.431	3.976	3.859	3.038	2.501	3.092	4.343	6.557	60.231
Total Power Generation of Dolna Arda HPProject	**7.817**	**7.423**	**7.215**	**5.981**	**4.431**	**3.976**	**3.859**	**3.038**	**2.501**	**3.092**	**4.343**	**6.557**	**60.231**

Energy Effects of Dolna Arda HPProject Rehabilitation

2011 Stage	Months												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Kurdjali HPP													
Power Generation before Rehabilitation	11.569	10.404	11.811	12.427	9.837	7.679	9.099	6.966	5.334	7.302	7.819	11.359	111.606
Additional Power Generation after Rehabilitation	404	364	413	434	344	268	318	243	186	255	273	397	3.900
Power Generation after Rehabilitation	11.973	10.768	12.224	12.861	10.181	7.947	9.417	7.209	5.520	7.557	8.092	11.756	115.506
Studen Kladenets HPP													
Power Generation before Rehabilitation	19.493	18.315	17.862	15.654	11.608	10.534	10.155	7.962	6.709	8.182	11.431	17.072	154.975
Additional Power Generation after Rehabilitation	1.199	1.126	1.098	963	714	648	624	490	413	503	703	1.050	9.531
Additional Power Generation of the new Unit No5	1.448	1.383	1.358	860	638	579	558	438	369	450	628	938	9.647
Power Generation of Unit No5	4.161	3.909	3.813	3.341	2.478	2.249	2.168	1.700	1.432	1.747	2.440	3.644	33.081
Power Generation after Rehabilitation	22.140	20.824	20.318	17.477	12.960	11.761	11.337	8.890	7.491	9.135	12.762	19.060	174.153
Ivailovgrad HPP													
Power Generation before Rehabilitation	20.177	20.345	18.291	14.688	10.476	9.255	8.554	7.031	5.021	6.560	10.885	17.859	149.142
Additional Power Generation after Rehabilitation	1005	1013	911	732	522	461	426	350	250	327	542	889	7.430
Power Generation after Rehabilitation	21.182	21.358	19.202	15.420	10.998	9.716	8.980	7.381	5.271	6.887	11.427	18.748	156.572
Dolna Arda HP Cascade													
Power Generation before Rehabilitation	51.238	49.064	47.964	42.769	31.921	27.468	27.808	21.959	17.064	22.044	30.135	46.290	415.723
Additional Power Generation after Rehabilitation	4.057	3.886	3.780	2.989	2.217	1.957	1.926	1.521	1.219	1.535	2.147	3.274	30.508
Power Generation after Rehabilitation	55.295	52.950	51.744	45.758	34.138	29.425	29.734	23.480	18.283	23.579	32.282	49.564	446.232
Difference in Power Generation before and after Rehabilitation	4.057	3.886	3.780	2.989	2.217	1.957	1.926	1.521	1.219	1.535	2.147	3.274	30.508
Power Generation of Dolna Arda HPProject	8.217	7.796	7.592	6.331	4.695	4.205	4.094	3.221	2.651	3.282	4.587	6.918	63.589
Total Power Generation of Dolna Arda HPProject	**8.217**	**7.796**	**7.592**	**6.331**	**4.695**	**4.205**	**4.094**	**3.221**	**2.651**	**3.282**	**4.587**	**6.918**	**63.589**

2012 Stage	Months												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Kurdjali HPP													
Power Generation before Rehabilitation	11.569	10.404	11.811	12.427	9.837	7.679	9.099	6.966	5.334	7.302	7.819	11.359	111.606
Additional Power Generation after Rehabilitation	404	364	413	434	344	268	318	243	186	255	273	397	3.900
Power Generation after Rehabilitation	11.973	10.768	12.224	12.861	10.181	7.947	9.417	7.209	5.520	7.557	8.092	11.756	115.506
Studen Kladenets HPP													
Power Generation before Rehabilitation	19.493	18.315	17.862	15.654	11.608	10.534	10.155	7.962	6.709	8.182	11.431	17.072	154.975
Additional Power Generation after Rehabilitation	1.199	1.126	1.098	963	714	648	624	490	413	503	703	1.050	9.531
Additional Power Generation of the new Unit No5	1.448	1.383	1.358	860	638	579	558	438	369	450	628	938	9.647
Power Generation of Unit No5	4.161	3.909	3.813	3.341	2.478	2.249	2.168	1.700	1.432	1.747	2.440	3.644	33.081
Power Generation after Rehabilitation	22.140	20.824	20.318	17.477	12.960	11.761	11.337	8.890	7.491	9.135	12.762	19.060	174.153
Ivailovgrad HPP													
Power Generation before Rehabilitation	20.177	20.345	18.291	14.688	10.476	9.255	8.554	7.031	5.021	6.560	10.885	17.859	149.142
Additional Power Generation after Rehabilitation	1005	1013	911	732	522	461	426	350	250	327	542	889	7.430
Power Generation after Rehabilitation	21.182	21.358	19.202	15.420	10.998	9.716	8.980	7.381	5.271	6.887	11.427	18.748	156.572
Dolna Arda HP Cascade													
Power Generation before Rehabilitation	51.238	49.064	47.964	42.769	31.921	27.468	27.808	21.959	17.064	22.044	30.135	46.290	415.723
Additional Power Generation after Rehabilitation	4.057	3.886	3.780	2.989	2.217	1.957	1.926	1.521	1.219	1.535	2.147	3.274	30.508
Power Generation after Rehabilitation	55.295	52.950	51.744	45.758	34.138	29.425	29.734	23.480	18.283	23.579	32.282	49.564	446.232
Difference in Power Generation before and after Rehabilitation	4.057	3.886	3.780	2.989	2.217	1.957	1.926	1.521	1.219	1.535	2.147	3.274	30.508
Power Generation of Dolna Arda HPProject	8.217	7.796	7.592	6.331	4.695	4.205	4.094	3.221	2.651	3.282	4.587	6.918	63.589
Total Power Generation of Dolna Arda HPProject	**8.217**	**7.796**	**7.592**	**6.331**	**4.695**	**4.205**	**4.094**	**3.221**	**2.651**	**3.282**	**4.587**	**6.918**	**63.589**

10.9 Annex: Baseline Scenario: Bulgarian Power Plants 2005 – 2012

Baseline Scenario, Year 2005

Maximum Power Supply Forecast

	Parameter		Available	Electricity	Gross	Energy	Net Calorific	Fuel	Carbon	Fraction	Actual	Actual	Specific	Auxiliary	Net	Net Specific
		Fuel	Capacity	Output	Heat	Output	Value (NCV)	Carbon	Emission	of Carbon	Carbon	CO2	CO2	Power	CO2	CO2
	Power Plant				Rate		GJ/Mg	Content	Factor	Unoxidized	Emissions	Emissions	Emission	needs	Emissions	Emission
	Unit		MWel	GWh	kJ/kWh	GJ	MJ/Nm3	%	kgC/GJ	%	kt/a	kt/a	kg/kWh	%	kt/a	kg/kWh
1.	TPP Bobov dol	brown coal	555	3138	11.062	34.712.556,00	9,37	28,48	30,395	2,03	1.033,666	3.790,107	1,208	10,70	4.244,241	1,353
2.	TPP Varna	steam coal	1200	3648	10.699	39.029.952,00	24,59	66,66	27,109	4,96	1.005,567	3.687,081	1,011	9,49	4.073,492	1,117
3.	TPP Brikel (Maritsa Iztok #1)	lignite	180	881	11.052	9.736.812,00	10,18	19,94	19,587	1,74	187,401	687,135	0,780	18,54	843,525	0,957
4.1.	TPP Maritsa Iztok #2 part (150MW)	lignite	574	3077	12.482	38.407.114,00	6,431	19,11	29,715	2,385	1.114,065	4.084,904	1,328	13,84	4.741,068	1,541
4.2.	TPP Maritsa Iztok #2 part (210MW)	lignite	800	4112	10.690	43.957.280,00	6,431	19,11	29,715	2,49	1.273,685	4.670,180	1,136	11,84	5.297,391	1,288
5.	TPP Maritsa Iztok #3	lignite	614	4227	11.340	47.934.180,00	6,562	19,61	29,884	2,74	1.393,224	5.108,488	1,209	10,72	5.721,873	1,354
6.	TPP Maritsa 3	lignite	95	205	12.928	2.650.240,00	10,38	21,56	20,771	3,33	53,214	195,119	0,952	11,34	220,076	1,074
6.1.	TPP Rousse (condensate plant)	steam coal	100	614	11.017	6.764.438,00	25,35	65,33	25,771	2,62	169,760	622,455	1,014	15,18	733,853	1,195
6.2.	TPP Rousse (cogeneration)	steam coal	70	184	11.585	2.131.640,00	25,48	65,44	25,683	2,59	53,329	195,539	1,063	15,18	230,534	1,253
7.1.	NPP Kozlodui # I and # II Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,00	0,000	0,000
7.2.	NPP Kozlodui # III and # IV Unit	nuclear	800	5494	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
7.3.	NPP Kozlodui # V and # VI Unit	nuclear	1900	11350	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
8.	Cogeneration PP - Sofia	natural gas	50	269	7.353	1.977.957,00	33,54	50,00	14,908	0,5	29,339	107,577	0,400	33,55	161,891	0,602
9.	Cogeneration PP - Sofia-Iztok	natural gas	100	537	6.795	3.648.915,00	33,55	50,00	14,903	0,5	54,108	198,397	0,369	19,65	246,916	0,460
10.	Cogenaration PP Plovdiv	natural gas	30	180	6.858	1.234.440,00	33,4	50,00	14,970	0,5	18,387	67,420	0,375	10,50	75,329	0,418
11.	Cogenaration PPs others	natural gas	80	517	7.465	3.859.405,00	33,49	50,00	14,930	0,5	57,332	210,218	0,407	22,18	270,134	0,523
12.	Industrial PP Bourgas	heavy oil/gases	80	419	9.217	3.861.923,00	40,1	85,00	21,197	1,00	81,043	297,156	0,709	14,68	348,284	0,831
13.	Industrial PP Deven	steam coal	70	367	7.151	2.624.417,00	26,11	66,00	25,278	4,5	63,354	232,298	0,633	12,54	265,604	0,724
14.	Industrial PP Himko	natural gas	20	156	10.783	1.682.148,00	34,1	50,00	14,663	0,5	24,542	89,986	0,577	14,86	105,692	0,678
15.	Industrial PP Sviloza	steam coal	40	204	11.850	2.417.400,00	24,65	64,00	25,963	1,08	62,086	227,650	1,116	15,27	268,677	1,317
16.	Industrial PPs others	steam coal	105	610	12.858	7.843.380,00	22,24	61,10	27,473	3,46	208,026	762,761	1,250	15,51	902,782	1,480
17.	Existing Hydro Power Plants	hydro	1380	2694	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,00	0,000	0,000
18.	Cascade HPPs Dolna Arda	hydro	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
19.	HPP Tsankov Kamak	hydro	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
20.	Expansion of Cogeneration PPs	natural gas	0	0	6.001	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,00	0,000	0,000
21.	New TPP burning imported coal	sub-bitum. coal	0	0	9.378	0,00	25,12	60,00	23,885	1,5	0,000	0,000	0,000	9,50	0,000	0,000
22.	New Combined Cycle PP	natural gas	0	0	6.547	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,50	0,000	0,000
23.	New TPP burning indigenous lignites	lignite	0	0	9410	0,00	6,28	19,50	31,051	2,00	0,000	0,000	0,000	8,95	0,000	0,000
24.	New NPP	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	6,80	0,000	0,000
25.	Pump Storage HPP Chaira - pumping mode	hydro		-416	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	- generation mode	hydro	420	312	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	Undilivered Power			71												
	Total		**9263**	**42850**							**6.882,128**	**25.234,469**	**1,081**		**28.751,362**	**0,671**

Baseline Scenario, Year 2006

Maximum Power Supply Forecast

	Parameter		Available	Electricity	Gross	Energy	Net Calorific	Fuel	Carbon	Fraction	Actual	Actual	Specific	Auxiliary	Net	Net Specific
		Fuel	Capacity	Output	Heat	Output	Value (NCV)	Carbon	Emission	of Carbon	Carbon	CO2	CO2	Power	CO2	CO2
	Power Plant				Rate		GJ/Mg	Content	Factor	Unoxidized	Emissions	Emissions	Emission	needs	Emissions	Emission
	Unit		MWel	GWh	kJ/kWh	GJ	MJ/Nm3	%	kgC/GJ	%	kt/a	kt/a	kg/kWh	%	kt/a	kg/kWh
1.	TPP Bobov dol	brown coal	555	3104	11.062	34.336.448,00	9,37	28,48	30,395	2,03	1.022,466	3.749,042	1,208	10,70	4.198,255	1,353
2.	TPP Varna	steam coal	1200	3580	10.699	38.302.420,00	24,59	66,66	27,109	4,96	986,823	3.618,352	1,011	9,49	3.997,561	1,117
3.	TPP Brikel (Maritsa Iztok #1)	lignite	180	878	11.052	9.703.656,00	10,18	19,94	19,587	1,74	186,762	684,796	0,780	18,54	840,653	0,957
4.1.	TPP Maritsa Iztok #2 part (150MW)	lignite	608	3581	11.546	41.346.226,00	6,431	19,11	29,715	2,385	1.199,319	4.397,502	1,228	13,84	5.103,879	1,425
4.2.	TPP Maritsa Iztok #2 part (210MW)	lignite	800	4026	10.690	43.037.940,00	6,431	19,11	29,715	2,49	1.247,047	4.572,506	1,136	11,84	5.186,599	1,288
5.	TPP Maritsa Iztok #3	lignite	642	5214	10.780	56.206.920,00	6,562	19,61	29,884	2,74	1.633,674	5.990,138	1,149	10,72	6.709,384	1,287
6.	TPP Maritsa 3	lignite	95	202	12.928	2.611.456,00	10,38	21,56	20,771	3,33	52,436	192,264	0,952	11,34	216,855	1,074
6.1.	TPP Rousse (condensate plant)	steam coal	100	258	11.017	2.842.386,00	25,35	65,33	25,771	2,62	71,333	261,553	1,014	15,18	308,362	1,195
6.2.	TPP Rousse (cogeneration)	steam coal	70	183	11.585	2.120.055,00	25,48	65,44	25,683	2,59	53,039	194,476	1,063	15,18	229,281	1,253
7.1.	NPP Kozlodui # I and # II Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,00	0,000	0,000
7.2.	NPP Kozlodui # III and # IV Unit	nuclear	800	5490	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
7.3.	NPP Kozlodui # V and # VI Unit	nuclear	1900	11290	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
8.	Cogeneration PP - Sofia	natural gas	50	269	7.353	1.977.957,00	33,54	50,00	14,908	0,5	29,339	107,577	0,400	33,55	161,891	0,602
9.	Cogeneration PP - Sofia-Iztok	natural gas	100	537	6.795	3.648.915,00	33,55	50,00	14,903	0,5	54,108	198,397	0,369	19,65	246,916	0,460
10.	Cogenaration PP Plovdiv	natural gas	30	180	6.858	1.234.440,00	33,4	50,00	14,970	0,5	18,387	67,420	0,375	10,50	75,329	0,418
11.	Cogenaration PPs others	natural gas	80	517	7.465	3.859.405,00	33,49	50,00	14,930	0,5	57,332	210,218	0,407	22,18	270,134	0,523
12.	Industrial PP Bourgas	heavy oil/gases	80	418	9.217	3.852.706,00	40,1	85,00	21,197	1,00	80,849	296,447	0,709	14,68	347,453	0,831
13.	Industrial PP Deven	steam coal	70	366	7.151	2.617.266,00	26,11	66,00	25,278	4,5	63,181	231,665	0,633	12,54	264,881	0,724
14.	Industrial PP Himko	natural gas	20	153	10.783	1.649.799,00	34,1	50,00	14,663	0,5	24,070	88,255	0,577	14,86	103,659	0,678
15.	Industrial PP Sviloza	steam coal	40	204	11.850	2.417.400,00	24,65	64,00	25,963	1,08	62,086	227,650	1,116	15,27	268,677	1,317
16.	Industrial PPs others	steam coal	105	608	12.858	7.817.664,00	22,24	61,10	27,473	3,46	207,344	760,260	1,250	15,51	899,822	1,480
17.	Existing Hydro Power Plants	hydro	1380	2695	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,00	0,000	0,000
18.	Cascade HPPs Dolna Arda	hydro	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
19.	HPP Tsankov Kamak	hydro	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
20.	Expansion of Cogeneration PPs	natural gas	0	0	6.001	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,00	0,000	0,000
21.	New TPP burning imported coal	sub-bitum. coal	0	0	9.378	0,00	25,12	60,00	23,885	1,5	0,000	0,000	0,000	9,50	0,000	0,000
22.	New Combined Cycle PP	natural gas	0	0	6.547	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,50	0,000	0,000
23.	New TPP burning indigenous lignites	lignite	0	0	9410	0,00	6,28	19,50	31,051	2,00	0,000	0,000	0,000	8,95	0,000	0,000
24.	New NPP	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	6,80	0,000	0,000
25.	Pump Storage HPP Chaira - pumping mode	hydro	0	-348	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	- generation mode	hydro	420	261	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	Undilivered Power			16												
	Total		**9325**	**43682**							**7.049,595**	**25.848,516**	**1,065**		**29.429,591**	**0,674**

Baseline Scenario, Year 2007

Maximum Power Supply Forecast

	Parameter		Available	Electricity	Gross	Energy	Net Calorific	Fuel	Carbon	Fraction	Actual	Actual	Specific	Auxiliary	Net	Net Specific
		Fuel	Capacity	Output	Heat	Output	Value (NCV)	Carbon	Emission	of Carbon	Carbon	CO2	CO2	Power	CO2	CO2
	Power Plant				Rate		GJ/Mg	Content	Factor	Unoxidized	Emissions	Emissions	Emission	needs	Emissions	Emission
	Unit		MWel	GWh	kJ/kWh	GJ	MJ/Nm3	%	kgC/GJ	%	kt/a	kt/a	kg/kWh	%	kt/a	kg/kWh
1.	TPP Bobov dol	brown coal	555	3157	11.062	34.922.734,00	9,37	28,48	30,395	2,03	1.039,924	3.813,056	1,208	10,70	4.269,939	1,353
2.	TPP Varna	steam coal	1200	3752	10.699	40.142.648,00	24,59	66,66	27,109	4,96	1.034,235	3.792,195	1,011	9,49	4.189,623	1,117
3.	TPP Brikel (Maritsa Iztok #1)	lignite	180	893	11.052	9.869.436,00	10,18	19,94	19,587	1,74	189,953	696,495	0,780	18,54	855,015	0,957
4.1.	TPP Maritsa Iztok #2 part (150MW)	lignite	676	4727	11.168	52.791.136,00	6,431	19,11	29,715	2,385	1.531,298	5.614,760	1,188	13,84	6.516,666	1,379
4.2.	TPP Maritsa Iztok #2 part (210MW)	lignite	800	3513	10.690	37.553.970,00	6,431	19,11	29,715	2,49	1.088,146	3.989,869	1,136	11,84	4.525,713	1,288
5.	TPP Maritsa Iztok #3	lignite	856	5840	10.500	61.320.000,00	6,562	19,61	29,884	2,74	1.782,288	6.535,054	1,119	10,72	7.319,729	1,253
6.	TPP Maritsa 3	lignite	95	202	12.928	2.611.456,00	10,38	21,56	20,771	3,33	52,436	192,264	0,952	11,34	216,855	1,074
6.1.	TPP Rousse (condensate plant)	steam coal	200	1235	10.783	13.317.005,00	25,35	65,33	25,771	2,62	334,204	1.225,413	0,992	15,18	1.444,722	1,170
6.2.	TPP Rousse (cogeneration)	steam coal	70	188	11.585	2.177.980,00	25,48	65,44	25,683	2,59	54,488	199,790	1,063	15,18	235,545	1,253
7.1.	NPP Kozlodui # I and # II Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,00	0,000	0,000
7.2.	NPP Kozlodui # III and # IV Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
7.3.	NPP Kozlodui # V and # VI Unit	nuclear	1900	12003	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
8.	Cogeneration PP - Sofia	natural gas	50	269	7.353	1.977.957,00	33,54	50,00	14,908	0,5	29,339	107,577	0,400	33,55	161,891	0,602
9.	Cogeneration PP - Sofia-Iztok	natural gas	100	537	6.795	3.648.915,00	33,55	50,00	14,903	0,5	54,108	198,397	0,369	19,65	246,916	0,460
10.	Cogenaration PP Plovdiv	natural gas	30	180	6.858	1.234.440,00	33,4	50,00	14,970	0,5	18,387	67,420	0,375	10,50	75,329	0,418
11.	Cogenaration PPs others	natural gas	80	517	7.465	3.859.405,00	33,49	50,00	14,930	0,5	57,332	210,218	0,407	22,18	270,134	0,523
12.	Industrial PP Bourgas	heavy oil/gases	80	422	9.217	3.889.574,00	40,1	85,00	21,197	1,00	81,623	299,284	0,709	14,68	350,778	0,831
13.	Industrial PP Deven	steam coal	70	367	7.151	2.624.417,00	26,11	66,00	25,278	4,5	63,354	232,298	0,633	12,54	265,604	0,724
14.	Industrial PP Himko	natural gas	20	153	10.783	1.649.799,00	34,1	50,00	14,663	0,5	24,070	88,255	0,577	14,86	103,659	0,678
15.	Industrial PP Sviloza	steam coal	40	204	11.850	2.417.400,00	24,65	64,00	25,963	1,08	62,086	227,650	1,116	15,27	268,677	1,317
16.	Industrial PPs others	steam coal	105	614	12.858	7.894.812,00	22,24	61,10	27,473	3,46	209,390	767,763	1,250	15,51	908,702	1,480
17.	Existing Hydro Power Plants	hydro	1380	2695	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,00	0,000	0,000
18.	Cascade HPPs Dolna Arda	hydro	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
19.	HPP Tsankov Kamak	hydro	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
20.	Expansion of Cogeneration PPs	natural gas	0	0	6.001	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,00	0,000	0,000
21.	New TPP burning imported coal	sub-bitum. coal	0	0	9.378	0,00	25,12	60,00	23,885	1,5	0,000	0,000	0,000	9,50	0,000	0,000
22.	New Combined Cycle PP	natural gas	0	0	6.547	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,50	0,000	0,000
23.	New TPP burning indigenous lignites	lignite	0	0	9410	0,00	6,28	19,50	31,051	2,00	0,000	0,000	0,000	8,95	0,000	0,000
24.	New NPP	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	6,80	0,000	0,000
25.	Pump Storage HPP Chaira - pumping mode	hydro		-345	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	- generation mode	hydro	420	259	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	Undilivered Power			78												
	Total		**8907**	**41460**							**7.706,661**	**28.257,756**	**1,056**		**32.225,499**	**0,777**

Baseline Scenario, Year 2008

Maximum Power Supply Forecast

No.	Power Plant	Fuel	Available Capacity	Electricity Output	Gross Heat Rate	Energy Output	Net Calorific Value (NCV)	Fuel Carbon Content	Carbon Emission Factor	Fraction of Carbon Unoxidized	Actual Carbon Emissions	Actual CO2 Emissions	Specific CO2 Emission	Auxiliary Power needs	Net CO2 Emissions	Net Specific CO2 Emission
	Unit		MWel	GWh	kJ/kWh	GJ	GJ/Mg MJ/Nm3	%	kgC/GJ	%	kt/a	kt/a	kg/kWh	%	kt/a	kg/kWh
1.	TPP Bobov dol	brown coal	370	2162	11.062	23.916.044,00	9,37	28,48	30,395	2,03	712,169	2.611,285	1,208	10,70	2.924,171	1,353
2.	TPP Varna	steam coal	1200	4366	10.699	46.711.834,00	24,59	66,66	27,109	4,96	1.203,483	4.412,773	1,011	9,49	4.875,238	1,117
3.	TPP Brikel (Maritsa Iztok #1)	lignite	180	923	11.052	10.200.996,00	10,18	19,94	19,587	1,74	196,335	719,893	0,780	18,54	883,738	0,957
4.1.	TPP Maritsa Iztok #2 part (150MW)	lignite	676	4760	10.750	51.170.000,00	6,431	19,11	29,715	2,385	1.484,274	5.442,339	1,143	13,84	6.316,549	1,327
4.2.	TPP Maritsa Iztok #2 part (210MW)	lignite	809	4418	10.418	46.026.724,00	6,431	19,11	29,715	2,49	1.333,649	4.890,045	1,107	11,84	5.546,784	1,255
5.	TPP Maritsa Iztok #3	lignite	856	5932	9.870	58.548.840,00	6,562	19,61	29,884	2,74	1.701,743	6.239,724	1,052	10,72	6.988,938	1,178
6.	TPP Maritsa 3	lignite	95	205	12.928	2.650.240,00	10,38	21,56	20,771	3,33	53,214	195,119	0,952	11,34	220,076	1,074
6.1.	TPP Rousse (condensate plant)	steam coal	200	1258	10.500	13.209.000,00	25,35	65,33	25,771	2,62	331,493	1.215,474	0,966	15,18	1.433,005	1,139
6.2.	TPP Rousse (cogeneration)	steam coal	70	190	11.585	2.201.150,00	25,48	65,44	25,683	2,59	55,068	201,915	1,063	15,18	238,051	1,253
7.1.	NPP Kozlodui # I and # II Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,00	0,000	0,000
7.2.	NPP Kozlodui # III and # IV Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
7.3.	NPP Kozlodui # V and # VI Unit	nuclear	1900	12066	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
8.	Cogeneration PP - Sofia	natural gas	50	269	7.353	1.977.957,00	33,54	50,00	14,908	0,5	29,339	107,577	0,400	33,55	161,891	0,602
9.	Cogeneration PP - Sofia-Iztok	natural gas	100	537	6.795	3.648.915,00	33,55	50,00	14,903	0,5	54,108	198,397	0,369	19,65	246,916	0,460
10.	Cogenaration PP Plovdiv	natural gas	30	180	6.858	1.234.440,00	33,4	50,00	14,970	0,5	18,387	67,420	0,375	10,50	75,329	0,418
11.	Cogenaration PPs others	natural gas	80	517	7.465	3.859.405,00	33,49	50,00	14,930	0,5	57,332	210,218	0,407	22,18	270,134	0,523
12.	Industrial PP Bourgas	heavy oil/gases	80	425	9.217	3.917.225,00	40,1	85,00	21,197	1,00	82,203	301,411	0,709	14,68	353,272	0,831
13.	Industrial PP Deven	steam coal	70	369	7.151	2.638.719,00	26,11	66,00	25,278	4,5	63,699	233,564	0,633	12,54	267,052	0,724
14.	Industrial PP Himko	natural gas	20	153	10.783	1.649.799,00	34,1	50,00	14,663	0,5	24,070	88,255	0,577	14,86	103,659	0,678
15.	Industrial PP Sviloza	steam coal	40	204	11.850	2.417.400,00	24,65	64,00	25,963	1,08	62,086	227,650	1,116	15,27	268,677	1,317
16.	Industrial PPs others	steam coal	105	618	12.858	7.946.244,00	22,24	61,10	27,473	3,46	210,754	772,764	1,250	15,51	914,622	1,480
17.	Existing Hydro Power Plants	hydro	1380	2695	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,00	0,000	0,000
18.	Cascade HPPs Dolna Arda	hydro	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
19.	HPP Tsankov Kamak	hydro	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
20.	Expansion of Cogeneration PPs	natural gas	0	0	6.001	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,00	0,000	0,000
21.	New TPP burning imported coal	sub-bitum. coal	0	0	9.378	0,00	25,12	60,00	23,885	1,5	0,000	0,000	0,000	9,50	0,000	0,000
22.	New Combined Cycle PP	natural gas	0	0	6.547	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,50	0,000	0,000
23.	New TPP burning indigenous lignites	lignite	300	437	9410	4.112.095,71	6,28	19,50	31,051	2,00	125,131	458,813	1,050	8,95	503,913	1,153
24.	New NPP	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	6,80	0,000	0,000
25.	Pump Storage HPP Chaira - pumping mode	hydro		-325	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	- generation mode	hydro	420	274	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	Undilivered Power			5												
	Total		**9031**	**42638**							**7.798,537**	**28.594,636**	**1,024**		**32.592,015**	**0,764**

Baseline Scenario, Year 2009

Maximum Power Supply Forecast

No.	Power Plant	Fuel	Available Capacity	Electricity Output	Gross Heat Rate	Energy Output	Net Calorific Value (NCV)	Fuel Carbon Content	Carbon Emission Factor	Fraction of Carbon Unoxidized	Actual Carbon Emissions	Actual CO2 Emissions	Specific CO2 Emission	Auxiliary Power needs	Net CO2 Emissions	Net Specific CO2 Emission
	Unit		MWel	GWh	kJ/kWh	GJ	GJ/Mg MJ/Nm3	%	kgC/GJ	%	kt/a	kt/a	kg/kWh	%	kt/a	kg/kWh
1.	TPP Bobov dol	brown coal	370	1667	11.062	18.440.354,00	9,37	28,48	30,395	2,03	549,114	2.013,419	1,208	10,70	2.254,669	1,353
2.	TPP Varna	steam coal	1000	1909	10.699	20.424.391,00	24,59	66,66	27,109	4,96	526,214	1.929,451	1,011	9,49	2.131,660	1,117
3.	TPP Brikel (Maritsa Iztok #1)	lignite	180	895	11.052	9.891.540,00	10,18	19,94	19,587	1,74	190,379	698,055	0,780	18,54	856,929	0,957
4.1.	TPP Maritsa Iztok #2 part (150MW)	lignite	676	4624	10.610	49.060.640,00	6,431	19,11	29,715	2,385	1.423,089	5.217,992	1,128	13,84	6.056,165	1,310
4.2.	TPP Maritsa Iztok #2 part (210MW)	lignite	818	4781	10.145	48.503.245,00	6,431	19,11	29,715	2,49	1.405,407	5.153,159	1,078	11,84	5.845,235	1,223
5.	TPP Maritsa Iztok #3	lignite	856	5809	9.660	56.114.940,00	6,562	19,61	29,884	2,74	1.631,001	5.980,336	1,029	10,72	6.698,405	1,153
6.	TPP Maritsa 3	lignite	95	202	12.928	2.611.456,00	10,38	21,56	20,771	3,33	52,436	192,264	0,952	11,34	216,855	1,074
6.1.	TPP Rousse (condensate plant)	steam coal	200	815	10.550	8.598.250,00	25,35	65,33	25,771	2,62	215,782	791,199	0,971	15,18	932,798	1,145
6.2.	TPP Rousse (cogeneration)	steam coal	70	169	11.585	1.957.865,00	25,48	65,44	25,683	2,59	48,981	179,598	1,063	15,18	211,740	1,253
7.1.	NPP Kozlodui # I and # II Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,00	0,000	0,000
7.2.	NPP Kozlodui # III and # IV Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
7.3.	NPP Kozlodui # V and # VI Unit	nuclear	1900	11921	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
8.	Cogeneration PP - Sofia	natural gas	50	269	7.353	1.977.957,00	33,54	50,00	14,908	0,5	29,339	107,577	0,400	33,55	161,891	0,602
9.	Cogeneration PP - Sofia-Iztok	natural gas	100	537	6.795	3.648.915,00	33,55	50,00	14,903	0,5	54,108	198,397	0,369	19,65	246,916	0,460
10.	Cogenaration PP Plovdiv	natural gas	30	180	6.858	1.234.440,00	33,4	50,00	14,970	0,5	18,387	67,420	0,375	10,50	75,329	0,418
11.	Cogenaration PPs others	natural gas	80	517	7.465	3.859.405,00	33,49	50,00	14,930	0,5	57,332	210,218	0,407	22,18	270,134	0,523
12.	Industrial PP Bourgas	heavy oil/gases	80	425	9.217	3.917.225,00	40,1	85,00	21,197	1,00	82,203	301,411	0,709	14,68	353,272	0,831
13.	Industrial PP Deven	steam coal	70	367	7.151	2.624.417,00	26,11	66,00	25,278	4,5	63,354	232,298	0,633	12,54	265,604	0,724
14.	Industrial PP Himko	natural gas	20	153	10.783	1.649.799,00	34,1	50,00	14,663	0,5	24,070	88,255	0,577	14,86	103,659	0,678
15.	Industrial PP Sviloza	steam coal	40	202	11.850	2.393.700,00	24,65	64,00	25,963	1,08	61,478	225,418	1,116	15,27	266,043	1,317
16.	Industrial PPs others	steam coal	105	599	12.858	7.701.942,00	22,24	61,10	27,473	3,46	204,274	749,006	1,250	15,51	886,503	1,480
17.	Existing Hydro Power Plants	hydro	1380	2702	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,00	0,000	0,000
18.	Cascade HPPs Dolna Arda	hydro	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
19.	HPP Tsankov Kamak	hydro	80	198	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
20.	Expansion of Cogeneration PPs	natural gas	130	483	6.001	2.898.483,00	33,3	50,00	15,015	0,5	43,303	158,778	0,329	8,00	172,585	0,357
21.	New TPP burning imported coal	sub-bitum. coal	0	0	9.378	0,00	25,12	60,00	23,885	1,5	0,000	0,000	0,000	9,50	0,000	0,000
22.	New Combined Cycle PP	natural gas	0	0	6.547	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,50	0,000	0,000
23.	New TPP burning indigenous lignites	lignite	600	1964	9410	18.480.906,12	6,28	19,50	31,051	2,00	562,373	2.062,034	1,050	8,95	2.264,727	1,153
24.	New NPP	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	6,80	0,000	0,000
25.	Pump Storage HPP Chaira - pumping mode	hydro		-168	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	- generation mode	hydro	420	126	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	Undilivered Power			24												
	Total		**9350**	**41370**							**7.242,623**	**26.556,285**	**1,000**		**30.271,119**	**0,732**

Baseline Scenario, Year 2010

Maximum Power Supply Forecast

No.	Power Plant	Fuel	Available Capacity	Electricity Output	Gross Heat Rate	Energy Output	Net Calorific Value (NCV)	Fuel Carbon Content	Carbon Emission Factor	Fraction of Carbon Unoxidized	Actual Carbon Emissions	Actual CO2 Emissions	Specific CO2 Emission	Auxiliary Power needs	Net CO2 Emissions	Net Specific CO2 Emission
	Unit		MWel	GWh	kJ/kWh	GJ	GJ/Mg MJ/Nm3	%	kgC/GJ	%	kt/a	kt/a	kg/kWh	%	kt/a	kg/kWh
1.	TPP Bobov dol	brown coal	370	889	11.062	9.834.118,00	9,37	28,48	30,395	2,03	292,839	1.073,743	1,208	10,70	1.202,400	1,353
2.	TPP Varna	steam coal	1018	2478	10.479	25.966.962,00	24,59	66,66	27,109	4,96	669,013	2.453,047	0,990	9,49	2.710,129	1,094
3.	TPP Brikel (Maritsa Iztok #1)	lignite	180	925	11.052	10.223.100,00	10,18	19,94	19,587	1,74	196,760	721,453	0,780	18,54	885,653	0,957
4.1.	TPP Maritsa Iztok #2 part (150MW)	lignite	676	4692	10.610	49.782.120,00	6,431	19,11	29,715	2,385	1.444,016	5.294,727	1,128	13,84	6.145,226	1,310
4.2.	TPP Maritsa Iztok #2 part (210MW)	lignite	818	4851	10.145	49.213.395,00	6,431	19,11	29,715	2,49	1.425,984	5.228,608	1,078	11,84	5.930,817	1,223
5.	TPP Maritsa Iztok #3	lignite	856	5900	9.660	56.994.000,00	6,562	19,61	29,884	2,74	1.656,551	6.074,020	1,029	10,72	6.803,338	1,153
6.	TPP Maritsa 3	lignite	95	156	12.928	2.016.768,00	10,38	21,56	20,771	3,33	40,495	148,481	0,952	11,34	167,472	1,074
6.1.	TPP Rousse (condensate plant)	steam coal	200	967	10.550	10.201.850,00	25,35	65,33	25,771	2,62	256,026	938,761	0,971	15,18	1.106,768	1,145
6.2.	TPP Rousse (cogeneration)	steam coal	70	173	11.585	2.004.205,00	25,48	65,44	25,683	2,59	50,141	183,849	1,063	15,18	216,752	1,253
7.1.	NPP Kozlodui # I and # II Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,00	0,000	0,000
7.2.	NPP Kozlodui # III and # IV Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
7.3.	NPP Kozlodui # V and # VI Unit	nuclear	1900	12019	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
8.	Cogeneration PP - Sofia	natural gas	50	269	7.353	1.977.957,00	33,54	50,00	14,908	0,5	29,339	107,577	0,400	33,55	161,891	0,602
9.	Cogeneration PP - Sofia-Iztok	natural gas	100	537	6.795	3.648.915,00	33,55	50,00	14,903	0,5	54,108	198,397	0,369	19,65	246,916	0,460
10.	Cogenaration PP Plovdiv	natural gas	30	180	6.858	1.234.440,00	33,4	50,00	14,970	0,5	18,387	67,420	0,375	10,50	75,329	0,418
11.	Cogenaration PPs others	natural gas	80	517	7.465	3.859.405,00	33,49	50,00	14,930	0,5	57,332	210,218	0,407	22,18	270,134	0,523
12.	Industrial PP Bourgas	heavy oil/gases	80	429	9.217	3.954.093,00	40,1	85,00	21,197	1,00	82,977	304,248	0,709	14,68	356,597	0,831
13.	Industrial PP Deven	steam coal	70	369	7.151	2.638.719,00	26,11	66,00	25,278	4,5	63,699	233,564	0,633	12,54	267,052	0,724
14.	Industrial PP Himko	natural gas	20	153	10.783	1.649.799,00	34,1	50,00	14,663	0,5	24,070	88,255	0,577	14,86	103,659	0,678
15.	Industrial PP Sviloza	steam coal	40	201	11.850	2.381.850,00	24,65	64,00	25,963	1,08	61,173	224,302	1,116	15,27	264,726	1,317
16.	Industrial PPs others	steam coal	105	600	12.858	7.714.800,00	22,24	61,10	27,473	3,46	204,615	750,257	1,250	15,51	887,983	1,480
17.	Existing Hydro Power Plants	hydro	1380	2702	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,00	0,000	0,000
18.	Cascade HPPs Dolna Arda	hydro	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
19.	HPP Tsankov Kamak	hydro	80	198	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
20.	Expansion of Cogeneration PPs	natural gas	130	483	6.001	2.898.483,00	33,3	50,00	15,015	0,5	43,303	158,778	0,329	8,00	172,585	0,357
21.	New TPP burning imported coal	sub-bitum. coal	0	0	9.378	0,00	25,12	60,00	23,885	1,5	0,000	0,000	0,000	9,50	0,000	0,000
22.	New Combined Cycle PP	natural gas	0	0	6.547	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,50	0,000	0,000
23.	New TPP burning indigenous lignites	lignite	600	2818	9410	26.516.900,94	6,28	19,50	31,051	2,00	806,908	2.958,661	1,050	8,95	3.249,491	1,153
24.	New NPP	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	6,80	0,000	0,000
25.	Pump Storage HPP Chaira - pumping mode	hydro		-155	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	- generation mode	hydro	630	116	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	Undilivered Power			24												
	Total		**9578**	**42491**							**7.477,736**	**27.418,365**	**0,994**		**31.224,917**	**0,735**

Baseline Scenario, Year 2011																
Maximum Power Supply Forecast																
	Parameter		**Available**	**Electricity**	**Gross**	**Energy**	**Net Calorific**	**Fuel**	**Carbon**	**Fraction**	**Actual**	**Actual**	**Specific**	**Auxiliary**	**Net**	**Net Specific**
		Fuel	**Capacity**	**Output**	**Heat**	**Output**	**Value (NCV)**	**Carbon**	**Emission**	**of Carbon**	**Carbon**	**CO2**	**CO2**	**Power**	**CO2**	**CO2**
	Power Plant				**Rate**		**GJ/Mg**	**Content**	**Factor**	**Unoxidized**	**Emissions**	**Emissions**	**Emission**	**needs**	**Emissions**	**Emission**
	Unit		**MWel**	**GWh**	**kJ/kWh**	**GJ**	**MJ/Nm3**	**%**	**kgC/GJ**	**%**	**kt/a**	**kt/a**	**kg/kWh**	**%**	**kt/a**	**kg/kWh**
1.	TPP Bobov dol	brown coal	185	1002	11.062	11.084.124,00	9,37	28,48	30,395	2,03	330,062	1.210,226	1,208	10,70	1.355,236	1,353
2.	TPP Varna	steam coal	1036	3482	10.259	35.721.838,00	24,59	66,66	27,109	4,96	920,337	3.374,570	0,969	9,49	3.728,230	1,071
3.	TPP Brikel (Maritsa Iztok #1)	lignite	0	0	11.052	0,00	10,18	19,94	19,587	1,74	0,000	0,000	0,000	18,54	0,000	0,000
4.1.	TPP Maritsa Iztok #2 part (150MW)	lignite	676	4772	10.610	50.630.920,00	6,431	19,11	29,715	2,385	1.468,637	5.385,003	1,128	13,84	6.250,004	1,310
4.2.	TPP Maritsa Iztok #2 part (210MW)	lignite	818	5054	10.145	51.272.830,00	6,431	19,11	29,715	2,49	1.485,657	5.447,410	1,078	11,84	6.179,004	1,223
5.	TPP Maritsa Iztok #3	lignite	856	6008	9.660	58.037.280,00	6,562	19,61	29,884	2,74	1.686,874	6.185,205	1,029	10,72	6.927,873	1,153
6.	TPP Maritsa 3	lignite	0	0	12.928	0,00	10,38	21,56	20,771	3,33	0,000	0,000	0,000	11,34	0,000	0,000
6.1.	TPP Rousse (condensate plant)	steam coal	200	1052	10.550	11.098.600,00	25,35	65,33	25,771	2,62	278,530	1.021,278	0,971	15,18	1.204,054	1,145
6.2.	TPP Rousse (cogeneration)	steam coal	70	163	11.585	1.888.355,00	25,48	65,44	25,683	2,59	47,242	173,222	1,063	15,18	204,223	1,253
7.1.	NPP Kozlodui # I and # II Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,00	0,000	0,000
7.2.	NPP Kozlodui # III and # IV Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
7.3.	NPP Kozlodui # V and # VI Unit	nuclear	1900	12129	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
8.	Cogeneration PP - Sofia	natural gas	50	269	7.353	1.977.957,00	33,54	50,00	14,908	0,5	29,339	107,577	0,400	33,55	161,891	0,602
9.	Cogeneration PP - Sofia-Iztok	natural gas	100	537	6.795	3.648.915,00	33,55	50,00	14,903	0,5	54,108	198,397	0,369	19,65	246,916	0,460
10.	Cogenaration PP Plovdiv	natural gas	30	180	6.858	1.234.440,00	33,4	50,00	14,970	0,5	18,387	67,420	0,375	10,50	75,329	0,418
11.	Cogenaration PPs others	natural gas	80	517	7.465	3.859.405,00	33,49	50,00	14,930	0,5	57,332	210,218	0,407	22,18	270,134	0,523
12.	Industrial PP Bourgas	heavy oil/gases	80	430	9.217	3.963.310,00	40,1	85,00	21,197	1,00	83,170	304,957	0,709	14,68	357,428	0,831
13.	Industrial PP Deven	steam coal	70	370	7.151	2.645.870,00	26,11	66,00	25,278	4,5	63,872	234,196	0,633	12,54	267,776	0,724
14.	Industrial PP Himko	natural gas	20	153	10.783	1.649.799,00	34,1	50,00	14,663	0,5	24,070	88,255	0,577	14,86	103,659	0,678
15.	Industrial PP Sviloza	steam coal	40	204	11.850	2.417.400,00	24,65	64,00	25,963	1,08	62,086	227,650	1,116	15,27	268,677	1,317
16.	Industrial PPs others	steam coal	105	607	12.858	7.804.806,00	22,24	61,10	27,473	3,46	207,003	759,010	1,250	15,51	898,343	1,480
17.	Existing Hydro Power Plants	hydro	1380	2702	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,00	0,000	0,000
18.	Cascade HPPs Dolna Arda	hydro	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
19.	HPP Tsankov Kamak	hydro	80	198	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
20.	Expansion of Cogeneration PPs	natural gas	130	502	6.001	3.012.502,00	33,3	50,00	15,015	0,5	45,007	165,024	0,329	8,00	179,374	0,357
21.	New TPP burning imported coal	sub-bitum. coal	0	0	9.378	0,00	25,12	60,00	23,885	1,5	0,000	0,000	0,000	9,50	0,000	0,000
22.	New Combined Cycle PP	natural gas	0	0	6.547	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,50	0,000	0,000
23.	New TPP burning indigenous lignites	lignite	600	3237	9410	30.459.619,71	6,28	19,50	31,051	2,00	926,884	3.398,576	1,050	8,95	3.732,648	1,153
24.	New NPP	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	6,80	0,000	0,000
25.	Pump Storage HPP Chaira - pumping mode	hydro		-252	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	- generation mode	hydro	630	189	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	Undilivered Power			95												
	Total		**9136**	**43600**							**7.788,598**	**28.558,194**	**1,001**		**32.410,797**	**0,743**

Baseline Scenario, Year 2012																
Maximum Power Supply Forecast																
	Parameter		**Available**	**Electricity**	**Gross**	**Energy**	**Net Calorific**	**Fuel**	**Carbon**	**Fraction**	**Actual**	**Actual**	**Specific**	**Auxiliary**	**Net**	**Net Specific**
		Fuel	**Capacity**	**Output**	**Heat**	**Output**	**Value (NCV)**	**Carbon**	**Emission**	**of Carbon**	**Carbon**	**CO2**	**CO2**	**Power**	**CO2**	**CO2**
	Power Plant				**Rate**		**GJ/Mg**	**Content**	**Factor**	**Unoxidized**	**Emissions**	**Emissions**	**Emission**	**needs**	**Emissions**	**Emission**
	Unit		**MWel**	**GWh**	**kJ/kWh**	**GJ**	**MJ/Nm3**	**%**	**kgC/GJ**	**%**	**kt/a**	**kt/a**	**kg/kWh**	**%**	**kt/a**	**kg/kWh**
1.	TPP Bobov dol	brown coal	185	320	11.062	3.539.840,00	9,37	28,48	30,395	2,03	105,409	386,499	1,208	10,70	432,810	1,353
2.	TPP Varna	steam coal	1054	1965	10.039	19.726.635,00	24,59	66,66	27,109	4,96	508,237	1.863,535	0,948	9,49	2.058,837	1,048
3.	TPP Brikel (Maritsa Iztok #1)	lignite	0	0	11.052	0,00	10,18	19,94	19,587	1,74	0,000	0,000	0,000	18,54	0,000	0,000
4.1.	TPP Maritsa Iztok #2 part (150MW)	lignite	676	4485	10.610	47.585.850,00	6,431	19,11	29,715	2,385	1.380,310	5.061,136	1,128	13,84	5.874,113	1,310
4.2.	TPP Maritsa Iztok #2 part (210MW)	lignite	818	4572	10.145	46.382.940,00	6,431	19,11	29,715	2,49	1.343,970	4.927,890	1,078	11,84	5.589,712	1,223
5.	TPP Maritsa Iztok #3	lignite	856	5640	9.660	54.482.400,00	6,562	19,61	29,884	2,74	1.583,550	5.806,351	1,029	10,72	6.503,529	1,153
6.	TPP Maritsa 3	lignite	0	0	12.928	0,00	10,38	21,56	20,771	3,33	0,000	0,000	0,000	11,34	0,000	0,000
6.1.	TPP Rousse (condensate plant)	steam coal	200	356	10.550	3.755.800,00	25,35	65,33	25,771	2,62	94,256	345,604	0,971	15,18	407,455	1,145
6.2.	TPP Rousse (cogeneration)	steam coal	70	161	11.585	1.865.185,00	25,48	65,44	25,683	2,59	46,663	171,096	1,063	15,18	201,717	1,253
7.1.	NPP Kozlodui # I and # II Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,00	0,000	0,000
7.2.	NPP Kozlodui # III and # IV Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
7.3.	NPP Kozlodui # V and # VI Unit	nuclear	1900	11647	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
8.	Cogeneration PP - Sofia	natural gas	50	269	7.353	1.977.957,00	33,54	50,00	14,908	0,5	29,339	107,577	0,400	33,55	161,891	0,602
9.	Cogeneration PP - Sofia-Iztok	natural gas	100	537	6.795	3.648.915,00	33,55	50,00	14,903	0,5	54,108	198,397	0,369	19,65	246,916	0,460
10.	Cogenaration PP Plovdiv	natural gas	30	180	6.858	1.234.440,00	33,4	50,00	14,970	0,5	18,387	67,420	0,375	10,50	75,329	0,418
11.	Cogenaration PPs others	natural gas	80	517	7.465	3.859.405,00	33,49	50,00	14,930	0,5	57,332	210,218	0,407	22,18	270,134	0,523
12.	Industrial PP Bourgas	heavy oil/gases	80	424	9.217	3.908.008,00	40,1	85,00	21,197	1,00	82,010	300,702	0,709	14,68	352,440	0,831
13.	Industrial PP Deven	steam coal	70	364	7.151	2.602.964,00	26,11	66,00	25,278	4,5	62,836	230,399	0,633	12,54	263,433	0,724
14.	Industrial PP Himko	natural gas	20	151	10.783	1.628.233,00	34,1	50,00	14,663	0,5	23,755	87,102	0,577	14,86	102,304	0,678
15.	Industrial PP Sviloza	steam coal	40	200	11.850	2.370.000,00	24,65	64,00	25,963	1,08	60,869	223,186	1,116	15,27	263,408	1,317
16.	Industrial PPs others	steam coal	105	593	12.858	7.624.794,00	22,24	61,10	27,473	3,46	202,228	741,504	1,250	15,51	877,623	1,480
17.	Existing Hydro Power Plants	hydro	1380	2703	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,00	0,000	0,000
18.	Cascade HPPs Dolna Arda	hydro	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
19.	HPP Tsankov Kamak	hydro	80	198	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
20.	Expansion of Cogeneration PPs	natural gas	130	477	6.001	2.862.477,00	33,3	50,00	15,015	0,5	42,765	156,806	0,329	8,00	170,441	0,357
21.	New TPP burning imported coal	sub-bitum. coal	0	0	9.378	0,00	25,12	60,00	23,885	1,5	0,000	0,000	0,000	9,50	0,000	0,000
22.	New Combined Cycle PP	natural gas	0	0	6.547	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,50	0,000	0,000
23.	New TPP burning indigenous lignites	lignite	600	2251	9410	21.181.527,33	6,28	19,50	31,051	2,00	644,553	2.363,359	1,050	8,95	2.595,672	1,153
24.	New NPP	nuclear	950	6538	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	6,80	0,000	0,000
25.	Pump Storage HPP Chaira - pumping mode	hydro		-334	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	- generation mode	hydro	630	251	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	Undilivered Power			0												
	Total		**10104**	**44465**							**6.340,577**	**23.248,781**	**0,991**		**26.447,767**	**0,595**

10.10 Annex: Project Scenario: Bulgarian Power Plants 2005 – 2012

Scenario with Dolna Arda HPProject, Year 2005

Maximum Power Supply Forecast

	Parameter / Power Plant	Fuel	Available Capacity	Electricity Output	Gross Heat Rate	Energy Output	Net Calorific Value (NCV) GJ/Mg	Fuel Carbon Content	Carbon Emission Factor	Fraction of Carbon Unoxidized	Actual Carbon Emissions	Actual CO2 Emissions	Specific CO2 Emission	Auxiliary Power needs	Net CO2 Emissions	Net Specific CO2 Emission
	Unit		MWel	GWh	kJ/kWh	GJ	MJ/Nm3	%	kgC/GJ	%	kt/a	kt/a	kg/kWh	%	kt/a	kg/kWh
1.	TPP Bobov dol	brown coal	555	3138	11.062	34.712.556,00	9,37	28,48	30,395	2,03	1.033,666	3.790,107	1,208	10,70	4.244,241	1,353
2.	TPP Varna	steam coal	1200	3648	10.699	39.029.952,00	24,59	66,66	27,109	4,96	1.005,567	3.687,081	1,011	9,49	4.073,492	1,117
3.	TPP Brikel (Maritsa Iztok #1)	lignite	180	881	11.052	9.736.812,00	10,18	19,94	19,587	1,74	187,401	687,135	0,780	18,54	843,525	0,957
4.1.	TPP Maritsa Iztok #2 part (150MW)	lignite	574	3077	12.482	38.407.114,00	6,431	19,11	29,715	2,385	1.114,065	4.084,904	1,328	13,84	4.741,068	1,541
4.2.	TPP Maritsa Iztok #2 part (210MW)	lignite	800	4112	10.690	43.957.280,00	6,431	19,11	29,715	2,49	1.273,685	4.670,180	1,136	11,84	5.297,391	1,288
5.	TPP Maritsa Iztok #3	lignite	614	4227	11.340	47.934.180,00	6,562	19,61	29,884	2,74	1.393,224	5.108,488	1,209	10,72	5.721,873	1,354
6.	TPP Maritsa 3	lignite	95	205	12.928	2.650.240,00	10,38	21,56	20,771	3,33	53,214	195,119	0,952	11,34	220,076	1,074
6.1.	TPP Rousse (condensate plant)	steam coal	100	614	11.017	6.764.438,00	25,35	65,33	25,771	2,62	169,760	622,455	1,014	15,18	733,853	1,195
6.2.	TPP Rousse (cogeneration)	steam coal	70	184	11.585	2.131.640,00	25,48	65,44	25,683	2,59	53,329	195,539	1,063	15,18	230,534	1,253
7.1.	NPP Kozlodui # I and # II Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,00	0,000	0,000
7.2.	NPP Kozlodui # III and # IV Unit	nuclear	800	5494	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
7.3.	NPP Kozlodui # V and # VI Unit	nuclear	1900	11350	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
8.	Cogeneration PP - Sofia	natural gas	50	269	7.353	1.977.957,00	33,54	50,00	14,908	0,5	29,339	107,577	0,400	33,55	161,891	0,602
9.	Cogeneration PP - Sofia-Iztok	natural gas	100	537	6.795	3.648.915,00	33,55	50,00	14,903	0,5	54,108	198,397	0,369	19,65	246,916	0,460
10.	Cogenaration PP Plovdiv	natural gas	30	180	6.858	1.234.440,00	33,4	50,00	14,970	0,5	18,387	67,420	0,375	10,50	75,329	0,418
11.	Cogenaration PPs others	natural gas	80	517	7.465	3.859.405,00	33,49	50,00	14,930	0,5	57,332	210,218	0,407	22,18	270,134	0,523
12.	Industrial PP Bourgas	heavy oil/gases	80	419	9.217	3.861.923,00	40,1	85,00	21,197	1,00	81,043	297,156	0,709	14,68	348,284	0,831
13.	Industrial PP Deven	steam coal	70	367	7.151	2.624.417,00	26,11	66,00	25,278	4,5	63,354	232,298	0,633	12,54	265,604	0,724
14.	Industrial PP Himko	natural gas	20	156	10.783	1.682.148,00	34,1	50,00	14,663	0,5	24,542	89,986	0,577	14,86	105,692	0,678
15.	Industrial PP Sviloza	steam coal	40	204	11.850	2.417.400,00	24,65	64,00	25,963	1,08	62,086	227,650	1,116	15,27	268,677	1,317
16.	Industrial PPs others	steam coal	105	610	12.858	7.843.380,00	22,24	61,10	27,473	3,46	208,026	762,761	1,250	15,51	902,782	1,480
17.	Existing Hydro Power Plants	hydro	1380	2694	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,00	0,000	0,000
18.	Cascade HPPs Dolna Arda	hydro	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
19.	HPP Tsankov Kamak	hydro	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
20.	Expansion of Cogeneration PPs	natural gas	0	0	6.001	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,00	0,000	0,000
21.	New TPP burning imported coal	sub-bitum. coal	0	0	9.378	0,00	25,12	60,00	23,885	1,5	0,000	0,000	0,000	9,50	0,000	0,000
22.	New Combined Cycle PP	natural gas	0	0	6.547	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,50	0,000	0,000
23.	New TPP burning indigenous lignites	lignite	0	0	9410	0,00	6,28	19,50	31,051	2,00	0,000	0,000	0,000	8,95	0,000	0,000
24.	New NPP	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	6,80	0,000	0,000
25.	Pump Storage HPP Chaira - pumping mode	hydro		-416	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	- generation mode	hydro	420	312	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	Undilivered Power			71												
	Total		**9263**	**42850**							**6.882,128**	**25.234,469**	**1,081**		**28.751,362**	**0,671**

Scenario with Dolna Arda HPProject, Year 2006

Maximum Power Supply Forecast

	Parameter / Power Plant	Fuel	Available Capacity	Electricity Output	Gross Heat Rate	Energy Output	Net Calorific Value (NCV) GJ/Mg	Fuel Carbon Content	Carbon Emission Factor	Fraction of Carbon Unoxidized	Actual Carbon Emissions	Actual CO2 Emissions	Specific CO2 Emission	Auxiliary Power needs	Net CO2 Emissions	Net Specific CO2 Emission
	Unit		MWel	GWh	kJ/kWh	GJ	MJ/Nm3	%	kgC/GJ	%	kt/a	kt/a	kg/kWh	%	kt/a	kg/kWh
1.	TPP Bobov dol	brown coal	555	3104	11.062	34.336.448,00	9,37	28,48	30,395	2,03	1.022,466	3.749,042	1,208	10,70	4.198,255	1,353
2.	TPP Varna	steam coal	1200	3580	10.699	38.302.420,00	24,59	66,66	27,109	4,96	986,823	3.618,352	1,011	9,49	3.997,561	1,117
3.	TPP Brikel (Maritsa Iztok #1)	lignite	180	878	11.052	9.703.656,00	10,18	19,94	19,587	1,74	186,762	684,796	0,780	18,54	840,653	0,957
4.1.	TPP Maritsa Iztok #2 part (150MW)	lignite	608	3581	11.546	41.346.226,00	6,431	19,11	29,715	2,385	1.199,319	4.397,502	1,228	13,84	5.103,879	1,425
4.2.	TPP Maritsa Iztok #2 part (210MW)	lignite	800	4026	10.690	43.037.940,00	6,431	19,11	29,715	2,49	1.247,047	4.572,506	1,136	11,84	5.186,599	1,288
5.	TPP Maritsa Iztok #3	lignite	642	5214	10.780	56.206.920,00	6,562	19,61	29,884	2,74	1.633,674	5.990,138	1,149	10,72	6.709,384	1,287
6.	TPP Maritsa 3	lignite	95	202	12.928	2.611.456,00	10,38	21,56	20,771	3,33	52,436	192,264	0,952	11,34	216,855	1,074
6.1.	TPP Rousse (condensate plant)	steam coal	100	258	11.017	2.842.386,00	25,35	65,33	25,771	2,62	71,333	261,553	1,014	15,18	308,362	1,195
6.2.	TPP Rousse (cogeneration)	steam coal	70	183	11.585	2.120.055,00	25,48	65,44	25,683	2,59	53,039	194,476	1,063	15,18	229,281	1,253
7.1.	NPP Kozlodui # I and # II Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,00	0,000	0,000
7.2.	NPP Kozlodui # III and # IV Unit	nuclear	800	5490	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
7.3.	NPP Kozlodui # V and # VI Unit	nuclear	1900	11290	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
8.	Cogeneration PP - Sofia	natural gas	50	269	7.353	1.977.957,00	33,54	50,00	14,908	0,5	29,339	107,577	0,400	33,55	161,891	0,602
9.	Cogeneration PP - Sofia-Iztok	natural gas	100	537	6.795	3.648.915,00	33,55	50,00	14,903	0,5	54,108	198,397	0,369	19,65	246,916	0,460
10.	Cogenaration PP Plovdiv	natural gas	30	180	6.858	1.234.440,00	33,4	50,00	14,970	0,5	18,387	67,420	0,375	10,50	75,329	0,418
11.	Cogenaration PPs others	natural gas	80	517	7.465	3.859.405,00	33,49	50,00	14,930	0,5	57,332	210,218	0,407	22,18	270,134	0,523
12.	Industrial PP Bourgas	heavy oil/gases	80	418	9.217	3.852.706,00	40,1	85,00	21,197	1,00	80,849	296,447	0,709	14,68	347,453	0,831
13.	Industrial PP Deven	steam coal	70	366	7.151	2.617.266,00	26,11	66,00	25,278	4,5	63,181	231,665	0,633	12,54	264,881	0,724
14.	Industrial PP Himko	natural gas	20	153	10.783	1.649.799,00	34,1	50,00	14,663	0,5	24,070	88,255	0,577	14,86	103,659	0,678
15.	Industrial PP Sviloza	steam coal	40	204	11.850	2.417.400,00	24,65	64,00	25,963	1,08	62,086	227,650	1,116	15,27	268,677	1,317
16.	Industrial PPs others	steam coal	105	608	12.858	7.817.664,00	22,24	61,10	27,473	3,46	207,344	760,260	1,250	15,51	899,822	1,480
17.	Existing Hydro Power Plants	hydro	1380	2695	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,00	0,000	0,000
18.	Cascade HPPs Dolna Arda	hydro	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
19.	HPP Tsankov Kamak	hydro	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
20.	Expansion of Cogeneration PPs	natural gas	0	0	6.001	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,00	0,000	0,000
21.	New TPP burning imported coal	sub-bitum. coal	0	0	9.378	0,00	25,12	60,00	23,885	1,5	0,000	0,000	0,000	9,50	0,000	0,000
22.	New Combined Cycle PP	natural gas	0	0	6.547	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,50	0,000	0,000
23.	New TPP burning indigenous lignites	lignite	0	0	9410	0,00	6,28	19,50	31,051	2,00	0,000	0,000	0,000	8,95	0,000	0,000
24.	New NPP	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	6,80	0,000	0,000
25.	Pump Storage HPP Chaira - pumping mode	hydro	0	-348	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	- generation mode	hydro	420	261	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	Undilivered Power			16												
	Total		**9325**	**43682**							**7.049,595**	**25.848,516**	**1,065**		**29.429,591**	**0,674**

Scenario with Dolna Arda HPProject, Year 2007

Maximum Power Supply Forecast

	Parameter / Power Plant	Fuel	Available Capacity	Electricity Output	Gross Heat Rate	Energy Output	Net Calorific Value (NCV) GJ/Mg	Fuel Carbon Content	Carbon Emission Factor	Fraction of Carbon Unoxidized	Actual Carbon Emissions	Actual CO2 Emissions	Specific CO2 Emission	Auxiliary Power needs	Net CO2 Emissions	Net Specific CO2 Emission
	Unit		MWel	GWh	kJ/kWh	GJ	MJ/Nm3	%	kgC/GJ	%	kt/a	kt/a	kg/kWh	%	kt/a	kg/kWh
1.	TPP Bobov dol	brown coal	555	3157	11.062	34.922.734,00	9,37	28,48	30,395	2,03	1.039,924	3.813,056	1,208	10,70	4.269,939	1,353
2.	TPP Varna	steam coal	1200	3752	10.699	40.142.648,00	24,59	66,66	27,109	4,96	1.034,235	3.792,195	1,011	9,49	4.189,623	1,117
3.	TPP Brikel (Maritsa Iztok #1)	lignite	180	893	11.052	9.869.436,00	10,18	19,94	19,587	1,74	189,953	696,495	0,780	18,54	855,015	0,957
4.1.	TPP Maritsa Iztok #2 part (150MW)	lignite	676	4727	11.168	52.791.136,00	6,431	19,11	29,715	2,385	1.531,298	5.614,760	1,188	13,84	6.516,666	1,379
4.2.	TPP Maritsa Iztok #2 part (210MW)	lignite	800	3513	10.690	37.553.970,00	6,431	19,11	29,715	2,49	1.088,146	3.989,869	1,136	11,84	4.525,713	1,288
5.	TPP Maritsa Iztok #3	lignite	856	5840	10.500	61.320.000,00	6,562	19,61	29,884	2,74	1.782,288	6.535,054	1,119	10,72	7.319,729	1,253
6.	TPP Maritsa 3	lignite	95	202	12.928	2.611.456,00	10,38	21,56	20,771	3,33	52,436	192,264	0,952	11,34	216,855	1,074
6.1.	TPP Rousse (condensate plant)	steam coal	200	1235	10.783	13.317.005,00	25,35	65,33	25,771	2,62	334,204	1.225,413	0,992	15,18	1.444,722	1,170
6.2.	TPP Rousse (cogeneration)	steam coal	70	188	11.585	2.177.980,00	25,48	65,44	25,683	2,59	54,488	199,790	1,063	15,18	235,545	1,253
7.1.	NPP Kozlodui # I and # II Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,00	0,000	0,000
7.2.	NPP Kozlodui # III and # IV Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
7.3.	NPP Kozlodui # V and # VI Unit	nuclear	1900	12003	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
8.	Cogeneration PP - Sofia	natural gas	50	269	7.353	1.977.957,00	33,54	50,00	14,908	0,5	29,339	107,577	0,400	33,55	161,891	0,602
9.	Cogeneration PP - Sofia-Iztok	natural gas	100	537	6.795	3.648.915,00	33,55	50,00	14,903	0,5	54,108	198,397	0,369	19,65	246,916	0,460
10.	Cogenaration PP Plovdiv	natural gas	30	180	6.858	1.234.440,00	33,4	50,00	14,970	0,5	18,387	67,420	0,375	10,50	75,329	0,418
11.	Cogenaration PPs others	natural gas	80	517	7.465	3.859.405,00	33,49	50,00	14,930	0,5	57,332	210,218	0,407	22,18	270,134	0,523
12.	Industrial PP Bourgas	heavy oil/gases	80	422	9.217	3.889.574,00	40,1	85,00	21,197	1,00	81,623	299,284	0,709	14,68	350,778	0,831
13.	Industrial PP Deven	steam coal	70	367	7.151	2.624.417,00	26,11	66,00	25,278	4,5	63,354	232,298	0,633	12,54	265,604	0,724
14.	Industrial PP Himko	natural gas	20	153	10.783	1.649.799,00	34,1	50,00	14,663	0,5	24,070	88,255	0,577	14,86	103,659	0,678
15.	Industrial PP Sviloza	steam coal	40	204	11.850	2.417.400,00	24,65	64,00	25,963	1,08	62,086	227,650	1,116	15,27	268,677	1,317
16.	Industrial PPs others	steam coal	105	614	12.858	7.894.812,00	22,24	61,10	27,473	3,46	209,390	767,763	1,250	15,51	908,702	1,480
17.	Existing Hydro Power Plants	hydro	1380	2695	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,00	0,000	0,000
18.	Cascade HPPs Dolna Arda	hydro	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
19.	HPP Tsankov Kamak	hydro	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
20.	Expansion of Cogeneration PPs	natural gas	0	0	6.001	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,00	0,000	0,000
21.	New TPP burning imported coal	sub-bitum. coal	0	0	9.378	0,00	25,12	60,00	23,885	1,5	0,000	0,000	0,000	9,50	0,000	0,000
22.	New Combined Cycle PP	natural gas	0	0	6.547	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,50	0,000	0,000
23.	New TPP burning indigenous lignites	lignite	0	0	9410	0,00	6,28	19,50	31,051	2,00	0,000	0,000	0,000	8,95	0,000	0,000
24.	New NPP	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	6,80	0,000	0,000
25.	Pump Storage HPP Chaira - pumping mode	hydro		-345	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	- generation mode	hydro	420	259	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	Undilivered Power			78												
	Total		**8907**	**41460**							**7.706,661**	**28.257,756**	**1,056**		**32.225,499**	**0,777**

	Scenario with Dolna Arda HPProject, Year 2008															
	Maximum Power Supply Forecast															
	Parameter		Available	Electricity	Gross	Energy	Net Calorific	Fuel	Carbon	Fraction	Actual	Actual	Specific	Auxiliary	Net	Net Specific
		Fuel	Capacity	Output	Heat	Output	Value (NCV)	Carbon	Emission	of Carbon	Carbon	CO2	CO2	Power	CO2	CO2
	Power Plant				Rate		GJ/Mg	Content	Factor	Unoxidized	Emissions	Emissions	Emission	needs	Emissions	Emission
	Unit		MWel	GWh	kJ/kWh	GJ	MJ/Nm3	%	kgC/GJ	%	kt/a	kt/a	kg/kWh	%	kt/a	kg/kWh
1.	TPP Bobov dol	brown coal	370	2149	11.062	23.772.238,00	9,37	28,48	30,395	2,03	707,886	2.595,583	1,208	10,70	2.906,588	1,353
2.	TPP Varna	steam coal	1200	4358	10.699	46.626.242,00	24,59	66,66	27,109	4,96	1.201,278	4.404,687	1,011	9,49	4.866,305	1,117
3.	TPP Brikel (Maritsa Iztok #1)	lignite	180	924	11.052	10.212.048,00	10,18	19,94	19,587	1,74	196,547	720,673	0,780	18,54	884,696	0,957
4.1.	TPP Maritsa Iztok #2 part (150MW)	lignite	676	4762	10.750	51.191.500,00	6,431	19,11	29,715	2,385	1.484,898	5.444,626	1,143	13,84	6.319,203	1,327
4.2.	TPP Maritsa Iztok #2 part (210MW)	lignite	809	4418	10.418	46.026.724,00	6,431	19,11	29,715	2,49	1.333,649	4.890,045	1,107	11,84	5.546,784	1,255
5.	TPP Maritsa Iztok #3	lignite	856	5921	9.870	58.440.270,00	6,562	19,61	29,884	2,74	1.698,587	6.228,153	1,052	10,72	6.975,978	1,178
6.	TPP Maritsa 3	lignite	95	204	12.928	2.637.312,00	10,38	21,56	20,771	3,33	52,955	194,167	0,952	11,34	219,002	1,074
6.1.	TPP Rousse (condensate plant)	steam coal	200	1250	10.500	13.125.000,00	25,35	65,33	25,771	2,62	329,385	1.207,745	0,966	15,18	1.423,892	1,139
6.2.	TPP Rousse (cogeneration)	steam coal	70	191	11.585	2.212.735,00	25,48	65,44	25,683	2,59	55,358	202,978	1,063	15,18	239,304	1,253
7.1.	NPP Kozlodui # I and # II Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,00	0,000	0,000
7.2.	NPP Kozlodui # III and # IV Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
7.3.	NPP Kozlodui # V and # VI Unit	nuclear	1900	12066	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
8.	Cogeneration PP - Sofia	natural gas	50	269	7.353	1.977.957,00	33,54	50,00	14,908	0,5	29,339	107,577	0,400	33,55	161,891	0,602
9.	Cogeneration PP - Sofia-Iztok	natural gas	100	537	6.795	3.648.915,00	33,55	50,00	14,903	0,5	54,108	198,397	0,369	19,65	246,916	0,460
10.	Cogenaration PP Plovdiv	natural gas	30	180	6.858	1.234.440,00	33,4	50,00	14,970	0,5	18,387	67,420	0,375	10,50	75,329	0,418
11.	Cogenaration PPs others	natural gas	80	517	7.465	3.859.405,00	33,49	50,00	14,930	0,5	57,332	210,218	0,407	22,18	270,134	0,523
12.	Industrial PP Bourgas	heavy oil/gases	80	426	9.217	3.926.442,00	40,1	85,00	21,197	1,00	82,397	302,121	0,709	14,68	354,103	0,831
13.	Industrial PP Deven	steam coal	70	369	7.151	2.638.719,00	26,11	66,00	25,278	4,5	63,699	233,564	0,633	12,54	267,052	0,724
14.	Industrial PP Himko	natural gas	20	153	10.783	1.649.799,00	34,1	50,00	14,663	0,5	24,070	88,255	0,577	14,86	103,659	0,678
15.	Industrial PP Sviloza	steam coal	40	205	11.850	2.429.250,00	24,65	64,00	25,963	1,08	62,391	228,766	1,116	15,27	269,994	1,317
16.	Industrial PPs others	steam coal	105	617	12.858	7.933.386,00	22,24	61,10	27,473	3,46	210,413	771,514	1,250	15,51	913,142	1,480
17.	Existing Hydro Power Plants	hydro	1380	2695	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,00	0,000	0,000
18.	Cascade HPPs Dolna Arda	hydro	16	49	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
19.	HPP Tsankov Kamak	hydro	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
20.	Expansion of Cogeneration PPs	natural gas	0	0	6.001	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,00	0,000	0,000
21.	New TPP burning imported coal	sub-bitum. coal	0	0	9.378	0,00	25,12	60,00	23,885	1,5	0,000	0,000	0,000	9,50	0,000	0,000
22.	New Combined Cycle PP	natural gas	0	0	6.547	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,50	0,000	0,000
23.	New TPP burning indigenous lignites	lignite	300	438	9410	4.121.505,54	6,28	19,50	31,051	2,00	125,417	459,863	1,050	8,95	505,066	1,153
24.	New NPP	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	6,80	0,000	0,000
25.	Pump Storage HPP Chaira - pumping mode	hydro		-355	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	- generation mode	hydro	420	292	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	Undilivered Power			3												
	Total		9047	42638							7.788,096	28.556,351	1,024		32.549,039	0,763

	Scenario with Dolna Arda HPProject, Year 2009															
	Maximum Power Supply Forecast															
	Parameter		Available	Electricity	Gross	Energy	Net Calorific	Fuel	Carbon	Fraction	Actual	Actual	Specific	Auxiliary	Net	Net Specific
		Fuel	Capacity	Output	Heat	Output	Value (NCV)	Carbon	Emission	of Carbon	Carbon	CO2	CO2	Power	CO2	CO2
	Power Plant				Rate		GJ/Mg	Content	Factor	Unoxidized	Emissions	Emissions	Emission	needs	Emissions	Emission
	Unit		MWel	GWh	kJ/kWh	GJ	MJ/Nm3	%	kgC/GJ	%	kt/a	kt/a	kg/kWh	%	kt/a	kg/kWh
1.	TPP Bobov dol	brown coal	370	1660	11.062	18.362.920,00	9,37	28,48	30,395	2,03	546,808	2.004,964	1,208	10,70	2.245,201	1,353
2.	TPP Varna	steam coal	1000	1901	10.699	20.338.799,00	24,59	66,66	27,109	4,96	524,009	1.921,365	1,011	9,49	2.122,727	1,117
3.	TPP Brikel (Maritsa Iztok #1)	lignite	180	894	11.052	9.880.488,00	10,18	19,94	19,587	1,74	190,166	697,275	0,780	18,54	855,972	0,957
4.1.	TPP Maritsa Iztok #2 part (150MW)	lignite	676	4625	10.610	49.071.250,00	6,431	19,11	29,715	2,385	1.423,396	5.219,120	1,128	13,84	6.057,475	1,310
4.2.	TPP Maritsa Iztok #2 part (210MW)	lignite	818	4781	10.145	48.503.245,00	6,431	19,11	29,715	2,385	1.406,920	5.158,708	1,079	13,84	5.987,359	1,252
5.	TPP Maritsa Iztok #3	lignite	856	5790	9.660	55.931.400,00	6,562	19,61	29,884	2,74	1.625,666	5.960,775	1,029	10,72	6.676,496	1,153
6.	TPP Maritsa 3	lignite	95	204	12.928	2.637.312,00	10,38	21,56	20,771	3,33	52,955	194,167	0,952	11,34	219,002	1,074
6.1.	TPP Rousse (condensate plant)	steam coal	200	801	10.550	8.450.550,00	25,35	65,33	25,771	2,62	212,075	777,608	0,971	15,18	916,775	1,145
6.2.	TPP Rousse (cogeneration)	steam coal	70	168	11.585	1.946.280,00	25,48	65,44	25,683	2,59	48,691	178,535	1,063	15,18	210,487	1,253
7.1.	NPP Kozlodui # I and # II Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,00	0,000	0,000
7.2.	NPP Kozlodui # III and # IV Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
7.3.	NPP Kozlodui # V and # VI Unit	nuclear	1900	11921	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
8.	Cogeneration PP - Sofia	natural gas	50	269	7.353	1.977.957,00	33,54	50,00	14,908	0,5	29,339	107,577	0,400	33,55	161,891	0,602
9.	Cogeneration PP - Sofia-Iztok	natural gas	100	537	6.795	3.648.915,00	33,55	50,00	14,903	0,5	54,108	198,397	0,369	19,65	246,916	0,460
10.	Cogenaration PP Plovdiv	natural gas	30	180	6.858	1.234.440,00	33,4	50,00	14,970	0,5	18,387	67,420	0,375	10,50	75,329	0,418
11.	Cogenaration PPs others	natural gas	80	517	7.465	3.859.405,00	33,49	50,00	14,930	0,5	57,332	210,218	0,407	22,18	270,134	0,523
12.	Industrial PP Bourgas	heavy oil/gases	80	425	9.217	3.917.225,00	40,1	85,00	21,197	1,00	82,203	301,411	0,709	14,68	353,272	0,831
13.	Industrial PP Deven	steam coal	70	366	7.151	2.617.266,00	26,11	66,00	25,278	4,5	63,181	231,665	0,633	12,54	264,881	0,724
14.	Industrial PP Himko	natural gas	20	153	10.783	1.649.799,00	34,1	50,00	14,663	0,5	24,070	88,255	0,577	14,86	103,659	0,678
15.	Industrial PP Sviloza	steam coal	40	200	11.850	2.370.000,00	24,65	64,00	25,963	1,08	60,869	223,186	1,116	15,27	263,408	1,317
16.	Industrial PPs others	steam coal	105	599	12.858	7.701.942,00	22,24	61,10	27,473	3,46	204,274	749,006	1,250	15,51	886,503	1,480
17.	Existing Hydro Power Plants	hydro	1380	2702	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,00	0,000	0,000
18.	Cascade HPPs Dolna Arda	hydro	16	54	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
19.	HPP Tsankov Kamak	hydro	80	198	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
20.	Expansion of Cogeneration PPs	natural gas	130	482	6.001	2.892.482,00	33,3	50,00	15,015	0,5	43,214	158,450	0,000	8,00	172,228	0,357
21.	New TPP burning imported coal	sub-bitum. coal	0	0	9.378	0,00	25,12	60,00	23,885	1,5	0,000	0,000	0,000	9,50	0,000	0,000
22.	New Combined Cycle PP	natural gas	0	0	6.547	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,50	0,000	0,000
23.	New TPP burning indigenous lignites	lignite	600	1964	9410	18.480.906,12	6,28	19,50	31,051	2,00	562,373	2.062,034	1,050	8,95	2.264,727	1,153
24.	New NPP	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	6,80	0,000	0,000
25.	Pump Storage HPP Chaira - pumping mode	hydro		-200	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	- generation mode	hydro	420	150	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	Undilivered Power			29												
	Total		9366	41370							7.230,038	26.510,138	1,000		30.354,441	0,734

	Scenario with Dolna Arda HPProject, Year 2010															
	Maximum Power Supply Forecast															
	Parameter		Available	Electricity	Gross	Energy	Net Calorific	Fuel	Carbon	Fraction	Actual	Actual	Specific	Auxiliary	Net	Net Specific
		Fuel	Capacity	Output	Heat	Output	Value (NCV)	Carbon	Emission	of Carbon	Carbon	CO2	CO2	Power	CO2	CO2
	Power Plant				Rate		GJ/Mg	Content	Factor	Unoxidized	Emissions	Emissions	Emission	needs	Emissions	Emission
	Unit		MWel	GWh	kJ/kWh	GJ	MJ/Nm3	%	kgC/GJ	%	kt/a	kt/a	kg/kWh	%	kt/a	kg/kWh
1.	TPP Bobov dol	brown coal	370	878	11.062	9.712.436,00	9,37	28,48	30,395	2,03	289,216	1.060,457	1,208	10,70	1.187,522	1,353
2.	TPP Varna	steam coal	1018	2464	10.479	25.820.256,00	24,59	66,66	27,109	4,96	665,233	2.439,187	0,990	9,49	2.694,818	1,094
3.	TPP Brikel (Maritsa Iztok #1)	lignite	180	924	11.052	10.212.048,00	10,18	19,94	19,587	1,74	196,547	720,673	0,780	18,54	884,696	0,957
4.1.	TPP Maritsa Iztok #2 part (150MW)	lignite	676	4692	10.610	49.782.120,00	6,431	19,11	29,715	2,385	1.444,016	5.294,727	1,128	13,84	6.145,226	1,310
4.2.	TPP Maritsa Iztok #2 part (210MW)	lignite	818	4850	10.145	49.203.250,00	6,431	19,11	29,715	2,49	1.425,690	5.227,530	1,078	11,84	5.929,594	1,223
5.	TPP Maritsa Iztok #3	lignite	856	5888	9.660	56.878.080,00	6,562	19,61	29,884	2,74	1.653,182	6.061,666	1,029	10,72	6.789,500	1,153
6.	TPP Maritsa 3	lignite	95	156	12.928	2.016.768,00	10,38	21,56	20,771	3,33	40,495	148,481	0,952	11,34	167,472	1,074
6.1.	TPP Rousse (condensate plant)	steam coal	200	953	10.550	10.054.150,00	25,35	65,33	25,771	2,62	252,319	925,169	0,971	15,18	1.090,744	1,145
6.2.	TPP Rousse (cogeneration)	steam coal	70	173	11.585	2.004.205,00	25,48	65,44	25,683	2,59	50,141	183,849	1,063	15,18	216,752	1,253
7.1.	NPP Kozlodui # I and # II Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,00	0,000	0,000
7.2.	NPP Kozlodui # III and # IV Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
7.3.	NPP Kozlodui # V and # VI Unit	nuclear	1900	12019	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
8.	Cogeneration PP - Sofia	natural gas	50	269	7.353	1.977.957,00	33,54	50,00	14,908	0,5	29,339	107,577	0,400	33,55	161,891	0,602
9.	Cogeneration PP - Sofia-Iztok	natural gas	100	537	6.795	3.648.915,00	33,55	50,00	14,903	0,5	54,108	198,397	0,369	19,65	246,916	0,460
10.	Cogenaration PP Plovdiv	natural gas	30	180	6.858	1.234.440,00	33,4	50,00	14,970	0,5	18,387	67,420	0,375	10,50	75,329	0,418
11.	Cogenaration PPs others	natural gas	80	517	7.465	3.859.405,00	33,49	50,00	14,930	0,5	57,332	210,218	0,407	22,18	270,134	0,523
12.	Industrial PP Bourgas	heavy oil/gases	80	428	9.217	3.944.876,00	40,1	85,00	21,197	1,00	82,783	303,539	0,709	14,68	355,765	0,831
13.	Industrial PP Deven	steam coal	70	368	7.151	2.631.568,00	26,11	66,00	25,278	4,5	63,527	232,931	0,633	12,54	266,328	0,724
14.	Industrial PP Himko	natural gas	20	153	10.783	1.649.799,00	34,1	50,00	14,663	0,5	24,070	88,255	0,577	14,86	103,659	0,678
15.	Industrial PP Sviloza	steam coal	40	201	11.850	2.381.850,00	24,65	64,00	25,963	1,08	61,173	224,302	1,116	15,27	264,726	1,317
16.	Industrial PPs others	steam coal	105	599	12.858	7.701.942,00	22,24	61,10	27,473	3,46	204,274	749,006	1,250	15,51	886,503	1,480
17.	Existing Hydro Power Plants	hydro	1380	2702	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,00	0,000	0,000
18.	Cascade HPPs Dolna Arda	hydro	16	60	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
19.	HPP Tsankov Kamak	hydro	80	198	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
20.	Expansion of Cogeneration PPs	natural gas	130	483	6.001	2.898.483,00	33,3	50,00	15,015	0,5	43,303	158,778	0,000	8,00	172,585	0,357
21.	New TPP burning imported coal	sub-bitum. coal	0	0	9.378	0,00	25,12	60,00	23,885	1,5	0,000	0,000	0,000	9,50	0,000	0,000
22.	New Combined Cycle PP	natural gas	0	0	6.547	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,50	0,000	0,000
23.	New TPP burning indigenous lignites	lignite	600	2819	9410	26.526.310,77	6,28	19,50	31,051	2,00	807,194	2.959,711	1,050	8,95	3.250,644	1,153
24.	New NPP	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	6,80	0,000	0,000
25.	Pump Storage HPP Chaira - pumping mode	hydro		-174	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	- generation mode	hydro	630	132	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	Undilivered Power			22												
	Total		9594	42491							7.462,329	27.361,874	0,994		31.160,805	0,733

Scenario with Dolna Arda HPProject, Year 2011

Maximum Power Supply Forecast

	Parameter		Available	Electricity	Gross	Energy	Net Calorific	Fuel	Carbon	Fraction	Actual	Actual	Specific	Auxiliary	Net	Net Specific
		Fuel	Capacity	Output	Heat	Output	Value (NCV)	Carbon	Emission	of Carbon	Carbon	CO2	CO2	Power	CO2	CO2
	Power Plant				Rate		GJ/Mg	Content	Factor	Unoxidized	Emissions	Emissions	Emission	needs	Emissions	Emission
	Unit		MWel	GWh	kJ/kWh	GJ	MJ/Nm3	%	kgC/GJ	%	kt/a	kt/a	kg/kWh	%	kt/a	kg/kWh
1.	TPP Bobov dol	brown coal	185	984	11.062	10.885.008,00	9,37	28,48	30,395	2,03	324,132	1.188,485	1,208	10,70	1.330,890	1,353
2.	TPP Varna	steam coal	1036	3475	10.259	35.650.025,00	24,59	66,66	27,109	4,96	918,487	3.367,786	0,969	9,49	3.720,735	1,071
3.	TPP Brikel (Maritsa Iztok #1)	lignite	0	0	11.052	0,00	10,18	19,94	19,587	1,74	0,000	0,000	0,000	18,54	0,000	0,000
4.1.	TPP Maritsa Iztok #2 part (150MW)	lignite	676	4771	10.610	50.620.310,00	6,431	19,11	29,715	2,385	1.468,330	5.383,875	1,128	13,84	6.248,694	1,310
4.2.	TPP Maritsa Iztok #2 part (210MW)	lignite	818	5053	10.145	51.262.685,00	6,431	19,11	29,715	2,49	1.485,363	5.446,332	1,078	11,84	6.177,781	1,223
5.	TPP Maritsa Iztok #3	lignite	856	5986	9.660	57.824.760,00	6,562	19,61	29,884	2,74	1.680,697	6.162,556	1,029	10,72	6.902,505	1,153
6.	TPP Maritsa 3	lignite	0	0	12.928	0,00	10,38	21,56	20,771	3,33	0,000	0,000	0,000	11,34	0,000	0,000
6.1.	TPP Rousse (condensate plant)	steam coal	200	1044	10.550	11.014.200,00	25,35	65,33	25,771	2,62	276,412	1.013,512	0,971	15,18	1.194,897	1,145
6.2.	TPP Rousse (cogeneration)	steam coal	70	163	11.585	1.888.355,00	25,48	65,44	25,683	2,59	47,242	173,222	1,063	15,18	204,223	1,253
7.1.	NPP Kozlodui # I and # II Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,00	0,000	0,000
7.2.	NPP Kozlodui # III and # IV Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
7.3.	NPP Kozlodui # V and # VI Unit	nuclear	1900	12129	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
8.	Cogeneration PP - Sofia	natural gas	50	269	7.353	1.977.957,00	33,54	50,00	14,908	0,5	29,339	107,577	0,400	33,55	161,891	0,602
9.	Cogeneration PP - Sofia-Iztok	natural gas	100	537	6.795	3.648.915,00	33,55	50,00	14,903	0,5	54,108	198,397	0,369	19,65	246,916	0,460
10.	Cogenaration PP Plovdiv	natural gas	30	180	6.858	1.234.440,00	33,4	50,00	14,970	0,5	18,387	67,420	0,375	10,50	75,329	0,418
11.	Cogenaration PPs others	natural gas	80	517	7.465	3.859.405,00	33,49	50,00	14,930	0,5	57,332	210,218	0,407	22,18	270,134	0,523
12.	Industrial PP Bourgas	heavy oil/gases	80	430	9.217	3.963.310,00	40,1	85,00	21,197	1,00	83,170	304,957	0,709	14,68	357,428	0,831
13.	Industrial PP Deven	steam coal	70	370	7.151	2.645.870,00	26,11	66,00	25,278	4,5	63,872	234,196	0,633	12,54	267,776	0,724
14.	Industrial PP Himko	natural gas	20	153	10.783	1.649.799,00	34,1	50,00	14,663	0,5	24,070	88,255	0,577	14,86	103,659	0,678
15.	Industrial PP Sviloza	steam coal	40	204	11.850	2.417.400,00	24,65	64,00	25,963	1,08	62,086	227,650	1,116	15,27	268,677	1,317
16.	Industrial PPs others	steam coal	105	607	12.858	7.804.806,00	22,24	61,10	27,473	3,46	207,003	759,010	1,250	15,51	898,343	1,480
17.	Existing Hydro Power Plants	hydro	1380	2702	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,00	0,000	0,000
18.	Cascade HPPs Dolna Arda	hydro	16	64	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
19.	HPP Tsankov Kamak	hydro	80	198	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
20.	Expansion of Cogeneration PPs	natural gas	130	501	6.001	3.006.501,00	33,3	50,00	15,015	0,5	44,917	164,695	0,000	15,51	194,929	0,389
21.	New TPP burning imported coal	sub-bitum. coal	0	0	9.378	0,00	25,12	60,00	23,885	1,5	0,000	0,000	0,000	9,50	0,000	0,000
22.	New Combined Cycle PP	natural gas	0	0	6.547	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,50	0,000	0,000
23.	New TPP burning indigenous lignites	lignite	600	3235	9410	30.440.800,05	6,28	19,50	31,051	2,00	926,312	3.396,476	1,050	8,95	3.730,341	1,153
24.	New NPP	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	6,80	0,000	0,000
25.	Pump Storage HPP Chaira - pumping mode	hydro		-267	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	- generation mode	hydro	630	200	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	Undilivered Power			95												
	Total		**9152**	**43600**							**7.771,260**	**28.494,620**	**1,001**		**32.355,148**	**0,742**

Scenario with Dolna Arda HPProject, Year 2012

Maximum Power Supply Forecast

	Parameter		Available	Electricity	Gross	Energy	Net Calorific	Fuel	Carbon	Fraction	Actual	Actual	Specific	Auxiliary	Net	Net Specific
		Fuel	Capacity	Output	Heat	Output	Value (NCV)	Carbon	Emission	of Carbon	Carbon	CO2	CO2	Power	CO2	CO2
	Power Plant				Rate		GJ/Mg	Content	Factor	Unoxidized	Emissions	Emissions	Emission	needs	Emissions	Emission
	Unit		MWel	GWh	kJ/kWh	GJ	MJ/Nm3	%	kgC/GJ	%	kt/a	kt/a	kg/kWh	%	kt/a	kg/kWh
1.	TPP Bobov dol	brown coal	185	309	11.062	3.418.158,00	9,37	28,48	30,395	2,03	101,785	373,213	1,208	10,70	417,932	1,353
2.	TPP Varna	steam coal	1054	1944	10.039	19.515.816,00	24,59	66,66	27,109	4,96	502,805	1.843,620	0,948	9,49	2.036,834	1,048
3.	TPP Brikel (Maritsa Iztok #1)	lignite	0	0	11.052	0,00	10,18	19,94	19,587	1,74	0,000	0,000	0,000	18,54	0,000	0,000
4.1.	TPP Maritsa Iztok #2 part (150MW)	lignite	676	4485	10.610	47.585.850,00	6,431	19,11	29,715	2,385	1.380,310	5.061,136	1,128	13,84	5.874,113	1,310
4.2.	TPP Maritsa Iztok #2 part (210MW)	lignite	818	4572	10.145	46.382.940,00	6,431	19,11	29,715	2,49	1.343,970	4.927,890	1,078	11,84	5.589,712	1,223
5.	TPP Maritsa Iztok #3	lignite	856	5624	9.660	54.327.840,00	6,562	19,61	29,884	2,74	1.579,058	5.789,879	1,029	10,72	6.485,080	1,153
6.	TPP Maritsa 3	lignite	0	0	12.928	0,00	10,38	21,56	20,771	3,33	0,000	0,000	0,000	11,34	0,000	0,000
6.1.	TPP Rousse (condensate plant)	steam coal	200	339	10.550	3.576.450,00	25,35	65,33	25,771	2,62	89,755	329,100	0,971	15,18	387,998	1,145
6.2.	TPP Rousse (cogeneration)	steam coal	70	161	11.585	1.865.185,00	25,48	65,44	25,683	2,59	46,663	171,096	1,063	15,18	201,717	1,253
7.1.	NPP Kozlodui # I and # II Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,00	0,000	0,000
7.2.	NPP Kozlodui # III and # IV Unit	nuclear	0	0	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
7.3.	NPP Kozlodui # V and # VI Unit	nuclear	1900	11647	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	7,00	0,000	0,000
8.	Cogeneration PP - Sofia	natural gas	50	269	7.353	1.977.957,00	33,54	50,00	14,908	0,5	29,339	107,577	0,400	33,55	161,891	0,602
9.	Cogeneration PP - Sofia-Iztok	natural gas	100	537	6.795	3.648.915,00	33,55	50,00	14,903	0,5	54,108	198,397	0,369	19,65	246,916	0,460
10.	Cogenaration PP Plovdiv	natural gas	30	180	6.858	1.234.440,00	33,4	50,00	14,970	0,5	18,387	67,420	0,375	10,50	75,329	0,418
11.	Cogenaration PPs others	natural gas	80	517	7.465	3.859.405,00	33,49	50,00	14,930	0,5	57,332	210,218	0,407	22,18	270,134	0,523
12.	Industrial PP Bourgas	heavy oil/gases	80	425	9.217	3.917.225,00	40,1	85,00	21,197	1,00	82,203	301,411	0,709	14,68	353,272	0,831
13.	Industrial PP Deven	steam coal	70	364	7.151	2.602.964,00	26,11	66,00	25,278	4,5	62,836	230,399	0,633	12,54	263,433	0,724
14.	Industrial PP Himko	natural gas	20	151	10.783	1.628.233,00	34,1	50,00	14,663	0,5	23,755	87,102	0,577	14,86	102,304	0,678
15.	Industrial PP Sviloza	steam coal	40	200	11.850	2.370.000,00	24,65	64,00	25,963	1,08	60,869	223,186	1,116	15,27	263,408	1,317
16.	Industrial PPs others	steam coal	105	595	12.858	7.650.510,00	22,24	61,10	27,473	3,46	202,910	744,004	1,250	15,51	880,583	1,480
17.	Existing Hydro Power Plants	hydro	1380	2703	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,00	0,000	0,000
18.	Cascade HPPs Dolna Arda	hydro	16	64	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
19.	HPP Tsankov Kamak	hydro	80	198	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	0,90	0,000	0,000
20.	Expansion of Cogeneration PPs	natural gas	130	477	6.001	2.862.477,00	33,3	50,00	15,015	0,5	42,765	156,806	0,329	8,00	170,441	0,357
21.	New TPP burning imported coal	sub-bitum. coal	0	0	9.378	0,00	25,12	60,00	23,885	1,5	0,000	0,000	0,000	9,50	0,000	0,000
22.	New Combined Cycle PP	natural gas	0	0	6.547	0,00	33,3	50,00	15,015	0,5	0,000	0,000	0,000	8,50	0,000	0,000
23.	New TPP burning indigenous lignites	lignite	600	2251	9410	21.181.527,33	6,28	19,50	31,051	2,00	644,553	2.363,359	1,050	8,95	2.595,672	1,153
24.	New NPP	nuclear	950	6538	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	6,80	0,000	0,000
25.	Pump Storage HPP Chaira - pumping mode	hydro		-352	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	- generation mode	hydro	630	264	0	0,00	0	0,00	0,000	0	0,000	0,000	0,000	1,20	0,000	0,000
	Undilivered Power			3												
	Total		**10120**	**44465**							**6.323,404**	**23.185,814**	**0,991**		**26.376,770**	**0,593**