# EU Project EUREMplus: Energy Efficiency Concepts

EUREM plus
European EnergyManager

**Publisher**
**Nuremberg Chamber of Commerce and Industry (CCI)**
**Innovation & Environmental Affairs Division**
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Co-funded by the Intelligent Energy Europe
Programm of the European Union

# FOREWORD

The European EnergyManager Training EUREM is a standardized training of further education that enhances the skills of technical experts in the field of energy efficiency improvement. It covers nearly all energy-relevant issues, which can arise in companies. The preparation of a so-called "energy concept" is a compulsory and very important element of the EUREM training. Participants examine in detail a solution to a given energy challenge of their company – which in the case of consultants of one of their clients – includes the technical elements and an analysis of financial viability. They receive mentoring and coaching by experienced EUREM trainers and present their concept to a jury as part of their course examination. The focus of these energy concepts is on energy efficiency, but the use of renewable energies (usually replacing fossil fuels and thus contributing to $CO_2$ emissions reductions) can be the topic of an energy concept as well.

About 75% of the organisations fully or at least partially implement the energy measures elaborated by the EUREM participants as course projects, thus contributing to their competitiveness and efficiency as well as to achieving the EU 2020 goals of reducing greenhouse gases. However, this is not the end of the benefits of the training. EUREM alumni continue to apply their enhanced knowledge and skills in their organisation, identify further energy improvement opportunities and plan solutions for them. EUREM providers worldwide know that this is the case, as many of them remain in contact with alumni, for example via dedicated events such as the International EnergyManager conferences or network meetings at national level.

The present brochure shows a collection of energy efficiency projects from the partners of the EUREMplus EU project and EUREM AWARD winners.

PROJECT

Heating

# Energy Optimization and Heating System Analysis

**Energy Manager**
**Rudolf Bittner**
Thermorent
Wärmeversorgung GmbH,
RSZ Automobile Stegmeier,
Germany

The aim of the Project is the optimization of the old heating system (gas boiler from 1998 and 2000, oil boiler from 1965 and 1980) of the car dealer RSZ Automobile Stegmeier. The heat requirement was recalculated and it was found that for heating the offices, the exhibition area and the workshop, the old two boilers were too large. The heating load was approximately 160 kW, but required is only a heating load of approximately 125 kW. Therefore, there was a potential for energy saving by replacing the existing heating system by a more modern and smaller one. It was recommended to install a condensing boiler with a modulation range of 57-290 kW and an efficiency of about 98%. This investment saves about 6,300 Euros a year on energy costs and has a pay-back time of 6.5 years. Furthermore, a combined heat and power unit was recommended to lower electricity costs for the car dealer.

**Results**

Investment in Euro: **41,000**
Cost reduction in Euro/Year: **6,300**
Pay-back-time in years: **6.5**
Energy saving potential in kWh/year: **134,000**
$CO_2$ saving potential in t/year: **33**


Heating System

PROJECT

Lighting

# Remodeling and Changeover of a Lighting Installation

**Energy Manager**
**Michael Stahl-Schlereth**
Poratec GmbH, Veit Dennert KG, Germany

The project aims at improving the current lighting situation in the production halls of Poratec GmbH to save energy and lower the costs. The possible options are technically, economically and environmentally (emissions) examined. A first evaluation of the installed lighting system showed that there are areas in the production hall which are unnecessarily illuminated all day long. Moreover some lights are oversized or in a wrong and useless position. The suggested solution was to dismantle or to separate some light circuits and to consider an exchange of the remaining fluorescent lights with new efficient LED lights to save energy and costs. The result is an energy saving of nearly 60% for lighting and about 10,000 Euro yearly.

**Results**

Investment in Euro: **29,578**
Cost reduction in Euro/Year: **10,526**
Pay-back-time in years: **2.8**
Energy saving potential in kWh/year: **60,152**
$CO_2$ saving potential in t/year: **33**

Old Lighting System

PROJECT

Compressed Air, Energy Data Management Systems

# Energy Monitoring and Optimisation of a Compressed Air System

**Energy Manager**
**Gerhard Zlabinger**
Eaton Industries GmbH, Austria

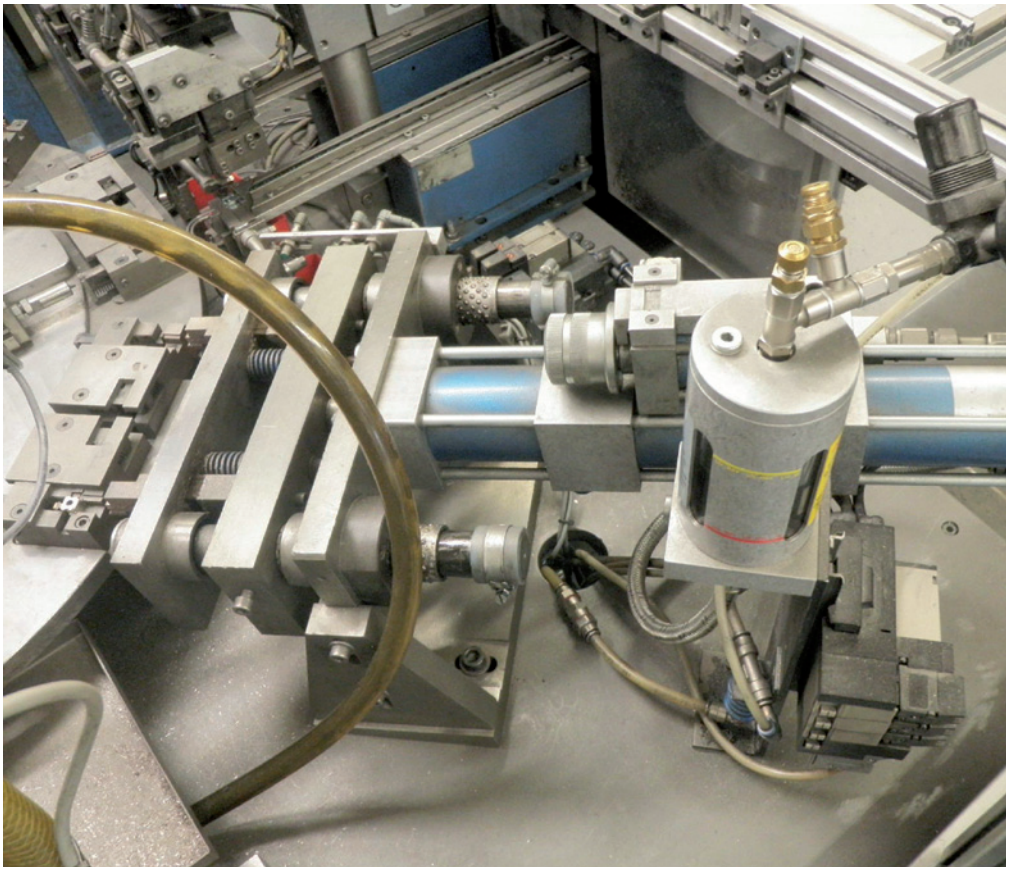
The starting point for this project was that there was relatively high leakage in parts of the compressed air systems of the 10 facilities that were examined and that, additionally, the process of some plant equipment had to be reviewed.

The following plan for optimization was developed: First, an energy monitoring system will be implemented to replace leakage detection that was carried out quite infrequently in the past and did not cover the entirety of the systems. For this purpose, the existing industrial data capture system will be extended with an energy data option. Then, all facilities will be checked and leakages repaired. In the original state, there was a leakage rate of 25%. A training should raise awareness of this issue among the employees.

This improvement of the 10 machines means a saving of 11,931 €. The investment required is 6,052 € which results in a payback period of only about 0.5 years. Also, this improvement will save nearly 33 tons of greenhouse gases per year.

**Results**

Investment in Euro: **6,052**
Cost reduction in Euro/Year: **11,931**
Pay-back-time in years: **0.5**
Energy saving potential in kWh/year: **119.308**
$CO_2$ saving potential in t/year: **33**

Usage of Compressed Air

PROJECT

Heat Recovery,
Process Heat

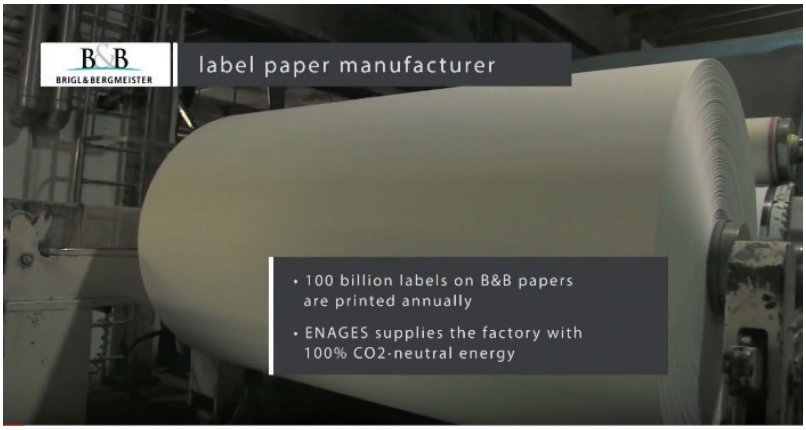
# Heat Recovery from Process Condensate in a Paper Mill

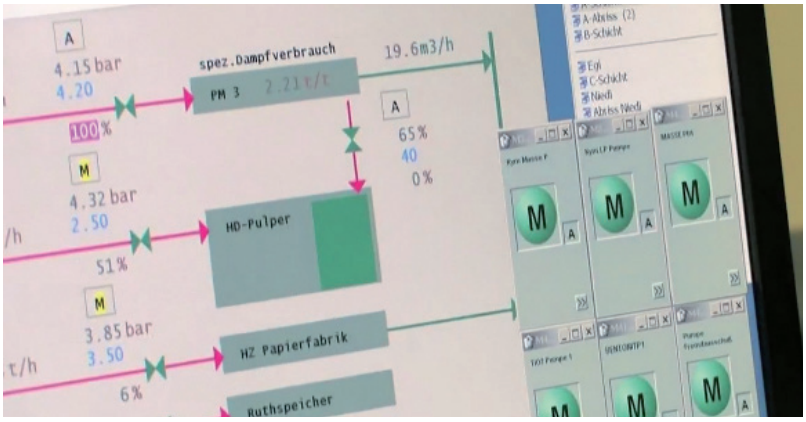
**Energy Manager**
**Wilhelm Fandler**
Brigl & Bergmeister GmbH,
Austria

Before the improvement, the temperature of the Ruth steam accumulator which supplies the primary circuit of the damper register was kept at 90 °C by means of steam contribution to the accumulator. Steam was also used to heat the process water for the HD-pulper to the required temperature. The 90 °C condensate that was not needed was pumped back to the external steam provider.

The improvement measures developed, concern the reduction of steam consumption for the heating system of the paper mill and the preheating of the process water for the HD-pulper: Thanks to the installation of one added tank in which the condensate originating from the process is stored, an optimal use of the residual energy for heating will be ensured, due to direct delivery to the heat-exchanger. The energy that is not needed for the heating of Brigl & Bergmeister will be used for preheating water for the HD-pulper. Also, just the contractually agreed amount of condensate will be returned to the external steam provider, while the remaining amount will also be added to the HD-pulper.

Due to this change of the heating-system, which was completed in summer 2015, 7,297 t of steam at a temperature of 185 °C and a pressure of 4,5 bar will be saved.




**Results**

Investment in Euro: **320,000**
Cost reduction in Euro/Year: **172,000**
Pay-back-time in years: **1.9**
Energy saving potential in kWh/year: **5,728,145**
$CO_2$ saving potential in t/year: **118.4**

PROJECT

# Cooling of Biogas Plant Engine Rooms

Cogeneration, Biogas

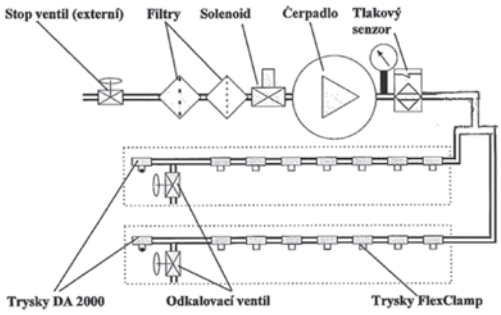
**Energy Manager**
**Gabriela Smetanová**
FARMTEC a.s., Czech Republic

The overheating of cogeneration units stationed in engine rooms of biogas plants is quite a common problem during the summer months. Extremely high outdoor temperatures cause an increase in engine temperature and in some cases lead to a reduction of power generation or even a shut-off of the cogeneration unit. Poor performance of cogeneration units or inability to operate at full power leads to financial losses in the form of ungenerated electricity or heat which lowers the overall efficiency of the cogeneration unit. One of the possible ways of cooling machinery space is adiabatic cooling. The principle of adiabatic cooling as well as the technical performance of the installed equipment is addressed in this paper. Adiabatic cooling measures will ensure automatic temperature control in the event of extreme outdoor temperatures and the possibility to operate cogeneration units without power loss and shutting off due to a too high temperature of the intake air. An important condition for the installation is an economic evaluation and the suitability evaluation for the use of this equipment.

**Results**

Investment in Euro: **3,895**
Cost reduction in Euro/Year: **7,089**
Pay-back-time in years: **0.55**
Energy saving potential in kWh/year: **45,600**
$CO_2$ saving potential in t/year: **39**


Combined Heat and Power Plant (CHP)



PROJECT

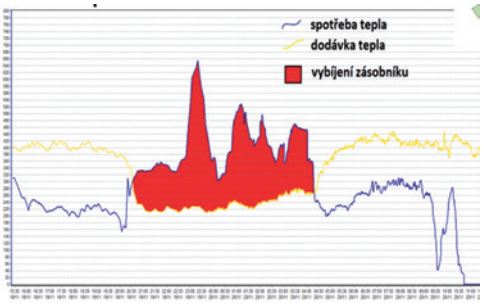
Lighting, Process Heat, Biogas

# Optimization of the Existing Biogas Power Plant

**Energy Manager**
**Adam Moravec**
Renergie s.r.o, Czech Republic

The project focuses on the optimization of the existing biogas power plant (BGP) with an output of 495 kW electricity power and 600 kW thermal power. The BGP is an energy center supplying the adjacent agricultural enterprises and the greenhouse for the production of herbs in pots. The extension of the greenhouse is projected with a doubled production area, i.e. two hectares instead of one now. For this enlargement, it is necessary to ensure a sufficient energy supply. The Project describes two variants. VAR1 - the zero variant – assumes that the energy production of the BGP will stay constant.

The additional energy for the enlarged greenhouse will be acquired from the distribution grids (electric power and natural gas). VAR2 – a software power increase of the BGP production capacity installed – proposes to increase the power output in agreement with given regulations up to 600 kW power and 700 kW thermal. This additional energy output from the BGP will reduce power consumption from the distribution grid by 40% and natural gas consumption by 30%. The maximum power output from the BGP will be produced during the period of working illumination in the greenhouse, i.e. during peak local energy consumption. Apart from this period, the output from CHPU will be regulated according to the actual local thermal power demand and to the actual amount of the biogas collected in the BGA integrated reservoir. Because the amount of the input raw materials is limited as well as their storage capacity, the output of the BGP will be reduced according to the lower local thermal demand the summer. This enables the operator of the BGP to maintain the annual energy production at the same level as now with the recent annual consumption of the input materials. Investment costs of this variant are in total 650,000,- CZK, from which 400,000,- CZK are costs for the technical (software) upgrade of the CHPU. The economical evaluation of the VAR2 exhibits a short payback-period (= 1.3 year) and a reasonably high value of IRR (78%). Annual emission reduction is expected to be 680 t $CO_{2eq}$.


**Results**

Investment in Euro: **24,000**
Cost reduction in Euro/Year: **23,000**
Pay-back-time in years: **1.3**
Energy saving potential in kWh/year: **–**
$CO_2$ saving potential in t/year: **680**

PROJECT

Lighting

# Improvement of the Lighting System Efficiency in an Office Building

**Energy Manager**
**Marios Halloumas**
Halloumas Construction Consultants LTD, Cyprus

This energy concept proposes the replacement of the existing luminaires (fluorescent type T26 2 and 4 ft, panel lights, halogen GU-10) with high efficient LED luminaires. An excel tool was used in order to calculate the energy consumption of the existing lighting system and the proposed lighting system. The aim of the energy concept was to improve the energy efficiency of the lighting systems of the Logicom public premises. For this purpose, solutions were developed for each type of luminaire of the company. Moreover, light intensity measurements took place in order to ensure that the quality of the lighting is sufficient. According to the results of the energy concept, the installed capacity of the proposed lighting system is approximately 40% in comparison with the existing lighting system. Therefore, there is a great energy saving potential which will significantly reduce electricity bills for these premises.

**Results**

Investment in Euro: **5,220**
Cost reduction in Euro/Year: **3,340**
Pay-back-time in years: **1.1**
Energy saving potential in kWh/year: **18,000**
$CO_2$ saving potential in t/year: **15.73**

Electric Power Measurements

Halloumas House Construction


Illuminance Measurements

PROJECT

# Energy Performance of Traffic Signals Systems

Lighting

**Energy Manager**
**Marios Georgiou**
Nicosia Municipality,
Cyprus

This energy concept includes laboratory measurements of LV and ELV centralized Traffic Signal Systems (lamps and controllers) which took place in the electrical laboratory of Frederick University of Cyprus and at the Nicosia Municipality workshop. Moreover, on-site measurements (energy consumption, illuminance) of these types of traffic signal systems (of the existing and pilot traffic signal systems), using relevant lighting standards methodologies, were undertaken in order to verivfy the potential energy saving from an energy retrofit for all the traffic signals of the Nicosia Municipality.

The calculations for energy saving (avoided energy consumption) and the cost savings (technical and economic analysis) took into consideration real measurements and actual costs (using electricity provider bills, maintenance cost, market prices, etc).

**Results**

Investment in Euro: **975,954**
Cost reduction in Euro/Year: **70,667**
Pay-back-time in years: **2.3**
Energy saving potential in kWh/year: **279,221**
$CO_2$ saving potential in t/year: **244**

Δήμος Λευκωσίας
Nicosia Municipality

Presentation of the Energy Concept During the EUREM Conference in Prague

Nicosia Municipality Town Hall Building

PROJECT

Building, Heating

# Energy Efficiency Improvement of an Industrial Building

**Energy Manager**
**Stoyan Djevizov**
Actemium BEA Balkan Ltd.,
Bulgaria

Aims: Analysis of an existing industrial building owned by the " Bitova tehnika - garant" AD, Plovdiv. Evaluate the potential for improving energy efficiency by appropriate technical and economic measures

Basic situation: Information for energy consumption - electricity, coal and wood for the period 2012-2014

Optimization potentials / weak points: The building's surrounding elements are in a bad condition from a thermo-technical point of view. The system is inefficient

Proposals of solution / Optimization possibilities: The implementation of several key measures to optimize the EE state of the industrial building is planned: replacement of windows, insulation of walls and roof, installation of a modern heating system

Effects: Improve working conditions in the company, increase labour productivity, reduce energy costs, reduce $CO_2$ emitted emissions.

**Results**

Investment in Euro: **171,237**
Cost reduction in Euro/Year: **98,000**
Pay-back-time in years: **1.75**
Energy saving potential in kWh/year: **985,000**
$CO_2$ saving potential in t/year: **740**

PROJECT

Heat

# A Technical Solution for Energy Savings in Heating of Office Space

**Energy Manager**
**Darian Strauss**
Zdenka mliječni proizvodi d.o.o., Croatia

The existing heating of office space is done by a counterflow heat exchanger – steam/water. The steam is transported by an old steam pipeline, 400 m in length, with poor insulation. The pipeline has some holes due to its age and releases steam into the atmosphere. There is no condensate return. The big steam boiler powered by natural gas is dislocated and is sized and used for technological processes.

The old heating system will be replaced with condensing boilers located in the office building. The old circulating pumps will be replaced with new "smart" low energy consumption pumps. The radiators will be equipped with thermostatic regulating valves. The heating regulation will be optimized for best heating performance with lowest possible energy consumption (day/night/weekend).

At this point, condensing boilers are the best technical and economic optimum.

**Results**

Investment in Euro: **374,000.00**
Cost reduction in Euro/Year: **92,859.20**
Pay-back-time in years: **1.68**
Energy saving potential in kWh/year: **66,250**
$CO_2$ saving potential in t/year: **46.69**

PROJECT

# Installation of a Natural Gas CHP System

Combined Heat & Power

**Energy Manager**
**Zarko Trpkoski**
Teteks, Manufacture of Outerwear, Macedonia

After reviewing the existing energy generation and consumption data at the Teteks textile production, we developed an integral energy optimization solution.

The main activity was to switch from a central energy coal plant to a modern local natural gas-fired CHP (Combined Heat and Power) system for the generation of electricity, steam and heat energy. The CHP system is the heart of the new energy concept and provides 600 kW electricity and 680 kW heat (water 90 °C). We use superheated steam (210 °C), therefore an additional gas-fired 4t/h boiler to generate the steam from hot water is necessary.

In total, 1,915 MWh of electricity and 11,907 MWh of heat (steam) are produced per year. Due to an energy efficiency improvement from 64% to 91% with the new system, there are annual savings of 252,228 Euro, with an investment of 985,036 Euro capital.

An internal rate of return of 19.97% and a net present value of 569,869 Euro for a 15 years life cycle were calculated. A significant reduction of $CO_2$ emission as well as zero ash pollution is expected.

**Results**

Investment in Euro: **985,036**
Cost reduction in Euro/Year: **252,228**
Pay-back-time in years: **3.9**
Energy saving potential in kWh/year: **4,128,727**
$CO_2$ saving potential in t/year: **2,441**

CHP System in Teteks

Central Coal Plant

PROJECT

Compressed Air

# Dolomite Refractory Production – Optimization of Sintering

**Energy Manager**
**Zlatko Gjurchinoski**
Vardar Dolomit ,
Macedonia

Vardar Dolomit uses compressed air needed for the sintering of dolomite in a vertical (shaft) kiln which is supplied by one compressor and one blower, each 30 years old.
The air from the compressor is used for cooling down the final product and to bring the heat back into the process.

In the beginning, the kiln was destined to work with 48 heavy fuel oil burners (16 burners radially positioned on each of 3 different levels of the kiln), but due to the good quality of the raw material, 32 burners (16 burners radially positioned on each of 2 different levels of the kiln) are sufficient for normal production. Therefore, the number of burners was decreased by 33%, but compressor and blower remained the same, so they have been oversized from the start.

Our calculations indicate that production process needs can be attained with 2 blowers with lower capacity. The new blowers will have better efficiency and will work closer to their nominal parameters which is more economical, so there is lower energy consumption and lower peak power demand. Moreover, the new blowers have lower servicing costs and lower lubricant oil usage. Last but not least, we will renew the equipment and increase reliability. Speaking of numbers, we plan to decrease annual operation costs from 64,400 Euro to 43,900 Euro and to obtain annual energy savings of 196 MWh of electrical energy.

**Results**

Investment in Euro: **47,845**
Cost reduction in Euro/Year: **20,497**
Pay-back-time in years: **2.17**
Energy saving potential in kWh/year: **195,640**
$CO_2$ saving potential in t/year: **117**


The Sintering Process at Vardar Dolomit

PROJECT

# Modernization of Ladle Preheating

Process Heat

**Energy Manager**
**Piotr Hajduk**
Ferrostal Łabędy Sp. z o.o.,
Poland

The aim of the project is the modernization of the ladle preheating system for gas use reduction. The gas-air burners are installed on the two heaters, each burner has a power of 1500 kW and works in 15-minute cycles every 70 minutes. Due to this, it is not possible to use a recuperator of exhaust heat. The current energy use is around 4300 MWh / year. The proposed solution for optimization is based on gas combustion in an oxygen atmosphere with full measurement and control. By applying this solution, gas use reduction will be achieved and energy use by ventilators will be eliminated, while at the same time oxygen will be used for combustion.

Planned results: better energy effectiveness (gas use reduction by 50%), $CO_2$ emission reduction, possibility to apply for and receive White Certificates (Energy Effectiveness Certificates), exact control of the technological process of heating, flexibility of the process of heating.

**Results**

Investment in Euro: **101,000**
Cost reduction in Euro/Year: **45,000**
Pay-back-time in years: **2.3**
Energy saving potential in kWh/year: **2,145,000**
$CO_2$ saving potential in t/year: **390**

One of the Main Ladles

"Ferrostal Łabędy" Steel Plant

PROJECT

District Heating

# Renovation of an Overground Heat Distribution Network

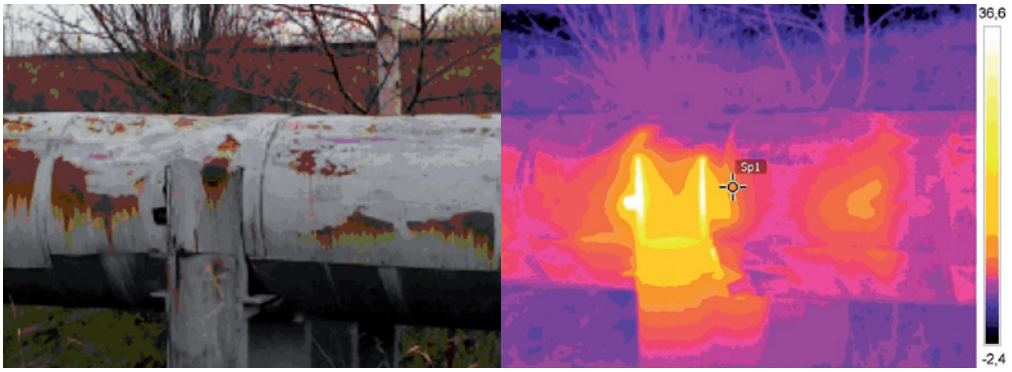
**Energy Manager**
**Ryszard Sobański**
Miejski Zakład Energetyki Cieplnej w Świdnicy Sp. z o.o (Municipal Heating Enterprise in Świdnica Ltd.), Poland

The aim of the project is loss reduction while sending heat to end users.

The basic situation: an overground heating network, 782 metres long, 600 mm in diameter, constructed 30 years ago in traditional technology, dual duct, changeable parameters 150/70 °C, steel tubes insulated with insulation wool and screened with steel sheet. The condition of the insulation has deteriorated considerably. Annual heat losses amount to 6,318 GJ. Two approaches have been considered – a total replacement of the network or a replacement of the insulation with a new insulator covering. An investment return period analysis recommended the replacement of the insulation only. Modernisation work will consist in a replacement of the existing traditional insulation with modern insulator covering, the so-called PUR plates, made of stiff polyurethane (PUR) foam.
This will ensure the largest loss reduction and investment durability. Reduction of heat losses in transport by 78%, i.e. 4,903 GJ annually.

**Results**

Investment in Euro: **185,846**
Cost reduction in Euro/Year: **35,980**
Pay-back-time in years: **5.0**
Energy saving potential in kWh/year: **1,362,053**
$CO_2$ saving potential in t/year: **466**


Part of overground heat distribution network with deteriorated insulation

Image of this part by infrared camera - heat losses

PROJECT

Heating

# Heat Recovery from Flue Gas of Heat Treatment Furnace

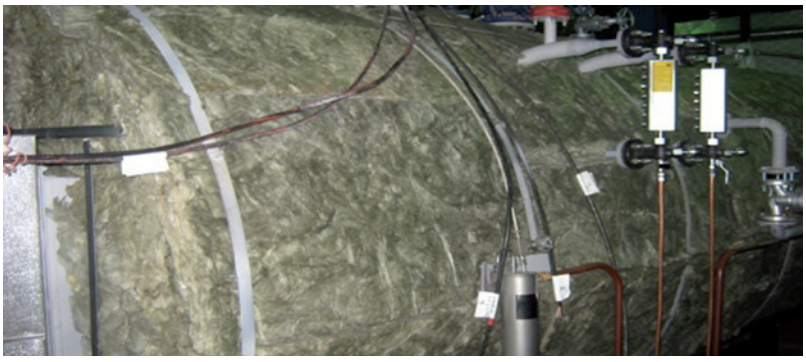
**Energy Manager**
**Berindean Catalin Vasile**
SC Erdemir Romania SRL,
Romania

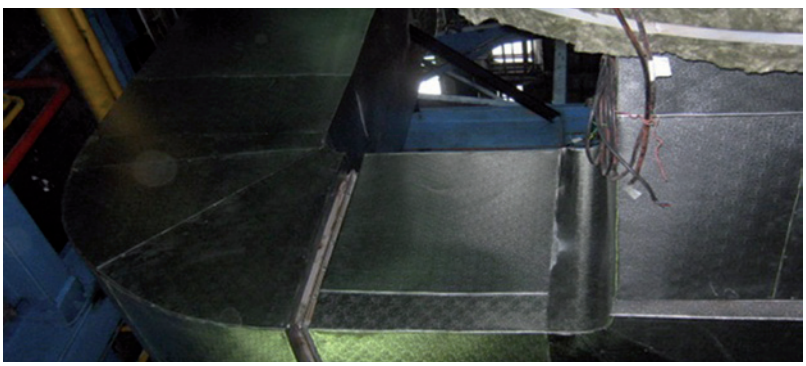
The main objective of the project was to recover heat from flue gases from a heat treatment furnace of SC ERDEMIR ROMANIA SRL Targoviste, taking into account the resizing and replacement of existing equipment that was used for flue gas recovery and the production of heat in the factory.

The solution proposed was mounting a recovery boiler in a plant that will produce steam for factory production lines.

**Results**

Investment in Euro: **185,846**
Cost reduction in Euro/Year: **35,980**
Pay-back-time in years: **5.0**
Energy saving potential in kWh/year: **1,362,053**
$CO_2$ saving potential in t/year: **466**



PROJECT

Electrical drives

# Optimize Flow as per Requirement Using an Electrical Drive

**Energy Manager**
**Yogesh Inamdar**
Bharat Forge Ltd., India

KALYANI

The aim of the project is to optimize the process of centralized cooling for machine components by providing a closed loop system. A centralized cooling system is used for cooling the machine elements (electronic components) and quenching media of 15 machines. This system consists of 120 kW motors which drive the pump and supply cooling water to 15 machines.

The cooling tower has also got a cooling fan motor (7.5 kW) which is used to induce forced air for cooling circulated water. This is one example for the high consumption of electrical energy in the machine component division, running at almost full load condition through-out the week and continuously without any overflow control.

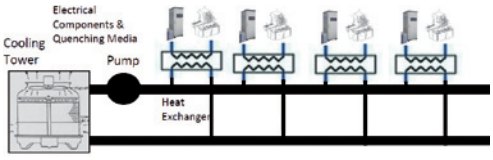
This leads to a capacity loss of 50-60 % of the pump flow, and there are also wastages in idle running.

The solution is a bundle of small changes. A reduction of the flow by reducing the speed of the electrical drives. An automatical switch on the cooling fan of the tower to reduce the fan's running-time and taking feedback of the machine's operating status to optimize the cooling requirements.

## Results

Investment in Euro: **4,500**
Cost reduction in Euro/Year: **31,500**
Pay-back-time in years: **0.15**
Energy saving potential in kWh/year: **360,000**
$CO_2$ saving potential in t/year: **280**

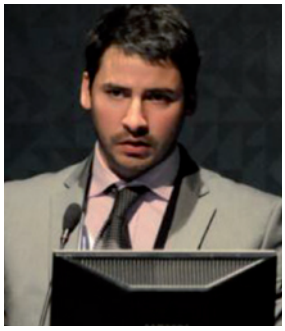
EUREM Award Ceremony in Prague 2015



PROJECT

# Implementation of a Solar Thermal System

Heating



**Energy Manager**
**Horacio Vásquez Mena**
Copper Mine – II Region of Antofagasta, Chile

In the hydrometallurgical process for copper cathode production, heat is required to supply three thermal energy consumers between the processes solvent extraction (SX) and electrowinning (EW).

Currently, this heat is supplied by three water heaters which use diesel. The solution proposed is the implementation of a solar thermal plant (MicroCSP) to assist in the production of heat, with the goal of reducing diesel consumption and generate savings.

**Results**

Investment in Euro: **2,000,000**
Cost reduction in Euro/Year: **600,000**
Pay-back-time in years: **3.8**
Energy saving potential in kWh/year: **4,548,827**
$CO_2$ saving potential in t/year: **1,732**

PROJECT

Heating

# Low Cost – High Impact. On-line Maintenance Practises for Process Furnaces

**Energy Manager**
**María Elisa Luque**
AXION Energy S.A.,
Argentina

Aims: reduce energy consumption in process furnaces, increase reliability.

Basic situation: an old process furnace with a lot of undesired air inlets and a dirty heat transfer area that leads to a decrease in the furnace efficiency and an increase in fuel consumption.

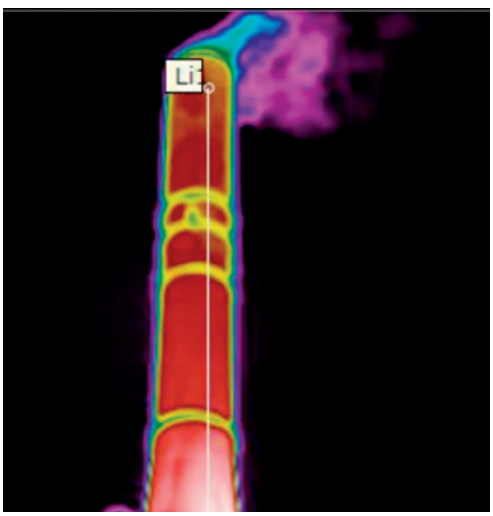
Optimization potentials: increase furnace efficiency on-line without affecting the production. Might not be as effective as cleaning and sealing during a planned maintenance shutdown of the plant.

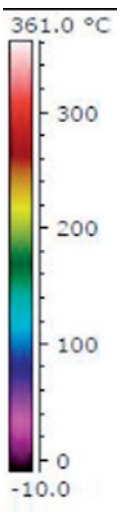
Proposals for solution: on-line casing sealing (in order to decrease undesired air inlets), on-line cleaning in order to increase heat transfer and optimize heating. Cleaning and sealing could also be performed during a planned maintenance shut down. There were no adequate opportunities like these in a reasonable time frame and it was not economically feasible to plan a plant shutdown just for furnace cleaning and repairs.

Effects: Reduced energy consumption, efficiency increase, reliability improvement, debottlenecking in order to avoid a decrease in plant performance.

**Results**

Investment in Euro: **50,615**
Cost reduction in Euro/Year: **245,060**
Pay-back-time in years: **0.15**
Energy saving potential in kWh/year: **6,194,000**
$CO_2$ saving potential in t/year: **3,685**

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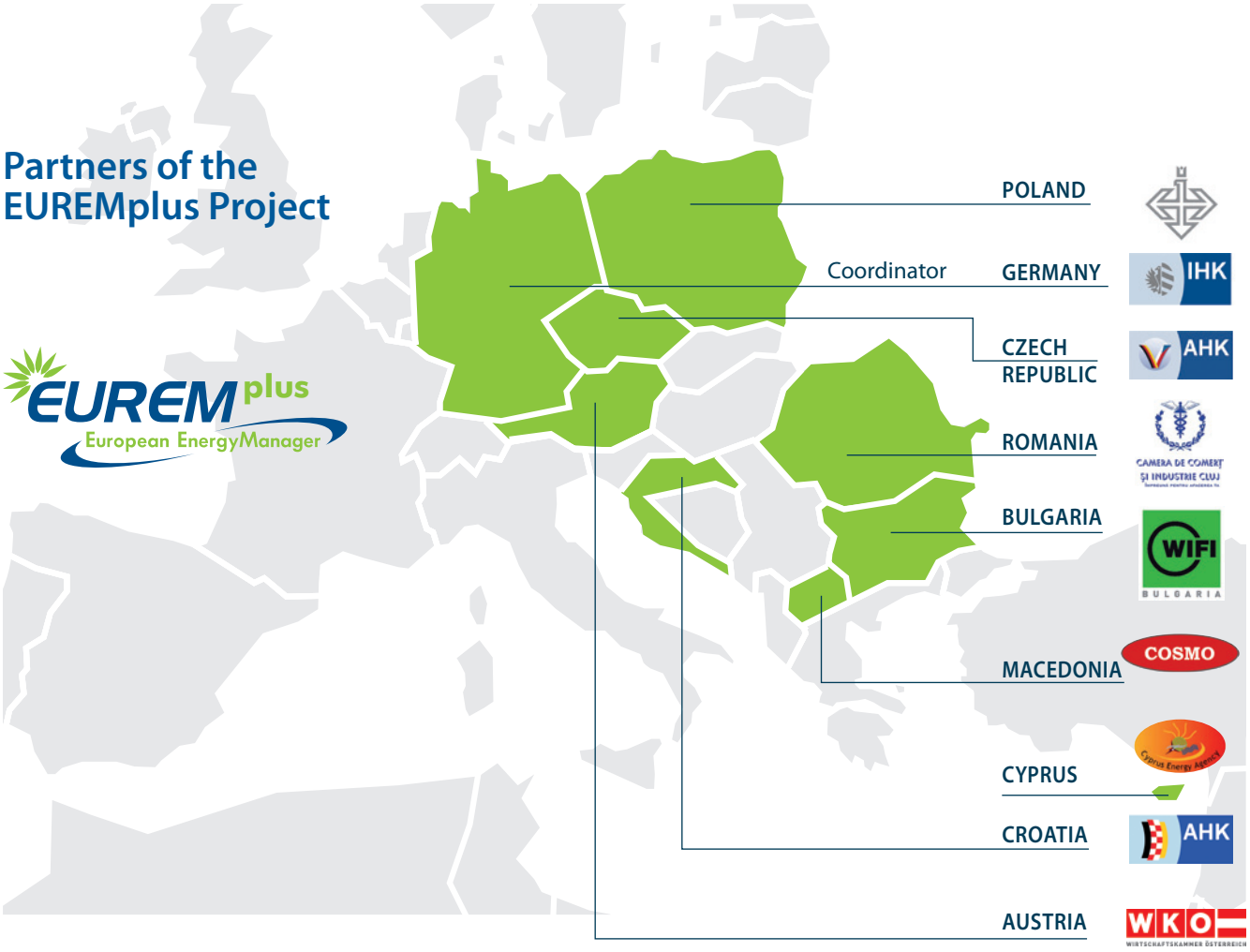

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