SVILOCELL EAD
In harmony with nature

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ANNUAL MONITORING REPORT

for the period 2007 – 2010
rev.4

PROJECT: Investment program for energy efficiency in Pulp Mill Svilocell EAD, Svishtov, Bulgaria

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I. Introduction

Svilocell EAD is the sole producer of sulphate ECF bleached hardwood pulp in Bulgaria. A classical sulphate wood cooking is used, and the bleaching includes oxygen delignification, alkali extraction with a follow-up oxygen and hydrogen peroxide supplement, handling and treatment with chlorine dioxide. The processed cooking solution is congested in the Evaporation Plant (EP) and is burnt in the Soda Recovery Boiler (SRB) for chemicals regeneration.

The finished goods are presented to the market as sheet pulp.

Aimed to strengthen the leadership in the pulp and paper industry in Balkans and Europe the company follows a competitive investment strategy.

The company fulfills its investment strategy for increasing of pulp production through improvement of the energy efficiency and conducting of the necessary investments for carrying in accordance to the environmental requirements of European Union (IPPC BAT).

A part of the whole investment project is the Energy Efficiency Project that improves the operation of the reconstructed facilities and in this way reduces the steam and electricity consumption of the facilities.

Emission reductions related to the project activity could be differentiated in three main categories:

- Emission reductions as a result of the reduction in the steam demands purchased by the near Thermal Power Plant;
- Emission reductions a result of the energy demands reduction purchased by the National Electric Company (NEK);
- Emission reductions a result of the diesel consumption reduction.

The Project influences positively the environment through implementation of the BAT as follows:

- Reduction of the air pollution;
- Reduction of the water consumption and the effluent water separation;
- Improvement of the sequestration of the wastes;
- Increasing of the raw-material and energy efficiency.

During the preparation of the verification several versions of the Monitoring report were prepared as follows:

- Annual Monitoring Report 2007 – 2009 prepared on March 24th, 2011.
- Annual Monitoring Report 2010 prepared on March 29th, 2011.
- Annual Monitoring Report 2007 – 2010 prepared on April 12th, 2011.
- Annual Monitoring Report 2007 – 2010 rev. 2 prepared on May 31st, 2011.
- Annual Monitoring Report 2007 – 2010 rev. 3 prepared on July 5th, 2011.
- Annual Monitoring Report 2007 – 2010 rev. 4 prepared on September 20th, 2011.

II. Project status

With the implementation of the project "Energy efficiency investment program in Svilocell pulp mill" the operation of the reconstructed equipment is improved and the steam and electricity consumption of the equipment is decreased.

On March 1st, 2007 started the new dewatering and drying line for the pulp sheet with a capacity of 270 tons/daily sheet pulp, i.e. **SVP-06 "Shift of production from pulp blocks to pulp sheets".**

The company initially hired by Svilocell for verification services was Japan Consulting Institute (JCI) CDM Center.

Within the period July 23rd – 26th 2007 JCI CDM Center conducted an initial verification of SVP-06. The initial verification of SVP-01, SVP-02 and SVP-03 was conducted on March 4th- 6th 2008.

There is issued an Initial Verification Report № JCI CDM VER 07/001 dated September 4th, 2007.

In 2008 the following sub-projects were introduced into operation:

SVP-01 "Replacement of cyclone evaporator with a new super concentrator for Soda Recovery Boiler (SRB)" was started on January 1st, 2008.

With the installation of Andritz' new super concentrator the following was achieved:

- Improvement of the black liquor (BL) concentration;
- Increasing of the liquor dry solids (DS) content up to 70% prior to feeding in the SRB for firing;
- Improvement of the firing process;
- Reduction of the additional energy for evaporation of the water in the liquor.

SVP-02 "Replacement of barometric condensers with surface condensers in evaporating systems for black liquor" was started on January 1st, 2008.

Two surface heat exchangers produced by Andritz were installed with a capacity 500 m^3 aimed to:

- Usage of the heat from the steam condensation for heating of the water for industrial needs;
- Reducing the necessity of the extra steam usage.

SVP-03 "Installation of frequency control drives on electric motors" was started on April 1st, 2008.

Frequency control devices Altivar 61 for asynchronous motors with capacity from 160 to 220 kW of Schneider Electric were installed. The positive effects are as follows:

- Reaching of a precise control of the flow on the basis of the production process demands;
- Reduction of the electricity consumption in the production process;
- Reduction of the electricity demands from the grid (NEK).

Performance tests of the main equipment for SVP-01, SVP-02 and SVP-03 were carried out in 2008. During the commissioning period malfunctions occurred for the removal of which frequent stops of the production process were needed. This influenced the carbon emissions reduction process as well.

For sub-projects SVP-01, SVP-02 and SVP-03 there is issued Initial Verification Report REPORT NO. JCI CDM VER 07/001 REVISION NO. 00 dated 24 December 2010.

SVP-05 "Installation of a blow down heat recovery system" was started on February 5th, 2010.

The project was completed in 2009. A shell and pipe heat exchanger with a surface 2,9 m^2 was installed in which the condensate from the blow down is used for heating of the demineralized water for the production demands.

In order the heat energy for water heating up to be measured heat energy meter was installed that is an electrical unit for reporting of the water consumed to the Recovery boiler and inlet and outlet water temperature.

The heat energy meter has an integrated calculator that generates directly heat energy in MWh, utilized for heating of the water to recovery boiler.

This technical solution was discussed and coordinated during the project implementation. Monitoring for SVP-05 was started in February 2010.

During 2010 there were several trials for starting of the turbine and numerous problems each time arose. This imposed additional calculations to be performed, the supportings to be adjusted, elimination of the steam leakages in the turbine, and heating of the turbine, etc. All activities were implemented by specialists from all companies that participated in the different stages of design, construction and installation of the equipment. In February 2011 (within February 14th-21st) were successfully carried out the 72 hours tests for performance guarantees of the turbine. Since March 1st, 2011 the turbine is started in regular operation.

Within the period 2008 – 2009 the world economic crisis undoubtedly affected Bulgarian economy as well and this reflected to the situation of the company. The management team of Svilosa AD took the decision to stop temporarily the production activities in Svilocell EAD aimed to reduce the losses due to:

- Worsen conditions on the pulp market;
- Sharp decrease of the prices;
- High historical values of the pulp stocks in the European ports;
- High prices of the main raw material in Bulgaria, i.e. wood.

The production activity of the company was renewed in December 2009.

The operation of the mill in 2010 could be characterized with loading of the equipment to the maximal capacity and stable operational mode of all equipment. On October 1st, 2010 the mill was stopped for carrying out of the annual maintenance overhaul.

After the annual overhaul was completed, taking into account the irregular wood supplies the management team decided to postpone the restart of the pulp production. The stopover was required by the fact that the company did not have the necessary wood inventories for operation in the winter period. In the middle of November 2010 production activity was restored.

The above mentioned explanations influenced the generation of carbon CO_2 emission reductions as well.

III. Generated carbon emissions

The amount of the generated carbon emissions (t CO_{2e}) are presented in Table 1:

Table 1

Year	Generated carbon emissions according to Svilocell' report							Emission Reductions according to the PDD
	SVP 01	SVP 02	SVP 03	SVP 04[1]	SVP 05	SVP 06	Total	
	t/CO_{2e}	t/CO_{2e}	t/CO_{2e}	t/CO_{2e}	t/CO_{2e}	t/CO_{2e}	t/CO_{2e}	t/CO_{2e}
2007	-	-	-	-	-	6,005	6,005	85,840
2008	86,822	11,762	343	-	-	16,194	115,121	143,608
2009	16,427	1,621	52	-	-	1,393	19,493	137,200
2010	108,514	28,488	469	-	945	29,888	168,305	135,136
2011								134,267
2012								131,932

The differences between the emission reductions reported in Table 1 and those estimated in the PDD can be explained considering the following reasons:

- Differently from the original time schedule, in 2007 there was only one energy efficiency measure in operation. At the end of 2007 the reconstruction of the mill was implemented.
- In 2008 the new equipment was installed and commissioned. Furthermore the tuning of the process was carried out to reach the optimal working conditions. All these operations did not allow working at the ideal conditions all along the year.
- In 2009 the mill was in operation only 2 months due to the world economic crisis.

[1] For the period 2007 – 2010 there are no emission reductions for SVP 04 as at that time the project was not in operation. Between February 14th and February 21st of 2011 the start-up tests for the turbine were carried out. The project started in regular operation in March 1st, 2011.

- In 2010 the achieved ERUs are the result of the stable operational mode of the equipment and of the optimal parameters of the processes. The most significant increase is due to SVP-01.

In the calculation of the expected emission reductions as a baseline and project values is used data defined in the Project Design Document (PDD) active at present.

In May 2010 the Government of Bulgaria ratified an Instruction for approval of projects generating emission reduction units under Track I of the Joint Implementation Mechanism.

In June Svilocell sent a letter to Bulgarian Ministry of Environment and Waters with request for registration under Track 1 procedures. In August 30th, 2010, the project was published on the UNFCCC web site and was registered in accordance to Track 1. The ITL project ID is BG1000177.

The document that has been registered is PDD rev. 2 since March 2006. Svilocell has a Determination Report rev. 01 dated May 3rd, 2006 for the above mentioned PDD.

IV. Project management

1. Management and Monitoring System

For defining the responsibilities of collecting, registration and documentation of the information required for the emissions' calculation and facilitating the processes for implementation of the verification and for certification of the reached reduced emissions a Management and Monitoring System is set up. The staff responsible for the management of the process data is aware with the procedures of the Management and Monitoring System. The responsibilities are clearly stated. A project manager, who controls the tasks' implementation, is defined. A quality manager controls the procedures' implementation and the data's quality.

2. Data management

All the required data for the calculation of the reduced emission volumes are collected and entered on annual basis in the electronic Excel workbook. All regulations for data collection in the company's database and the principles for collection of information are observed.

The electronic workbook was modified. For each sub-project additional Sheets for Monthly Inputs were entered. The values in these Monthly Input Sheets are entered to the digit corresponding to the original documents. The responsible person enters the data of the relevant sub-projects' reports in the workbook on a monthly basis. The results of these additional Sheets are used as an Input data for Sheets EEM01; EEM02; EEM03; EEM04; EEM05 and EEM06 for calculation of the generated carbon emissions for each sub-project.

A contract between Svilosa AD and TPP Svilosa AD for submission of the required information for the project operational period is concluded.

All reports are stored by the Project manager.

2.1 Data used in each electronic workbook Sheet

In the EF NCF Sheet is entered data used in all sheets for calculation of the carbon emissions reduction. Their determination is performed according to the PDD, section D "Monitoring methodology and plan".

- TPP Svilosa AD submits an annual report for the coals' emission factor, coal' calorific value and thermal efficiency of the Station;
- Emission factors and Net Calorific Values for the other fuels (diesel and heavy oil) are taken from *2006 IPCC Guidelines for National Greenhouse Gas Inventories* ;
- Electricity transmission losses from the grid are fixed at 10% as a conservative assessment;
- According to the PDD, the grid emission factor is evaluated ex-post and is taken from the latest version of the "Baseline study of joint implementation projects in the Bulgarian energy sector". The latest version of this study was prepared by NEK on May 5th, 2005, as a request to the Ministry of Environment and Water of Bulgaria and is attached to the PDD as Appendix 4. This approach for the evaluation of the CO2 emission factor for JI projects is widely accepted and is adopted by other projects which have already been issued of ERUs. Details on how these values are calculated are given below.

The methodology used for Baseline Determination is developed on the basis of merit order dispatch analysis and does not consider the build margin. However, in case of Bulgaria, it is appropriate to only consider the operating margin, because the combined margin concept was developed for CDM projects in developing countries where electricity demand exceeds electricity supply, and a CDM project will thus also potentially displace the construction of new power plants (reflected by the build margin). This is not the case of Bulgaria where electricity exports are higher than imports[2].

Two analyses are performed by the NEK:

1. Baseline emission factor for all plants, including nuclear and hydro-power plants;
2. Baseline emission factor for generation plants, less Nuclear, Pumped-Storage and Hydro-Power Plants;

The first approach is too imprecise to analyze the reduction of CO2 emissions in a Joint-Implementation Project, because the operation of nuclear power plants and, to less extent, the operation of the four large hydro-power cascades of the power system are not influenced by the implementation of such projects. The second analysis has been considered in the current Monitoring Report. The next table summarizes the latest emission factors published by the NEK for two scenarios: minimum demand and maximum demand.

[2] http://www.iea.org/stats/electricitydata.asp?COUNTRY_CODE=BG

Table 2

Scenarios	UoM	2007	2008	2009	2010	2011	2012
Scenario Stagnation – Minimum Demand	tC02/MWh	1.100	1.078	0.956	0.917	0.902	0.899
Scenario Prosperity - Maximum Demand	tC02/MWh	1.156	1.059	0.947	0.908	0.884	0.833

Dispatch data adjusted operating margin emission factor (latest emission factors)

In order to be conservative the maximum demand scenario, which is resulting in lower carbon emission factors, has been considered. A similar approach has been approved by other Bulgarian JI projects which have already been issued of ERUs, e.g. the Track 2 JI "Sreden Iskar Cascade HPP Portfolio Project".

The defined values for the period 2007 – 2010 are presented in Table 3.

Table 3

Emission factors	UoM	2007	2008	2009	2010
Coal	t CO2/t				
Electricity purchased by the Power Plant	t CO2/MWh	1.156	1.059	0.947	0.908
Diesel	t CO2/t	2.994	2.994	2.994	2.994
Heavy oil	t CO2/t	3.328	3.328	3.328	3.328
Fuels calorific values	**UoM**				
Coals	MWh/t				
Diesel	MWh/t	11.944	11.944	11.944	11.944
Heavy oil	MWh/t	11.222	11.222	11.222	11.222
Efficiency factors for energy conversion	**UoM**				
Thermal efficiency of the Power Plant	%				
Electricity transmission losses	%	10	10	10	10

Emission Factors and Net Calorific Values of the fuels have been updated according to *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, Chapter 2 and Chapter 1 respectively.

The data for the thermal efficiency of the Power Plant, coal emission factor and coal calorific value are submitted to Svilocell as an official document by the Power Plant (CHP), signed by the Executive Director. This is an external company and Svilocell could not comment or discuss in any way the submitted data.

2.2 Data used for the determination of the generated carbon emissions

For the baseline emissions calculation, a single entry of the values was performed; these values remain unchanged for the whole crediting period.

Some of the values presented in this version of the Monitoring Report have been updated with regard to version 2. Most of the changes are minor (decimal digits) and result from more accurate rounding. Where modifications are due to other reasons, the specific explanation is given.

SVP-01 "Replacement of cyclone evaporator with a new super concentrator for Soda Recovery Boiler (SRB)"

The baseline values are presented in Table 4.

Table 4

Index	UoM	Baseline values
Black Liquor (BL) calorific value in 60% DS	kcal/kg	1,747
SRB efficiency	%	67
BL concentration after the cyclone evaporator	%	60

For the calculation of the emissions of the project activities monthly and annual data are entered in the workbook as follows:

- BL flow;
- Operating hours for SRB;
- Outlet steam temperature;
- Outlet steam pressure;
- BL concentration at the super concentrator inlet;
- BL concentration at the super concentrator outlet;
- BL calorific value in 72% DS;
- SRB annual efficiency;
- Steam purchased by the Power Plant.

The project activity values for the period 2007 – 2010 are presented in Table 5.

Table 5

Index	UoM	2007	2008	2009	2010
BL flow	t/h	-	26.4	29.7	36.7
Operating hours for SRB	hours	-	7,119	1,034	7,148
Outlet steam temperature	°C	-	434	433	435
Outlet steam pressure	bar	-	37	37	37
BL concentration at the super	%	-	59	59	59

concentrator inlet					
BL concentration at the super concentrator outlet	%	-	70	70	70
BL calorific value	kcal/kg	-	2,562	2,524	2,806
SRB annual efficiency	%	-	67	67	59
Steam purchased by the Power Plant	MWh	-	107,999	22,282	55,146

The main changes that have been applied to SVP-01 values, with regard to previous version are:

- Reduction of Black Liquor flow rate due to previous incorrect transcription of some numbers from the daily data log to the electronic template;
- Modification of BL calorific value for 2010. In 2010 an analysis of the black liquor calorific value was carried out at the same laboratory that performed the analysis in 2008. Svilocell received the results too late for their insertion in the previous version of the monitoring report, while included the outcomes in this revision.
- Recalculation of the annual flow rate of BL using the weighted average instead of the simple arithmetic average.

SVP-02 "Replacement of barometric condensers with surface condensers in evaporating systems for black liquor"

The baseline values are presented in Table 6.

Table 6

Index	**UoM**	**Baseline value**
BL concentration after washing	%	13
BL concentration after evaporation plant	%	54

For the calculation of the emissions of the project activities monthly and annual data are entered in the workbook as follows:

- BL volumes as 100% DS content;
- Annual operating hours;
- Steam temperature;
- Steam pressure;
- BL concentration after washing;
- BL concentration after heat exchanger.

The project activity values for the period 2007 – 2010 are presented in Table 7.

Table 7

Index	**UoM**	**2007**		**2008**		**2009**		**2010**	
Evaporation plant		EP1	EP2	EP1	EP2	EP1	EP2	EP1	EP2
BL mass rate at 100%	t/d	-	-	185	108	165	107	166	149

DS content									
Annual operating hours	hours	-	-	6039,5	3510,5	981,5	640,5	6802,5	6132
Steam temperature	^{0}C	-		152		150		152	
Steam pressure	bar	-		4		4		4	
BL concentration after washing	%	-		15		15		16	
BL concentration after evaporation plant	%	-		59		59		59	

The annual operating hours refer to the two evaporation plants, for this reason they can exceed the total hours in one year (8,760).

SVP-03 "Installation of frequency control drives on electric motors"

As baseline values for calculation of the expected emission reductions were used the data for the nominal power of the pumps' motors defined in Table 8.

Table 8

Pump	70.0480	60.0460	08.0406	70.0485
Motor nominal power, kW	132	160	200	160

For the calculation of the emissions of the project activities monthly and annual data are entered in the workbook as follows:

- Actual power consumed;
- Operating hours;
- Average power consumed;
- Motor efficiency reported by Schneider Electric graphs that present the connection between the load factor and motor efficiency.

The project activity values for the period 2007 – 2010 for each pump are presented in Tables 9 – Table 12 below: The 4 columns below in each table refer to the 4 frequency control drives installed on the different pumps.

Table 9

Year	**2007**[3]			
Pump	70.0480	60.0460	08.0406	70.0485
Pump serial number	*EL 0733054 361*	*EL 0733054 364*	*EL 0733054 362*	*EL 0733054 358*
Actual power consumed, kWh	-	-	-	-
Operating hours, h	-	-	-	-
Average power consumed, kW	-	-	-	-
Motor efficiency, % defined by Schneider Electric graphs	-	-	-	-

[3] During 2007 the frequency control drives were not installed on the pumps. Due to that reason there is no information in the table and we do not report any emission reductions.

Table 10

Year	**2008**			
Pump	70.0480	60.0460	08.0406	70.0485
Pump serial number	*EL 0733054 361*	*EL 0733054 364*	*EL 0733054 362*	*EL 0733054 358*
Actual power consumed, kWh	291,000	398,000	431,000	262,000
Operating hours, h	5,112	5,054	5,382	5,125
Average power consumed, kW	57	79	80	51
Motor efficiency, % defined by Schneider Electric graphs	83	84	83	80

Table 11

Year	**2009**			
Pump	70.0480	60.0460	08.0406	70.0485
Pump serial number	*EL 0733054 361*	*EL 0733054 364*	*EL 0733054 362*	*EL 0733054 358*
Actual power consumed, kWh	49,000	67,000	65,000	47,000
Operating hours, h	893	876	956	899
Average power consumed, kW	55	76	68	52
Motor efficiency, % defined by Schneider Electric graphs	83	84	81	81

Table 12

Year	**2010**			
Pump	70.0480	60.0460	08.0406	70.0485
Pump serial number	*EL 0733054 361*	*EL 0733054 364*	*EL 0733054 362*	*EL 0733054 358*
Actual power consumed, kWh	448,000	644,000	1,130,000	450,000
Operating hours, h	6,946	6,906	7,118	6,953
Average power consumed, kW	64	93	159	65
Motor efficiency, % defined by Schneider Electric graphs	84	85	87	83

The corrections are due to typing errors in the previous version of the MR, i.e. for 2008 and 2009 the baseline consumption was indicated instead of the consumption in the project scenario. The error was just in the Word document and not in the calculation spreadsheet.

SVP-04 "Installation of a back pressure heat turbine"

The monitoring of this project starts in 2011.

SVP-05 "Installation of a blow down heat recovery system"

As baseline value for calculation of the anticipated emission reductions is used blow down rate 3%, which is defined according to the PDD.

For calculation of the emission reductions the following data are entered in the workbook on monthly and annual basis:

- Average annual steam production;
- Annual working hours;
- Temperature at the inlet of the heat exchanger;
- Temperature at the outlet of the heat exchanger;
- Heat recovery.

The project activity' values for 2010 are presented in Table 13:

Table 13

Index	**UoM**	**2010**
Average annual steam production	t/h	66.80
Annual working hours for SRB	h	6,469
Temperature inlet heat exchanger	^{o}C	251
Temperature outlet heat exchanger	^{o}C	60
Heat recovery	MWh	1,034

The average annual steam production has been recalculated using the weighted average instead of the simple arithmetic average.

SVP-06 "Shift from block pulp to sheet pulp"

For the calculation of the baseline emissions a single entry of the data, stated as baseline values according to the PDD. These values are presented in the Table 14 and remain unchanged.

Table 14

Index	**UoM**	**Baseline values**
Diesel specific consumption in block line	t /t pulp	0.0383
Steam specific consumption in block line	MWh / t pulp	0.9569
Electricity specific consumption in block line	MWh / t pulp	0.2791
Block pulp production	t /y	58 % of the total production

For the calculation of the emissions of the project activities monthly and annual data are entered in the workbook as follows:

- Total pulp production;
- Diesel specific consumption in sheet line;

- Steam specific consumption in block line;
- Electricity specific consumption in block line.

The project activity' values for the period 2007 – 2010 are presented in Table 15:

Table 15

Index	**UoM**	**2007**	**2008**	**2009**	**2010**
Total pulp production	t/y	38,016	72,509	10,707	104,861
Diesel specific consumption in sheet line	t/t pulp	0	0	0	0
Steam specific consumption in sheet line	MWh/t pulp	0.8325	0.8014	0.9356	0.7069
Electricity specific consumption in sheet line	MWh/t pulp	0.2239	0.1694	0.1989	0.1368