NORSK ENERGI

UNIDO The National Cleaner Production Center - Macedonia

CLEANER AND MORE COST EFFECTIVE INDUSTRY IN MACEDONIA

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ROUNDTABLE DISCUSSION

FROM ANALYSIS TO REALISATION

How to realise energy efficiency projects in Macedonian industry?

SILMAK - JEGUNOVCE

Information about the company

- SILMAK is a private company producing ferrosilicon and a leading producer of ferroalloys on the Balkan Peninsula.
- Location - Jegunovce, 45 km west from Skopje, R. Macedonia.
- Established - 2002 as a successor of the JUGOHROM company, which was established in 1952.

	Product or service/ Intended use	Quantity per year (in tones)
1	Ferrosilicon with 65 % Si	8.000
2	Ferrosilicon with 75 % Si	55.000
3	Ferrosilicon with 90 % Si	5.000
4	Silicon metal with 98 % Si	10,000

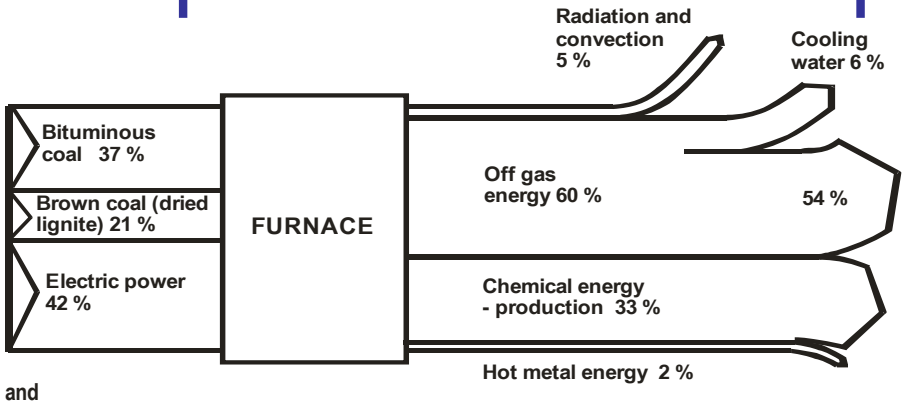
Energy consumption in the company

- Main processes in SILMAK are performed in seven electro furnaces with total installed electric power of 94 MW. Due to the nature of the applied technology, the company as whole is a large energy consumer, mostly by the electric furnaces and the rest of the electrical energy is consumed by: electrical drives for pumps used for ground water pumping, compressor station, transportation and ventilation facilities (about 1 MW) and lightning facilities (about 250 kW). Part of the waste heat in the process of smelting is used for the plant heating in winter period.

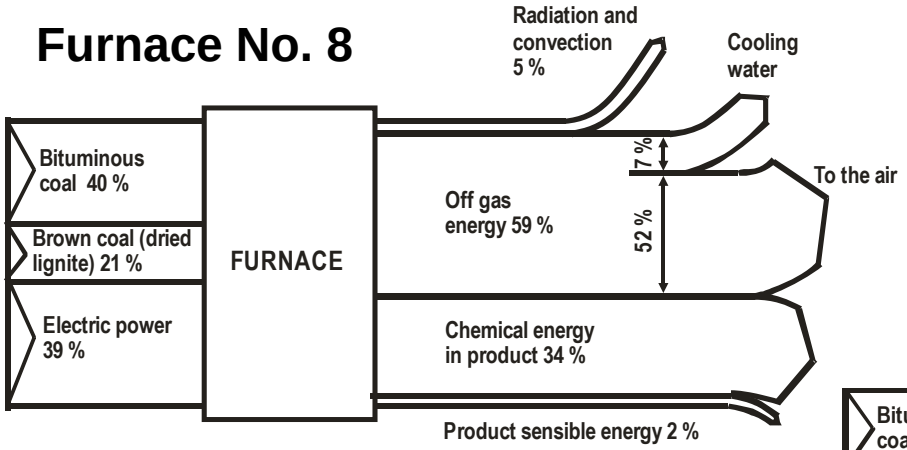
	Type of electrical energy	**Annual consumption**	**Unit**	**Percentage [%]**
1	Active electrical energy (by day)	124,868,123	kWh	38.8
2	Active electrical energy(by night)	197,000,200	kWh	61.2
3	Maximal power	35,000	kW	
4	Reactive electrical energy	70,342,540	kVArh	
	Total	321,868,323	kWh	100

Energy consumption in the company

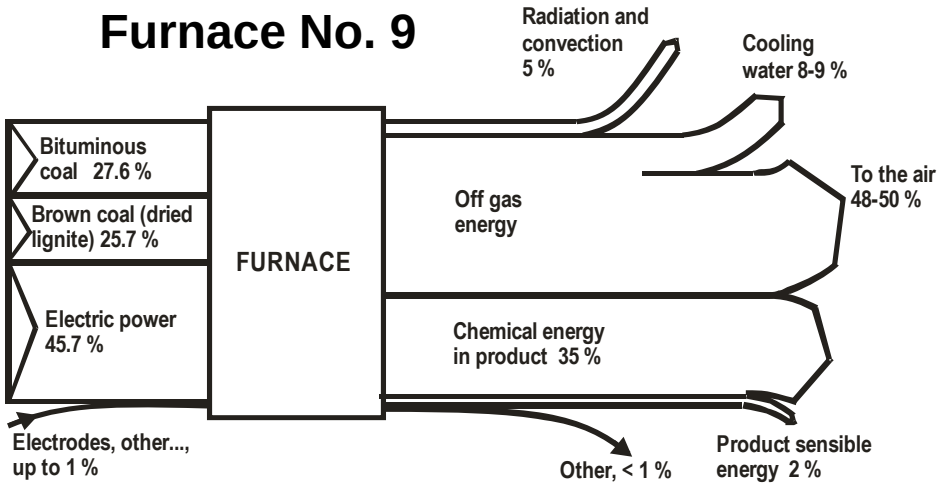
Furnace No. 7



Furnace No. 8



Furnace No. 9



Energy efficiency options identified

Option / measure	Description and reasons for an investment	
1. Use of heat contained in flue gases. Installation of heat recovery boiler, steam turbine, electric generator and additional equipment for electrical energy generation	**Reasons for undertaking the investment** There is lot of energy in the hot flue gases, which can be recovered with proper technical measures. **Description of the investment:** Solution of the problem with a large volumetric flow of flue gas; installation of heat recovery steam boiler, steam turbine, electric generator and other equipment for electricity generation. Dust filter must be installed before or within this investment. **Improvement:** **Technical aspect -** Electrical energy generation; reduction of energy consumption **Environmental effects -** Lower emissions of different gases (SO_2, NO_x, etc.), including CO_2; lower dust emission **Economical aspect -** Reduction of the energy consumption costs; possible additional income through the CDM procedures	
	Estimated value: **22 000 000 €**	Estimated savings (incl. CDM benefit): **6 000 000 €**/year

Energy efficiency options identified

Option / measure	Description and reasons for an investment	
2. Management of maximal electrical power consumption	**Reasons for undertaking the investment** Company do not use all allowed electrical power (usually 500 kW to 1MW are not used) **Description of the investment** First phase - energy consumption of all the furnaces has to be manually controlled from one place. In the second phase automatic monitoring and control system has to be implemented	
	Estimated value: 50 000 €	Estimated savings:
3. Optimization of the furnace working regime	**Reasons for undertaking the investment** Optimized furnace regimes will increase production with the same energy consumption **Description of the investment** Implementation of sophistical automatic control system on each furnace	
	Estimated value: 30 000 €/furnace	Estimated savings: 20 000 €/year/furn.
4. Energy saving – electrical motors for compressors, fans and pumps	**Reasons for undertaking the investment** Reducing electrical power consumption **Description of the investment** Installing the power converters and appropriate control scheme	
	Estimated value: The investment level depends on the electric drive power	Estimated savings: Pay-back period for the investment is about two years
5. Reduction of electrical energy consumption for lighting	**Reasons for undertaking the investment** Savings of electric energy and better lighting **Description of the investment:** Change of the regular light bulbs with economical (sodium, solid state..)	
	Estimated value: 40 000 €	Estimated savings: 8 000 €/year

Estimated energy savings, cost savings and investment budget

The main identified energy efficiency options:

- Waste heat recovery
- Off gases dust trap, collection and selling
- Optimization of the dust generation in the production process.

Benefits for SILMAK:

- Reduction of electricity costs by 20 %.
- Combination with installation of baghouse filters (to do within 2013), will reduce the total investments because the need for gas coolers is eliminated.
- Sale of carbon credits as a CDM project. It is estimated CO_2 reductions to be 60-65.000 tons/year. A CO_2 price of 10 EUR/ton CO_2 could give annual income of 600.000-650.000 EUR/year for post-Kyoto delivery.
- Installation of a baghouse filter makes it possible to recover microsilica dust. An average price for microsilica of 200 EUR/ton is used in this report.

Estimated energy savings, cost savings and investment budget

	LE investment	HE investment
Waste heat recovery (WHR)		
Electrical capacity, furnace 7, Elkem (MW)	32	32
Electrical capacity, furnace 8, Krupp (MW)	15	15
Sum electrical furnace capacity (MW)	47	47
Recovery of electricity 20 % (MW)	9,4	9,4
Electricity price (EUR/MWh)	45	45
Value of recovered electricity (EUR/year)	3384000	3384000
Specific investment WHR (EUR/kWel)	1700	2200
Investment WHR (EUR)	15980000	20680000
Gas purification		
Investment air cooler	1598000	2068000
Microsilica recovery		
Price microsilica (EUR/ton)	200	200
Amount of microsilica (200 ton/MW) (ton/year)	9400	9400
Value of microsilica (EUR/year)	1880000	1880000

Estimated energy savings, cost savings and investment budget

Project economy WHR+MicSi+CDM	Low estimated investment	High estimated investment
Sum investments (EUR)	17578000	22748000
Sum income WHR+MicSi+CDM (EUR/year)	5952080	5952080
Sum income WHR+MicSi (without CDM) (EUR/year)	5264000	5264000
Payback (Years)	2,95	3,8
Payback without CDM	3,3	4,3

CDM		
Grid emission factor (ton CO2 / MWh el)	0,915	0,915
CO2 emission reduction (ton/year)	68808	68808
CER price (EUR/ton CO2)	10	10
Income from sale of CERs (EUR/year)	688080	688080

Challenges for implementation

- The potential for implementation of energy efficiency measures in SILMAK is significant - the focus has to be put on waste heat recovery system. Implementation of waste heat recovery system could result in around 20 % reduction of the needs for purchasing electricity.
- The waste heat recovery project qualifies for CDM. This means that if the project is approved by the UN as a CDM project, sale of CO2 certified emission reductions could improve the profitability of the investment.
- Preparation of proper project documentation for SILMAK, with more accurate operational data over a certain period and with more detailed calculations, could be a real support and initial point for the company.
- Permanent search for financing for accomplishment of the energy efficiency and energy saving options is necessary.
- Cooperation with companies that are offering technical assistance to the industry in identifying and developing projects on energy efficiency and energy saving.

BARRIERS AND LIMITING FACTORS

- Discontinuities in the work of the furnaces and of the company as whole; sometimes, with breaks lasting several months.
- Variations of the company products prices, which are typical stock products.
- Changes in the ratio of the ferro-silica price, versus the price of electrical energy on the market.
- Design and operation problems arising from the semi-closed, to open working regime of the furnaces, that increases the emission of flue gasses/per ton product by 2,5 times more than the world normative.
- Not well defined legislation for energy efficiency, energy savings and environmental protection measures in the industrial sector in Macedonia,
- Not sufficient governmental support for companies that are huge consumers of electrical energy, for implementation of energy saving measures.
- Lack of financial resources as support for energy saving investments