BULGARIA ELECTRICITY STUDY
ELECTRICITY DEMAND FORECAST

Final Report

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Ms. Ana Maria Reategui	Word processing
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Ms. Jane Enright	Graphics

Bailly, and others in 1992. The NEK forecast is within the band of forecasting uncertainty of the Hagler Bailly forecast, and so we agree that the NEK forecast should be adopted for least cost planning studies.

S.1.2 Background and Recent History of Electricity Demand

Beginning in 1990, the Bulgarian economy went into severe recession. Production decreased from most factories, traditional markets and trading partners were lost, centralized production structures were dismantled, state subsidies were cut drastically, prices increased, and unemployment grew rapidly. During this period, Bulgaria was faced with particularly acute energy problems, including power outages.

Total consumers' electric energy demand in Bulgaria in 1992 was 25% less than the maximum recorded in 1988. Reductions in annual energy sales (comparing 1992 with 1988) were 34% for industrial, 4% for households (no real price increases occurred in this sector until 1991), and 28% for other consumers (agriculture, transportation, public buildings). Analysis of the load duration curves reveals that most of the reduction in demand has occurred during summer months, and that some reduction has occurred during off-peak periods in the winter.

Peak power demand (absolute maximum gross MW recorded during the year) has reduced less than energy demand, and is now 15% less than the maximum recorded in 1989. During 1991 (the base year for this study), the maximum was recorded in January (7,500 MW), and August experienced the lowest peak (4,300 MW).

S.2 RESULTS OF INDUSTRIAL ENERGY SURVEY

The largest industrial consumers in Bulgaria are judged to be at the greatest risk of losing their market, and their ability to cope with this dislocation will determine their survival, and thus their demand for electricity. To develop a better understanding of the conditions at these large consumers, a survey of the NEK's 106 largest electrical consumers was commissioned by RCG/Hagler Bailly as part of the project. Hagler Bailly subcontracted with DBC, a private Bulgarian firm, to carry out the work.

In general, the survey responses reflected the dire economic conditions and the need to find new markets. However, on balance it seems that these plants may have reached the bottom, with 1993 production and electricity usage not expected to decline much further.

According to NEK, Bulgaria now has nine large industrial cogenerators (with capacities of 20 MW or greater). Six of the 61 plants surveyed can generate their own electricity, but the survey discovered that two of these do not operate their generators regularly.

Electric motors and lighting are the dominant loads in the plants surveyed, and less than half have installed efficient lighting systems (such as high pressure sodium). Process loads are significant in the chemicals and metals industries for electrolysis, heat treatment, furnaces, and rolling mills.

Most plants surveyed are interested in energy conservation, and are willing to invest in such projects. Most have ideas for projects, but have not implemented them for lack of funds or for fear that they might disrupt production. Energy audits have been conducted in half the enterprises, but respondents indicated problems with the quality of the energy audits.

S.3 DEMAND FORECAST

S.3.1 Review of Previous Forecasts of Electricity Demand

Several forecasts of electricity demand in Bulgaria have been completed over the past several years. Prior forecasts differ because of differences in scenarios, differences in forecasting techniques, and differences in data. However, the more recent forecasts that build on the data obtained after the initiation of Bulgaria's transition to a market economy will more accurately capture the Bulgarian economy's energy response to this transition and the probable future of electricity demand.

The forecasts are summarized graphically in Exhibit S-3-1, and listed below.

- Forecast by NEK, the guidance from the World Bank, in 1992, with three variants:
  - -- most likely scenario
  - -- high demand scenario
  - -- low demand scenario
- Forecast by Equipe Cousteau for the EBRD in 1992
- Forecast by Prof. Gordon Hughes for the World Bank in 1991
- Energoproekt forecast 1991 (high and low demand scenarios)

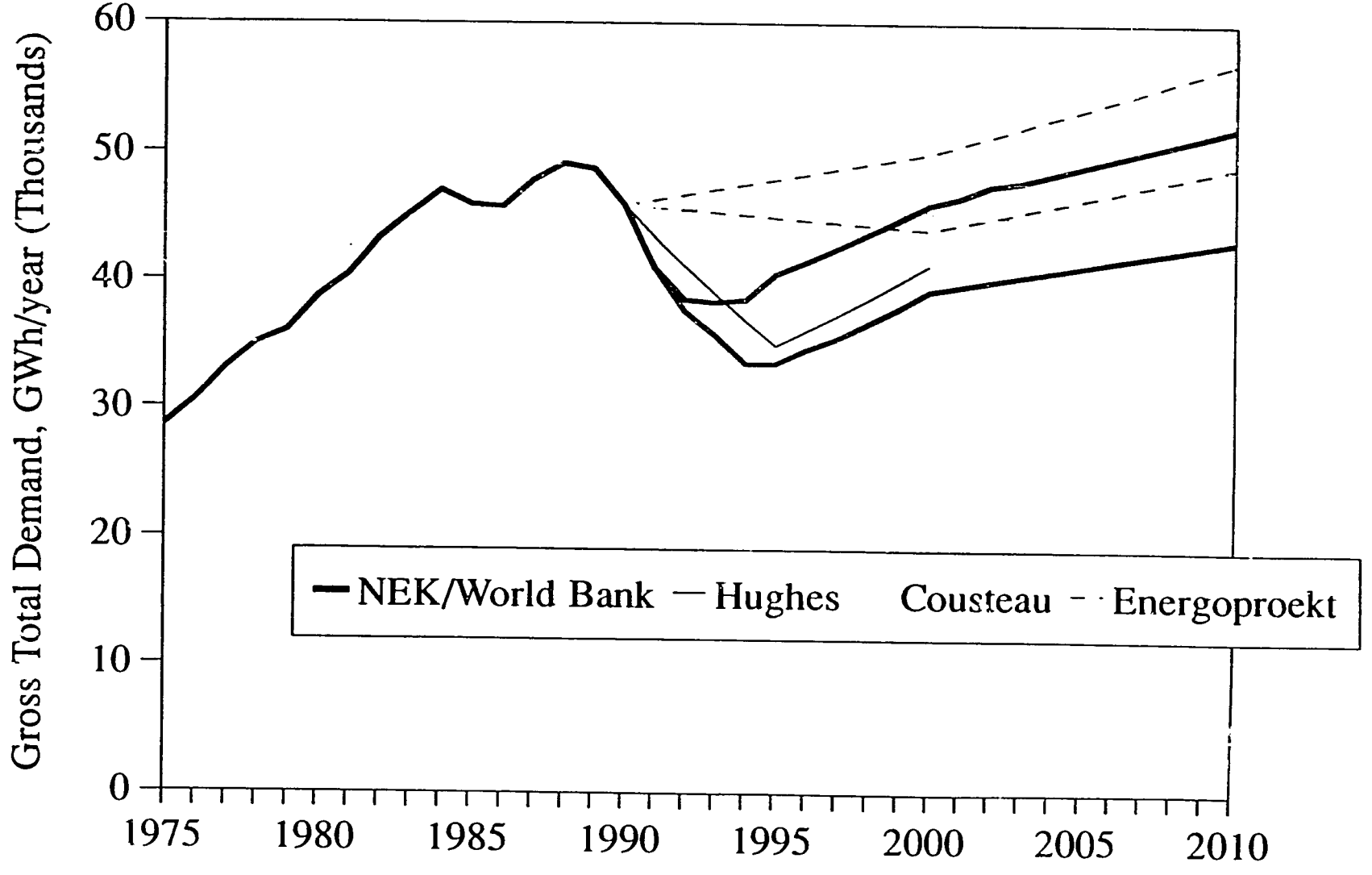
These forecasts establish a range of expected demand in the year 2000 from 35-50 TWh[1]. The spread of these forecasts indicates a high level of uncertainty.

[1] The NEK most likely scenario shows 46 TWh in year 2000.

Exhibit S-3-1

Bulgaria - Total Electricity Demand

Comparison of Previous Forecasts



S.3.2 Scenarios Selected for Forecasting Electricity Demand

For the purposes of this report, three scenarios were developed. The scenario assumptions are summarized briefly in the table below, in terms of the economic growth, electricity efficiency, and other factors important to electricity demand:

	ELECTRICITY DEMAND SCENARIOS		
Variables	Moderate	Low	High
Economic Growth	low	low	high
Inflation	high	high	med
Electricity Prices	market	market	market
Industry DSM	low	med	high
Household DSM	low	med	high

S.3.3 Demand Forecasting Techniques

Separate forecasts were developed for households, industry, and the other sectors.

For households, we first developed an econometric equation based on income and price elasticities. The estimation used elasticities of income and price that are slightly higher than one would expect for a centralized economy and lower than that of a free market economy. The price elasticity was high, because the real price of electricity in Bulgaria generally declined for the last 12 years, with only variation from the long term trend in 1990 and 1991. The partial elasticities are:

Elasticity of real income	0.603
Elasticity of real electricity price	-0.381

However, the analysis revealed that the large price increases expected in the first few years caused the forecast to drop below what we judged to be bare minimum for heating, cooking, and light. Therefore, we adjusted the results to account for these technical factors.

For industry, the survey (see above), together with consumption data for large customers and by industrial sector obtained from NEK, were used as the basis for a disaggregated approach, developing estimates of prospects for each of the large customers, and for each sector for 1993 and beyond.

We identified the electricity use patterns in the separate industries and developed forecasts of electricity use at this disaggregate industry level. We also identified those industries with more mature domestic markets and international markets that are most likely to succeed. In addition, estimates were made of the likely changes in electricity intensity in each industry in the future, as Bulgaria develops in the direction of the intensities in Western Europe industries. The speed of the changes will depend on the growth of domestic and international markets and the focus of the government programs.

The following industries were forecast as higher than average growth sectors: electrical equipment and electronics, glass and ceramics, agriculture, transportation and communication.

The following industries were forecast as relatively average growth sectors: non-ferrous metals, engineered metal products, textiles, food and beverage, construction, public sector buildings.

The following industries were forecast as lower than average growth sectors: iron & steel (ferrous metals), chemicals, building materials, timber, pulp & paper.

Future changes in peak demand will depend mainly on the possible recovery of equipment which has been shut down, or installation of new electrical equipment over time. Secondary effects will result from the future development of prices during peak periods, and the possible installation of demand control equipment. For the purposes of this analysis, these effects have been simulated by tracking the rate of change of GDP.

The demand forecasts are forecasts first of energy sales. The sales forecasts were then increased (to achieve "total demand") by adding estimated losses and station use of electricity. Station use was held constant at 11.1% of gross generation. Losses were brought back to a historical normal level of 11.5% (of energy for distribution) over a five year period. Exports and imports were ignored, and power purchases were held constant.

S.3.4 Demand Forecast Results

A summary of the assumptions and results for the expected case is shown in Exhibit S-3-2.

- demand for electricity in the household sector continues to decline, reaching a minimum of 8,400 GWh in 1995, then climbs, reaching 11,000 GWh in 2010.
- in the industrial sector, demand drops slightly, with a minimum of 13,300 GWh in 1994-96, and then begins a gradual climb to 17,000 GWh in 2010.
- total electricity sales reach a minimum of 28,000 GWh in 1994-96 and then rise gradually to its 1988 level of 35,600 GWh around year 2008.
- peak demand reaches a minimum of 6,500 MW in 1994-95, then increases to 9,600 MW by 2010. The 1989 peak of 8,332 MW is reached again in year 2005.

Exhibit S-3-2
BULGARIA
ELECTRICITY DEMAND FORECAST
EXPECTED CASE – MODERATE SCENARIO

ASSUMPTIONS	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
GDP Growth	-5.0%	-2.0%	0.0%	1.0%	1.5%	2.0%	2.5%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Real Electricity Price Changes																		
Households	75.0%	50.0%	25.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Industry	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Population Growth	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Changes in Industrial Electricity Intensity																		
Growth Sectors	-4.0%	0.0%	5.0%	8.5%	11.5%	17.0%	22.5%	18.0%	18.0%	13.0%	13.0%	13.0%	10.5%	10.5%	10.5%	10.5%	8.0%	8.0%
Constant Sectors	-6.0%	-3.0%	0.0%	1.0%	1.5%	3.0%	3.5%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Declining Sectors	-9.0%	-6.0%	-4.0%	-3.0%	0.5%	1.0%	2.5%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
FORECAST OF ELECTRICITY SALES, GWh/year																		
Household Sector	8,990	8,548	8,398	8,465	8,559	8,681	8,830	9,008	9,190	9,376	9,565	9,759	9,956	10,157	10,362	10,572	10,785	11,003
Industry Sector	13,484	13,296	13,267	13,303	13,417	13,621	13,898	14,186	14,485	14,762	15,047	15,339	15,620	15,907	16,202	16,502	16,788	17,079
Other Sectors	6,050	6,090	6,182	6,301	6,411	6,480	6,564	6,662	6,762	6,846	6,931	7,017	7,104	7,192	7,282	7,372	7,464	7,557
Total Sales	**28,525**	**27,934**	**27,847**	**28,070**	**28,387**	**28,782**	**29,291**	**29,856**	**30,437**	**30,984**	**31,543**	**32,114**	**32,680**	**33,257**	**33,846**	**34,447**	**35,037**	**35,639**
FORECAST OF GENERATION REQUIREMENTS, GWh/year																		
Distribution Losses	4,119	3,887	3,725	3,603	3,489	3,534	3,592	3,656	3,721	3,782	3,844	3,908	3,970	4,034	4,099	4,165	4,230	4,295
Losses (pct of for distribution)	13.5%	13.0%	12.5%	12.0%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%
For Distribution	30,509	29,897	29,798	30,023	30,341	30,732	31,238	31,792	32,360	32,889	33,429	33,981	34,524	35,077	35,642	36,218	36,780	37,352
Power Purchases from Factories & Others	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
Imports	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exports	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factory Self-Generation	3,024	2,975	2,975	2,999	3,035	3,084	3,145	3,221	3,298	3,377	3,458	3,541	3,626	3,713	3,803	3,894	3,987	4,083
Power Plant Auxiliaries	4,058	3,975	3,961	3,992	4,035	4,089	4,157	4,233	4,310	4,383	4,456	4,531	4,606	4,681	4,758	4,837	4,913	4,991
Auxiliaries (pct of gross generation)	11.1%	11.1%	11.1%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.1%	11.1%	11.1%	11.1%
Gross Total Demand	**36,701**	**35,795**	**35,533**	**35,664**	**35,912**	**36,405**	**37,041**	**37,745**	**38,469**	**39,149**	**39,843**	**40,554**	**41,256**	**41,972**	**42,703**	**43,448**	**44,180**	**44,926**
Peak Demand (MW)	6,650	6,517	6,517	6,582	6,681	6,815	6,985	7,194	7,410	7,633	7,862	8,097	8,340	8,591	8,848	9,114	9,387	9,669

The low demand case is shown in Exhibit S-3-3.

- demand for electricity in the household sector continues to decline, reaching a minimum of 8,000 GWh in 1995, then climbs, reaching 10,000 GWh in 2010.
- in the industrial sector, demand continues to drop, with a minimum of 12,500 GWh in 1996-97, and then begins a gradual climb to 15,000 GWh in 2010.
- total electricity sales reach a minimum of 26,600 GWh in 1995-96 and then rise gradually to 32,000 GWh in year 2010, but never reach the 1988 level of 35,600 GWh.
- peak demand reaches a minimum of 6,100 MW in 1994-97, then increases to 8,300 MW by 2010, the same as the historical maximum of 8,332 recorded in 1989.

Exhibit S-3-3
BULGARIA
ELECTRICITY DEMAND FORECAST
LOW DEMAND SCENARIO

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
ASSUMPTIONS																		
GDP Growth	-9.0%	-4.0%	-1.0%	0.0%	1.0%	1.5%	2.0%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Real Electricity Price Changes																		
Households	75.0%	50.0%	25.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Industry	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Population Growth	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Changes in Industrial Electricity Intensity																		
Growth Sectors	-9.0%	-3.0%	1.5%	5.0%	8.5%	11.5%	12.0%	12.5%	12.5%	12.5%	12.5%	12.5%	10.0%	10.0%	10.0%	10.0%	7.5%	7.5%
Constant Sectors	-12.0%	-7.0%	-3.0%	-1.0%	1.0%	2.5%	3.0%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Declining Sectors	-17.0%	-11.5%	-8.0%	-5.0%	-4.0%	-3.5%	-0.5%	1.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
FORECAST OF ELECTRICITY SALES, GWh/year																		
Household Sector	8,759	8,221	8,027	8,043	8,108	8,198	8,314	8,457	8,602	8,750	8,900	9,053	9,208	9,366	9,527	9,691	9,857	10,027
Industry Sector	13,186	12,777	12,582	12,510	12,536	12,634	12,789	12,990	13,207	13,430	13,658	13,892	14,116	14,344	14,578	14,816	15,041	15,269
Other Sectors	5,948	5,935	5,996	6,085	6,179	6,234	6,302	6,383	6,466	6,533	6,601	6,670	6,739	6,809	6,880	6,952	7,025	7,098
Total Sales	27,893	26,933	26,605	26,638	26,822	27,065	27,404	27,830	28,275	28,713	29,159	29,614	30,063	30,520	30,985	31,459	31,923	32,394
FORECAST OF GENERATION REQUIREMENTS, GWh/year																		
Distribution Losses	4,038	3,761	3,573	3,435	3,313	3,340	3,378	3,426	3,476	3,525	3,575	3,626	3,676	3,727	3,778	3,831	3,882	3,934
Losses (pct of for distribution)	13.5%	13.0%	12.5%	12.0%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%
For Distribution	29,910	28,930	28,585	28,623	28,805	29,042	29,373	29,788	30,224	30,650	31,085	31,528	31,963	32,405	32,855	33,313	33,759	34,211
Power Purchases from Factories & Others	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
Imports	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exports	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factory Self-Generation	2,923	2,829	2,807	2,837	2,829	2,863	2,909	2,967	3,027	3,087	3,149	3,212	3,276	3,342	3,408	3,477	3,546	3,617
Power Plant Auxiliaries	3,976	3,843	3,796	3,801	3,826	3,858	3,903	3,960	4,019	4,077	4,137	4,197	4,256	4,317	4,378	4,440	4,501	4,563
Auxiliaries (pct of gross generation)	11.1%	11.1%	11.2%	11.2%	11.3%	11.3%	11.3%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%
Gross Total Demand	35,907	34,536	33,974	33,874	33,960	34,263	34,685	35,215	35,770	36,315	36,870	37,437	37,995	38,563	39,142	39,730	40,306	40,891
Peak Demand (MW)	6,370	6,115	6,054	6,054	6,115	6,206	6,330	6,489	6,651	6,817	6,988	7,162	7,341	7,525	7,713	7,906	8,103	8,306

EXHS-3-3WK1

The high demand case is shown in Exhibit S-3-4.

- demand for electricity in the household sector declines slightly, reaching a minimum of 8,700 GWh in 1995, then climbs, reaching 12,800 GWh in 2010.
- in the industrial sector, demand holds firm at 13,600 GWh until 1996, and then begins a gradual climb to 19,500 GWh in 2010.
- total electricity sales reach a minimum of 28,700 GWh in 1994 and then rise gradually to 41,000 GWh in year 2010, but never reach the 1988 level of 35,600 GWh.
- peak demand holds at 6,900 MW until 1996, then increases to 12,300 MW by 2010, passing the historical maximum of 8,332 in year 2002.

Exhibit S-3-4
BULGARIA
ELECTRICITY DEMAND FORECAST
HIGH DEMAND SCENARIO

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
ASSUMPTIONS																		
GDP Growth	-2.0%	0.0%	1.0%	1.5%	2.0%	2.8%	3.3%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
Real Electricity Price Changes																		
Households	75.0%	50.0%	25.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Industry	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Population Growth	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Changes in Industrial Electricity Intensity																		
Growth Sectors	0.0%	2.0%	4.0%	6.5%	9.5%	12.8%	18.3%	24.5%	19.5%	14.5%	14.5%	14.5%	12.0%	12.0%	12.0%	12.0%	9.5%	9.5%
Constant Sectors	-3.0%	0.0%	1.0%	1.5%	3.0%	4.8%	6.3%	9.5%	8.5%	7.5%	6.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%
Declining Sectors	-7.0%	-4.0%	-2.0%	-0.5%	1.0%	1.8%	2.8%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
FORECAST OF ELECTRICITY SALES, GWh/year																		
Household Sector	9,164	8,824	8,723	8,820	8,944	9,112	9,310	9,583	9,863	10,153	10,450	10,757	11,072	11,396	11,731	12,074	12,428	12,793
Industry Sector	13,616	13,572	13,601	13,680	13,849	14,112	14,480	15,047	15,572	16,043	16,488	16,902	17,309	17,728	18,158	18,600	19,031	19,472
Other Sectors	6,145	6,325	6,537	6,729	6,918	7,075	7,224	7,388	7,553	7,698	7,843	7,987	8,135	8,285	8,437	8,593	8,751	8,912
Total Sales	28,925	28,721	28,861	29,229	29,711	30,299	31,014	32,018	32,988	33,894	34,781	35,646	36,516	37,409	38,326	39,267	40,210	41,177
FORECAST OF GENERATION REQUIREMENTS, GWh/year																		
Distribution Losses	4,168	3,984	3,847	3,738	3,638	3,705	3,787	3,902	4,012	4,113	4,210	4,305	4,399	4,495	4,594	4,696	4,797	4,900
Losses (pct of for distribution)	13.5%	13.0%	12.5%	12.0%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%
For Distribution	30,877	30,646	30,776	31,149	31,637	32,221	32,933	33,930	34,884	35,761	36,611	37,431	38,250	39,090	39,950	40,832	41,709	42,607
Power Purchases from Factories & Others	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
Imports	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exports	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factory Self-Generation	3,099	3,099	3,124	3,162	3,212	3,283	3,368	3,489	3,615	3,745	3,880	4,020	4,164	4,314	4,470	4,631	4,797	4,970
Power Plant Auxiliaries	4,108	4,077	4,094	4,145	4,212	4,292	4,389	4,525	4,655	4,774	4,890	5,002	5,114	5,228	5,345	5,466	5,585	5,708
Auxiliaries (pct of gross generation)	11.0%	11.1%	11.1%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.1%	11.1%	11.1%	11.1%	11.1%	11.1%	11.0%	11.0%
Gross Total Demand	37,202	36,782	36,803	37,112	37,561	38,296	39,190	40,444	41,654	42,781	43,881	44,952	46,028	47,132	48,265	49,428	50,592	51,785
Peak Demand (MW)	6,860	6,860	6,929	7,033	7,173	7,370	7,610	7,952	8,310	8,684	9,075	9,483	9,910	10,356	10,822	11,309	11,818	12,350

Exhibit S-3-4WK1

S.3.5 Comparison of Demand Forecasts

These three scenarios are compared in a series of graphs. Each graph also shows the historical situation since 1975, for clarity.

- A comparison of the changes in the total domestic sales of electricity are provided in Exhibit S-3-5. In year 2000, the high scenario has a 15% greater level of electricity demand than the low scenario.

- Gross total electricity demand, including power plant auxiliaries and distribution losses, is shown in Exhibit S-3-6.

- Annual maximum peak demand is illustrated in Exhibit S-3-7, and shows a different patte., consistent with the economic restructuring away from heavy industry.

Exhibit S-3-5

Bulgaria - Total Domestic Sales

Comparison of Scenarios

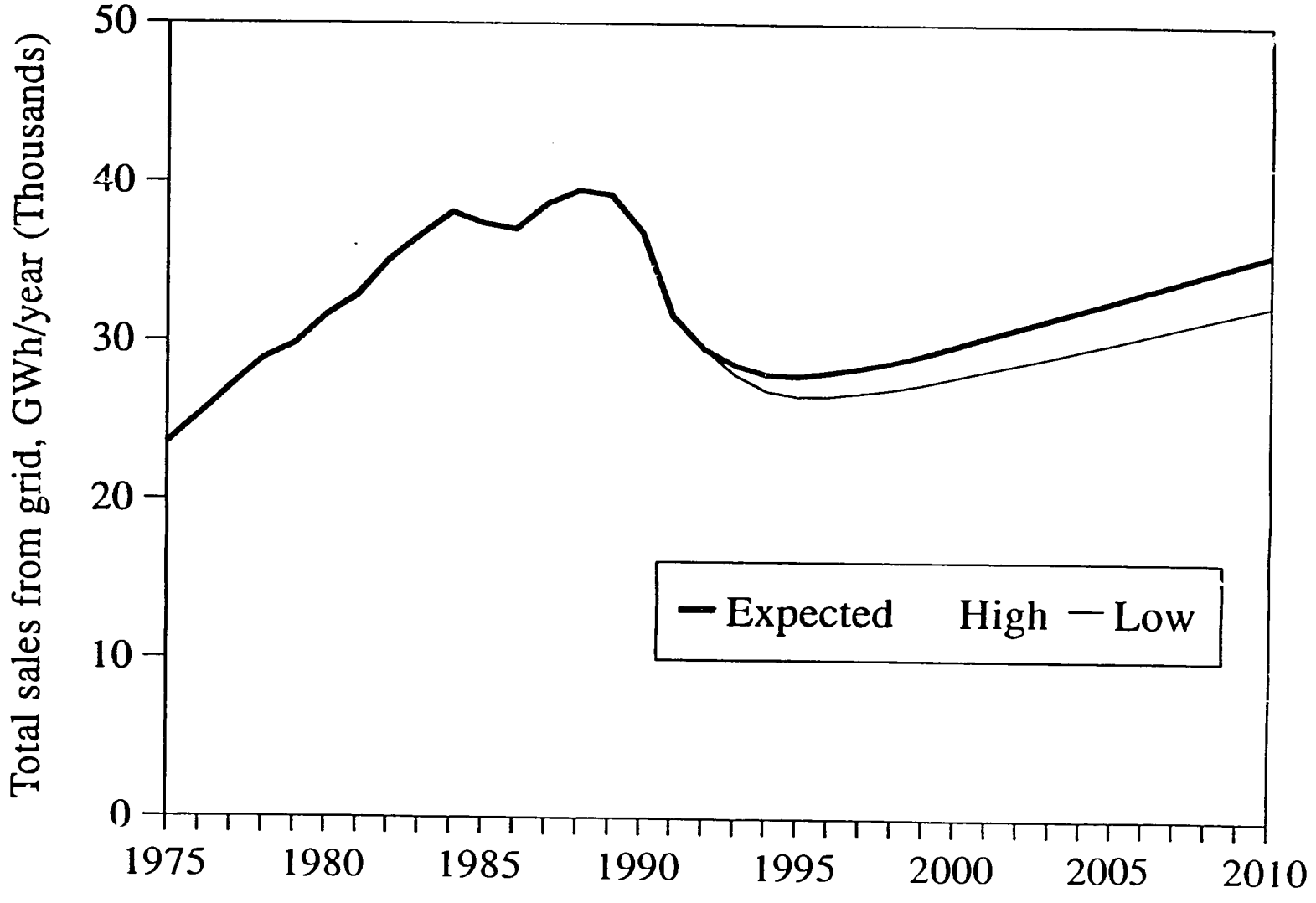


Exhibit S-3-6

Bulgaria - Total Electricity Demand

Comparison of Scenarios

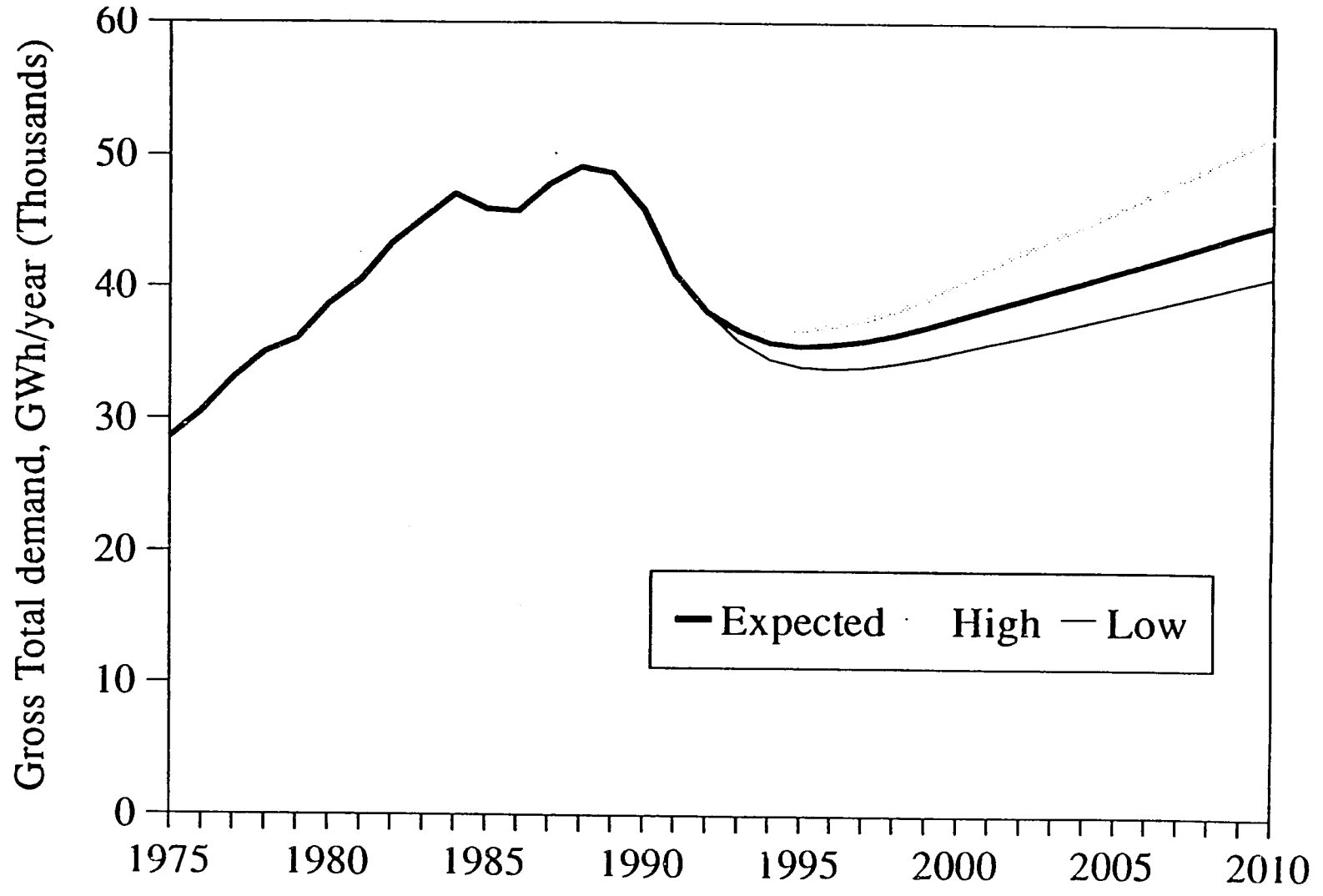
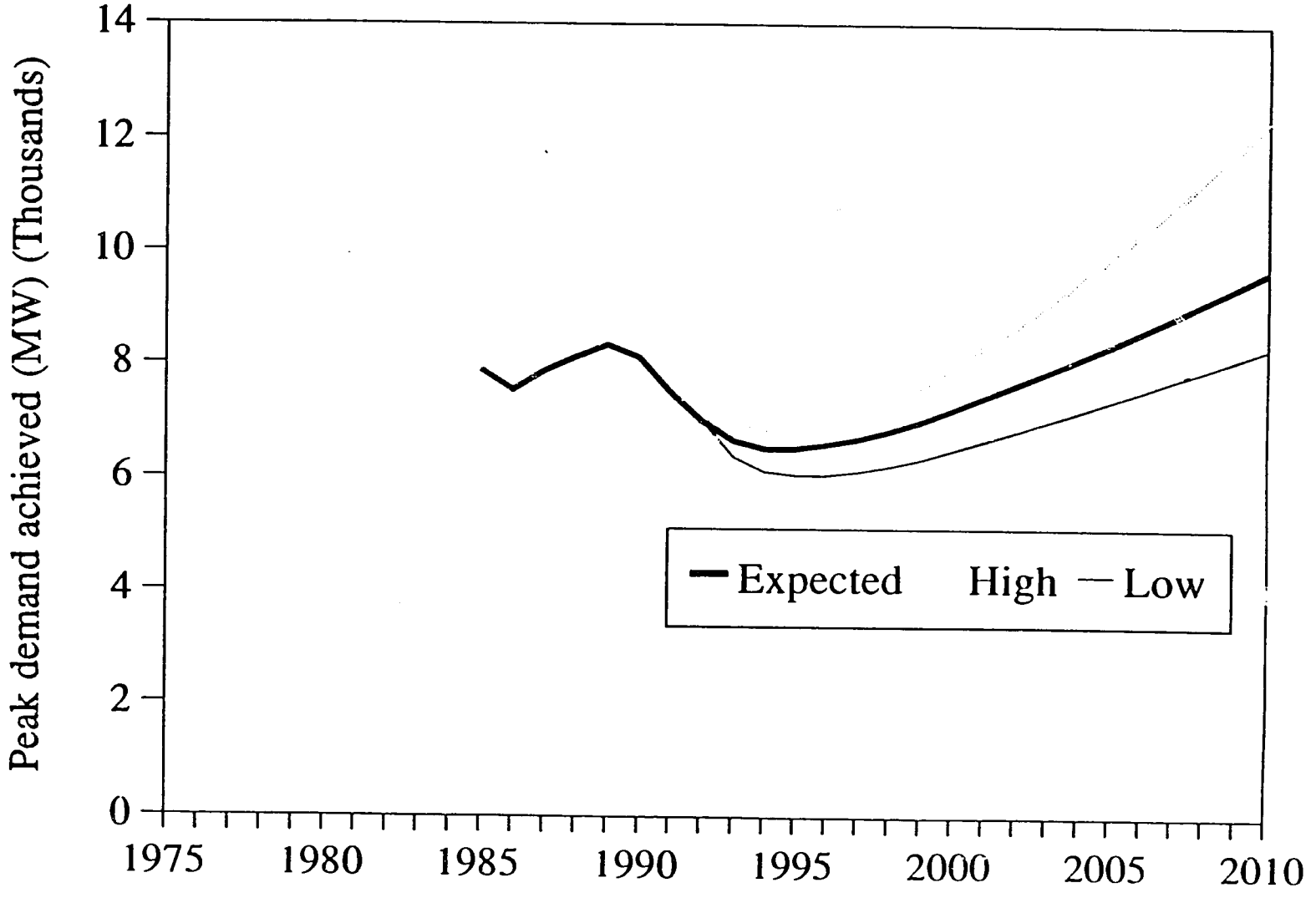


Exhibit S-3-7

Bulgaria - Annual Peak Demand

Comparison of Scenarios



1. INTRODUCTION

1.1 PROJECT OVERVIEW

This report presents partial results of work performed as part of the energy sector assistance provided to Bulgaria by the U.S. Agency for International Development. It was prepared as part of Task 1 - Electricity Sector Study and Action Plan, by RCG/Hagler, Bailly, Inc. as part of the A.I.D. Eastern Europe Regional Energy Efficiency Project's Energy Pricing, Energy Efficiency, and Energy Sector Restructuring Component. The report prepares a forecast of electricity demand.

Under Task 1 - Electricity Sector Study and Action Plan, Hagler, Bailly also prepared companion reports on the organization of the National Electric Company (NEK) and an assessment of the potential for Demand-side Management (DSM). Bechtel Corporation, under subcontract from Hagler Bailly, prepared a report on environmental improvement opportunities in thermal power generation, also under Task 1.

The objective of this study area was to develop a demand forecast for use in investment and operations planning.

The scope of the analysis was limited to analysis of the following data:

- reports and other published data provided by NEK and COE;
- electronic spreadsheets of monthly energy consumption for 1991-92 for 106 largest consumers, provided by NEK;
- survey of largest consumers, carried out by Hagler, Bailly and DBC on behalf of COE.

Hagler Bailly's analysis was carried out from October 1992 to February 1993, and resulted in the demand forecast described in this report. Near the end of this study period, the G-7 ordered the World Bank to carry out an assessment of electricity demand in Bulgaria, including development of a forecast. The World Bank reviewed the results of the latest forecast developed by NEK at the time, and adopted NEK's forecast for use in the report to the G-7. NEK's forecast fully reflected the consultations with Hagler Bailly over the period, and was markedly less optimistic than the forecasts which were first shown to the World Bank, USAID, Hagler Bailly, and others in 1992. The NEK forecast is within the band of forecasting uncertainty of the Hagler Bailly forecast, and so we agree that the NEK forecast should be adopted for least

cost planning studies.

1.2 HISTORICAL ELECTRICITY USE

In 1991 total installed capacity in Bulgaria was 12,074 MW, of which 10,460 MW is owned by NEK. District heating companies have an installed capacity of 574 MW in combined heat and power . Industrial enterprises have an installed capacity of 1,040 MW, mostly also combined heat and power.

Exhibit 1-1 illustrates the historical electrical energy balance in Bulgaria for 1975 and 1980-92.

Exhibit 1–1

BULGARIA
HISTORICAL ELECTRICITY BALANCE

	GWh/year													
	1975	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Gross Generation	24,965	34,841	37,045	40,634	42,863	44,672	41,633	41,821	43,474	45,007	44,327	42,121	38,891	36,437
Power Plant Auxiliaries	2,668	3,640	3,897	4,315	4,577	4,661	4,544	4,595	4,766	4,897	4,841	4,623	4,221	3,986
Auxiliaries (pct of net production)	10.7%	10.4%	10.5%	10.6%	10.7%	10.4%	10.9%	11.0%	11.0%	10.9%	10.9%	11.0%	10.9%	10.9%
Net Generation	22,296	31,201	33,148	36,319	38,286	40,011	37,089	37,226	38,708	40,110	39,486	37,498	34,670	32,451
Imports	3,902	4,698	4,497	4,441	4,582	4,636	5,959	4,571	4,673	4,450	4,937	5,387	3,082	2,700
Exports	279	866	1,095	1,794	2,221	2,243	1,655	599	324	304	548	1,597	959	1,000
Power Purchases from Factories & Others										773	774	735	754	759
Total For Distribution	25,920	35,033	36,551	38,966	40,647	42,403	41,393	41,198	43,056	44,256	43,875	41,288	36,793	34,151
Distribution Losses	2,387	3,454	3,695	3,888	4,046	4,301	4,016	4,170	4,413	4,762	4,656	4,443	5,191	4,576
Losses (pct of for distribution)	9.2%	9.9%	10.1%	10.0%	10.0%	10.1%	9.7%	10.1%	10.2%	10.8%	10.6%	10.8%	14.1%	13.4%
Final Sales	23,533	31,579	32,856	35,077	36,601	38,102	37,376	37,027	38,643	39,494	39,219	36,845	31,602	29,575
Household Sector	4,588	6,844	6,992	8,105	8,516	9,444	9,552	8,685	9,445	9,935	10,183	10,475	10,404	9,541
Industry Sector	14,306	17,524	18,498	19,227	20,004	20,414	20,038	20,283	20,674	21,208	20,815	19,386	15,013	14,013
Other Sectors	4,640	7,211	7,366	7,746	8,081	8,244	7,786	8,059	8,524	8,351	8,221	6,984	6,185	6,021
Factory Self–Generation	3,000	4,500	4,500	4,500	4,500	4,553	4,688	4,378	4,435	4,339	4,281	3,751	3,547	3,150
Total Consumers' Demand	26,533	36,079	37,356	39,577	41,101	42,655	42,064	41,405	43,078	43,833	43,500	40,596	35,149	32,725
Gross Peak Demand (MW)		6,922					7,878	7,514	7,853	8,114	8,332	8,111	7,489	7,500
Load factor														
based on Total for Distribution		0.58					0.60	0.63	0.63	0.62	0.60	0.58	0.56	0.52
based on Net Generation		0.51					0.54	0.57	0.56	0.56	0.54	0.53	0.53	0.49
based on Gross Generation		0.57					0.60	0.64	0.63	0.63	0.61	0.59	0.59	0.55

HISTOR WK1

Key points shown in Exhibit 1-1 include the following:

- Total consumers' electric energy demand in Bulgaria has taken a sharp drop, and is now 25% less than the maximum recorded in 1988. After dropping about 6% in 1990, total energy demand plummeted more than 13% during 1991 and dropped a further 7% during 1992.

- However, the reduction in electricity usage was not uniform across all sectors. Until 1992, the drop in demand was concentrated, for the most part, in the industrial sector as this sector fought to adjust to a market economy.

- Transmission and distribution losses increased substantially in 1991. This is probably due to energy diversion following increases in tariffs.

- Peak power demand (absolute maximum recorded during the year) has reduced, but much less than energy demand, and is now 15% less than the maximum recorded in 1989. The drop in 1990 (from 8,332 MW to 8,111 MW) amounted to 2.6% and in 1991 a further 7.7% to 7,489 MW and finally to 7,050 MW in 1992.

- Classifying energy sales (GWH/year) into three groups, reductions since 1988 are as follows:
  - -- industrial sales are down 34%
  - -- household sales are down 4%
  - -- other (agriculture, transportation, public buildings) sales are down 28%

- Power generation by industrial enterprises peaked in 1985 at 4,688 GWh, and has since declined by 33%.

Exhibit 1-2 presents the peak demand for each month of 1991. The maximum was recorded in January (7,500 MW), and August experienced the lowest peak (4,300 MW). The difference of more than 3,000 MW is attributed to the demand for heating.

Exhibit 1-3 presents the load duration curve for the NEK system for two years, 1982 and 1991. The difference between the two curves shows that most of the reduction in demand has occurred during summer months, and that some reduction has occurred during off-peak periods in the winter.

Exhibit 1-4 shows the daily load curve for typical working days in January 1991 and July 1991. The load swing in winter is only about 13% between peak and minimum, whereas in summer it is more than 25%.

Exhibit 1-2

Peak Demand by Month
Bulgaria 1991

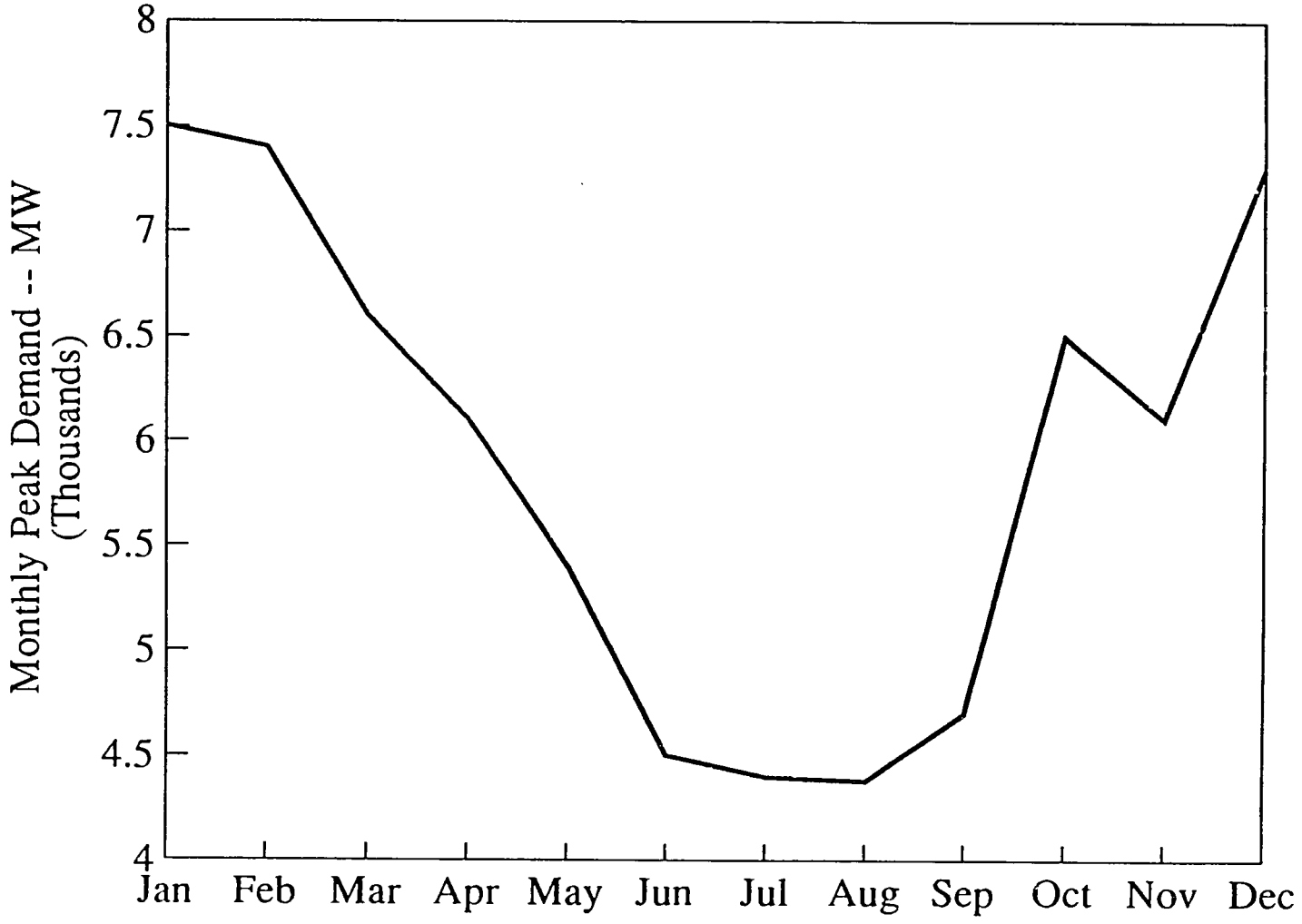


Exhibit 1-3

Load Duration Curve
Bulgaria -- 1991 and 1982

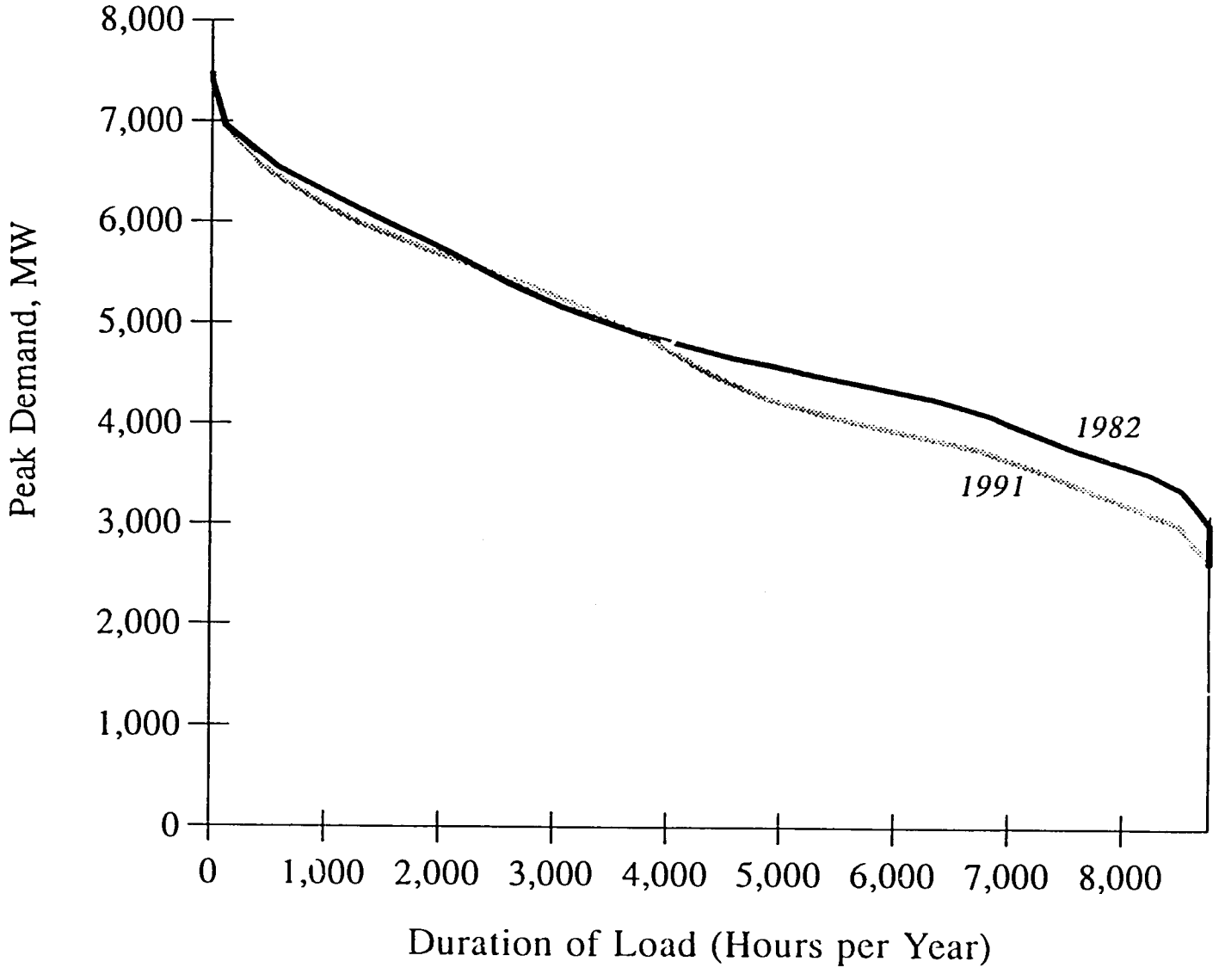
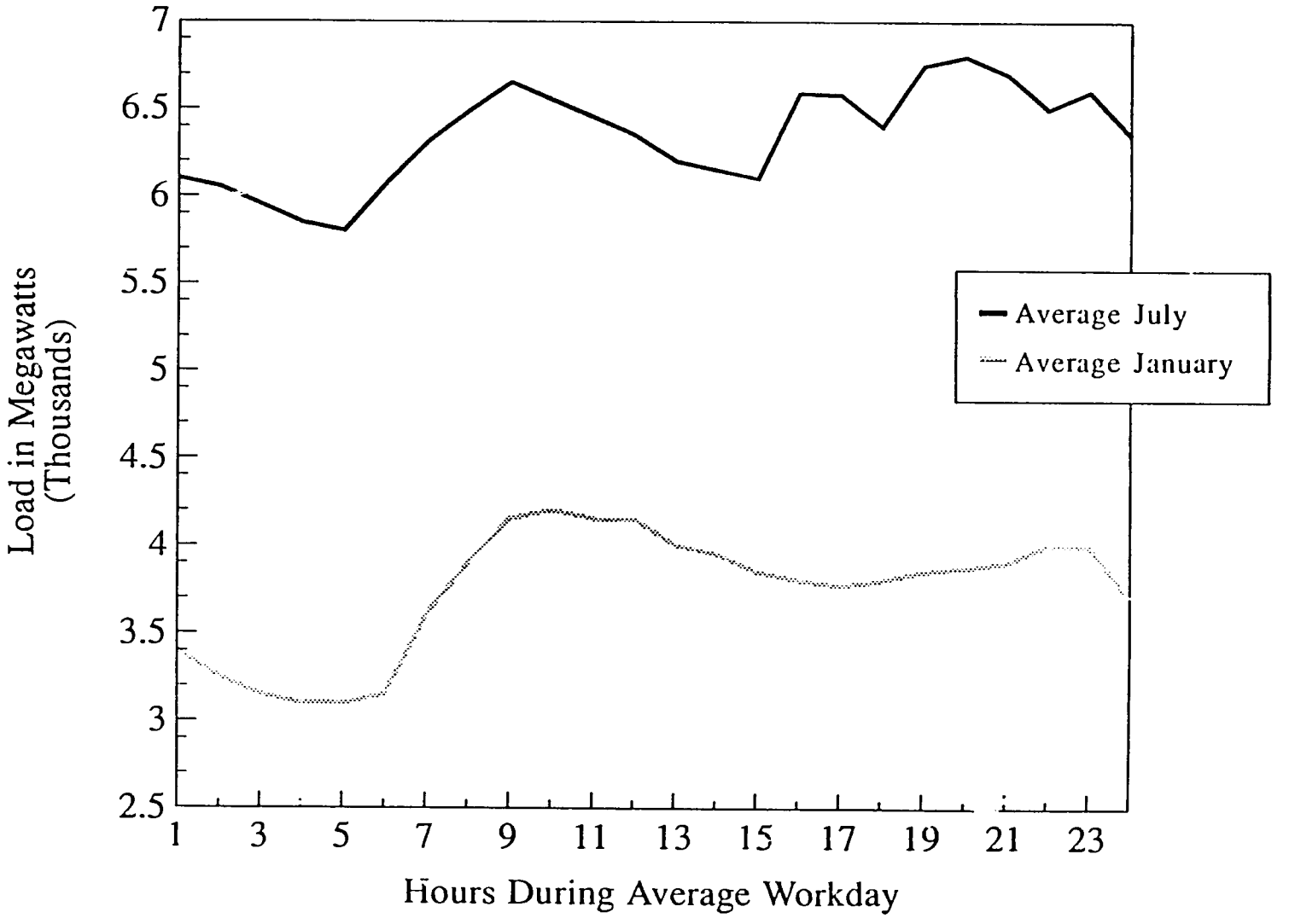


Exhibit 1-4

Daily Load Profile - Bulgaria

Average Day in January & July



1.2.1 Industrial and Commercial Sales by NEK

Industrial electric energy sales remained fairly constant during the latter part of the 1980s at 20-21,000 GWh per year through 1989. In 1990, sales decreased about 7% and in 1991, sales decreased a further 23%.

Data were provided by NEK for the breakdown of electricity consumption by industrial sector, and individually for the 106 largest electricity consumers. These data are summarized in Exhibit 1-5.

The dramatic drop in industrial electricity use in 1991 from 1990 was virtually universal across all sectors. Plants reduced their operations significantly and some shut down completely. The data indicate the greatest declines (using 1989 as a base) in the following sectors:

- -- chemicals (38%)
- -- pulp & paper (45%)
- -- timber (34%)
- -- food & beverage (25%)
- -- construction (30%)
- -- public sector buildings (34%)

1.2.2 Household Sales by NEK

During the decade of the 1980s, the price of electricity to households remained constant, and so, with inflation, the real price of electricity drifted downwards. No real increases in household tariffs occurred until 1992.

Referring back to Exhibit 1-1, household electricity demand increased steadily over the several years leading up to 1991. During 1991, while total electricity consumption was decreasing almost 15%, household consumption decreased by less than 1%. However, with substantial increases in tariffs, reductions in demand began in 1992, and sales were down about 8%.

1.3 FACTORS INFLUENCING DEMAND

Several factors influence the demand for electricity. The two primary effects are:

> *Income* - For the industrial sector, the health of the economy, both local and worldwide, determines the demand for goods and services, and in turn, this determines the demand for electricity. For households, income affects ability to buy electric appliances or even electric energy itself.

Exhibit 1–5
BULGARIA
RECENT ELECTRICITY SALES
TO INDUSTRY SECTORS AND LARGEST CUSTOMERS

	1987	1988	1989	1990	1991	1992
Ferrous Metals	2,988	3,029	2,980	2,869	2,640	2,481
Promet (S)					37	44
Kremikovtsi (S)					849	764
Stomana					446	487
Other					1,308	806
Non–ferrous Metals	**1,878**	**1,906**	**1,863**	**1,777**	**1,635**	**1,537**
Medril Mihi					44	54
Chiprovech					15	22
Polimet					41	40
MDP "Elatsite"					0	17
GORYBSO–AD IVru					27	26
OTSK–OOD					118	117
Olovo i Tsink					24	22
OP "Elatsite"					161	400
Redki Metali					34	18
Medodobiven K. (S)					152	260
D. Blagoev (S)					198	200
Alumina					35	34
OTSM (S)					41	40
Other					746	286
Chemicals	**6,350**	**6,378**	**4,443**	**3,771**	**3,017**	**2,752**
Kaltsit (S)					50	55
Neftohim (S)					195	116
Agropolihim					143	123
Polimeri					347	114
TK "Sodi"–star					192	38
F "Neohim"					207	175
Agrabiohim					576	581
HIMKO					452	455
Yambolen					50	54
Plasthin					17	21
Lateks (S)					10	7
Geoson					25	23
Gavril Genov (S)					14	13
P. Karaminchev					12	13
Smyadovo–OOD					11	5
Odesos (S)					10	13
Antibiotik (S)					107	109
Other					601	837
Engineering – metallic products			**2,212**	**2,159**	**1,987**	**1,867**
Energorem. 3–D (S)					25	19
K–t za Traktori					18	12
Osam					26	10

30

Exhibit 1-5
BULGARIA
RECENT ELECTRICITY SALES
TO INDUSTRY SECTORS AND LARGEST CUSTOMERS

	1987	1988	1989	1990	1991	1992
Akumikar					13	17
Fitingi					30	24
LEKO-KO					102	34
SLZ (S)					149	21
ZTM-OOD (S)					25	16
Korabostr. -OOD					10	11
Madara					45	21
G. Dimitrov (S)					16	14
TKEP "6 Sept." (S)					18	11
ZMM-AD (S)					14	15
MK "VMZ"					88	84
Progres					17	13
Varn. Korabostr. (S)					31	41
Veslets 91					39	52
KAMET (S)					99	36
Rekora (S)					5	15
Other					1,215	1,400
Electrical & Electronics			817	700	686	648
B. Kolarov					12	26
Eltos					10	11
Feromagniti					21	20
Svetlkna					19	15
Elprom-Dinamo					14	9
Elprom-ZEM-ad (S)					0	14
D S U					29	17
Elima					22	19
Elkom (S)					9	12
Other					551	506
Building Materials		1,395	1,305	1,161	1,068	1,004
Eeloiz. Tsiment					88	55
Devn. Tsiment					120	103
Bulkan					33	37
Izida					16	16
Pl. Tsiment					50	60
Zl. Panega					84	89
Han Asparuh (S)					18	16
Kaolin (S)					8	18
Other					652	610
Timber			419	380	304	277
Pulp & paper, wood products			637	481	385	351
Rulon-Iskar (S)					26	27
PHHI					29	24
TKTSH					34	57
ZMK (S)					76	32

Exhibit 1–5
BULGARIA
RECENT ELECTRICITY SALES
TO INDUSTRY SECTORS AND LARGEST CUSTOMERS

	1987	1988	1989	1990	1991	1992
Lesil					49	17
St. Kirajiev (S)					55	55
TKHTS (S)					31	13
Other					85	126
Glass			**424**	**504**	**494**	**466**
Belopal					42	38
Kitka					29	25
Fayans					24	26
Rubin					35	25
Drushba					44	44
Kvarts					22	18
Diamant (S)					21	21
Other					276	269
Textiles		**784**	**767**	**662**	**609**	**572**
Manuela					18	23
Dobruja					8	9
Sliteks					21	21
Vratitsa					18	14
Other					543	505
Food & Beverage		**1,454**	**1,521**	**1,312**	**1,207**	**1,135**
N. Vaptsarov					6	33
Tyot. Kombinat (S)					12	11
MEZ "Kambana" (S)					8	8
SKPPPMYA (S)					14	8
Other					1,167	1,075
Other Industries			**1,047**	**1,066**	**981**	**922**
Bules (S)					14	11
Chemo More (S)					8	9
Construction	1,091	1,139	994	896	740	696
Agriculture	1,143	1,094	1,070	995	870	873
Transport & Communications	1,441	1,489	1,493	1,483	1,400	1,392
Public Sector	4,849	4,629	4,664	3,610	3,175	3,061

INDDB.WK1

- *Price* - Low electricity tariffs encourage greater consumption, and higher prices should lead to conservation. The structure of tariffs (for example, amount charged to large industrial customers as compared to households) is very important in determining sector demand.

Secondary effects are:

- *Structure of industry* - As the prices of energy and inputs increase, the cost of producing goods increases. Those goods that have the greatest increases in productivity or are the most energy efficient in production will tend to be relatively lower cost industries, and the demand for goods will shift towards these industries. This shift will bring about a scale effect as inefficient plants close and a substitution effect as demand is shifted to the more electricity-efficient industries.

- *Energy conservation programs* - The government can directly affect the demand for electricity through the level of its promulgation of energy conservation programs.

- *Privatization* - The government indirectly affects the use of electricity by its industrial policies. The industries that the government promotes through either subsidies or by assisting in the privatization process should become more healthy, affecting the eventual demand for electricity.

- *Commercial services* - The privatization process will also spur the development of the commercial sector, which will require electricity for lighting, cooking, refrigeration, heating, ventilation and air conditioning.

- *Weather conditions* - Bulgaria's peak demand increases by more than 3,000 MW in the winter, so a cold winter will cause an increase in demand.

- *Household formation* - Population growth and residential construction leads to the formation of new households and the creation of new customers. Since 1980, population growth has average only about 0.2% per year in Bulgaria.

- *Regional differences* - The demand for electricity varies by region, because of the concentration of industry, the size of the population, and differing weather patterns. The historical regional distribution of electricity sales is provided in Exhibit 1-6. The change in electricity use varies over time by district, with some districts increasing their share as their decreases in electricity use are less than other those of other districts.

Exhibit 1-6
SALES OF ELECTRICITY BY REGION (GWh)

Year	1985	1986	1987	1988	1989	1990	1991
Sofia City	5,109	4,935	5,054	5,193	5,150	4,694	4,025
Sofia District	4,126	4,278	4,564	4,653	4,649	4,308	3,497
Pleven	4,723	4,671	5,025	5,049	4,773	4,914	4,199
G. Oryahvitza	4,069	3,926	4,196	4,373	4,319	4,096	3,493
Varna	4,743	4,614	4,523	4,694	4,626	4,335	3,629
St. Zagora	5,398	5,506	5,751	6,063	6,030	5,666	4,979
Plovdiv	6,269	6,244	6,583	6,671	6,723	6,494	5,579
Total	34,437	34,174	35,696	36,696	36,270	34,507	29,401

2. RESULTS OF INDUSTRIAL ENERGY SURVEY

The largest industrial consumers in Bulgaria are judged to be at the greatest risk of losing their market, and their ability to cope with this dislocation will determine their survival, and thus their demand for electricity. To develop a better understanding of the conditions at these large consumers, a survey of the NEK's 106 largest electrical consumers was commissioned by RCG/Hagler Bailly as part of the project. Hagler Bailly subcontracted with Dimitar Baev - DBC, a private Bulgarian firm, to carry out the work.

2.1 OBJECTIVE

The objective of the survey was to poll the 106 largest industrial electricity consumers with respect to their electricity consumption, business and economic activity, electrical generation at the facility (if any) and energy efficiency.

2.2 ACTIVITIES

The project included the following tasks:

1) An English draft survey instrument was developed by Hagler, Bailly, and subsequently a Bulgarian version of the survey questionnaire by DBC, taking into account locally-accepted survey techniques by means of network of interviewers, as well as the recommendations of the experts from the Committee of Energy.

2) A test run of the survey was made in 7 enterprises in Sofia to verify that the survey instrument was acceptable. Based on the results, Hagler, Bailly determined that a two-stage methodology was required.

3) The survey instrument was distributed to the 106 largest electric consumers, and personal visits were made to each site in an attempt to achieve a high response rate to the survey.

4) For those who agreed to participate, on-site interviews were done by a nationwide network of interviewers (comprising over 20 interviewers) over the period November - December 1992.

5) A follow-up survey was conducted in the cooperating industries in December 1992 -

January 1993 to obtain more quantitative data on energy consumption and production, and to evaluate the plant's attitudes toward energy conservation.

6) A data base was created containing the data from all the responses of the questionnaires.

7) Statistical analysis of the results was carried out by DBC.

8) Reports were prepared for both the main and the follow-up surveys by DBC, and provided to Hagler, Bailly and Committee of Energy.

2.3 DESCRIPTION OF THE SURVEY

2.3.1 Conditions in which the survey was conducted

The survey was influenced by number of factors, characteristic of the state of the Bulgarian economy and industry:

- deep economic recession, and decrease of the production;
- loss of most of Bulgaria's traditional markets and trading partners;
- de-monopolization and disintegration of old production structures;
- considerable increase in the percentage of unemployment;
- slow rates of the progress of restructuring of the economy and privatization;
- substantial decrease of state subsidies and increase of the debts of the enterprises.

During this period, Bulgaria was faced with particularly acute energy problems, including power outages. The period of the survey also coincided with government decisions for substantial increases in electricity tariffs and other energy prices.

Finally, another important fact should be taken into account - that in Bulgaria there is no tradition for conducting such surveys in industry.

2.3.2 Survey interview techniques

The enterprises, subject to the survey are situated over the whole territory of Bulgaria, most of them being some distance from the large cities. From the point of view of the number of

questions as well as from the point of view of it's content, the study could be classified as technically complicated.

The officials which took part in the filling up of the questionnaires, were as follows:

- Top managers of the enterprises (general directors, executive directors);
- Deputy directors, responsible for the economics or production;
- Chief power engineering specialists, or Heads of departments "Power engineering";
- Heads of departments "Planning and Economics";
- Experts and specialists;

As a rule several of them took part successively in the responding of the questionnaires. The mean time to receive the full response was 15-20 days. During that time it was necessary for the interviewers to visit the enterprise several times in order to stimulate a response to the questionnaires.

From the total of 106 questionnaires send, 61 responded (57% rate), and 35 of these responded to the follow-up survey (33% response rate to full survey). In certain sectors of industry as coal mining, iron and steel, timber, construction and other branches the response rate was 100%. Of those who did not respond, some of the more important reasons were the following:

- The enterprises refuse in principle to accept questionnaires, because of the following motives:

  -- the questions represent firm's secrets;
  -- there are apprehensions of misuse of the information against the interests of the enterprise;
  -- essential structural and personnel changes are in progress;
  -- it is considered a priori that this is a pure waste of time.

  This group includes about 20 % of those who didn't answer.

- Enterprises which accepted the questionnaires, but didn't respond because of the following reasons:

  -- responding to the survey is of low priority, compared with the current operative tasks;
  -- it is impossible to create organization for joint completion of the

questionnaires;
- -- fear of responsibility;
- -- during the progress of the filling up it is realized that more effort is necessary than originally considered;
- -- the questionnaire is left without control to somebody's working place, etc.

This group is the largest and includes about 75% of those who didn't answer.

- The enterprise said that the questionnaires were completed and sent to the interviewers by post, but were lost. This is about 5% of those not responding.

2.4 SUMMARY OF THE RESULTS

2.4.1 Business and operating conditions

Exhibit 2-1 shows the results of part 1 of the survey, which was intended to summarize business conditions and operating characteristics. The exhibit shows each survey item and a summary of the responses, by percentage. The percentages do not add up to 100% in those cases in which one or more respondents did not answer an item or judged two choices equal.

As shown in Exhibit 2-1:

- Employment is in decline, and is expected to decline further in 48% of the sites;
- Plant capacity utilization declined significantly in 1991 (number of plants operating at 50% capacity or less went from 11% to 28%) and slightly in 1992 (35% of plants at 50% capacity or less), the largest declines were in the engineered products and chemicals/petroleum sectors;
- Capacity utilization is forecast to improve slightly in 1993 (only 20% at 50% capacity or less, with the food industry particularly optimistic);
- The principal factor required for recovery:
  - -- new markets (mentioned by 57%);
  - -- better management, efficiency, productivity or quality (20%);
  - -- new technology (14%);
  - -- supply of raw materials (14%);
  - -- higher prices (6%);
  - -- economic recovery (6%).
- Half of the plants have made significant investments in the past two years, and

43% expect to make significant investments in 1993 (metallurgy industries expect to invest, pulp & paper does not);

- Privatization is expected in the next two years by only 20% of the plants;
- Backlogs of manufacturing orders are fairly good, and inventories are not excessive;
- Most plants work multiple shifts - 17% have changed working hours since 1990, and 9% expect to change in 1993;
- Hours of operation correspond with NEK peaks, and 59% work 24 hours per day;
- Solving manufacturing problems (such as marketing, raw material supply, quality, and productivity) are judged higher priorities than energy cost reduction;
- Among energy costs, electricity was the highest priority.

EXHIBIT 2–1
BULGARIA
SURVEY OF LARGEST ELECTRICAL CONSUMERS
DECEMBER 1992 BY ET "DIMITAR BAEV – DBC"

PART 1 – SUMMARY OF OPERATIONS AND BUSINESS CONDITIONS

HOW MANY NUMBER OF EMPLOYEES AT THIS FACILITY?

less than 1000	1000–2000	2000–5000	over 5000
38%	32%	18%	5%

HOW HAS THE NUMBER OF EMPLOYEES CHANGED IN THE LAST YEAR?

same	increased	reduced by: 5–10%	reduced by: 10–20%	reduced by: more than 20%
21%	9%	39%	11%	13%

HOW DO YOU EXPECT THE NUMBER OF EMPLOYEES TO CHANGE OVER THE NEXT YEAR?

same	increased	reduced by: 5–10%	reduced by: 10–20%	reduced by: more than 20%
52%	7%	23%	9%	5%

WHAT IS THE BUSINESS OUTLOOK FOR YOUR INDUSTRIAL SECTOR?

optimistic	pessimistic	not clear
46%	2%	46%

APPROXIMATELY WHAT PERCENT OF MAXIMUM CAPACITY DID YOUR ENTERPRISE PRODUCE?

Year	less than 25%	25–50%	51–75%	76–100%
1990	4%	7%	27%	48%
1991	7%	21%	41%	18%
1992	5%	30%	43%	11%

APPROXIMATELY WHAT PERCENT OF MAXIMUM CAPACITY DOES YOUR ENTERPRISE EXPECT TO PRODUCE IN 1993?

less than 25%	25–50%	51–75%	76–100%
0%	20%	41%	21%

HAS YOUR ENTERPRISE MADE ANY SIGNIFICANT CAPITAL INVESTMENTS?

	Yes	No
In the last 2 years	50%	43%
In the last 6 months	25%	61%

EXHIBIT 2–1
BULGARIA
SURVEY OF LARGEST ELECTRICAL CONSUMERS
DECEMBER 1992 BY ET "DIMITAR BAEV – DBC"

PART 1 – SUMMARY OF OPERATIONS AND BUSINESS CONDITIONS

DOES YOUR ENTERPRISE PLAN TO MAKE SIGNIFICANT INVESTMENTS IN THE NEXT YEAR?

Yes	No
43%	48%

WHEN DO YOU ANTICIPATE THAT THIS ENTERPRISE WILL BE PRIVATIZED?

already done	0–12 months	12–24 months	more than 24 months	not likely ever
0%	11%	9%	36%	36%

APPROXIMATELY HOW LONG IS YOUR ENTERPRISE'S BACKLOG OF ORDERS?
months of production at current production rate

less than 1	1 – 2	2 – 4	4 – 6	6 – 9	9 – 12
11%	20%	11%	6%	11%	6%

APPROXIMATELY HOW LARGE IS YOUR ENTERPRISE'S INVENTORY OF FINISHED PRODUCTS?
months of production at current production rate

less than 1	1 – 2	2 – 4	4 – 6	6 – 9	9 – 12
23%	17%	6%	0%	0%	3%

HOW DOES THE ENTERPRISE OPERATE DURING THE DAY?

24 hours/day	2 shifts	1 shift
59%	29%	13%

HOW MANY HOURS PER WEEK DOES THE MAIN PRODUCTION PROCESS OPERATE?

less than 24	24–48	48–72	72–96	96–120	120–144	144–168
9%	17%	9%	12%	3%	9%	41%

EXHIBIT 2–1
BULGARIA
SURVEY OF LARGEST ELECTRICAL CONSUMERS
DECEMBER 1992 BY ET "DIMITAR BAEV – DBC"

PART 1 – SUMMARY OF OPERATIONS AND BUSINESS CONDITIONS

WHAT ARE THE HOURS OF OPERATION OF THE PRODUCTION PROCESS AT YOUR ENTERPRISE?

hours of operation	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
0 – 1	62%	65%	65%	65%	65%	59%	56%
1 – 2	62%	65%	65%	65%	65%	59%	56%
2 – 3	62%	65%	65%	65%	65%	59%	56%
3 – 4	62%	65%	65%	65%	65%	59%	56%
4 – 5	62%	65%	65%	65%	65%	59%	56%
5 – 6	68%	71%	71%	71%	71%	62%	59%
6 – 7	76%	76%	76%	76%	76%	65%	65%
7 – 8	82%	82%	82%	82%	82%	68%	68%
8 – 9	100%	100%	100%	100%	100%	74%	68%
9 – 10	100%	100%	100%	100%	100%	74%	68%
10 – 11	100%	100%	100%	100%	100%	74%	68%
11 – 12	100%	100%	100%	100%	100%	74%	68%
12 – 13	100%	100%	100%	100%	100%	74%	68%
13 – 14	100%	100%	100%	100%	100%	71%	68%
14 – 15	100%	100%	100%	100%	100%	71%	68%
15 – 16	100%	100%	100%	100%	100%	71%	68%
16 – 17	91%	91%	91%	91%	91%	71%	68%
17 – 18	79%	79%	79%	79%	79%	65%	65%
18 – 19	79%	79%	79%	79%	79%	65%	65%
19 – 20	79%	79%	79%	79%	79%	65%	65%
20 – 21	79%	79%	79%	79%	79%	65%	65%
21 – 22	76%	76%	76%	76%	76%	62%	62%
22 – 23	74%	74%	74%	74%	74%	62%	62%
23 – 24	71%	71%	71%	71%	71%	62%	62%

HAVE THERE BEEN ANY CHANGES TO THESE HOURS SINCE 1990?

Yes	No
17%	77%

DO YOU EXPECT ANY CHANGES TO THESE HOURS IN 1993?

Yes	No
9%	86%

EXHIBIT 2-1
BULGARIA
SURVEY OF LARGEST ELECTRICAL CONSUMERS
DECEMBER 1992 BY ET "DIMITAR BAEV - DBC"

PART 1 - SUMMARY OF OPERATIONS AND BUSINESS CONDITIONS

WHAT ARE NOW THE SHORT-TERM PRIORITIES IN YOUR ENTERPRISE?

	Percentage who ranked it (5 is top priority)							
Description of the problem	5	4	3	2	1	0	Score	Rank
Finding a way to sell more of our finished products	63%	14%	6%	3%	3%	11%	3.97	1
Obtaining reliable sources of raw materials	34%	20%	3%	11%	6%	26%	2.89	2
Reducing the cost of production, not including energy	26%	14%	23%	11%	6%	20%	2.83	3
Improving the quality of our products	20%	17%	17%	9%	0%	37%	2.37	4
Reducing the cost of electric energy	17%	20%	14%	9%	3%	37%	2.29	5
Managing people and improving labor productivity	20%	6%	26%	9%	9%	31%	2.26	6
Maintaining our equipment, reducing break-downs	14%	14%	26%	3%	3%	40%	2.14	7
Reducing the cost of fuel energy	14%	17%	11%	14%	6%	37%	2.09	8
Reducing pollution, improving ecology	17%	11%	11%	17%	6%	37%	2.06	9
Obtaining reliable sources of electric energy	9%	11%	20%	11%	3%	46%	1.74	10
Dealing with inefficient government bureacracy	11%	6%	23%	9%	0%	51%	1.66	11
Reducing the cost of heat energy	6%	17%	17%	6%	3%	51%	1.63	12
Privatizing our plant	9%	11%	23%	0%	3%	54%	1.60	13
Changing our plant to produce different products	6%	11%	14%	11%	6%	51%	1.46	14
Obtaining reliable sources of heat energy	14%	6%	0%	11%	6%	63%	1.23	15
Reducing operations to meet the market conditions	3%	6%	17%	11%	3%	60%	1.14	16
Obtainining reliable sources of fuel energy	0%	14%	9%	6%	11%	60%	1.06	17
Other	3%	0%	0%	3%	0%	94%	0.20	18

2.4.2 Current and projected electricity usage

Exhibit 2-2 shows the results of part 2 of the survey, which concerned electricity usage. Again, the exhibit shows each survey item and a summary of the responses, by percentage. The percentages do not add up to 100% in those cases in which one or more respondents did not answer an item.

As shown in Exhibit 2-2:

- 83% of the sites have a load of 10 MW or more;
- 1992 electricity consumption was reduced from 1991 in 46% of the plants;
- 1992 reductions were significant (10% or more) in 31% of the plants, and very large (20% or more) in 20% of the plants;
- 1993 electricity consumption and peak usage is forecast to be the same as 1992, or higher, in 91% of the plants;
- Peak demand (MW) seems be about the same as day MW;
- Reductions in peak demand have been significantly less than reductions in energy consumption, and this trend is expected to continue;
- The expected changes in electricity consumption are well correlated with the expected changes in production;

EXHIBIT 2–2
BULGARIA
SURVEY OF LARGEST ELECTRICAL CONSUMERS
DECEMBER 1992 BY ET "DIMITAR BAEV – DBC"

PART 2 – CURRENT AND PROJECTED ELECTRIC ENERGY USAGE

WHAT IS THE ELECTRIC ENERGY CONSUMPTION FOR YOUR ENTERPRISE FOR 1992?

Period:	Gigawatt–hours (GWh): less than 2	2 – 5	5 – 10	10 – 20	20 or more
peak GWh	9%	51%	17%	9%	11%
day GWh	3%	14%	34%	23%	23%
night GWh	14%	40%	9%	20%	14%
TOTAL GWh	3%	0%	11%	40%	43%

HOW IS YOUR ELECTRIC ENERGY CONSUMPTION DISTRIBUTED FOR 1992?

Peak energy	Day energy	Night energy
22%	45%	32%

HOW HAS THE TOTAL ELECTRIC ENERGY CONSUMPTION CHANGED IN COMPARISON WITH 1991?

CHANGE	the same	increased by...	decreased by...
0	31%		
1–5%		6%	14%
5–10%		0%	0%
10–20%		6%	11%
20–50%		9%	17%
> 50%		0%	3%
TOTAL	31%	20%	46%

HOW DO YOU EXPECT THE TOTAL ELECTRIC ENERGY CONSUMPTION TO CHANGE IN 1993, COMPARED WITH 1992?

CHANGE	the same	to increase by...	to decrease...
0	51%		
1–5%		11%	0%
5–10%		3%	0%
10–20%		6%	3%
20–50%		11%	6%
> 50%		9%	0%
TOTAL	51%	40%	9%

EXHIBIT 2-2
BULGARIA
SURVEY OF LARGEST ELECTRICAL CONSUMERS
DECEMBER 1992 BY ET "DIMITAR BAEV – DBC"

PART 2 – CURRENT AND PROJECTED ELECTRIC ENERGY USAGE

HOW DID THE ENERGY CONSUMPTION DURING PEAK HOURS CHANGE IN 1992, COMPARED WITH 1991?

CHANGE	the same	increased by...	decreased by...
0	29%		
1–5%		9%	0%
5–10%		9%	3%
10–20%		9%	6%
20–50%		14%	14%
> 50%		6%	3%
TOTAL	29%	47%	26%

HOW DO YOU EXPECT THE ENERGY CONSUMPTION DURING PEAK HOURS TO CHANGE IN 1993, COMPARED WITH 1992?

CHANGE	the same	to increase by...	to decrease by...
0	51%		
1–5%		9%	0%
5–10%		6%	0%
10–20%		3%	6%
20–50%		20%	0%
> 50%		3%	0%
TOTAL	51%	41%	6%

CORRELATION OF RESPONSES TO QUESTIONS ON ENERGY USAGE AND PRODUCTION:
HOW DO YOU EXPECT THE LEVEL OF PRODUCTION OUTPUT TO CHANGE IN 1993?
HOW DO YOU EXPECT THE TOTAL ELECTRIC ENERGY CONSUMPTION TO CHANGE IN 1993?

	Electric energy consumption:							
Production Output:	the same	up 1–10%	up 10–20%	up > 20%	down 1–10%	down 10–20%	down > 20%	TOTAL
the same	73%	9%	9%	9%	0%	0%	0%	31%
up 1–10%	33%	33%	17%	17%	0%	0%	0%	17%
up 10–20%	57%	14%	0%	14%	0%	0%	14%	20%
up more than 20%	29%	0%	0%	57%	0%	0%	14%	20%
down 1–10%	0%	0%	0%	0%	0%	0%	0%	0%
down 10–20%	0%	0%	0%	0%	0%	0%	0%	0%
down more than 20%	0%	50%	0%	0%	0%	50%	0%	6%
TOTAL	51%	14%	6%	20%	0%	3%	6%	

EXHIBIT 2-2
BULGARIA
SURVEY OF LARGEST ELECTRICAL CONSUMERS
DECEMBER 1992 BY ET "DIMITAR BAEV - DBC"

PART 2 - CURRENT AND PROJECTED ELECTRIC ENERGY USAGE

WHAT IS THE MAXIMUM ELECTRIC POWER DEMAND FOR YOUR ENTERPRISE FOR 1992?

Megawatts: Period:	0 - 5	5 - 10	10 - 20	20 - 50	50 or more
peak MW	29%	39%	6%	6%	6%
day MW	32%	32%	10%	6%	3%
night MW	42%	23%	10%	6%	3%

HOW DID THE MAXIMUM DEMAND (MW) CHANGE IN 1992, COMPARED WITH 1991?

CHANGE	the same	increased by...	decreased by...
0	51%		
1-5%		3%	0%
5-10%		3%	3%
10-20%		6%	9%
20-50%		6%	14%
> 50%		0%	0%
TOTAL	51%	18%	26%

HOW DO YOU EXPECT THE MAXIMUM DEMAND (MW) TO CHANGE IN 1993, COMPARED WITH 1992?

CHANGE	the same	to increase by...	to decrease by...
0	63%		
1-5%		6%	0%
5-10%		3%	0%
10-20%		9%	3%
20-50%		11%	3%
> 50%		0%	0%
TOTAL	63%	29%	6%

EXHIBIT 2-2
BULGARIA
SURVEY OF LARGEST ELECTRICAL CONSUMERS
DECEMBER 1992 BY ET "DIMITAR BAEV – DBC"

PART 2 – CURRENT AND PROJECTED ELECTRIC ENERGY USAGE

WHAT IS YOUR ESTIMATED COST FOR PURCHASED ENERGY 1992?
MILLIONS OF LEVA

	0–5	5–10	10–20	20–50	50–100	more than 100	no answer
Electricity	3%	23%	23%	17%	6%	6%	23%
Heat	6%	9%	0%	3%	0%	0%	83%
Gas	9%	6%	9%	3%	0%	3%	71%
Oil	14%	6%	14%	3%	6%	3%	54%
Coal	14%	0%	0%	3%	0%	0%	83%

2.4.3 Equipment installed for electricity generation and use

Exhibit 2-3 shows the results of part 3 of the survey, which concerned equipment available for power generation, and principal electricity using equipment. Again, the exhibit shows each survey item and a summary of the responses, by percentage. The percentages do not add up to 100% in those cases in which one or more respondents did not answer an item.

As shown in Exhibit 2-3:

- Only six of the plants responding have a generator, of these three are in the chemicals and petroleum sector, two in non-ferrous metals and one in glass;
- Of those six that have a generator, two do not operate regularly, but probably could do so;
- Among those six that have a generator, only half felt that the purchase price of power paid by NEK is too low;
- Among those six that have a generator, the following reasons were given for not increasing the output:
  - -- three (50%) said they were at their technical potential;
  - -- one said because of the reduced production rate;
  - -- one said because of low electricity prices;
  - -- one said because of lack of fuel.
- Among those that do not have a generator, only 2% considered it possible to install one (25% no answer or did not know);
- Motors driving pumps, fans, compressors, and other equipment were cited as primary loads by 77% of the respondents;
- Less than half of the plants use efficient lighting systems (sodium vapor, metal halide, or compact fluorescent).
- For the specific process equipment identified (some of which are relevant only to specific industrial sectors), the following totals were developed:

--	electrolysis (chemicals)	27 MW
--	heat treatment (metals)	25 MW
--	rolling mills (metals)	24 MW
--	compressors	20 MW
--	electric furnaces (metals)	18 MW

--	water pumps	16 MW
--	catalytic cracking (petroleum)	15 MW
--	motors for other uses	15 MW
--	machine tools (engineered products)	11 MW
--	fans	10 MW

EXHIBIT 2–3
BULGARIA
SURVEY OF LARGEST ELECTRICAL CONSUMERS
DECEMBER 1992 BY ET "DIMITAR BAEV – DBC"

PART 3 – EQUIPMENT INSTALLED FOR ELECTRICITY GENERATION AND USE

IS THERE AN ELECTRIC GENERATOR AT THIS FACILITY?	
Yes	No
11%	88%

IF SO, DOES THE GENERATOR OPERATE REGULARLY?	
Yes	No
67%	33%

(FOR THOSE WHO HAVE A GENERATOR) IS THE PRICE PAID BY NEK FOR PURCHASED POWER TOO LOW?	
Yes	No
50%	50%

IS THERE A POSSIBILITY OF INCREASING THE OUTPUT OF YOUR EXISTING GENERATOR?	
Yes	No
33%	67%

IS THERE A SIGNIFICANT REQUIREMENT FOR STEAM OR HOT WATER AT YOUR FACILITY?	
Yes	No
71%	14%

IF YOU DO NOT HAVE A GENERATOR, IS IT POSSIBLE TO INSTALL ONE?	
Yes	No
2%	73%

WHAT ARE THE PRIMARY CONSUMERS OF ELECTRIC ENERGY IN YOUR ENTERPRISE?	Mentioned by:
Motors driving pumps, fans, compressors	77%
Lighting	61%
Electric heating, furnaces, boilers	52%
Welding	34%
Machine tools, metal working	25%
Electrochemical processes	14%
Refrigeration	11%
Other	7%

EXHIBIT 2–3
BULGARIA
SURVEY OF LARGEST ELECTRICAL CONSUMERS
DECEMBER 1992 BY ET "DIMITAR BAEV – DBC"

PART 3 – EQUIPMENT INSTALLED FOR ELECTRICITY GENERATION AND USE

WHAT TYPES OF LIGHTS ARE USED AT YOUR ENTERPRISE?	Mentioned by:
Fluorescent	89%
Incandescent	86%
Mercury vapor	75%
Sodium vapor	45%
Metal halide	27%
Compact fluorescent	14%
Other	0%

2.4.4 Energy conservation experience, opportunities, and attitudes

Exhibit 2-4 shows the results of part 4 of the survey, which concerned energy conservation. Again, the exhibit shows each survey item and a summary of the responses, by percentage. The percentages do not add up to 100% in those cases in which one or more respondents did not answer an item.

As shown in Exhibit 2-4:

- Some 13% of plants could curtail usage during peak periods a significant amount, and another 50% could reduce slightly;
- Some 77% are interested in pursuing energy conservation opportunities in their plant;
- 69% of the respondents are aware of ideas to improve energy efficiency, the measures could be grouped in the following way:
  - -- expedient technological changes and improvements (65% of respondents);
  - -- improvements in lighting systems and controls (20%);
  - -- correct operations of production processes, such as loading of equipment and coordination of energy consumers (20%);
  - -- measures for improvement of cos Φ (power factor) (9%);
- The reasons why these improvements have not yet been implemented are:
  - -- lack or scarcity of funds, finances (53% of respondents);
  - -- production process limitations, such as continuous operations (25%);
  - -- lack of incentives, existing energy prices (9%);
  - -- lack of suitable organization (6%);
  - -- lack of suitable projects (6%);
- About half the plants are willing to invest in energy efficiency projects, including borrowing from a bank if necessary;
- Energy audits have been conducted in 50% of the enterprises:
  - -- 58% of audits were conducted by external organizations (institutes and design organizations in energetics and automation),
  - -- 27% were conducted by specialists of the enterprises themselves,
  - -- 15% were joint studies by external organizations and specialists from the enterprise.

- Of the plants that had energy audits, 6% were completely satisfied with the results, 62% found the audits to be partially satisfactory, and 28% found the audit to be useless;

- 70% of the plants would be willing to participate in an energy audit program financed by COE or NEK, and 14% refuse;

- 42% of the plants would be willing to hire an energy auditor (and about one-quarter of these had already done so);

- Only 14% of the plants were aware of any energy efficiency activities in Bulgaria by Western experts.

EXHIBIT 2–4
BULGARIA
SURVEY OF LARGEST ELECTRICAL CONSUMERS
DECEMBER 1992 BY ET "DIMITAR BAEV – DBC"

PART 4 – ENERGY CONSERVATION EXPERIENCE, OPPORTUNITIES AND ATTITUDES

COULD THE ENTERPRISE CURTAIL ALL OR PART OF ITS ELECTRICAL USE DURING PEAK PERIODS?

Yes, significant amount	Yes, a little	None at all
13%	50%	34%

COULD THE ENTERPRISE SWITCH SOME OF ITS ELECTRICAL USAGE TO FUELS?

Yes, significant amount	Yes, a little	None at all
13%	20%	68%

DO YOU KNOW OR EXPECT THAT THERE ARE OTHER ENERGY EFFICIENCY MEASURES APPLICABLE TO YOUR FACILITY?

Yes, significant amount	Yes, a little	None at all
14%	55%	29%

WOULD YOU BE INTERESTED IN IMPLEMENTING ENERGY EFFICIENCY MEASURES AT YOUR FACILITY

Yes, very interested	Yes, somewhat interested	No
50%	27%	9%

WOULD YOU MAKE THE EXPENDITURE REQUIRED FOR ENERGY SAVING PROJECTS?

Yes	49%
No, we have no money available	34%
No, we have other priorities for our money	9%

WOULD YOU BORROW MONEY FROM A BANK TO INVEST IN AN ENERGY EFFICIENCY PROJECT?

Yes, we have already done this	9%
Yes, but we need help to arrange credit	23%
Yes, but we don't know of any appropriate investment projects	20%
No, we have other priorities for investment	40%

WOULD YOU BE INTERESTED IN LEARNING MORE ABOUT WAYS TO REDUCE ENERGY COSTS?

Yes, very interested	Yes, somewhat	No, energy is low priority	No, we already know how
57%	29%	3%	6%

HAS AN ENERGY AUDIT BEEN CONDUCTED AT YOUR ENTERPRISE?

Yes	No
50%	46%

EXHIBIT 2–4
BULGARIA
SURVEY OF LARGEST ELECTRICAL CONSUMERS
DECEMBER 1992 BY ET "DIMITAR BAEV – DBC"

PART 4 – ENERGY CONSERVATION EXPERIENCE, OPPORTUNITIES AND ATTITUDES

IF YOUR PLANT HAS RECIEVED AN ENERGY AUDIT, HOW SATISFACTORY WERE THE RESULTS?	
Yes, we had energy audit and are absolutely satisfied	3%
Yes, we had energy audit and are partially satisfied	31%
Yes, we had energy audits, and it turned out to be useless	14%
No, we have not had an energy audit	46%

WOULD YOU BE INTERESTED AN ENERGY AUDIT PAID FOR BY COE/NEK?		
Yes	No	Maybe
70%	14%	14%

WOULD YOUR FIRM BE WILLING TO PAY FOR ENERGY AUDIT BY BULGARIAN EXPERTS?	
Yes, in fact we already hired someone	11%
Yes, we would pay a market price	31%
No, only if we can get it at no cost	31%
No, not interested in an energy audit	17%

ARE YOU AWARE OF ANY ENERGY EFFICIENCY PROGRAMS CARRIED OUT IN BULGARIA BY FOREIGN EXPERTS?	
Yes	No
14%	80%

DID YOU HEAR ABOUT THE 1991 INDUSTRIAL ENERGY EFFICIENCY PROGRAM IN BULGARIA SPONSORED BY USAID?	
Yes	No
3%	89%

3. BULGARIA ELECTRICITY DEMAND FORECAST

This Section (1) briefly reviews several of the existing forecasts of electricity use in Bulgaria, (2) explains the scenarios that provide the structure of the demand forecasts, (3) describes the underlying rationale for the electricity forecasts for the several sectors of the Bulgarian economy, and (4) describes the results of the electricity demand forecasts for each scenario.

3.1 REVIEW OF PREVIOUS FORECASTS OF ELECTRICITY DEMAND

Several forecasts of electricity demand in Bulgaria have been completed over the past several years. Prior forecasts differ because of differences in scenarios, differences in forecasting techniques, and differences in data. However, the more recent forecasts that build on the data obtained after the initiation of Bulgaria's transition to a market economy will more accurately capture the Bulgarian economy's energy response to this transition and the probable future of electricity demand.

The forecasts are summarized graphically in Exhibit 3-1, and described briefly below.

3.1.1 World Bank forecast by Prof. Gordon Hughes in 1991

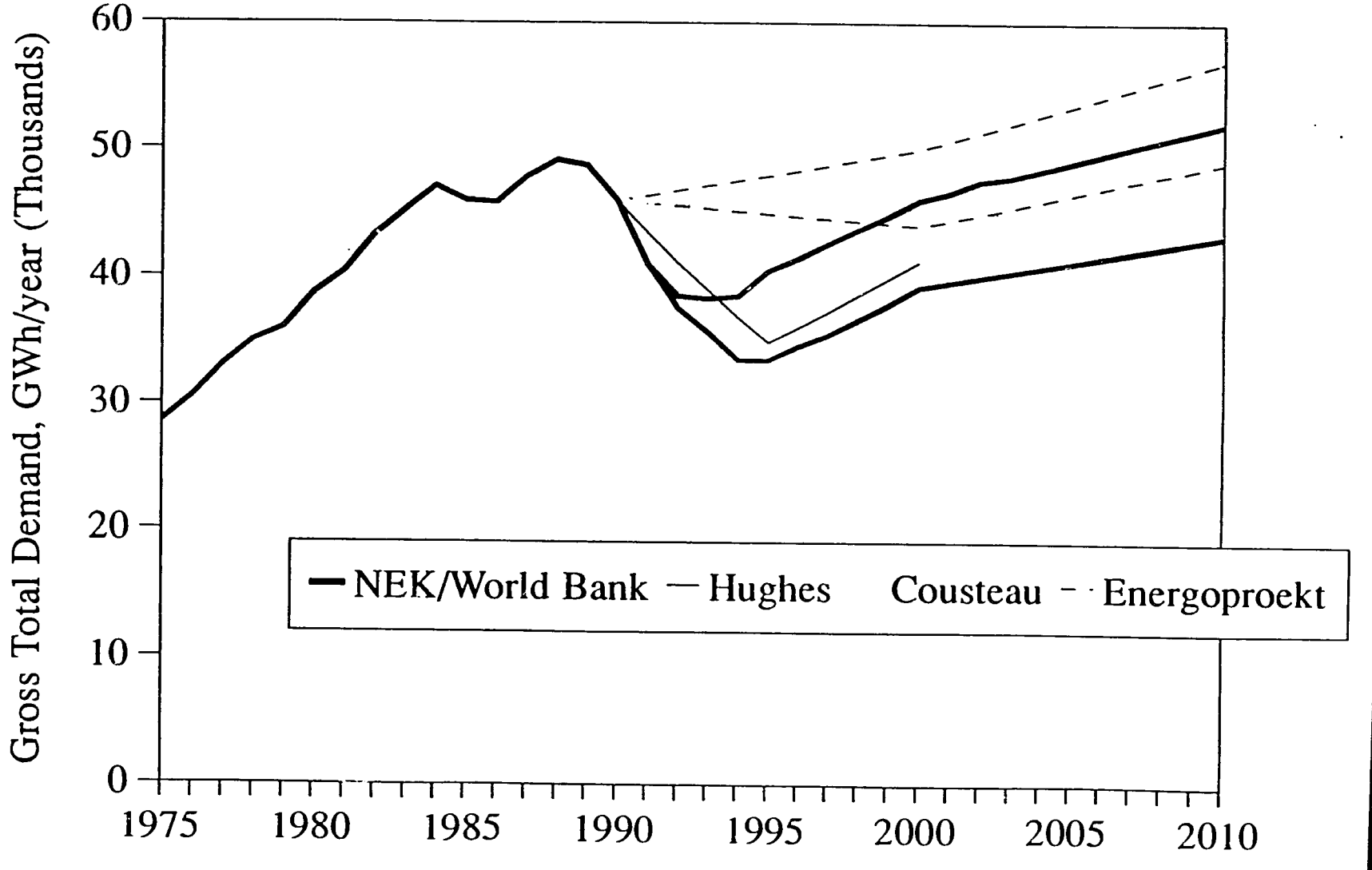
Professor Gordon Hughes performed a forecast in 1991, based on a pooled regression model. He obtained the coefficients for the model from previous analyses of centrally planned economies and analyses of vaguely similar economies in Europe. His forecasts show severe declines in aggregate electricity demand over several time periods as follows:

1989 to 1992	-29%
1989 to 1995	-44%
1989 to 2000	-47%

Exhibit 3-1

Bulgaria - Total Electricity Demand

Comparison of Previous Forecasts



Prof. Hughes further uses an energy industry input-output model to look at alternative policy scenarios, where the main policy response is that to electricity price changes. Under this long run interindustry approach, he estimates the following changes to electricity demand:

	1989 to 1995	1989 to 2000
Main Projection	-32%	-15%
Low Response	-27%	-16%
High Response	-32%	-14%

The response represents changes in electricity demand due to large changes in the price of electricity, deemed necessary to reach appropriate prices for operating a profitable utility.

3.1.2 Forecast by NEK, with guidance from the World Bank, in 1992

For a power system study of the Bulgarian power system at the request of the Group of 7, the World Bank requested a set of demand forecasts from NEK, then worked with NEK in November 1992 to make slight adjustments.

In this forecast, there are three scenarios: maximum, medium, and minimum. The maximum scenarios assumes the most rapid economic growth and the least adjustment by industry to the anticipated higher prices of electricity. The minimum scenario assumes lower economic growth and more adjustment by industry. It also assumes that 450,000 households convert from electricity heating to gas heating after the year 2000. The medium scenario assumes an economic growth between the other two and assumes no major conversions of households to gas heating.

In the medium scenario, electricity demand increases to 52,000 GWh in 2010, and to 56,000 GWh in the maximum scenario. In the minimum scenario, electricity demand increases to 43,200 GWh in 2010. The annual rates of growth in the electricity demand are quite different among these scenarios as can be seen below:

	1993 to 2000	**2000 to 2010**
Medium	2.25%	1.23%
Maximum	3.69%	1.22%
Minimum	0.60%	0.98%

The electricity demand in 2010 for the maximum scenario is approximately 30% larger than that of the minimum scenario.

3.1.3 Energoproekt Forecasts

Energoproekt has furnished several forecasts of electricity demand in the Bulgarian economy. One forecast was done for the United Nations Economic Commission for Europe (ECE) in 1990. This forecast had Bulgarian GDP increasing at about 1.94% per year from 1990 to 2000, with electricity demand increasing from 39,000 GWH to 50,000 GWH, an increase of about 2.5% per year.

In 1991, Energoproekt published a forecast with two scenarios, a high scenario and a low scenario. Both scenarios were based on a GDP growth rate of approximately 2% per year to 2010 (1.94% from 1990 to 2000 and 2.1% from 2000 to 2010). The high forecast shows an increase in electricity demand to 50,000 GWh in 2000 and 57,000 GWh in 2010. This represents an annual rate of increase of 2.5% from 1990 to 2000, and an increase of 1.3% from 2000 to 2010. The low scenario incorporates some energy efficiency into the forecast and forecasts a growth in electricity demand to the year 2000 of 44,000 GWh (an increase of 1.2% per year) and an electricity demand of 49,000 GWh (an increase of 1.1% per year) in the year 2000.

3.1.4 Forecast by Equipe Cousteau for the EBRD in 1992

In 1992, Equipe Cousteau prepared a study of the Bulgarian energy future for the European Bank for Reconstruction and Development (EBRD). This study, in collaboration with International Consulting on Energy, was called "Energy in the Danubian Countries, Current Situation, Outlook, and Energy Policy Proposals." The study used the methodology that Energoproekt has used for analyzing the Bulgarian economy, but expanded the methodology to analyze changes in industry structure and improvements in energy efficiency over time. This study assumed that GDP would grow at 2% per year until 2000 and then at 3% per year from 2000 to 2010. Using these assumptions and a decrease in final energy intensity from 0.93 in 1989 to 0.7 in 2000 and 0.5 in 2010, electricity demand decreases from 39,000 GWh in 1989 to 36,500 GWh in 2000 and 35,000 GWh in 2010. This represents a decrease of about 0.67% per year to 2000 and 0.42% per year from 2000 to 2010.

3.2 SCENARIOS SELECTED FOR FORECASTING ELECTRICITY DEMAND

For the purposes of this report, three scenarios were developed. The scenario assumptions are summarized briefly in the table below, in terms of the economic growth, electricity efficiency, and other factors important to electricity demand:

ELECTRICITY DEMAND SCENARIOS

Variables	Moderate	Low	High
Economic Growth	low	low	high
Inflation	high	high	med
Electricity Prices	market	market	market
Industry DSM	low	med	high
Household DSM	low	med	high

3.2.1 Moderate Scenario: low economic growth - high energy efficiency

This base case scenario reflects a continued difficult economic environment in Bulgaria with low exports, a continued retrenching of industry, high unemployment, high inflation, and high interest rates. Electricity use in industry is low because of successful conservation and increased efficiency programs and because of the reduction in industry output.

Under these assumptions, GDP will decrease by 9% in 1993, 4% in 1994, 1% in 1995 and will level off in 1996. GDP will increase by 1% in 1997 and gradually improve to 3% by the year 2000. Inflation will decrease in 1993 to 50%, to 40% in 1994, and 20% in 1995, with an approximate rate of 10 to 15 percent from 1995 to 2000.

Electricity prices to households are set to market levels by 1996. Government is successful in implementing taxes and incentives for product switching away from products with high energy consumptions. Industries with potential markets and/or a high probability of success will receive the investment necessary for restructuring and installation of technologically advanced and efficient equipment.

3.2.2 Low Scenario: low economic growth - moderate energy efficiency

This scenario reflects a continued difficult economic environment in Bulgaria with low exports, a continued retrenching of industry, high unemployment, high inflation, and high interest rates. Electricity use in industry is somewhat higher than Scenario 1 because the conservation and increased efficiency programs are only partially successful, but contrariwise electricity use is down because industry output is reduced in electricity intensive industries.

In this case, GDP will decrease by 9% in 1993, 4% in 1994, 1% in 1995 and will stop decreasing at 0% growth in 1996. GDP will increase by 1% in 1997 and gradually improve to 2.5% by the year 2000. Inflation will decrease in 1993 to 50%, to 40% in 1994, and 20% in 1995, with an approximate rate of 10 to 15 percent from 1995 to 2000.

Electricity prices to households are set to market levels by 1996. Government is moderately successful in implementing taxes and incentives for product switching away from products with high energy consumptions. Industries with potential markets and/or a high probability of success receive additional investment, but restructuring is slow and installation of technologically advanced and efficient equipment does not occur as rapidly as anticipated. Some marginal and energy intensive firms are kept in existence keeping energy use higher than desired.

3.2.3 High Scenario: high economic growth - moderately high energy efficiency

This scenario reflects a turnaround in the economic environment in Bulgaria with high economic growth in the latter part of the next decade with an increased level of exports, a successful reallocation of resources to growth industries, a restructuring of industry and a growing private sector reducing unemployment, a continued reduction in the inflation rate, and continued reduction in interest rates. Electricity use in industry is somewhat higher than Scenario 1 because the conservation and increased efficiency programs are only partially successful, but contrariwise electricity use is down because industry output is reduced in electricity intensive industries.

In the high case, GDP will decrease by 2% in 1993, will have 0% growth in 1994, and will increase at 1% in 1995. GDP will increase by 1.5% in 1996 and gradually improve to 4.5% by the year 2000. Inflation will decrease in 1993 to 45%, to 35% in 1994, and 20% in 1995, with an approximate rate of 10 to 15 percent from 1995 to 2000.

Electricity prices to households are set to market levels by 1996. Government is moderately successful in implementing taxes and incentives for product switching away from products with high energy consumptions and is also successful in its DSM programs in the household and buildings sector. Industries with potential markets and/or a high probability of success

receive additional investment, but restructuring is slow and installation of technologically advanced and efficient equipment does not occur as rapidly as anticipated. Some marginal and energy intensive firms are kept in existence keeping energy use higher than desired.

3.3 DEMAND FORECASTING TECHNIQUES

The forecasts were divided into three major parts: household, industry, and the commercial/institutions sectors. The reason for this categorization lies in the way in which the Bulgarian data is collected as well as the nature of the changes that the Bulgarian economy and infrastructure are undergoing.

3.3.1 Household Sector

As noted in Chapter 1, household energy consumption is a function of household income, electricity prices, and technical factors. The amount of income that a family has will affect the number of appliances, the size of the structure, and general concerns about electricity use, given the price structure for electricity. The price of electricity will also affect the usage because higher priced electricity, given the proportion of the budget, will reduce the amount of income available for other, perhaps discretionary, items. The number of people and buildings clearly has a direct relationship on the amount of electricity used.

In the household sector, people use electricity as one of the basic necessities of life: for heat, cooking, lighting, etc. The amount of electricity used will depend on the configuration of the heating system, the number of appliances, the age of the appliances, the amount of lighting, and the general patterns of electricity use.

Electricity consumption is first a function of the number and size of households primarily and then a function of real income and the real price of electricity. However, considering that population is stable in Bulgaria, the analysis can be simplified.

We first developed an econometric equation based on income and price elasticities. The estimation used elasticities of income and price that are slightly higher than one would expect for a centralized economy and lower than that of a free market economy. The price elasticity was high because the real price of electricity in Bulgaria generally declined for the last 12 years, with only variation from the long term trend in 1990 and 1991. The partial elasticities are:

Elasticity of real income	0.603
Elasticity of real electricity price	-0.381

However, the analysis revealed that the large price increases expected in the first few years caused the forecast to drop below what we judged to be bare minimum for heating, cooking, and light. Therefore, we adjusted the results to account for these technical factors.

3.3.2 Industrial and Other Sectors

As described in Chapter 2, a survey of the largest electricity customers was conducted, and consumption data for large customers and by industrial sector was obtained from NEK. These data served as the basis for a disaggregated approach, developing estimates of prospects for each of the large customers, and for each sector.

We identified the electricity use patterns in the separate industries and developed forecasts of electricity use at this disaggregate industry level. We also identified those industries with more mature domestic markets and international markets that are most likely to succeed. In addition, estimates were made of the likely changes in electricity intensity in each industry in the future, as Bulgaria develops in the direction of the intensities in Western Europe industries. The speed of the changes will depend on the growth of domestic and international markets and the focus of the government programs.

The survey was used, in part, to assess assumptions about the industrial sector for 1992 and 1993. In general, the survey corroborated our assumptions and the trends that had been observed over 1991 and 1992. Every industry except timber and building materials (with no positive indicators) had at least one company that was doing better in 1992 than in 1991, however, the majority of the firms were doing worse. Although the majority of the firms are optimistic about the future (which was to be expected), it appears from the data provided by the companies that only the engineering industry and the textile industry expect to have firms that will do substantially better during 1993. Capacity utilization dropped in 1992 and appears to be dropping further, although not as drastically, in 1993.

We used the survey results to forecast demand on an individual basis for 1993 and beyond. In addition, the survey shed light on the speed of privatization and general restructuring of industry. The privatization process is perceived to be very slow and the investment that accompanies this privatization and the refurbishment of the capital stock will take longer than anticipated. As a result, the industrial outlook is much more pessimistic than that of the Bulgarian policy makers and other analyses. The firms in some industries expect that the next year will be relatively tough for most firms in those industries. These include iron and steel, non-ferrous metals, chemicals, engineering, glass, and electrical equipment. On the other hand, the engineering industry has firms that expect to do very well as well as those firms that expect to retrench considerably.

The following industries were forecast as higher than average growth sectors:

- electrical equipment and electronics
- glass and ceramics
- agriculture
- transportation and communication

The following industries were forecast as relatively average growth sectors:

- non-ferrous metals
- engineered metal products
- textiles
- food and beverage
- construction
- public sector buildings

The following industries were forecast as lower than average growth sectors:

- iron & steel (ferrous metals)
- chemicals
- building materials
- timber
- pulp & paper

3.3.3 Peak Power Demand

The peak demand (maximum annual recorded level for one hour during the year) is a function of installed equipment, the operation of that equipment, and weather conditions.

Over the past few years, peak demand has declined less than energy consumption. This "decoupling" is expected to continue.

Because of the strong influence of weather conditions, peak demand in the household sector is not expected to reduce much unless electric heating is replaced. In the industrial and other sectors, peak demand can only be reduced by further factory shutdowns, which the survey does not seem to support.

Future changes in peak demand will depend mainly on the possible recovery of equipment which has been shut down, or installation of new electrical equipment over time. Secondary effects will result from the future development of prices during peak periods, and the possible installation of demand control equipment. For the purposes of this analysis, these effects have been simulated by tracking the rate of change of GDP.

3.3.4 Forecasting losses and generation requirements

The demand forecasts are forecasts first of energy sales. The sales forecasts were then increased (to achieve "total demand") by adding estimated losses and station use of electricity. Station use was held constant at 11.1% of gross generation. Losses were brought back to a historical normal level of 11.5% (of energy for distribution) over a five year period. Exports and imports were ignored, and power purchases were held constant.

3.4 DEMAND FORECAST RESULTS

The results and detailed assumptions on a year-to-year basis are shown in a series of exhibits.

3.4.1 Expected Case - Moderate Scenario

The expected case is shown in Exhibit 3-2. The first page is a summary, and the subsequent three pages show the build-up of industrial and other sales.

- demand for electricity in the household sector continues to decline, reaching a minimum of 8,400 GWh in 1995, then climbs, reaching 11,000 GWh in 2010.
- in the industrial sector, demand drops slightly, with a minimum of 13,300 GWh in 1994-96, and then begins a gradual climb to 17,000 GWh in 2010.
- total electricity sales reach a minimum of 28,000 GWh in 1994-96 and then rise gradually to its 1988 level of 35,600 GWh around year 2008.

- peak demand reaches a minimum of 6,500 MW in 1994-95, then increases to 9,600 MW by 2010. The 1989 peak of 8,332 MW is reached again in year 2005.

3.4.2 Low Demand Scenario

The low demand case is shown in Exhibit 3-3. The first page is a summary, and the subsequent three pages show the build-up of industrial and other sales.

- demand for electricity in the household sector continues to decline, reaching a minimum of 8,000 GWh in 1995, then climbs, reaching 10,000 GWh in 2010.

- in the industrial sector, demand continues to drop, with a minimum of 12,500 GWh in 1996-97, and then begins a gradual climb to 15,000 GWh in 2010.

- total electricity sales reach a minimum of 26,600 GWh in 1995-96 and then rise gradually to 32,000 GWh in year 2010, but never reach the 1988 level of 35,600 GWh.

- peak demand reaches a minimum of 6,100 MW in 1994-97, then increases to 8,300 MW by 2010, the same as the historical maximum of 8,332 recorded in 1989.

Exhibit 3-2
BULGARIA
ELECTRICITY DEMAND FORECAST
EXPECTED CASE – MODERATE SCENARIO

ASSUMPTIONS	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
GDP Growth	-5.0%	-2.0%	0.0%	1.0%	1.5%	2.0%	2.5%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Real Electricity Price Changes																		
Households	75.0%	50.0%	25.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Industry	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Population Growth	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Changes in Industrial Electricity Intensity																		
Growth Sectors	-4.0%	0.0%	5.0%	8.5%	11.5%	17.0%	22.5%	18.0%	18.0%	13.0%	13.0%	13.0%	10.5%	10.5%	10.5%	10.5%	8.0%	8.0%
Constant Sectors	-6.0%	-3.0%	0.0%	1.0%	1.5%	3.0%	3.5%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Declining Sectors	-9.0%	-6.0%	-4.0%	-3.0%	0.5%	1.0%	2.5%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
FORECAST OF ELECTRICITY SALES, GWh/year																		
Household Sector	8,990	8,548	8,398	8,465	8,559	8,681	8,830	9,008	9,190	9,376	9,565	9,759	9,956	10,157	10,362	10,572	10,785	11,003
Industry Sector	13,484	13,296	13,267	13,303	13,417	13,621	13,898	14,186	14,485	14,762	15,047	15,339	15,620	15,907	16,202	16,502	16,788	17,079
Other Sectors	6,050	6,090	6,182	6,301	6,411	6,480	6,564	6,662	6,762	6,846	6,931	7,017	7,104	7,192	7,282	7,372	7,464	7,557
Total Sales	**28,525**	**27,934**	**27,847**	**28,070**	**28,387**	**28,782**	**29,291**	**29,856**	**30,437**	**30,984**	**31,543**	**32,114**	**32,680**	**33,257**	**33,846**	**34,447**	**35,037**	**35,639**
FORECAST OF GENERATION REQUIREMENTS, GWh/year																		
Distribution Losses	4,119	3,887	3,725	3,603	3,489	3,534	3,592	3,656	3,721	3,782	3,844	3,908	3,970	4,034	4,099	4,165	4,230	4,295
Losses (pct of for distribution)	13.5%	13.0%	12.5%	12.0%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%
For Distribution	30,509	29,897	29,798	30,023	30,341	30,732	31,238	31,792	32,360	32,889	33,429	33,981	34,524	35,077	35,642	36,218	36,780	37,352
Power Purchases from Factories & Others	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
Imports	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exports	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factory Self-Generation	3,024	2,975	2,975	2,999	3,035	3,084	3,145	3,221	3,298	3,377	3,458	3,541	3,626	3,713	3,803	3,894	3,987	4,083
Power Plant Auxiliaries	4,058	3,975	3,961	3,992	4,035	4,089	4,157	4,233	4,310	4,383	4,456	4,531	4,606	4,681	4,758	4,837	4,913	4,991
Auxiliaries (pct of gross generation)	11.1%	11.1%	11.1%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.1%	11.1%	11.1%	11.1%
Gross Total Demand	**36,701**	**35,795**	**35,533**	**35,664**	**35,912**	**36,405**	**37,041**	**37,745**	**38,469**	**39,149**	**39,843**	**40,554**	**41,256**	**41,972**	**42,703**	**43,448**	**44,180**	**44,926**
Peak Demand (MW)	6,650	6,517	6,517	6,582	6,681	6,815	6,985	7,194	7,410	7,633	7,862	8,097	8,340	8,591	8,848	9,114	9,387	9,669

MOD SUM WK1

Exhibit 3–2 (continued)
BULGARIA
ELECTRICITY DEMAND FORECAST
EXPECTED CASE – MODERATE DEMAND SCENARIO

	FORECAST OF INDUSTRIAL SALES, GWh/year																	
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
TOTAL INDUSTRIAL SALES	13,484	13,296	13,267	13,303	13,417	13,621	13,898	14,186	14,485	14,762	15,047	15,339	15,620	15,907	16,202	16,502	16,788	17,079
Ferrous Metals	2,146	2,120	2,120	2,129	2,141	2,167	2,197	2,233	2,268	2,305	2,341	2,379	2,417	2,456	2,495	2,535	2,575	2,617
Promet (S)	44	44	44	44	44	45	45	46	47	47	48	49	50	50	51	52	53	54
Kremikovtsi (S)	840	830	830	833	838	848	860	874	888	902	917	931	946	961	977	992	1,008	1,024
Stomana	475	469	469	471	474	480	486	494	502	510	518	527	535	543	552	561	570	579
Other	787	777	777	780	785	794	806	818	832	845	858	872	886	900	915	929	944	959
Non–ferrous Metals	1,512	1,494	1,494	1,500	1,509	1,527	1,549	1,573	1,598	1,624	1,650	1,676	1,703	1,731	1,758	1,786	1,815	1,844
Medril Mihi	53	52	52	53	53	53	54	55	56	57	58	59	60	61	62	63	64	65
Chiprovech	21	21	21	21	21	21	22	22	22	23	23	23	24	24	25	25	25	26
Polimet	39	38	38	39	39	39	40	41	41	42	42	43	44	45	45	46	47	47
MDP "Elatsite"	17	17	17	17	17	17	17	17	18	18	18	19	19	19	20	20	20	20
GORYBSO–AD IVru	26	26	26	26	26	26	26	27	27	28	28	29	29	30	30	31	31	32
OTSK–OOD	114	113	113	113	114	115	117	119	121	123	124	126	128	131	133	135	137	139
Olovo i Tsink	22	21	21	22	22	22	22	23	23	23	24	24	24	25	25	26	26	27
OP "Elatsite"	391	386	386	387	390	394	400	406	413	419	426	433	440	447	454	461	469	476
Redki Metali	17	17	17	17	17	17	18	18	18	18	19	19	19	20	20	20	21	21
Medodobiven K. (S)	260	257	257	258	259	263	266	271	275	279	284	288	293	298	302	307	312	317
D. Blagoev (S)	200	198	198	199	200	202	205	208	212	215	219	222	226	229	233	237	240	244
Alumina	33	33	33	33	33	34	34	35	35	36	37	37	38	38	39	40	40	41
OTSM (S)	40	39	39	39	39	40	41	41	42	43	43	44	45	45	46	47	48	48
Other	280	276	276	277	279	282	286	291	295	300	305	310	315	320	325	330	336	341
Chemicals	2,664	2,600	2,559	2,528	2,533	2,543	2,569	2,599	2,631	2,662	2,694	2,727	2,759	2,792	2,826	2,860	2,894	2,929
Kaltsit (S)	55	54	53	52	52	53	53	54	54	55	56	56	57	58	58	59	60	60
Neftohim (S)	116	113	111	110	110	110	111	113	114	115	117	118	120	121	123	124	126	127
Agropolihim	118	116	114	112	113	113	114	116	117	118	120	121	123	124	126	127	129	130
Polimeri	110	107	105	104	104	105	106	107	108	110	111	112	114	115	116	118	119	121
TK "Sodi"–star	36	35	35	34	35	35	35	35	36	36	37	37	38	38	38	39	39	40
F "Neohim"	169	165	162	160	161	161	163	165	167	169	171	173	175	177	179	182	184	186
Agrabiohim	560	547	538	532	533	535	540	547	553	560	567	573	580	587	594	601	609	616
HIMKO	438	428	421	416	417	418	422	428	433	438	443	448	454	459	465	470	476	482
Yambolen	52	51	50	49	49	49	50	51	51	52	52	53	54	54	55	56	56	57
Plasthin	21	20	20	20	20	20	20	20	20	21	21	21	21	22	22	22	22	23
Lateks (S)	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8
Geosoe	22	21	21	21	21	21	21	21	22	22	22	23	23	23	23	24	24	24
Gavril Genov (S)	14	13	13	13	13	13	13	13	14	14	14	14	14	14	15	15	15	15
P. Karaminchev	12	12	12	12	12	12	12	12	12	12	13	13	13	13	13	13	14	14
Smyadovo–OOD	5	5	5	5	5	5	5	5	5	5	5	5	5	6	6	6	6	6
Odesos (S)	13	13	13	12	12	13	13	13	13	13	13	13	14	14	14	14	14	14
Antibiotik (S)	109	106	105	104	104	104	105	106	108	109	110	112	113	114	116	117	119	120
Other	807	787	775	765	767	770	778	787	796	806	816	825	835	845	855	865	876	887

Exhibit 3-2 (continued)
BULGARIA
ELECTRICITY DEMAND FORECAST
EXPECTED CASE - MODERATE DEMAND SCENARIO

	FORECAST OF INDUSTRIAL SALES, GWh/year																	
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Engineering - metallic products	1,832	1,810	1,810	1,817	1,828	1,850	1,876	1,906	1,936	1,967	1,999	2,031	2,063	2,096	2,130	2,164	2,199	2,234
Energorem. 3-D (S)	17	17	17	17	17	17	17	18	18	18	18	19	19	19	20	20	20	21
K-t za Traktori	12	12	12	12	12	12	12	12	13	13	13	13	13	14	14	14	14	15
Osam	10	10	10	10	10	10	10	11	11	11	11	11	11	12	12	12	12	12
Akumikar	17	17	17	17	17	17	17	18	18	18	19	19	19	19	20	20	20	21
Fitingi	24	23	23	23	24	24	24	25	25	25	26	26	27	27	27	28	28	29
LEKO-KO	33	33	33	33	33	34	34	35	35	36	36	37	38	38	39	39	40	41
SLZ (S)	21	20	20	20	21	21	21	21	22	22	23	23	23	24	24	24	25	25
ZTM-OOD (S)	24	23	23	23	24	24	24	25	25	25	26	26	27	27	27	28	28	29
Korabostr. -OOD	11	11	11	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13
Madara	21	21	21	21	21	21	21	22	22	23	23	23	24	24	24	25	25	26
G. Dimitrov (S)	14	14	14	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17
TKEP "6 Sept." (S)	17	17	17	17	17	17	17	18	18	18	18	19	19	19	20	20	20	21
ZMM-AD (S)	17	17	17	17	17	18	18	18	18	19	19	19	20	20	20	21	21	21
MK "VMZ"	82	81	81	82	82	83	84	86	87	88	90	91	93	94	96	97	99	100
Progres	13	13	13	13	13	13	13	13	13	14	14	14	14	15	15	15	15	16
Varn. Korabostr. (S)	42	41	41	41	42	42	43	44	44	45	46	46	47	48	49	49	50	51
Veslets 91	50	50	50	50	50	51	52	53	53	54	55	56	57	58	59	60	61	62
KAMET (S)	25	25	25	25	25	25	26	26	27	27	27	28	28	29	29	30	30	31
Rekora (S)	16	16	16	16	16	16	16	16	17	17	17	17	18	18	18	19	19	19
Other	1,366	1,350	1,350	1,355	1,363	1,380	1,399	1,421	1,444	1,467	1,491	1,515	1,539	1,563	1,588	1,614	1,640	1,666
Electrical & Electronics	639	639	652	674	705	753	821	880	944	993	1,044	1,099	1,145	1,193	1,243	1,295	1,337	1,379
B. Kolarov	25	25	26	27	28	30	32	35	37	39	41	43	45	47	49	51	53	54
Eltos	11	11	11	11	12	13	14	15	16	17	18	19	19	20	21	22	23	23
Feromagniti	19	19	20	20	21	23	25	27	28	30	31	33	35	36	37	39	40	42
Svetlina	15	15	15	16	16	18	19	21	22	23	24	26	27	28	29	30	31	32
Elprom-Dinamo	9	9	9	10	10	11	12	13	14	14	15	16	17	17	18	19	19	20
Elprom-ZEM-ad (S)	16	16	16	16	17	18	20	21	23	24	25	27	28	29	30	31	32	33
D S U	17	17	17	17	18	20	21	23	24	26	27	28	30	31	32	34	35	36
Elima	19	19	19	20	21	22	24	26	28	29	31	32	34	35	37	38	39	41
Elkom (S)	12	12	12	12	13	14	15	16	17	18	19	20	21	21	22	23	24	25
Other	497	497	507	525	549	586	639	685	734	772	813	845	891	928	967	1,008	1,040	1,073
Building Materials	981	969	969	973	979	991	1,005	1,021	1,037	1,054	1,070	1,088	1,105	1,123	1,141	1,159	1,177	1,196
Beloiz. Tsiment	53	53	53	53	53	54	55	55	56	57	58	59	60	61	62	63	64	65
Devn. Tsiment	101	99	99	100	100	102	103	105	106	108	110	112	113	115	117	119	121	123
Bulkan	36	35	35	36	36	36	37	37	38	39	39	40	40	41	42	42	43	44
Izida	16	16	16	16	16	16	16	17	17	17	17	18	18	18	19	19	19	20
Pl. Tsiment	59	58	58	58	59	59	60	61	62	63	64	65	66	67	68	70	71	72
Zl. Panega	87	86	86	86	87	88	89	90	92	93	95	96	98	99	101	102	104	106
Han Asparuh (S)	16	16	16	16	16	16	17	17	17	18	18	18	18	19	19	19	20	20
Kaolin (S)	18	18	18	18	18	18	18	19	19	19	20	20	20	21	21	21	22	22
Other	595	588	588	591	594	601	610	619	629	639	650	660	671	681	692	703	715	726
Timber	267	261	257	254	254	255	258	261	264	267	270	274	277	280	283	287	290	294

Exhibit 3-2 (continued)
BULGARIA
ELECTRICITY DEMAND FORECAST
EXPECTED CASE – MODERATE DEMAND SCENARIO

	FORECAST OF INDUSTRIAL SALES, GWh/year																	
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Pulp & paper, wood products	**347**	**338**	**333**	**329**	**330**	**331**	**334**	**338**	**342**	**346**	**350**	**355**	**359**	**363**	**368**	**372**	**376**	**381**
Rulon–Iskar (S)	27	26	26	26	26	26	26	26	27	27	27	28	28	28	29	29	29	30
PHHI	23	23	23	22	22	22	23	23	23	23	24	24	24	25	25	25	25	26
TKTSH	55	53	52	52	52	52	53	53	54	54	55	56	56	57	58	59	59	60
ZMK (S)	38	37	36	36	36	36	37	37	37	38	38	39	39	40	40	41	41	42
Lesil	16	16	16	16	16	16	16	16	16	16	17	17	17	17	17	18	18	18
St. Kirajiev (S)	55	54	53	52	53	53	53	54	55	55	56	57	57	58	59	59	60	61
TKHTS (S)	10	10	10	10	10	10	10	10	10	10	11	11	11	11	11	11	11	11
Other	122	119	117	115	116	116	117	119	120	122	123	125	126	128	129	131	132	134
Glass	**459**	**459**	**468**	**484**	**507**	**541**	**590**	**632**	**678**	**713**	**750**	**789**	**822**	**857**	**893**	**930**	**960**	**991**
Belopal	37	37	38	39	41	44	48	51	55	58	61	64	67	69	72	75	78	80
Kitka	25	25	25	26	27	29	32	34	37	38	40	43	44	46	48	50	52	53
Fayans	26	26	26	27	29	31	33	36	38	40	42	44	46	48	50	52	54	56
Rubin	25	25	25	26	27	29	32	34	36	38	40	42	44	46	48	50	51	53
Drushba	43	43	44	45	47	51	55	59	63	67	70	74	77	80	84	87	90	93
Kvarts	18	18	18	19	20	21	23	25	26	28	29	31	32	33	35	36	37	39
Diamant (S)	21	21	21	22	23	25	27	29	31	33	34	36	38	39	41	43	44	45
Other	265	265	270	279	292	312	340	365	391	411	432	455	474	494	515	536	554	571
Textiles	**559**	**552**	**552**	**554**	**558**	**564**	**572**	**581**	**591**	**600**	**610**	**619**	**629**	**639**	**650**	**660**	**671**	**681**
Manuela	23	22	22	23	23	23	23	24	24	24	25	25	26	26	26	27	27	28
Dobruja	9	9	9	9	9	9	9	9	9	9	10	10	10	10	10	10	11	11
Sliteks	20	20	20	20	20	21	21	21	22	22	22	23	23	23	24	24	24	25
Vratitsa	14	14	14	14	14	14	14	14	15	15	15	15	16	16	16	16	17	17
Other	493	487	487	489	492	498	505	513	521	530	538	547	555	564	573	582	592	601
Food & Beverage	**1,178**	**1,164**	**1,164**	**1,169**	**1,176**	**1,190**	**1,206**	**1,226**	**1,245**	**1,265**	**1,285**	**1,306**	**1,327**	**1,348**	**1,370**	**1,392**	**1,414**	**1,437**
N. Vaptsarov	32	32	32	32	32	32	33	33	34	34	35	36	36	37	37	38	38	39
Tyut. Kombinat (S)	11	11	11	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13
MEZ "Kambana" (S)	76	75	75	75	76	77	78	79	80	82	83	84	86	87	88	90	91	93
SKPPPMYA (S)	10	10	10	10	10	10	10	10	10	11	11	11	11	11	11	12	12	12
Other	1,049	1,037	1,037	1,041	1,047	1,060	1,074	1,092	1,109	1,127	1,145	1,163	1,182	1,201	1,220	1,239	1,259	1,279
Other Industries	**900**	**889**	**889**	**893**	**898**	**909**	**921**	**936**	**951**	**966**	**982**	**997**	**1,013**	**1,030**	**1,046**	**1,063**	**1,080**	**1,097**
Bulex (S)	14	13	13	14	14	14	14	14	14	15	15	15	15	16	16	16	16	17
Chorno More (S)	9	9	9	9	9	9	10	10	10	10	10	10	10	11	11	11	11	11
Construction	**679**	**671**	**671**	**673**	**677**	**686**	**695**	**706**	**718**	**729**	**741**	**753**	**765**	**777**	**789**	**802**	**815**	**828**
Agriculture	**891**	**902**	**920**	**942**	**957**	**964**	**974**	**986**	**998**	**1,010**	**1,022**	**1,034**	**1,046**	**1,059**	**1,072**	**1,085**	**1,098**	**1,111**
Transport & Communications	**1,419**	**1,451**	**1,494**	**1,545**	**1,585**	**1,614**	**1,646**	**1,682**	**1,719**	**1,740**	**1,761**	**1,782**	**1,803**	**1,825**	**1,847**	**1,869**	**1,891**	**1,914**
Public Sector	**3,061**	**3,067**	**3,097**	**3,141**	**3,191**	**3,217**	**3,249**	**3,288**	**3,327**	**3,367**	**3,408**	**3,448**	**3,490**	**3,532**	**3,574**	**3,617**	**3,660**	**3,704**

MOD IND WK1

Exhibit 3–3
BULGARIA
ELECTRICITY DEMAND FORECAST
LOW DEMAND SCENARIO

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
ASSUMPTIONS																		
GDP Growth	−9.0%	−4.0%	−1.0%	0.0%	1.0%	1.5%	2.0%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Real Electricity Price Changes																		
Households	75.0%	50.0%	25.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Industry	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Population Growth	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Changes in Industrial Electricity Intensity																		
Growth Sectors	−9.0%	−3.0%	1.5%	5.0%	8.5%	11.5%	12.0%	12.5%	12.5%	12.5%	12.5%	12.5%	10.0%	10.0%	10.0%	10.0%	7.5%	7.5%
Constant Sectors	−12.0%	−7.0%	−3.0%	−1.0%	1.0%	2.5%	3.0%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Declining Sectors	−17.0%	−11.5%	−8.0%	−5.0%	−4.0%	−3.5%	−0.5%	1.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
FORECAST OF ELECTRICITY SALES, GWh/year																		
Household Sector	8,759	8,221	8,027	8,043	8,108	8,198	8,314	8,457	8,602	8,750	8,900	9,053	9,208	9,366	9,527	9,691	9,857	10,027
Industry Sector	13,186	12,777	12,582	12,510	12,536	12,634	12,789	12,990	13,207	13,430	13,658	13,892	14,116	14,344	14,578	14,816	15,041	15,269
Other Sectors	5,948	5,935	5,996	6,085	6,179	6,234	6,302	6,383	6,466	6,533	6,601	6,670	6,739	6,809	6,880	6,952	7,025	7,098
Total Sales	27,893	26,933	26,605	26,638	26,822	27,065	27,404	27,830	28,275	28,713	29,159	29,614	30,063	30,520	30,985	31,459	31,923	32,394
FORECAST OF GENERATION REQUIREMENTS, GWh/year																		
Distribution Losses	4,038	3,761	3,573	3,435	3,313	3,340	3,378	3,426	3,476	3,525	3,575	3,626	3,676	3,727	3,778	3,831	3,882	3,934
Losses (pct of for distribution)	13.5%	13.0%	12.5%	12.0%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%
For Distribution	29,910	28,930	28,585	28,623	28,805	29,042	29,373	29,788	30,224	30,650	31,085	31,528	31,963	32,405	32,855	33,313	33,759	34,211
Power Purchases from Factories & Others	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
Imports	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exports	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factory Self–Generation	2,923	2,829	2,807	2,807	2,829	2,863	2,909	2,967	3,027	3,087	3,149	3,212	3,276	3,342	3,408	3,477	3,546	3,617
Power Plant Auxiliaries	3,976	3,843	3,796	3,801	3,826	3,858	3,903	3,960	4,019	4,077	4,137	4,197	4,256	4,317	4,378	4,440	4,501	4,563
Auxiliaries (pct of gross generation)	11.1%	11.1%	11.2%	11.2%	11.3%	11.3%	11.3%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%
Gross Total Demand	35,907	34,536	33,974	33,874	33,960	34,263	34,685	35,215	35,770	36,315	36,870	37,437	37,995	38,563	39,142	39,730	40,306	40,891
Peak Demand (MW)	6,370	6,115	6,054	6,054	6,115	6,206	6,330	6,489	6,651	6,817	6,988	7,162	7,341	7,525	7,713	7,906	8,103	8,306

LOW SUM4

Exhibit 3–3 (continued)
BULGARIA
ELECTRICITY DEMAND FORECAST
LOW DEMAND SCENARIO

	FORECAST OF INDUSTRIAL SALES, GWh/year																	
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
TOTAL INDUSTRIAL SALES	13,186	12,777	12,582	12,510	12,536	12,634	12,789	12,990	13,207	13,430	13,658	13,892	14,116	14,344	14,578	14,816	15,041	15,269
Ferrous Metals	2,115	2,056	2,031	2,023	2,031	2,051	2,076	2,105	2,134	2,164	2,195	2,225	2,256	2,288	2,320	2,353	2,385	2,419
Promet (S)	44	43	42	42	42	43	43	44	45	45	46	46	47	48	48	49	50	50
Kremikovtsi (S)	840	817	807	804	807	815	825	836	848	860	872	884	896	909	922	935	948	961
Stomana	463	450	445	443	445	449	455	461	468	474	481	487	494	501	508	515	523	530
Other	767	746	737	734	737	744	753	764	774	785	796	807	819	830	842	854	866	878
Non–ferrous Metals	1,487	1,446	1,428	1,423	1,428	1,443	1,460	1,480	1,501	1,522	1,543	1,565	1,587	1,609	1,632	1,654	1,678	1,701
Medril Mihi	52	50	50	49	50	50	51	51	52	53	54	54	55	56	57	57	58	59
Chiprovech	21	20	20	20	20	20	20	20	21	21	21	22	22	22	23	23	23	24
Polimet	38	37	36	36	36	37	37	38	38	39	39	40	41	41	42	42	43	43
MDP "Elatsite"	16	16	16	16	16	16	16	16	17	17	17	17	17	18	18	18	18	19
GORYBSO–AD IVru	25	24	24	24	24	24	25	25	25	26	26	27	27	27	28	28	28	29
OTSK–OOD	111	108	107	106	107	108	109	111	112	114	115	117	119	120	122	124	126	127
Olovo i Tsink	21	21	20	20	20	21	21	21	21	22	22	22	23	23	23	24	24	24
OP "Elatsite"	381	370	366	364	366	370	374	379	385	390	395	401	407	412	418	424	430	436
Redki Metali	17	16	16	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19
Medodobiven K. (S)	260	253	250	249	250	252	255	259	262	266	270	274	277	281	285	289	293	297
D. Blagoev (S)	200	195	192	192	192	194	197	199	202	205	208	211	214	217	220	223	226	229
Alumina	33	32	31	31	31	32	32	32	33	33	34	34	35	35	36	36	37	37
OTSM (S)	40	38	38	38	38	38	39	39	40	41	41	42	42	43	43	44	45	45
Other	273	265	262	261	262	264	268	271	275	279	283	287	291	295	299	303	308	312
Chemicals	2,586	2,467	2,388	2,341	2,303	2,271	2,256	2,280	2,303	2,326	2,349	2,373	2,396	2,420	2,444	2,469	2,494	2,518
Kaltsit (S)	55	52	51	50	49	48	48	48	49	49	50	50	51	51	52	53	53	54
Neftohim (S)	116	110	107	105	103	101	101	102	103	104	105	106	107	108	109	110	111	113
Agropolihim	114	109	106	104	102	101	100	101	102	103	104	105	106	107	108	109	110	111
Polimeri	106	101	98	96	94	93	93	93	94	95	96	97	98	99	100	101	102	103
TK "Sodi"–star	35	33	32	32	31	31	31	31	31	32	32	32	33	33	33	33	34	34
F "Neohim"	164	156	151	148	146	144	143	144	146	147	149	150	152	153	155	156	158	159
Agrabiohim	542	517	500	490	482	476	475	478	482	487	492	497	502	507	512	517	522	527
HIMKO	424	404	391	383	377	372	371	373	377	381	385	389	393	396	400	404	408	413
Yambolen	50	48	46	45	45	44	44	44	45	45	45	46	46	47	47	48	48	49
Plastbin	20	19	18	18	18	18	17	18	18	18	18	18	18	19	19	19	19	19
Lateks (S)	7	7	6	6	6	6	6	6	6	6	6	6	6	7	7	7	7	7
Geoson	21	20	20	19	19	19	19	19	19	19	19	20	20	20	20	20	21	21
Gavril Genov (S)	14	13	13	12	12	12	12	12	12	12	13	13	13	13	13	13	13	13
P. Karaminchev	12	12	11	11	11	11	11	11	11	11	11	11	11	11	11	12	12	12
Smyadovo–OOD	5	5	5	5	5	4	4	5	5	5	5	5	5	5	5	5	5	5
Odesos (S)	13	13	12	12	12	12	12	12	12	12	12	12	12	12	12	13	13	13
Antibiotik (S)	109	104	101	99	97	96	96	96	97	98	99	100	101	102	103	104	105	106
Other	780	744	720	706	694	685	683	687	694	701	708	715	722	730	737	744	752	759

Exhibit 3 – 3 (continued)
BULGARIA
ELECTRICITY DEMAND FORECAST
LOW DEMAND SCENARIO

	FORECAST OF INDUSTRIAL SALES, GWh/year																	
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Engineering – metallic products	1,791	1,741	1,720	1,713	1,720	1,737	1,758	1,783	1,808	1,833	1,859	1,885	1,911	1,938	1,965	1,992	2,020	2,048
Energorem. 3 – D (S)	17	16	16	16	16	16	17	17	17	17	17	18	18	18	18	19	19	19
K – t za Traktori	12	11	11	11	11	11	11	12	12	12	12	12	12	13	13	13	13	13
Osam	10	10	9	9	9	10	10	10	10	10	10	10	11	11	11	11	11	11
Akumikar	17	16	16	16	16	16	16	17	17	17	17	17	18	18	18	18	19	19
Fitingi	23	22	22	22	22	22	23	23	23	24	24	24	25	25	25	26	26	26
LEKO – KO	33	32	31	31	31	32	32	32	33	33	34	34	35	35	36	36	37	37
SLZ (S)	20	20	19	19	19	30	20	20	20	21	21	21	21	22	22	22	23	23
ZTM – OOD (S)	24	23	23	23	23	23	23	23	24	24	24	25	25	25	26	26	27	27
Korabostr. – OOD	11	10	10	10	10	10	10	11	11	11	11	11	11	12	12	12	12	12
Madara	20	20	20	20	20	20	20	20	21	21	21	22	22	22	22	23	23	23
G. Dimitrov (S)	14	14	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16
TKEP "6 Sept." (S)	17	16	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19
ZMM – AD (S)	17	17	17	17	17	17	17	17	18	18	18	18	19	19	19	19	20	20
MK "VMZ"	80	78	77	77	77	78	79	80	81	82	83	85	86	87	88	89	91	92
Progres	12	12	12	12	12	12	12	12	13	13	13	13	13	13	14	14	14	14
Varn. Korabostr. (S)	42	41	40	40	40	41	41	42	42	43	43	44	45	45	46	47	47	48
Veslets 91	49	48	47	47	47	48	48	49	50	50	51	52	53	53	54	55	56	56
KAMET (S)	25	24	24	24	24	24	25	25	25	26	26	27	27	27	28	28	28	29
Rekora (S)	16	15	15	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18
Other	1,333	1,295	1,280	1,275	1,280	1,293	1,308	1,326	1,345	1,364	1,383	1,402	1,422	1,442	1,462	1,482	1,503	1,524
Electrical & Electronics	627	619	623	636	657	687	720	756	794	834	876	920	956	995	1,034	1,076	1,108	1,141
B. Kolarov	25	24	25	25	26	27	28	30	31	33	34	36	38	39	41	42	44	45
Eltos	11	11	11	11	11	12	12	13	13	14	15	16	16	17	18	18	19	19
Feromagniti	19	19	19	19	20	21	22	23	24	25	26	28	29	30	31	32	33	34
Svetlina	15	14	15	15	15	16	17	18	19	19	20	21	22	23	24	25	26	27
Elprom – Dinamo	9	9	9	9	10	10	10	11	12	12	13	13	14	14	15	16	16	17
Elprom – ZEM – ad (S)	16	15	15	16	16	17	18	19	20	21	22	23	24	25	26	27	27	28
D S U	16	16	16	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Elma	18	18	18	19	19	20	21	22	23	24	26	27	28	29	30	32	33	33
Elkom (S)	12	11	11	12	12	13	13	14	15	15	16	17	18	18	19	20	20	21
Other	487	482	484	494	511	534	560	588	617	648	681	715	743	773	804	836	861	887
Building Materials	958	931	920	916	920	929	940	953	967	980	994	1,008	1,022	1,036	1,051	1,065	1,080	1,095
Beloiz. Tsiment	52	50	50	50	50	50	51	52	52	53	54	55	55	56	57	58	59	59
Devn. Tsiment	98	95	94	94	94	95	96	98	99	100	102	103	105	106	108	109	111	112
Bulkan	35	34	34	34	34	34	34	35	35	36	36	37	37	38	38	39	40	40
Izida	16	15	15	15	15	15	15	16	16	16	16	16	17	17	17	17	18	18
Pl. Tsiment	57	56	55	55	55	56	56	57	58	59	60	60	61	62	63	64	65	66
Zl. Panega	85	82	81	81	81	82	83	84	85	87	88	89	90	92	93	94	95	97
Han Asparuh (S)	16	16	16	16	16	16	16	16	16	17	17	17	17	18	18	18	18	19
Kaolin (S)	18	17	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	21
Other	581	564	558	555	558	563	570	578	586	594	603	611	620	628	637	646	655	664
Timber	258	247	239	234	230	227	226	228	230	232	235	237	239	242	244	247	249	252

Exhibit 3-3 (continued)
BULGARIA
ELECTRICITY DEMAND FORECAST
LOW DEMAND SCENARIO

	FORECAST OF INDUSTRIAL SALES, GWh/year																	
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Pulp & paper, wood products	339	324	313	307	302	298	297	299	302	305	308	311	314	318	321	324	327	331
Rulon-Iskar (S)	27	26	25	24	24	24	24	24	24	24	25	25	25	25	26	26	26	26
PHrll	23	22	21	21	20	20	20	20	20	20	21	21	21	21	21	22	22	22
TKTSH	53	50	49	48	47	46	46	46	47	47	48	48	49	49	50	50	51	51
ZMK (S)	38	36	35	34	34	33	33	33	34	34	34	35	35	35	36	36	37	37
Lesil	16	15	15	14	14	14	14	14	14	14	14	15	15	15	15	15	15	15
St. Kirajiev (S)	55	53	51	50	49	48	48	49	49	50	50	51	51	52	52	53	53	54
TKHTS (S)	10	10	10	9	9	9	9	9	9	9	9	10	10	10	10	10	10	10
Other	118	112	109	106	105	103	103	104	105	106	107	108	109	110	111	112	113	115
Glass	450	445	447	456	472	494	517	543	570	599	629	660	687	714	743	772	796	820
Belopal	36	36	36	37	38	40	42	44	46	49	51	54	56	58	60	63	64	66
Kitka	24	24	24	25	25	27	28	29	31	32	34	36	37	38	40	42	43	44
Fayans	25	25	25	26	27	28	29	31	32	34	35	37	39	40	42	44	45	46
Rubin	24	24	24	24	25	26	28	29	30	32	34	35	37	38	40	41	43	44
Drushba	42	42	42	43	44	46	48	51	53	56	59	62	64	67	69	72	74	77
Kvarts	18	17	17	18	18	19	20	21	22	23	25	26	27	28	29	30	31	32
Diamant (S)	21	21	21	21	22	23	24	25	27	28	29	31	32	33	35	36	37	38
Other	259	256	258	263	272	284	298	313	329	345	362	380	396	411	428	445	458	472
Textiles	545	530	523	521	523	529	535	542	550	558	566	573	582	590	598	606	615	623
Manueda	22	22	21	21	21	21	22	22	22	23	23	23	24	24	24	25	25	25
Dobruja	9	8	8	8	8	8	8	9	9	9	9	9	9	9	9	10	10	10
Sliteks	20	19	19	19	19	19	19	20	20	20	21	21	21	21	22	22	22	23
Vratitsa	13	13	13	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15
Other	481	468	462	460	462	467	472	479	485	492	499	506	513	520	528	535	543	550
Food & Beverage	1,151	1,119	1,106	1,101	1,106	1,117	1,130	1,146	1,162	1,178	1,195	1,212	1,229	1,246	1,263	1,281	1,299	1,317
N. Vaptsarov	31	30	30	30	30	30	31	31	32	32	32	33	33	34	34	35	35	36
Tyut. Kombinat (S)	11	11	11	11	11	11	11	11	11	11	11	12	12	12	12	12	12	13
MEZ "Kambana" (S)	76	74	73	73	73	74	75	76	77	78	79	80	81	82	83	85	86	87
SKPPPMYA (S)	10	10	9	9	9	9	10	10	10	10	10	10	10	11	11	11	11	11
Other	1,023	995	983	979	983	993	1,005	1,019	1,033	1,047	1,062	1,077	1,092	1,107	1,123	1,138	1,154	1,171
Other Industries	878	853	843	839	843	851	861	874	886	898	911	923	936	949	963	976	990	1,004
Bules (S)	14	13	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16
Chemo More (S)	9	9	9	9	9	9	9	9	9	10	10	10	10	10	10	10	11	11
Construction	662	644	636	633	636	642	650	659	668	678	687	697	707	716	726	737	747	757
Agriculture	877	880	895	912	925	931	938	948	957	967	976	986	996	1,006	1,016	1,026	1,036	1,047
Transport & Communications	1,397	1,417	1,454	1,497	1,533	1,558	1,586	1,617	1,650	1,666	1,683	1,700	1,717	1,734	1,751	1,769	1,786	1,804
Public Sector	3,012	2,994	3,012	3,042	3,084	3,103	3,128	3,159	3,191	3,222	3,255	3,287	3,320	3,353	3,387	3,421	3,455	3,489

LOW END WK1

3.4.3 High Demand Scenario

The high demand case is shown in Exhibit 3-4. Again, the first page is a summary, and the subsequent three pages show the build-up of industrial and other sales.

- demand for electricity in the household sector declines slightly, reaching a minimum of 8,700 GWh in 1995, then climbs, reaching 12,800 GWh in 2010.
- in the industrial sector, demand holds firm at 13,600 GWh until 1996, and then begins a gradual climb to 19,500 GWh in 2010.
- total electricity sales reach a minimum of 28,700 GWh in 1994 and then rise gradually to 41,000 GWh in year 2010, but never reach the 1988 level of 35,600 GWh.
- peak demand holds at 6,900 MW until 1996, then increases to 12,300 MW by 2010, passing the historical maximum of 8,332 in year 2002.

Exhibit 3–4
BULGARIA
ELECTRICITY DEMAND FORECAST
HIGH DEMAND SCENARIO

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
ASSUMPTIONS																		
GDP Growth	−2.0%	0.0%	1.0%	1.5%	2.0%	2.8%	3.3%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
Real Electricity Price Changes																		
Households	75.0%	50.0%	25.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Industry	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Population Growth	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Changes in Industrial Electricity Intensity																		
Growth Sectors	0.0%	2.0%	4.0%	6.5%	9.5%	12.8%	18.3%	24.5%	19.5%	14.5%	14.5%	14.5%	12.0%	12.0%	12.0%	12.0%	9.5%	9.5%
Constant Sectors	−3.0%	0.0%	1.0%	1.5%	3.0%	4.8%	6.3%	9.5%	8.5%	7.5%	6.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%
Declining Sectors	−7.0%	−4.0%	−2.0%	−0.5%	1.0%	1.8%	2.8%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
FORECAST OF ELECTRICITY SALES, GWh/year																		
Household Sector	9,164	8,824	8,723	8,820	8,944	9,112	9,310	9,583	9,863	10,153	10,450	10,757	11,072	11,396	11,731	12,074	12,428	12,793
Industry Sector	13,616	13,572	13,601	13,680	13,849	14,112	14,480	15,047	15,572	16,043	16,488	16,902	17,309	17,728	18,158	18,600	19,031	19,472
Other Sectors	6,145	6,325	6,537	6,729	6,918	7,075	7,224	7,388	7,553	7,698	7,843	7,987	8,135	8,285	8,437	8,593	8,751	8,912
Total Sales	28,925	28,721	28,861	29,229	29,711	30,299	31,014	32,018	32,988	33,894	34,781	35,646	36,516	37,409	38,326	39,267	40,210	41,177
FORECAST OF GENERATION REQUIREMENTS, GWh/year																		
Distribution Losses	4,168	3,984	3,847	3,738	3,638	3,705	3,787	3,902	4,012	4,113	4,210	4,305	4,399	4,495	4,594	4,696	4,797	4,900
Losses (pct of for distribution)	13.5%	13.0%	12.5%	12.0%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%
For Distribution	30,877	30,646	30,776	31,149	31,637	32,221	32,933	33,930	34,884	35,761	36,611	37,431	38,250	39,090	39,950	40,832	41,709	42,607
Power Purchases from Factories & Others	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
Imports	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exports	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factory Self–Generation	3,099	3,099	3,124	3,162	3,212	3,283	3,368	3,489	3,615	3,745	3,880	4,020	4,164	4,314	4,470	4,631	4,797	4,970
Power Plant Auxiliaries	4,108	4,077	4,094	4,145	4,212	4,292	4,389	4,525	4,655	4,774	4,890	5,002	5,114	5,228	5,345	5,466	5,585	5,708
Auxiliaries (pct of gross generation)	11.0%	11.1%	11.1%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.1%	11.1%	11.1%	11.1%	11.1%	11.1%	11.0%	11.0%
Gross Total Demand	37,202	36,782	36,803	37,112	37,561	38,296	39,190	40,444	41,654	42,781	43,881	44,952	46,028	47,132	48,265	49,428	50,592	51,785
Peak Demand (MW)	6,860	6,860	6,929	7,033	7,173	7,370	7,610	7,952	8,310	8,684	9,075	9,483	9,910	10,356	10,822	11,309	11,818	12,350

HIGH SUM WK1

Exhibit 3-4 (continued)
BULGARIA
ELECTRICITY DEMAND FORECAST
HIGH DEMAND SCENARIO

FORECAST OF INDUSTRIAL SALES, GWh/year

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
TOTAL INDUSTRIAL SALES	13,616	13,572	13,601	13,680	13,849	14,112	14,480	15,047	15,572	16,043	16,488	16,902	17,309	17,728	18,158	18,600	19,031	19,472
Ferrous Metals	2,161	2,161	2,170	2,183	2,209	2,251	2,307	2,395	2,477	2,551	2,617	2,675	2,734	2,794	2,855	2,918	2,982	3,048
Promet (S)	44	44	44	45	45	46	47	49	51	52	53	55	56	57	58	60	61	62
Kremikovtsi (S)	840	840	844	849	859	875	897	931	963	992	1,017	1,040	1,063	1,086	1,110	1,134	1,159	1,185
Stomana	481	481	483	486	491	501	513	533	551	567	582	595	608	621	635	649	663	678
Other	796	796	800	804	814	829	850	882	912	940	964	985	1,007	1,029	1,052	1,075	1,099	1,123
Non-ferrous Metals	1,525	1,525	1,531	1,540	1,558	1,588	1,628	1,690	1,747	1,799	1,846	1,887	1,928	1,971	2,014	2,058	2,104	2,150
Medni Mihi	54	54	54	54	55	56	57	59	61	63	65	66	68	69	71	72	74	76
Chiprovech	21	21	21	22	22	22	23	24	24	25	26	26	27	28	28	29	29	30
Polimet	39	39	40	40	40	41	42	44	45	47	48	49	50	51	52	53	54	56
MDP "Elatsite"	17	17	17	17	17	18	18	19	19	20	21	21	22	22	22	23	23	24
GORYBSO-AD 1Vru	26	26	26	26	27	27	28	29	30	31	32	32	33	34	35	35	36	37
OTSK-OOD	115	115	116	117	118	120	123	128	132	136	140	143	146	149	153	156	159	163
Olovo i Tsink	22	22	22	22	22	23	23	24	25	26	27	27	28	28	29	30	30	31
OP "Elatsite"	395	395	397	399	404	412	422	438	453	467	479	489	500	511	522	534	546	558
Redki Metali	17	17	18	18	18	18	19	19	20	21	21	22	22	23	23	24	24	25
Medodobiven K. (S)	260	260	261	263	266	271	278	288	298	307	315	322	329	336	343	351	359	367
D. Blagoev (S)	200	200	201	202	205	209	214	222	230	236	243	248	253	259	265	270	276	282
Alumina	34	34	34	34	35	35	36	38	39	40	41	42	43	44	45	46	47	48
OTSM (S)	40	40	40	40	40	41	42	44	45	47	48	49	50	51	52	53	55	56
Other	283	283	284	286	289	295	302	314	324	334	343	350	358	366	374	382	390	399
Chemicals	2,684	2,641	2,620	2,614	2,625	2,643	2,672	2,721	2,769	2,819	2,870	2,922	2,974	3,028	3,082	3,138	3,194	3,252
Kaltsit (S)	55	54	54	54	54	54	55	56	57	58	59	60	61	62	63	64	65	67
Neftohim (S)	116	114	113	113	113	114	115	117	119	121	124	126	128	130	133	135	138	140
Agropolihim	119	117	117	116	117	118	119	121	123	125	128	130	132	135	137	140	142	145
Polimeri	111	109	108	108	108	109	110	112	114	116	118	120	123	125	127	129	132	134
TK "Sodi"-star	37	36	36	36	36	36	36	37	38	38	39	40	41	41	42	43	44	44
F "Neohim"	171	168	166	166	167	168	170	173	176	179	182	186	189	192	196	199	203	207
Agrabiohim	565	556	551	550	553	556	563	573	583	593	604	615	626	637	649	660	672	684
HIMKO	442	435	431	430	432	435	440	448	456	464	473	481	490	499	507	517	526	535
Yambolen	52	51	51	51	51	51	52	53	54	55	56	57	58	59	60	61	62	63
Plasthin	21	20	20	20	20	20	21	21	21	22	22	23	23	23	24	24	25	25
Lateks (S)	7	7	7	7	7	7	7	7	7	7	7	8	8	8	8	8	8	8
Geoson	22	22	22	22	22	22	22	22	23	23	24	24	25	25	25	26	26	27
Gavril Genov (S)	14	14	13	13	14	14	14	14	14	15	15	15	15	16	16	16	16	17
P. Karaminchev	13	12	12	12	12	12	13	13	13	13	13	14	14	14	14	15	15	15
Smyadovo-OOD	5	5	5	5	5	5	5	5	6	6	6	6	6	6	6	6	6	6
Odesos (S)	13	13	13	13	13	13	13	13	14	14	14	14	15	15	15	15	16	16
Antibiotik (S)	109	107	106	106	107	107	109	111	113	115	117	119	121	123	125	128	130	132
Other	813	800	794	792	795	801	810	824	839	854	870	885	901	917	934	951	968	985

Exhibit 3-4 (continued)
BULGARIA
ELECTRICITY DEMAND FORECAST
HIGH DEMAND SCENARIO

FORECAST OF INDUSTRIAL SALES, GWh/year

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Engineering - metallic products	**1,852**	**1,852**	**1,860**	**1,871**	**1,893**	**1,929**	**1,977**	**2,053**	**2,122**	**2,186**	**2,243**	**2,292**	**2,343**	**2,394**	**2,447**	**2,501**	**2,556**	**2,612**
Energorem. 3-D (S)	17	17	17	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24
K-t za Traktori	12	12	12	12	12	13	13	13	14	14	15	15	15	16	16	16	17	17
Osam	10	10	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	14
Akumikar	17	17	17	17	18	18	18	19	20	20	21	21	22	22	23	23	24	24
Fitingi	24	24	24	24	24	25	25	26	27	28	29	30	30	31	31	32	33	34
LEKO-KO	34	34	34	34	35	35	36	37	39	40	41	42	43	44	45	46	47	48
SLZ (S)	21	21	21	21	21	22	22	23	24	25	25	26	26	27	28	28	29	29
ZTM-OOD (S)	24	24	24	24	24	25	25	26	27	28	29	29	30	30	31	32	32	33
Korabostr. -OOD	11	11	11	11	11	12	12	12	13	13	13	14	14	14	15	15	15	16
Madara	21	21	21	21	22	22	23	24	24	25	26	26	27	27	28	29	29	30
G. Dimitrov (S)	14	14	14	14	14	15	15	16	16	17	17	17	18	18	18	19	19	20
TKEP "6 Sept." (S)	17	17	17	17	17	18	18	19	19	20	21	21	21	22	22	23	23	24
ZMM-AD (S)	17	17	17	18	18	18	19	19	20	21	21	22	22	22	23	23	24	25
MK "VMZ"	83	83	84	84	85	87	89	92	96	98	101	103	105	108	110	113	115	118
Progres	13	13	13	13	13	13	14	14	15	15	16	16	16	17	17	17	18	18
Varn. Korabostr. (S)	42	42	42	42	43	44	45	46	48	49	51	52	53	54	55	56	58	59
Veslets 91	51	51	51	52	52	53	55	57	59	60	62	63	65	66	68	69	71	72
KAMET (S)	25	25	25	25	26	26	27	28	29	30	31	31	32	33	33	34	35	36
Rekora (S)	16	16	16	16	16	16	17	17	18	19	19	19	20	20	21	21	22	22
Other	1,383	1,383	1,389	1,397	1,414	1,441	1,477	1,533	1,585	1,632	1,675	1,712	1,749	1,788	1,827	1,867	1,908	1,950
Electrical & Electronics	**649**	**655**	**665**	**682**	**708**	**744**	**799**	**877**	**945**	**1,000**	**1,058**	**1,120**	**1,173**	**1,230**	**1,289**	**1,351**	**1,402**	**1,455**
B. Kolarov	26	26	26	27	28	29	31	35	37	39	42	44	46	48	51	53	55	57
Ehos	11	11	11	12	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Feromagnit	20	20	20	21	21	22	24	26	29	30	32	34	35	37	39	41	42	44
Svetlina	15	15	16	16	17	17	19	20	22	23	25	26	27	29	30	32	33	34
Elprom-Dinamo	9	10	10	10	10	11	12	13	14	15	15	16	17	18	19	20	20	21
Elprom-ZEM-ad (S)	16	16	16	16	17	18	19	21	23	24	25	27	28	29	31	32	33	35
D S U	17	17	17	18	18	19	21	23	25	26	27	29	30	32	33	35	36	38
Elma	19	19	20	20	21	22	23	26	28	29	31	33	34	36	38	40	41	43
Elkom (S)	12	12	12	12	13	13	14	16	17	18	19	20	21	22	23	24	25	26
Other	506	510	518	531	551	580	622	683	736	779	824	872	914	957	1,003	1,051	1,091	1,133
Building Materials	**993**	**993**	**997**	**1,003**	**1,015**	**1,034**	**1,060**	**1,100**	**1,138**	**1,172**	**1,202**	**1,229**	**1,256**	**1,283**	**1,311**	**1,340**	**1,370**	**1,400**
Beloiz. Tsiment	54	54	54	54	55	56	58	60	62	64	65	67	68	70	71	73	74	76
Devn. Tsiment	102	102	102	103	104	106	109	113	117	120	123	126	129	132	135	138	141	144
Bulkan	36	36	37	37	37	38	39	40	42	43	44	45	46	47	48	49	50	51
Izida	16	16	16	16	17	17	17	18	19	19	20	20	21	21	21	22	22	23
Pl. Tsiment	60	60	60	60	61	62	64	66	68	70	72	74	75	77	79	80	82	84
Zl. Panega	88	88	88	89	90	91	94	97	101	104	106	109	111	113	116	119	121	124
Han Asparuh (S)	16	16	16	16	17	17	17	18	19	19	20	20	21	21	22	22	23	23
Kaolin (S)	18	18	18	18	18	19	19	20	21	21	22	22	23	23	24	24	25	25
Other	603	603	605	609	616	628	643	668	691	711	730	746	762	779	796	814	832	850

Exhibit 3-4 (continued)
BULGARIA
ELECTRICITY DEMAND FORECAST
HIGH DEMAND SCENARIO

FORECAST OF INDUSTRIAL SALES, GWh/year

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Timber	269	265	263	263	264	265	268	273	278	283	288	293	299	304	310	315	321	327
Pulp & paper, wood products	**348**	**343**	**340**	**339**	**341**	**343**	**347**	**353**	**360**	**366**	**373**	**379**	**386**	**393**	**400**	**407**	**415**	**422**
Rulon-Iskar (S)	27	27	26	26	26	27	27	27	28	28	29	29	30	30	31	32	32	33
PHHI	24	23	23	23	23	23	24	24	24	25	25	26	26	27	27	28	28	29
TKTSH	55	54	54	54	54	54	55	56	57	58	59	60	61	62	63	64	65	67
ZMK (S)	38	37	37	37	37	37	38	38	39	40	41	41	42	43	44	44	45	46
Lesil	17	16	16	16	16	16	16	17	17	17	18	18	18	19	19	19	20	20
St. Kirajiev (S)	55	54	54	54	54	54	55	56	57	58	59	60	61	62	63	65	66	67
TKHTS (S)	10	10	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13
Other	123	121	120	120	120	121	122	124	127	129	131	134	136	138	141	143	146	149
Glass	**466**	**470**	**478**	**490**	**509**	**534**	**573**	**630**	**679**	**718**	**760**	**804**	**842**	**883**	**925**	**970**	**1,007**	**1,045**
Belopal	38	38	39	40	41	43	47	51	55	58	62	65	68	72	75	79	82	85
Kitka	25	25	26	26	27	29	31	34	37	39	41	43	45	48	50	52	54	56
Fayans	26	27	27	28	29	30	32	36	38	41	43	45	48	50	52	55	57	59
Rubin	25	25	26	26	27	29	31	34	36	38	41	43	45	47	50	52	54	56
Drushba	44	44	45	46	48	50	54	59	64	67	71	75	79	83	87	91	94	98
Kvarts	18	18	19	19	20	21	22	25	27	28	30	31	33	35	36	38	39	41
Diamant (S)	21	21	22	22	23	24	26	28	31	32	34	36	38	40	42	44	45	47
Other	269	271	276	283	293	308	331	363	392	414	439	464	486	510	534	560	581	603
Textiles	**566**	**566**	**568**	**571**	**578**	**589**	**604**	**627**	**648**	**668**	**685**	**700**	**715**	**731**	**747**	**764**	**780**	**798**
Manuela	23	23	23	23	24	24	25	25	26	27	28	28	29	30	30	31	32	32
Dobruja	9	9	9	9	9	9	10	10	10	11	11	11	11	12	12	12	12	13
Slucks	21	21	21	21	21	21	22	23	24	24	25	25	26	27	27	28	28	29
Vratitsa	14	14	14	14	14	15	15	15	16	16	17	17	18	18	18	19	19	20
Other	499	499	501	504	510	520	533	553	572	589	604	618	631	645	659	674	689	704
Food & Beverage	**1,191**	**1,191**	**1,196**	**1,203**	**1,218**	**1,241**	**1,272**	**1,320**	**1,365**	**1,406**	**1,443**	**1,474**	**1,507**	**1,540**	**1,574**	**1,608**	**1,644**	**1,680**
N. Vaptsarov	32	32	33	33	33	34	35	36	37	38	39	40	41	42	43	44	45	46
Tyut. Kombinat (S)	11	11	11	11	11	11	12	12	13	13	13	14	14	14	15	15	15	16
MEZ "Kambana" (S)	76	76	76	77	78	79	81	84	87	90	92	94	96	98	100	103	105	107
SKPPPMYA (S)	10	10	10	10	10	10	10	11	11	12	12	12	12	13	13	13	14	14
Other	1,062	1,062	1,066	1,073	1,086	1,106	1,134	1,177	1,217	1,254	1,286	1,314	1,343	1,373	1,403	1,434	1,465	1,498
Other Industries	**911**	**911**	**914**	**920**	**931**	**949**	**972**	**1,009**	**1,044**	**1,075**	**1,103**	**1,127**	**1,152**	**1,177**	**1,203**	**1,230**	**1,257**	**1,284**
Bules (S)	14	14	14	14	14	14	15	15	16	16	16	17	17	18	18	18	19	19
Cherno More (S)	9	9	9	9	10	10	10	10	11	11	11	12	12	12	12	13	13	13
Construction	687	687	690	694	702	716	734	762	787	811	832	851	869	888	908	928	948	969
Agriculture	910	956	1,007	1,054	1,094	1,128	1,153	1,174	1,195	1,217	1,239	1,261	1,284	1,307	1,330	1,354	1,379	1,404
Transport & Communications	1,456	1,523	1,605	1,695	1,776	1,849	1,910	1,963	2,018	2,055	2,092	2,129	2,168	2,207	2,246	2,287	2,328	2,370
Public Sector	3,097	3,159	3,235	3,287	3,346	3,383	3,427	3,489	3,551	3,615	3,680	3,747	3,814	3,883	3,953	4,024	4,096	4,170

HIGH DEMAND

3.5 COMPARISON OF DEMAND FORECASTS

These three scenarios are compared in a series of graphs. Each graph also shows the historical situation since 1975, for clarity.

- Exhibit 3-5 shows that the demand for electricity in the household sector increases steadily for all cases.

- Exhibit 3-6 illustrates industrial demand. In no case does industrial energy consumption reach historical maximums.

- Electricity demand in other sectors is given in Exhibit 3-7. Growth in demand is low, except in the case of high economic growth.

- A comparison of the changes in the total domestic sales of electricity are provided in Exhibit 3-8. In year 2000, the high scenario has a 15% greater level of electricity demand than the low scenario.

- Gross total electricity demand, including power plant auxiliaries and distribution losses, is shown in Exhibit 3-9.

  Referring back to Exhibit 3-1, it can be seen that all three scenarios fall within the band of projections by other forecasters.

- Annual maximum peak demand is illustrated in Exhibit 3-10, and shows a different pattern, consistent with the economic restructuring away from heavy industry.

Exhibit 3-5

Bulgaria - Household Electricity Demand

Comparison of Scenarios

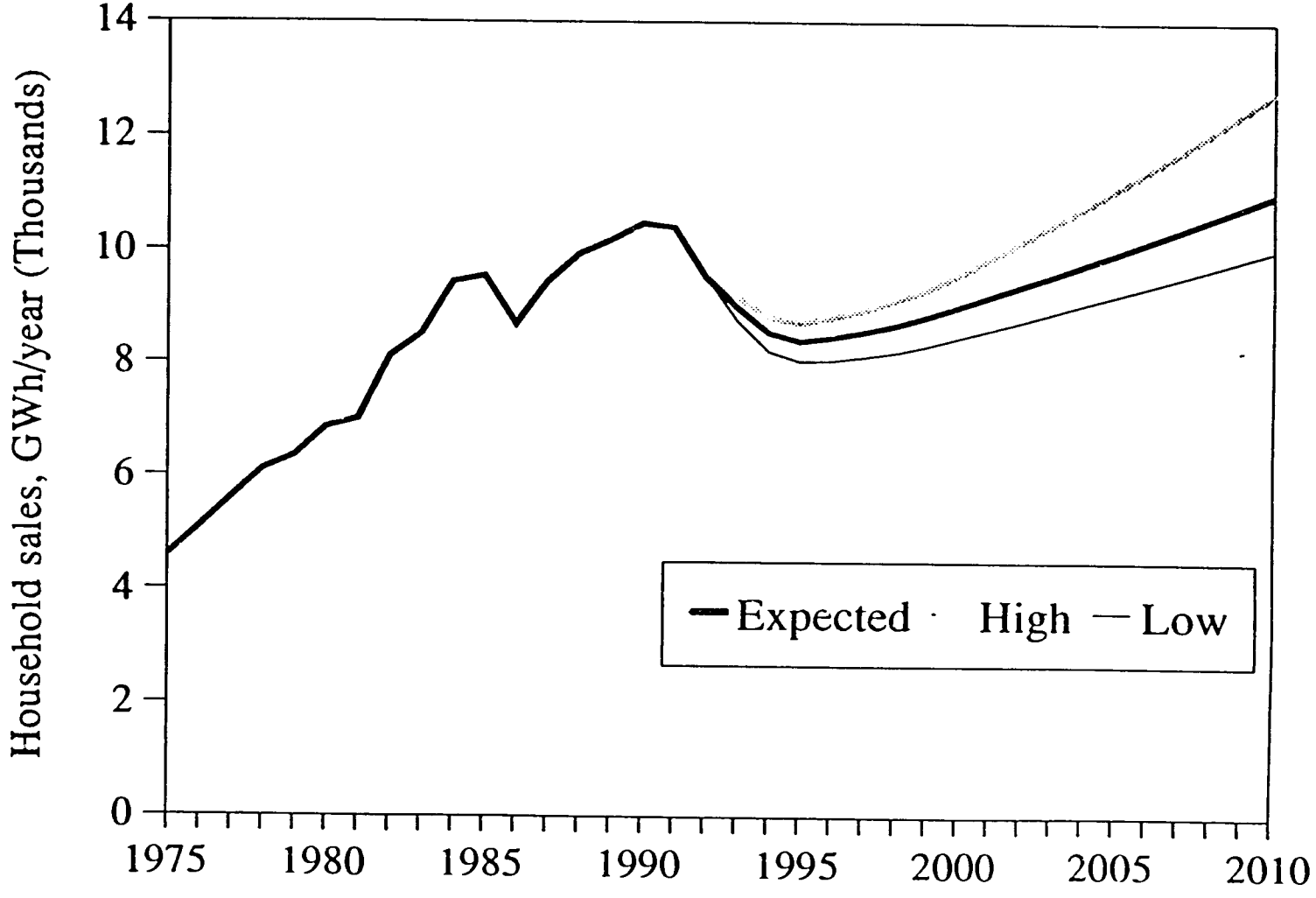


Exhibit 3-6

Bulgaria - Industry Electricity Demand

Comparison of Scenarios

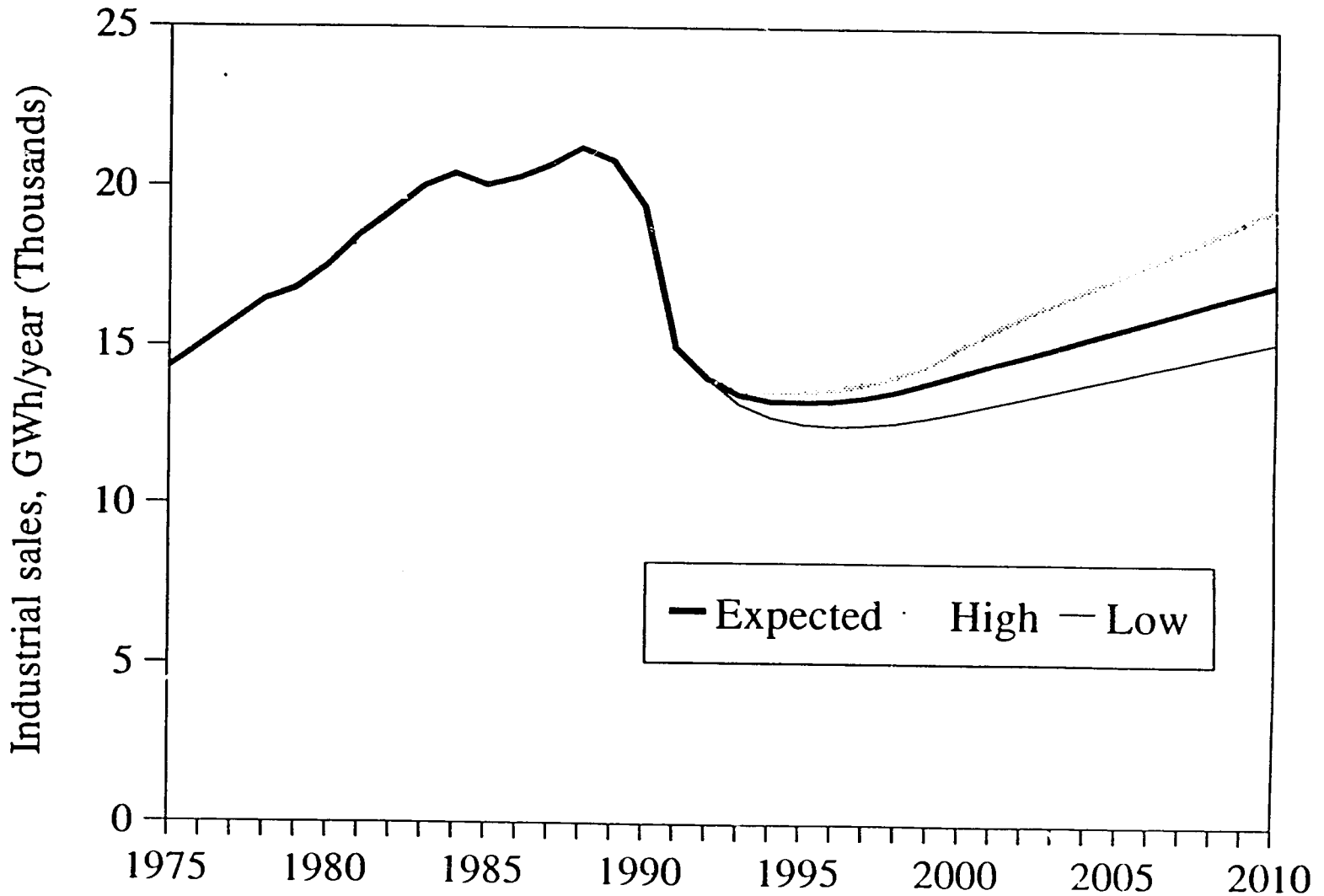


Exhibit 3-7

Bulgaria - Other Electricity Demand

Comparison of Scenarios

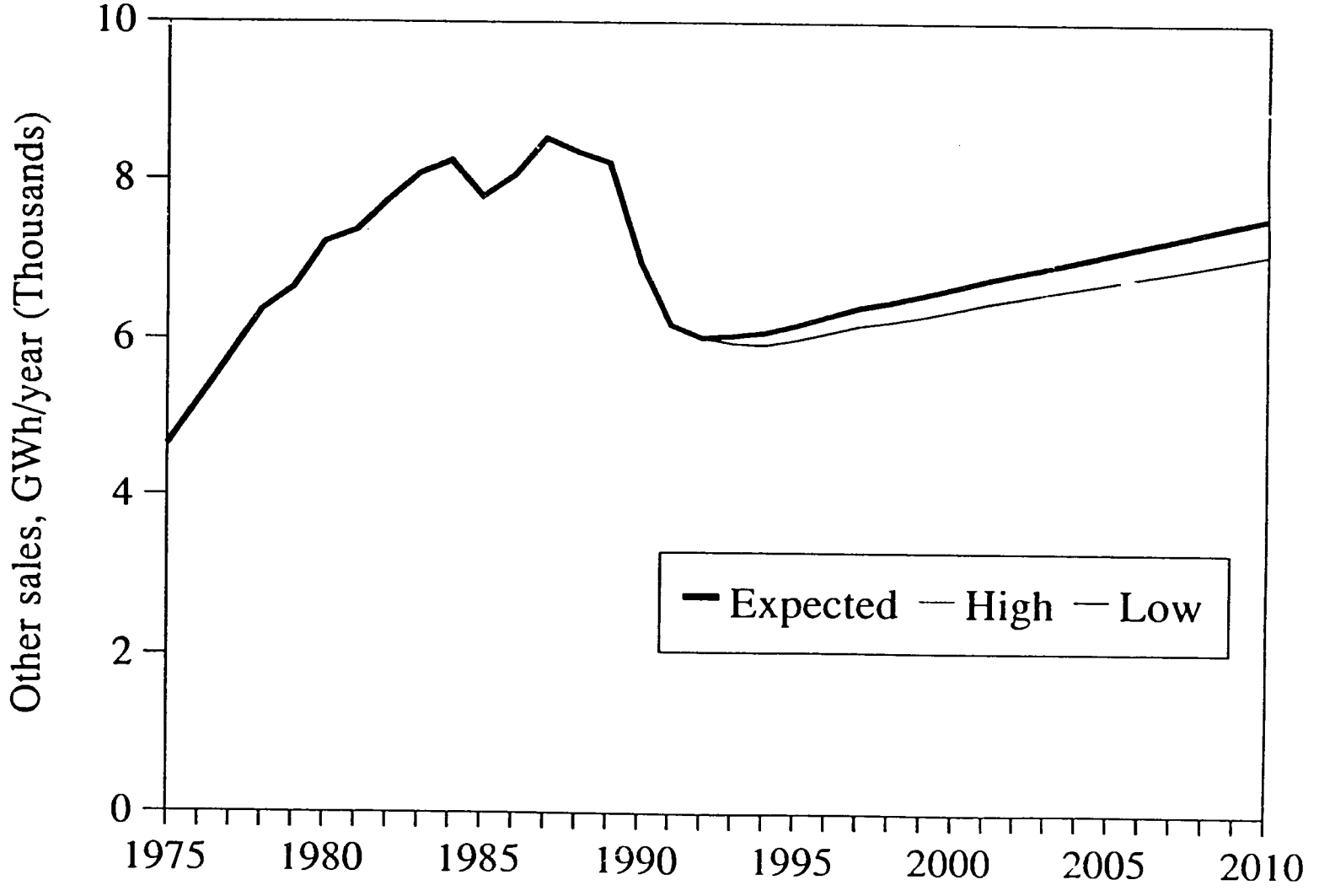


Exhibit 3-8

Bulgaria - Total Domestic Sales

Comparison of Scenarios

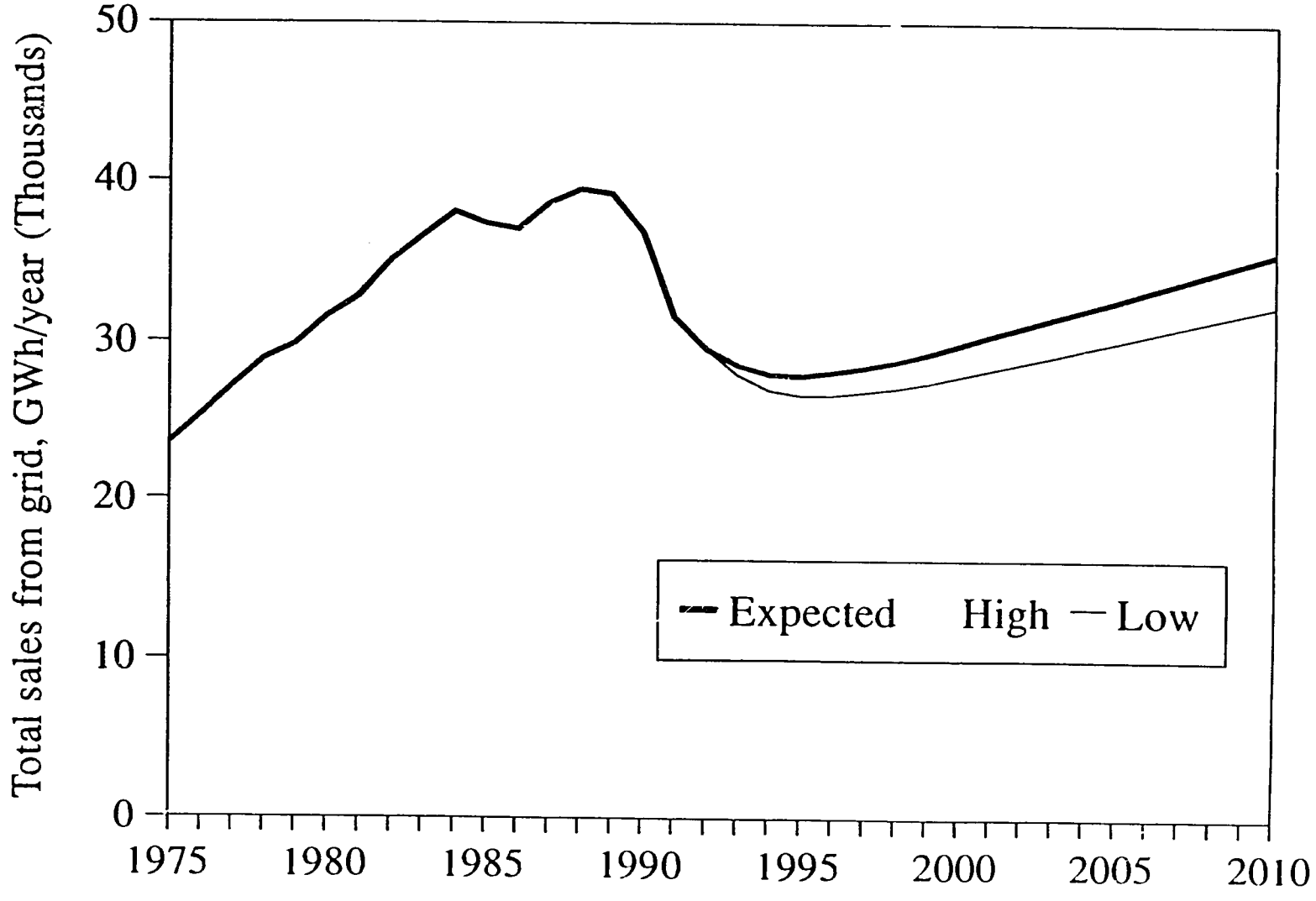


Exhibit 3-9

Bulgaria - Total Electricity Demand

Comparison of Scenarios

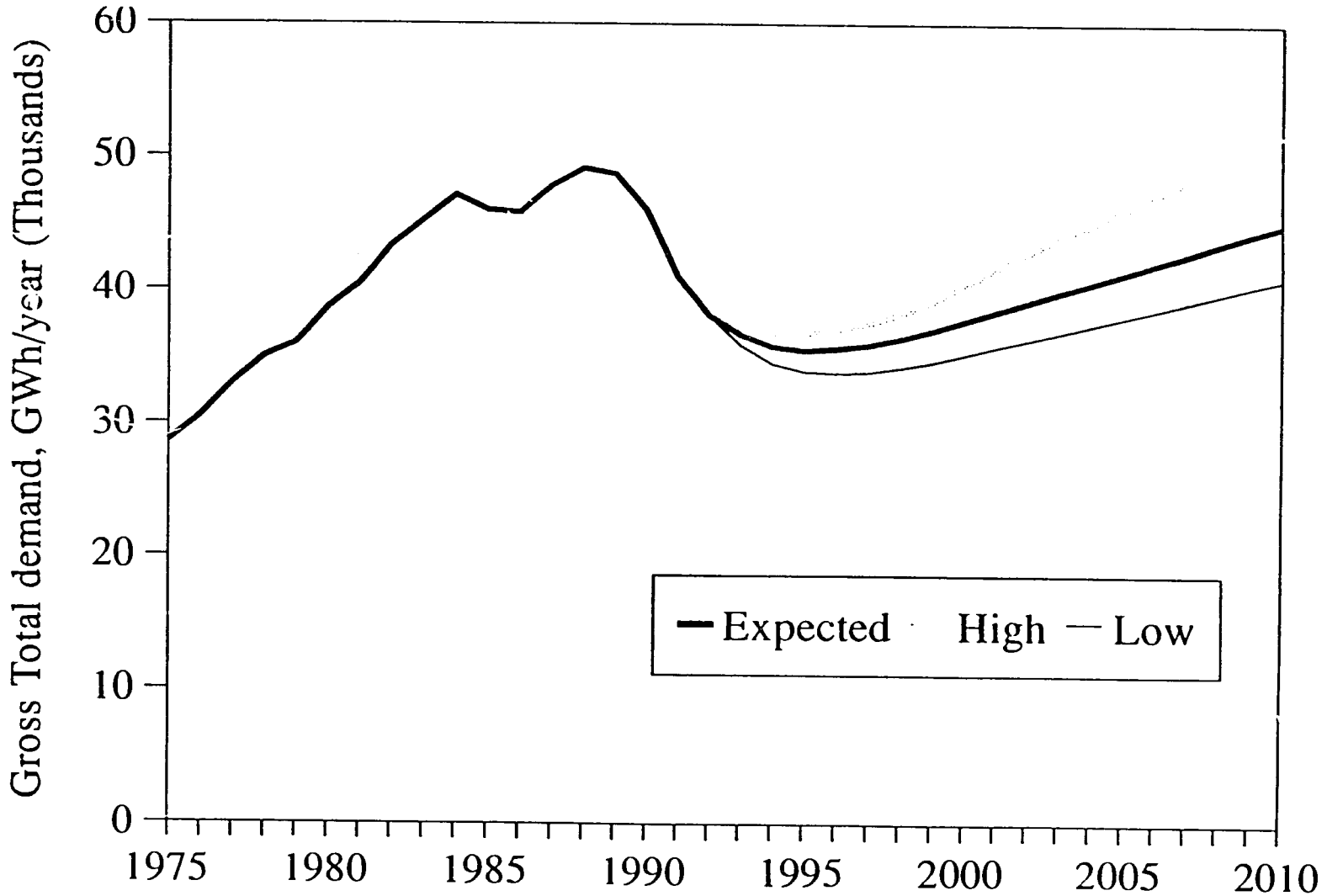


Exhibit 3-10

Bulgaria - Annual Peak Demand

Comparison of Scenarios