Summary Report of
"Onsite Interventions carried out in "partner country"

Prepared by:

"ESD Bulgaria Ltd."

within the framework of the

Project Nº EIE/05/193/SI2.419685:

Motor Challenge Programme - Energy Efficient Electric Motor Systems in New Member and Candidate Countries (4EM-MCP)

4EM-MCP is supported by:

Intelligent Energy Europe

Core partner:

esd
Part of the Camco Group

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EXECUTIVE SUMMARY

In the period September – November 2007 ESD Bulgaria performed energy efficiency scans of electric motors and electric motor systems in 5 industrial enterprises from different industrial sectors:

- Progress AD
- Hraninvest-Hranmashkomplect AD
- Natalia AD
- Construction Company Zagora EAD
- Preskov AD

The audits were implemented under the 4EM-MCP Project with financial support of The European Motor Challenge Programme of the European Commission.

The main objective of the 4EM-MCP program and the energy audit of industrial sites is to decrease the electricity consumption by electric motors and electric driving motor systems, as well as assessment of the energy saving potential based on replacement of the existing old motors with new energy efficiency ones. This will increase the reliability of the work of the motors, quality of production and decrease the production cost.

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1 OBJECTIVES OF "ESD BULGARIA" REGARDING ONSITE INTERVENTIONS

Asynchrony 4 poles electrical motors with capacity of 0,75-500kW were subject to energy audits under the EU funded 4EM Project.

The energy scanning was undertaken on the basis of set criteria and technical parameters for assessment of energy efficiency of electric motor systems, preliminary defined by the Bulgarian partners and the Project coordinator, as follow:

- Short description of the company
- Main field of application of electric motor driven systems
- Estimation of the Energy Consumption for the different systems (Fans, pumps, compressed air system, drives)
- Detail analysis of the most important systems or part of systems;
  - Data from the label of the electrical motor (Type of the motor, Nominal capacity, Nominal Electricity, Efficiency of the capacity cos φ, Efficiency factor, Nominal rotation density, Calculated nominal capacity);
  - Measurement on site (Supplied voltage, Consumed electricity, Consumed capacity, Efficiency of capacity cos φ, Rotation density, Calculated consumed capacity, Relative loading – calculated by 3 methods);
- Results of audit according to MCP documents

It was difficult to identify the measurable indicators for all companies and for all systems (fans, compressed air and pumps), which can be easily applied.

In each enterprise we focused on 3 types of electric motors, suggested by the companies. Three methods of measurements of relative loading factor of the electric motors were used. See *Annex 1*.

The relative loading according to Method 1 is calculated on the basis of the data provided on the label: nominal load, nominal electricity and nominal efficiency of capacity *cos φ*, but on the provided in the label nominal capacity.

Due to the inability to stop the motor in order to install reflecting foil on the moving part and/or inaccessibility to the moving parts, the rotation frequency and the relative loading in accordance with *Method 3* have not been measured.

Methods for calculation of electricity savings after replacement of the old electric motors with the new energy efficiency ones are described in *Annex 2*.

The power measurements have been performed using combined device from the "Laboratory for equipment testing" at the "Center for testing and European Certification" EOOD, Stara Zagora. See *Table 1*

Table 1

Type of device: MX 200/HX-3PM, Germany № 904748438	
Voltage	750V
Density	1000Hz
Electricity	20A / 200A
Active capacity	20kW
Full capacity	20kvA

You can find additional information on the audited companies in *Section 2.*

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2 RESULTS OF THE ONSITE INTERVENTIONS

Performed were energy audits of different types of electric motors and electric motor driving systems in 5 Industrial enterprises. Measurements and calculations of typical electric motors parameters have been done.

All 5 audited companies are situated in Stara Zagora Region.

The experts from ESD-Bulgaria worked in cooperation with the experts of the enterprises during the scanning process.

On the basis of practical experience, the experts of ESD-Bulgaria considered that the key element for the success of the scans is the establishment of working groups. Working Groups (WG) were established in each Enterprise. The WG members consisted of: local experts (engineers, technical assistants, managers), acquainted with the structure of their companies and technologies of the different processes. They were closely involved in the scanning process since the beginning to the end.

2.1 Company Nº 1 – "Progress AD"

2.1.1 Introduction to the company

Progress AD is a company with 100 years of history in the production of high quality technical grey and nodular graphite iron casting. The company has the most modern equipment for production of casting mould and core:

- Automatic line for casting with moulding machine HEINRICH WAGNER SINTO
- Conveyor with pressing machines FOROMAT
- Site with pressing machines DOZAMET
- Two crushing lines and machines for internal cleaning and moulding
- Site for production of core with ROPERVERK machines for HOT-BOX process and LAEMPE LL20 for cold process

The Company produces the following types of cast irons: EN GJL 200, EN GJL 250, EN GJL 300, EN GJS 500-7 and EN GJS 600-3.

There is well equipped laboratory, which is certified to perform full control of:

- input raw materials,
- characteristics of the melted material and moulding mixture,
- physical, chemical and mechanical characteristics of the ready products.

The production capacity is 12 000 tons of moulding per year.

Progress AD is a long-term supplier of mouldings for the most prominent producers of hydro motor systems, hydro valves, diesel motors, spare automobile parts and construction of car bodies, reduction gear, machines for wood processing industry, electrical motors and other machines in Bulgaria and in, etc.

Progress AD received a Complex License, according the EC Directive 96/16/EC. This is a regulation system that applies complex approach for management and control of environmental impacts.

Progress AD is certified by ISO9001:2000

Table 2

PRESENTATION OF "Progress AD"	
Activity / Sector	Production of high-quality gray and spheroidal-graphite iron castings
Address of Company	Industrial Zone Stara Zagora 6000, Bulgaria Phone: +359 42 605697 Fax: +359 42 605661 E-mail: contact@progress-sz.com Website: http://www.progress-sz.com
Number of Company [Chosen by Partner, e.g. order of finished audit reports]	1
Energy Audit conducted by [Name of Subcontractor]	ESD Bulgaria Ltd.
Date of Energy Audit [month, year]	September – November 2007
Number of employees	> 250
Total electricity consumption and cost: (data of a 12 months obtained at the time of the energy diagnosis, bills for example)	> 3000 MWh/year The Company is in the List of The Biggest Electricity consummators in Bulgaria and detailed audit of all their energy systems have to be provided.
Average unit cost of electricity (for the reference period)	The electricity cost paid by the industrial enterprises is about 70€/MWh

Note:
Some of the parameters and data (as Total electricity consumption and average unit cost of electricity) are incompleted because they were not included in the preliminary set criteria.

2.1.2 MCP Modules "tested" during the energy diagnosis carried out and main results / energy saving measures identified

Table 3

Summary of the onsite intervention	
MCP modules applied [management, drives, pumps, fans, compressed air, refrigeration, and/or electric distribution]	The locations of the measured electric motors are as follow: Motor I – "Progres" AD - Pump №3 on the battery cooler on the indiction furnace AEG Motor II – "Progres" AD - Pump for cooling the inductors Motor III - "Progres" AD - Pump for cooling the compressor
Energy Savings identified [kWh/year]	Total energy savings after replacement of the audited electric motors will be: **6804,62** kWh/y

Main activities proposed	Replacement of the existing electric motors with Energy Efficiency ones. Regulating the operation of the electric motors, through adjusting the frequency of rotation. Improvement of electricity supply.

The relative loading according to Method 1 is calculated on the basis of the data provided on the label: nominal load, nominal electricity and nominal efficiency of capacity *cos φ*, but on the provided in the label nominal capacity.

Technical data and information:

Table 4

		Number of the motor		I	II	III
Data from the label of the electrical motor	1.	Tape of the motor		R3 20 397	QUFA 160 M2B	AOZ 51-2
	2.	Nominal Capacity	kW	12,5	15	10
	3.	Nominal Voltage	V	400	400	440
	4.	Nominal Electricity	A	27	25,6	16,9
	5.	Power factor, *cos φ*		0,81	0,90	0,88
	6.	Efficiency factor, *η*	%	-	-	-
	7.	Nominal rotation speed	min^{-1}	2 870	2 910	3 500
	8.	Calculated nominal capacity	kW	15,2	16,0	11,3
Measurement on site	10.	Supplied Voltage	V	366	366	405
	11.	Consumed Electricity	A	25,4	22,8	15
	12.	Consumed Capacity	kW	-	4,55	-
	13.	Power factor, *cos φ*		0,89	0,92	0,83
	14.	Rotation speed	min^{-1}	-	-	-
	15.	Calculated consumed capacity	kW	14,3	13,3	8,7
Relative loading according to *Method 1*			%	94,6	83,3	77,1
Relative loading according to *Method 2*			%	86,1	81,5	81,7
Relative loading according to *Method 3*			%	-	-	-

Economical information:

The energy saving, after replacement of the existing electric motors and electric motor driving systems with the energy efficiency ones is shown in the *Table 5* bellow:

Table 5

Type of the motor	η_{old}	η_{new}	h	OH	P_n	E_{saved}	E_{saved}
	%	%		%	*kW*	*kWh/y*	*Euro/y*
I	0,884	0,915	4000	0,95	12,5	1820,46	131,07
II	0,894	0,918	4000	0,83	15,0	1456,33	104,86
III	0,820	0,905	4000	0,77	10,0	3527,83	254,00
					Total	**6804,62**	**489,93**

2.2 Company Nº 2 – "Hraninvest-Hranmashkomplect AD"

2.2.1 Introduction to the company

The company was established in 1968. "Hraninvest-Hranmashkomplect" AD is a leading company in the Bulgarian machine construction industry. The company structure includes ex-enterprises such as: „Cherveno Zname", "Tacho Daskalov", "Jeleznik", engineering enterprises "Hranmashkomplect" and "Hraninvest". After the privatization of the company the existing technological base was preserved and developed, through constant investments in the purchase of new equipment and technologies.

The company provides total engineering /design, production, supply, installation services, setting system in operation, guarantee service/ and "total to key" implementation of lines and equipment for production and bottling of soft drinks, beer, wine, highly alcoholic drinks and other liquids; milk production and a lot of other machinery and equipment for the food & beverages industry.

Table 6

PRESENTATION OF "Hraninvest-Hranmashkomplect AD"	
Activity / Sector	Leading company in the Bulgarian machine construction industry
Address of Company	23, Patriarh Evtimii Blvd., Stara Zagora 6000, Bulgaria Phone: +359 42 600633 Fax: +359 42 600460 E-mail: td@hraninvest.com Website: http://www.hraninvest.com
Number of Company [Chosen by Partner, e.g. order of finished audit reports]	2
Energy Audit conducted by [Name of Subcontractor]	ESD Bulgaria Ltd.
Date of Energy Audit [month, year]	September – November 2007
Number of employees	> 250
Total electricity consumption and cost: (data of a 12 months obtained at the time of the energy diagnosis, bills for example)	> 3000 MWh/year The Company is in the List of The Biggest Electricity consummators in Bulgaria and detailed audit of all their energy systems have to be provided.
Average unit cost of electricity (for the reference period)	The electricity cost paid by the industrial enterprises is about 70€/MWh

Note:
Some of the parameters and data (as Total electricity consumption and average unit cost of electricity) are incompleted because they were not included in the preliminary set criteria.

2.2.2 *MCP Modules "tested" during the energy diagnosis carried out and main results / energy saving measures identified*

Table 7

Summary of the onsite intervention	
MCP modules applied [management, drives, pumps, fans, compressed air, refrigeration, and/or electric distribution]	The locations of the measured electric motors are as follow: Motor I – "HI-HMC" AD - compressor helical Motor II – "HI-HMC" AD - compressor helical - Ventilator for aspiration of pearl jet
Energy Savings identified [kWh/year]	Total energy savings after replacement of the audited electric motors will be: **4616,10** kWh/y
Main activities proposed	Replacement of the existing electric motors with Energy Efficiency ones. Regulating the operation of the electric motors, through adjusting the frequency of rotation. Improvement of electricity supply.

The relative loading according to Method 1 is calculated on the basis of the data provided on the label: nominal load, nominal electricity and nominal efficiency of capacity *cos φ*, but on the provided in the label nominal capacity.

Technical information:

Table 8

	Number of the motor			I	II	III
Data from the label of the electrical motor	1.	Tape of the motor		MO 180 M2	1A6 280-4AA913	-
	2.	Nominal Capacity	kW	30	75	-
	3.	Nominal Voltage	V	380	380	-
	4.	Nominal Electricity	A	56	140	-
	5.	Power factor, *cos φ*		0,89	0,86	-
	6.	Efficiency factor, *η*	%			-
	7.	Nominal rotation speed	min^{-1}	2 940	1 480	-
	8.	Calculated nominal capacity	kW	32,8	79,2	-
Measurement on site	10.	Supplied Voltage	V	402	384	-
	11.	Consumed Electricity	A	43,7	120,4	-
	12.	Consumed Capacity	kW	27,2	4,55	-
	13.	Power factor, *cos φ*		0,89	0,87	-
	14.	Rotation speed	min^{-1}			-
	15.	Calculated consumed capacity	kW	27,1	69,7	-
Relative loading according to *Method 1*			%	82,6	87,9	-
Relative loading according to *Method 2*			%	82,6	86,9	-
Relative loading according to *Method 3*			%	-	-	-

Economical information:

The energy savings after replacement of the existing electric motors and electric motor driving systems with the energy efficiency one is shown in the *Table 9* bellow:

Table 9

Type of the motor	η_{old} %	η_{new} %	h	OH %	P_n kW	E_{saved} kWh/y	E_{saved} Euro/y
I	0,920	0,932	4000	0,82	30	1377,12	99,15
II	0,936	0,947	4000	0,87	75	3238,97	233,21
					Total	**4616,10**	**332,36**

2.3 Company Nº 3 – "Natalia AD"

2.3.1 Introduction to the company

Natalia AD is established during 1926 as a small worksop for colouring textile. Today it is an enterprise with closed cycle for: ranging from production of knitwear to production of all types of knitted goods. Since 1999, the company is privately owned and is situated on an area of 39 000 m2. Currently the company sells theirs products in Bulgaria, Finland, Swiden, USA, Germany, France, etc.

Quality control system, according to the requirements of EN ISO 9001: 2000, was integrated in the company.

Production capacities:
The company has "Knitting" workshop, "Finishing" workshop and "Clothes" workshop.
Knitting machines are used in the "Knitting" workshop, producing variety in sheer and structure knitted fabrics, such as: single-jersey, interlok, shrik, cotton, etc.

The following activities are performed in the "Finishing" workshop": washing, coloring, drying of fabrics 100% cotton, cotton-polyester, cotton-lycra/reagent, direct and dispersive/viscose with lycra, die of circle-knitted fabric, etc. Multi-color screen printing with high productivity, fininshing of fabrics, compactation and framing, guaranteeing softness and low contraction of the fabrics. In the "Clothes" workshop (full set of cutting and sewing machinery) apart from the traditional products, provisioned for export, is working with materials provided by the client.

Table 10

PRESENTATION OF "Natalia AD"	
Activity / Sector	Production of production of knitwear and all types of knitted goods
Address of Company	167, Tsar Simeon Veliki Blv., Stara Zagora 6000, Bulgaria Phone: +359 42 26 31 37 Fax: +359 42 26 60 24 E-mail: natalia@natalia-sz.com Website: http://www.natalia-sz.com
Number of Company [Chosen by Partner, e.g. order of finished audit reports]	2
Energy Audit conducted by [Name of Subcontractor]	ESD Bulgaria Ltd.
Date of Energy Audit [month, year]	September – November 2007
Number of employees	> 250
Total electricity consumption and cost: (data of a 12 months obtained at the time of the energy diagnosis, bills for example)	> 3000 MWh/year The Company is in the List of The Biggest Electricity consummators in Bulgaria and detailed audit of all their energy systems have to be provided.
Average unit cost of electricity (for the reference period)	The electricity cost paid by the industrial enterprises is about 70€/MWh

Note:
Some of the parameters and data (as Total electricity consumption and average unit cost of electricity) are incompleted because they were not included in the preliminary set criteria.

2.3.2 MCP Modules "tested" during the energy diagnosis carried out and main results / energy saving measures identified

Table 11

Summary of the onsite intervention	
MCP modules applied [management, drives, pumps, fans, compressed air, refrigeration, and/or electric distribution]	The locations of the measured electric motors are as follow: Motor I – "Natalia" AD - Main compressor of the factory Motor II – "Natalia" AD - Water Pump Motor III - "Natalia" AD - Knitting Machine
Energy Savings identified [kWh/year]	Total energy savings after replacement of the audited electric motors will be: **5181,42** kWh/y
Main activities proposed	Replacement of the existing electric motors with Energy Efficiency ones. Regulating the operation of

	the electric motors, through adjusting the frequency of rotation. Improvement of electricity supply.

The relative loading according to Method 1 is calculated on the basis of the data provided on the label: nominal load, nominal electricity and nominal efficiency of capacity *cos φ*, but on the provided in the label nominal capacity.

Technical information:

Table 12

	Number of the motor			I	II	III
Data from the label of the electrical motor	1.	Tape of the motor		1A6 775 2A89	A0252/2	UU26224 0170 0056
	2.	Nominal Capacity	kW	45	13	5,5
	3.	Nominal Voltage	V	380	380	400
	4.	Nominal Electricity	A	82	24,6	11,4
	5.	Power factor, *cos φ*		0,9	0,9	0,81
	6.	Efficiency factor, *η*	%	-	-	-
	7.	Nominal rotation speed	min^{-1}	2 955	2 920	1 455
	8.	Calculated nominal capacity	kW	48,6	14,6	6,4
Measurement on site	10.	Supplied Voltage	V	400	398	384
	11.	Consumed Electricity	A	84,76	19,6	8,4
	12.	Consumed Capacity	kW	-	-	-
	13.	Power factor, *cos φ*		0,88	0,9	0,85
	14.	Rotation speed	min^{-1}	-	-	-
	15.	Calculated consumed capacity	kW	51,7	12,2	4,7
Relative loading according to *Method 1*			%	106,4	83,4	74,2
Relative loading according to *Method 2*			%	108,8	83,4	70,7
Relative loading according to *Method 3*			%	-	-	-

Economical information:

The energy savings after replacement of the existing electric motors and electric motor driving systems with the energy efficiency one is shown in the *Table 13* bellow:

Table 13

Type of the motor	η_{old}	η_{new}	h	OH	P_n	E_{saved}	E_{saved}
	%	%		%	*kW*	*kWh/y*	*Euro/y*
I	0,925	0,939	4000	0,910	45	2640,19	190,09
II	0,882	0,915	4000	0,834	13	1773,35	127,68
III	0,857	0,893	4000	0,742	5,5	767,89	55,68
					Total	**5181,42**	**373,06**

2.4 Company Nº 4 – "Construction Company Zagora EAD"

2.4.1 Introduction to the company

„Construction Company Zagora" EAD - Stara Zagora is part of the "Holding Zagora", with variety of subject of activities.

„Construction Company zagora" EAD is the only producer in the region with closed production cycle - from processing of inert materials, to ready concrete product and construction.

Te company was established in 1956, as an enterprise supporting DSU - Stara Zagora. The enterprise become a separate entity called "Stroikombinat-M" AD in 1991. At the end of 2006, after the separation of "Stroikombinat-M" AD, "Construction Company Zagora " EAD was established.

About 200 people work at "Construction Company Zagora" EAD - management personnel, engineers, technical staff and workers with various field of expertise and high level of professional qualification.

Subject of activity:
1. Production of construction materials, intermediate products and products for personal needs and the client's needs, namely:
   - Production of inert materials - sand, felt, gravel;
   - Production of concrete and cement-sand solutions;
   - Production of concrete elements - cones, cylinder, hoods for revision shafts and wells, chimneys, curbs, pavement tiles, etc. ;
   - Production of reinforcing products;
   - Production of electrical tables, construction of power grids, substations, power installations of domestic and industrial enterprises;
   - Construction of metal constructions;
2. Services with construction mechanization and autotransport;
3.Construction activities.

Table 14

PRESENTATION OF "**Construction Company Zagora EAD**"	
Activity / Sector	Producer in the region with closed production cycle - from processing of inert materials, to ready concrete product and construction.
Address of Company	Industrialna Area, Stara Zagora 6000, Bulgaria Phone: +359 42 63 10 11 Fax: +359 42 60 07 94 E-mail: office@skzagora.com Website: http://www.skzagora.com
Number of Company [Chosen by Partner, e.g. order of finished audit reports]	4
Energy Audit conducted by [Name of Subcontractor]	ESD Bulgaria Ltd.
Date of Energy Audit [month, year]	September – November 2007

Number of employees	> 250
Total electricity consumption and cost: (data of a 12 months obtained at the time of the energy diagnosis, bills for example)	> 3000 MWh/year The Company is in the List of The Biggest Electricity consummators in Bulgaria and detailed audit of all their energy systems have to be provided.
Average unit cost of electricity (for the reference period)	The electricity cost paid by the industrial enterprises is about 70€/MWh

Note:
Some of the parameters and data (as Total electricity consumption and average unit cost of electricity) are incompleted because they were not included in the preliminary set criteria.

2.4.2 MCP Modules "tested" during the energy diagnosis carried out and main results / energy saving measures identified

Table 15

Summary of the onsite intervention	
MCP modules applied [management, drives, pumps, fans, compressed air, refrigeration, and/or electric distribution]	The locations of the measured electric motors are as follow: Motor I – "Construction company Zagora" EAD - Hydraulic machines for cutting fittings Motor II – "Construction company Zagora" EAD - Hydraulic machines for cutting fittings Motor III - "Construction company Zagora" EAD - Drill press
Energy Savings identified [kWh/year]	Total energy savings after replacement of the audited electric motors will be: **593,52** kWh/y
Main activities proposed	Replacement of the existing electric motors with Energy Efficiency ones. Regulating the operation of the electric motors, through adjusting the frequency of rotation. Improvement of electricity supply.

The relative loading according to Method 1 is calculated on the basis of the data provided on the label: nominal load, nominal electricity and nominal efficiency of capacity *cos φ*, but on the provided in the label nominal capacity.

Technical information:

Table 16

		Number of the motor		I	II	III
Data from the label of the electrical motor	1.	Tape of the motor		4AO 112M 2D	T100L2ABC3	4AO 100L 8/4D
	2.	Nominal Capacity	kW	4	3	0,7
	3.	Nominal Voltage	V	380	380	380
	4.	Nominal Electricity	A	8	6,2	2,5
	5.	Power factor, *cos φ*		0,9	0,87	0,61
	6.	Efficiency factor, *η*	%	-	-	-
	7.	Nominal rotation speed	min^{-1}	2 870	2 880	1 430
	8.	Calculated nominal capacity	kW	4,7	3,6	1,0
Measurement on site	10.	Supplied Voltage	V	333	350	380
	11.	Consumed Electricity	A	3,44	2,5	2,53
	12.	Consumed Capacity	kW	-	-	-
	13.	Power factor, *cos φ*		0,55	0,4	0,3
	14.	Rotation speed	min^{-1}	-	-	-
	15.	Calculated consumed capacity	kW	1,1	0,6	0,5
Relative loading according to *Method 1*			%	23,0	17,1	49,8
Relative loading according to *Method 2*			%	37,7	37,1	101,2
Relative loading according to *Method 3*			%	-	-	-

Economical information:

The energy savings after replacement of the existing electric motors and electric motor driving systems with the energy efficiency one is shown in the *Table 17* bellow:

Table 17

Type of the motor	η_{old} %	η_{new} %	h	OH %	P_n kW	E_{saved} kWh/y	E_{saved} Euro/y
I	0,842	0,883	4000	0,230	4	202,94	14,61
II	0,826	0,874	4000	0,171	3	136,44	9,82
III	0,702	0,805	4000	0,498	0,7	254,15	18,30
					Total	**593,52**	**42,73**

2.5 Company Nº 5 – "Preskov AD"

2.5.1 Introduction to the company

"Preskov" AD is one of the oldest and largest producers of hot wrough products in Bulgaria, established during 1900.

Produced are wide rage of products, used in the different spheres of economy such as power industry, machine industry. transport, agriculture, hydraulic, mines and production of hoisting-transport and construction machinery.

The company has it own base for design and production of tools for hot wrough and forge of metals.

Tool production (construction and development of forges for stamping press and steam and air hammer) is secured with funding fron hightech CAD-CAM system IDEAS.
The plant has introduced the EN ISO 9001:2000.

It has been issued by the British Certification Institute and applicable for design, development and production of forging press equipment.

The production capacity of the company is located in the industrial zone of Stara Zagora. The company is situated on an area of 116 kekars. The main products of the company are forgings, produced using the method of hot volume forge with weight from 0,300 kg to 25 kg/ The capacity of the plant is 8000 tons per year for one shift.

Table 18

PRESENTATION OF "Preskov AD"	
Activity / Sector	One of the oldest and largest producers of hot wrough products in Bulgaria
Address of Company	r.a. Industrialen Stara Zagora 6000 Bulgaria Phone: +359 42 252083; 627 327 Fax: +359 42 631063 E-mail: marketing@preskov.com Website: http://www.preskov.com
Number of Company [Chosen by Partner, e.g. order of finished audit reports]	5
Energy Audit conducted by [Name of Subcontractor]	ESD Bulgaria Ltd.
Date of Energy Audit [month, year]	September – November 2007
Number of employees	> 250
Total electricity consumption and cost: (data of a 12 months obtained at the time of the energy diagnosis, bills for example)	> 3000 MWh/year The Company is in the List of The Biggest Electricity consummators in Bulgaria and detailed audit of all their energy systems have to be provided.
Average unit cost of electricity (for the reference period)	The electricity cost paid by the industrial enterprises is about 70€/MWh

Note:
Some of the parameters and data (as Total electricity consumption and average unit cost of electricity) are incompleted because they were not included in the preliminary set criteria.

2.5.2 MCP Modules "tested" during the energy diagnosis carried out and main results / energy saving measures identified

Table 19

Summary of the onsite intervention

MCP modules applied [management, drives, pumps, fans, compressed air, refrigeration, and/or electric distribution]	The locations of the measured electric motors are as follow: Motor I – "Preskov" AD - Transport line Motor II – "Preskov" AD - Water pump Motor III - "Preskov" AD - Machine foe pipe curving
Energy Savings identified [kWh/year]	Total energy savings after replacement of the audited electric motors will be: **593,52** kWh/y
Main activities proposed	Replacement of the existing electric motors with Energy Efficiency ones. Regulating the operation of the electric motors, through adjusting the frequency of rotation. Improvement of electricity supply.

The relative loading according to Method 1 is calculated on the basis of the data provided on the label: nominal load, nominal electricity and nominal efficiency of capacity *cos φ*, but on the provided in the label nominal capacity.

Technical information:

Table 20

		Number of the motor		I	II	III
Data from the label of the electrical motor	1.	Tape of the motor				
	2.	Nominal Capacity	kW	1,5	30	4
	3.	Nominal Voltage	V	380	400	380
	4.	Nominal Electricity	A	4	53	8,8
	5.	Power factor, *cos φ*		0,77	0,88	0,82
	6.	Efficiency factor, *η*	%	-	-	
	7.	Nominal rotation speed	min^{-1}	1 100	2 945	1 430
	8.	Calculated nominal capacity	kW	2,0	32,3	4,7
Measurement on site	10.	Supplied Voltage	V	409	405	403
	11.	Consumed Electricity	A	1,9	39	5,3
	12.	Consumed Capacity	kW	-	-	-
	13.	Power factor, *cos φ*		0,94	0.82	0,93
	14.	Rotation speed	min^{-1}	-	-	-
	15.	Calculated consumed capacity	kW	1,3	22,4	3,4
Relative loading according to *Method 1*			%	62,4	69,4	72,4
Relative loading according to *Method 2*			%	51,1	74,5	63,9
Relative loading according to *Method 3*			%	-	-	-

Economical information:

The energy savings after replacement of the existing electric motors and electric motor driving systems with the energy efficiency one is shown in the *Table 21* bellow:

Table 21

Type of the motor	η_{old} %	η_{new} %	h	OH %	P_n *kW*	E_{saved} *kWh/y*	E_{saved} *Euro/y*
I	0,785	0,850	4000	0,624	1,5	364,72	26,26
II	0,914	0,932	4000	0,694	30	1759,75	126,70
III	0,842	0,883	4000	0,724	4	638,81	45,99
					Total	**2763,28**	**198,96**

3 MAIN DIFFICULTIES ENCOUNTERED. CONCLUSIONS

The is a common understanding of the advisability for replacement of old electric motors with the new energy efficiency ones, regarding energy savings and decreasing the production costs.

Most of the electric motors and electric motor systems on the Bulgarian market are not energy efficiency – class A.

From a technical and engineering points of view the replacement of the existing electric motors is difficult, due to their mechanical connection to the aggregates.

Almost all the enterprises have developed short, mid-term and long-term energy efficiency strategies. Currently, however, the enterprises do not like to commit themselves with stating period of replacement of old motor systems with new ones, since other priority measures have been considered and funds respectively allocated for these measures.

According to the Energy Efficiency Act, enterprises with annual energy consumption of over 3000 MWh are liable to compulsory detailed energy audit. All the enterprises audited by ESD Bulgaria are in the Ministry of Economy and Energy's List of the Biggest Electricity consumers in Bulgaria and are liable to detailed energy audit.

On the basis of this audit, the enterprises are obliged to develop a plan, consisting of deadlines and experts responsible for the implementation of the identified energy efficiency measures, which include also replacement of obsolete electric motors with new energy efficient ones, as well as identification and application for funding.

Currently Bulgaria has accepted the so-called Long-term voluntary agreements for energy efficiency in industry, which are grounded in the Energy and Energy Efficiency Act, as a stimulating measure for the application of energy efficiency measures.

The enterprises, which have signed such agreements will receive 50% grant from the investment costs, related with the application of the energy efficiency measures. Currently, none of the audited enterprises have signed such agreements, but they have expressed interest for future cooperation.

The Bulgarian enterprises are still not convinced that the replacement of the old electric motor systems with the new ones (High energy efficiency) is currently their higher priority, from a point of view of application of energy efficiency measures. They prefer to implement other EE measures, with shorter payback period, as well as measures closely connected to their technological production line.

ESD-Bulgaria was unable to attract any partners and endorsers until present. One of the main reasons is that the stimulus represented by the MCP program do not correspond to the current economic situation in Bulgaria, which makes them not attractive enough for the Industrial enterprises. The other reason is the amount of the responsibilities that the Companies have to follow during their membership period without any financial or other incentives.

However, ESD-Bulgaria will keep communicating and encouraging companies to become partners and endorsers, further communicating the benefits and granting support. In November 2007, after the partner's meeting held in Bulgaria, on the basis of their experience, the Austrian Energy Agency provided the partners with extremely useful document "4 EM - Information for Getting MCP Partners or Endorsers", which ESD-Bulgaria will try and apply to attract partners and endorsers. Naturally the different conditions and possibilities in Bulgaria will be considered.

ANNEX 1
Methods for assessment of relative loading of electric motors

Method 1

The method is based on the ratio between the real consumed capacity and nominal capacity:

(1) $$OH(\%) = \left(\frac{P_1}{P_{1ном}} \right).100$$

where:

(1a) $$P_1 = \frac{\sqrt{3}.U_л.I_л.\cos\varphi}{1000}, kW$$

(1b) $$P_{1ном} = \frac{P_{2ном}}{\eta_{ном}}, kW$$

$P_{2ном}$ – mechanical capacity of the shaft

Note:
If the line voltages or currency for the different phases are different, you should use their average value.

Method 2

The method is based on the calculation of the ratio between actual electricity and nominal electricity. When the load factor of the electrical motors is in the diapason (0,5 – 1,0), the variation of the $P_{2ном}$ can be accepted as directly proportional of the electricity variation:

(2) $$OH(\%) = \left(\frac{I_{,л}}{I_{л.ном}} \right).\left(\frac{U_н}{U_{л.ном}} \right).100$$

Method 3

The method is based on the calculation of the ratio between the actual sliding and nominal sliding. There is line connection between sliding of the asynchrony motor and its load factor:

(3) $$OH(\%) = \left(\frac{s}{s_{ном}} \right).100$$

Or

(4) $$OH(\%) = \frac{(n_{син} - n)}{(n_{син} - n_{ном})}.100$$

where:

$n_{син}$ – asynchrony speed of rotation, min^{-1}
n – actual speed of rotation, min^{-1}
$n_{ном}$ – nominal speed of rotation, min^{-1}

Due to:

1) the small relative error in measurement of **n** can be a big error in assessment of **$(n_{син}-n)$** the total error in *Method 3* can be up to 20%.
2) the connection between the rotating moment and the square of the supplied voltage and the correction for assessment of this factor have to be added. So the *Equation (4)* should be:

(4') $$OH(\%) = \frac{s}{\left[s_{ном} \left(\frac{U_{л.ном}}{U_{л}} \right)^2 \right]}.100$$

The **Efficiency Factor** of the electrical motors is calculated as follows:

(5) $$\eta(\%) = \frac{P_{2ном}.OH(\%)}{P_1}$$

ANNEX 2
Economical evaluations

The method for economic evaluation of the energy efficiency after replacement of the existing electric motors with the new ones is calculated on the basis of electricity consumption and total annual working hours of the motors.

The energy savings after replacement of the existing electric motors and electric motor driving systems with the energy efficiency one is calculated as follows:

(1) $E = h.\left(P_n.OH.\left(\frac{1}{\eta_{old}} - \frac{1}{\eta_{new}} \right) \right)$, *kWh/y*

where:

h – total annual working hours

P_n – nominal capacity, kW

OH – relative loading factor, %

η_{old} – efficiency factor of the old electric motor, %

η_{new} - efficiency factor of the new electric motor, %

ANNEX 3
PARTNERSHIP COMMITMENTS: copies of Action Plans presented to the EC

ESD-Bulgaria was unable to attract any partners and endorsers until present. One of the main reasons is that the stimulus represented by the MCP program is not corresponding with the current economic situation in Bulgaria, which makes them not attractive enough for the Industrial enterprises. The other reason is the amount of the responsibilities that the Companies have to follow during their membership period without any financial or other incentives.

However, ESD-Bulgaria will keep communicating and encouraging companies to become partners and endorsers, further communicating the benefits and granting support. In November 2007, after the partner's meeting held in Bulgaria, on the basis of their experience, the Austrian Energy Agency provided the partners with extremely useful document "4 EM - Information for Getting MCP Partners or Endorsers", which ESD-Bulgaria will try and apply to attract partners and endorsers. Naturally the different conditions and possibilities in Bulgaria will be considered.