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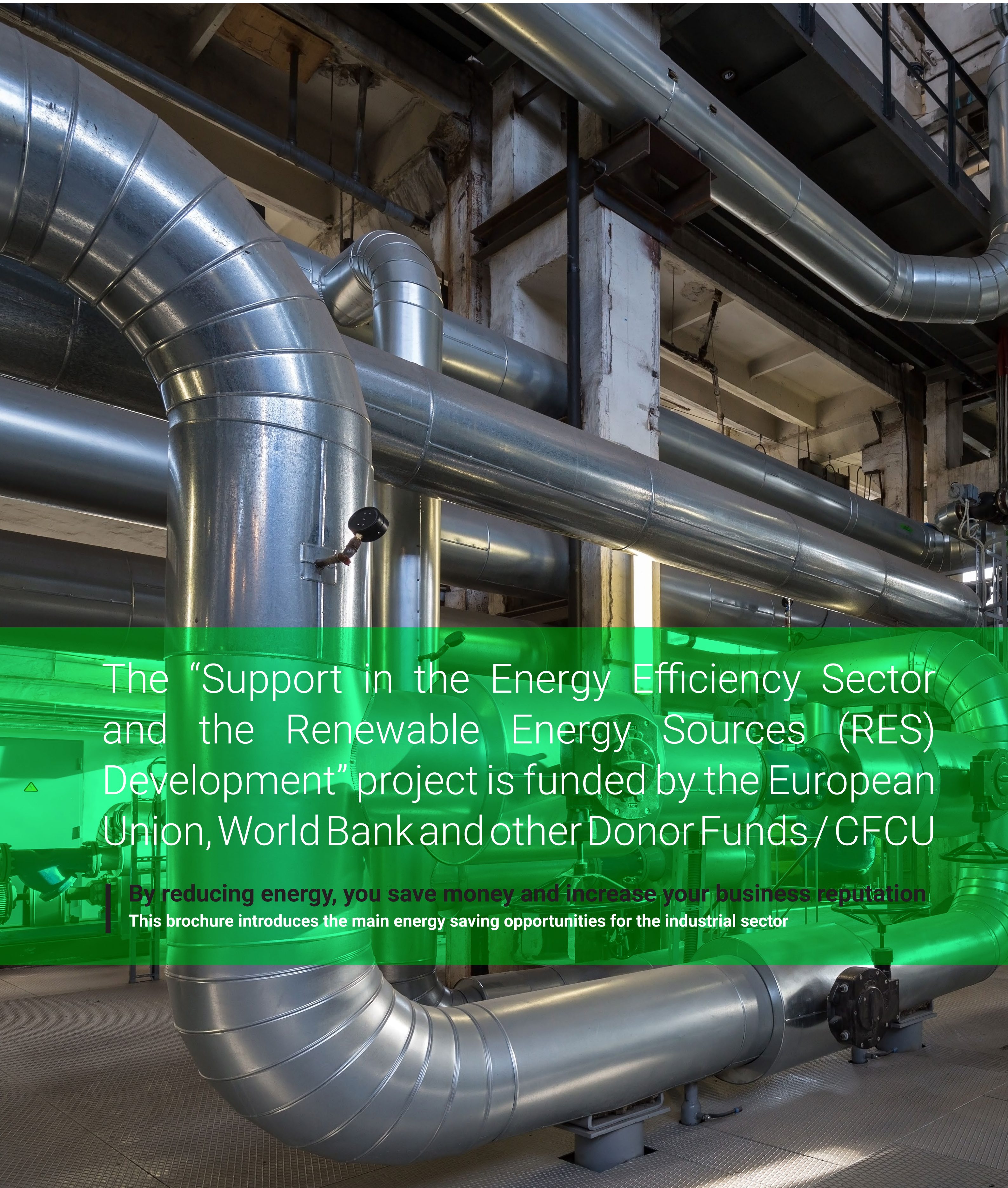

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By reducing energy, you save money and increase your business reputation

This brochure introduces the main energy saving opportunities for the industrial sector

AEE Agency for Energy Efficiency

Introduction

The industry sector has recorded very positive developments during the last decade. Its sales in 2016, accounted for about a quarter of total sales of economic enterprises, making the industry sector to be second in importance, after the service sector[1].

The industrial sector in Albania consumes approximately 25% of the total energy consumption[2] and almost 20% of the total electricity consumption[3].

Therefore, significant energy savings potential exists within the sector.

This brochure introduces a number of main energy saving opportunities for the industrial sector.

1. Energy Management System

A successful program in energy management (i.e. according to ISO 50001 standard) starts with a strong organizational commitment to continuous improvement of energy efficiency. This involves assigning oversight and management duties to an energy director, establishing an energy policy, and creating a cross-functional energy team.

Steps and procedures are then put in place to assess performance through regular reviews of energy data, technical assessments, and benchmarking. From this assessment, an organization is able to develop a baseline of energy use and set goals for improvement. Performance goals help to shape the development and implementation of an action plan.

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[1] *National Strategy for Development and Integration 2015-2020*

[2] *National Strategy of Energy, 2018*

[3] *Yearly Electricity Balance, 2016*

2. Boilers

Steam and high temperature hot water boilers offer many energy savings opportunities which can make significant cost savings to industries. The most appropriate option depends on the type of boiler and heating system, the requirements of the process or other heating demands and budget.

Operation and maintenance: Effective maintenance is needed for optimum performance and efficient operation of a boiler. In this respect, sophisticated control systems are used instead of manual controls. The three main areas where maintenance is necessary are: combustion efficiency, heat transfer efficiency and boiler heat loss.

Pre-heating Combustion Air: The thermal efficiency of a boiler plant can be increased by 1% if the temperature of the combustion air is raised by 20°C[4]. The heat required to pre-heat combustion air can be drawn from a number of sources, including the boiler's flue gases, air drawn from the top of the boiler house, and air drawn over or through the boiler casing.

Use of Economisers: An economiser typically reduces energy consumption between 2% and 5% although larger savings may be possible depending on the flue gas temperature and the type of economiser[5].

VSDs: A VSD system reproduces the operating characteristics of a fixed-speed combustion air fan and adjustable damper arrangement by controlling the speed of the motor to match the required load. Using a VSD system has been shown to be cost-effective while maintaining good combustion conditions and high boiler efficiency. VSDs for combustion air fans (and oxygen trimming) can be fitted as options with new burners or as a retrofit to existing equipment[6].

Minimization of Radiation Losses: In modern and efficient boilers, the radiation loss should be less than 1% of the heat input rating[7]. All pipe work, valves, flanges and fittings in the boiler house should be adequately insulated and valve mats/covers should be replaced after maintenance work.

Increase Condensate Return: In steam boilers, a method to improve energy efficiency is to increase the condensate return to the boiler. Returning hot condensate to the boiler, less make-up water is required, saving fuel, makeup water, and chemicals and treatment costs. Return of high purity condensate also reduces energy losses due to boiler blowdown[8].

Use of condensing boilers: A condensing boiler is a high efficiency modern boiler that incorporates an extra heat exchanger so that the vapour in flue gases is condensed to water and the heat recovered to pre-heat the water entering the boiler system – this can increase a boiler's efficiency by as much as 10% to 12%[9].

Excess air control: Controlling excess air to an optimum level always results in reduction in flue gas losses; for every 1% reduction in excess air there is approximately 0.6% rise in efficiency[10].

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[4] *Carbon Trust, Steam and high temperature hot water boilers, 2012*
[5] *Carbon Trust, Steam and high temperature hot water boilers, 2012*
[6] *Carbon Trust, Steam and high temperature hot water boilers, 2012*
[7] *Carbon Trust, Steam and high temperature hot water boilers, 2012*
[8] *US Department of Energy, Energy Efficiency and Renewable Energy, Energy Tips: Steam, Jan 2012*
[9] *https://eua.org.uk/condensing-boilers-do-they-do-what-it-says-on-the-tin/, 2017*

3. Furnaces and kilns

For most heating equipment, a large proportion of the heat supplied can be "lost" in the form of exhaust or flue gases – the extent of these losses depend on various factors related to design and operation of the heating equipment. Furnace heat losses include: flue gas losses, losses from moisture in fuel, losses due to openings in the furnace, furnace surface losses.

Waste Heat Recovery from Flue Gases: High temperature heat recovery equipment (recuperators and regenerative air heaters) can be used to recover heat from flue gases. Typical savings in the order of 5%-30% can be achieved[11].

Reduction of losses from furnace surface and openings: Heat losses can be reduced by minimizing the number and size of the openings (where applicable), or by employing methods such as radiation shields or curtains. Such measures can reduce heat losses by between 2% and 15% of a furnace's fuel consumption[12].

Optimisation of Combustion Air: Optimising combustion air is one of the simplest and most economical means of conserving energy in furnaces. To ensure the complete combustion of fuel with the minimum amount of air, the operator of a furnace needs to control air filtration, maintain the pressure of combustion air, ensure high fuel quality and monitor the amount of "excess air". These measures can generate savings of 5% - 25%[13].

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[10] Amit Kumar Jain, An Approach towards Efficient Operation of Boilers, International Journal of Scientific & Engineering Research, Volume 3, Issue 6, June 2012

[11] US Department of Energy, Energy Tips – Process Heating, 2005

[12] US DoE Office of Industrial Technologies, Roadmap for Process Heating Technology, 2001

[13] US DoE Office of Industrial Technologies, Roadmap for Process Heating Technology, 2001

4. Steam distribution

Steam is used to transfer heat energy from one location to another. Its use is popular throughout industry for a broad range of tasks from mechanical power production to space heating and process applications.

Avoid Steam Leaks: It is estimated that a 3 mm diameter hole on a pipeline carrying 7 kg/cm2

steam would waste about 32,000 litters of fuel per year[14]. To eliminate leaks a company should repair leaks immediately and develop a regular surveillance programme for identifying leaks ay pipelines, valves, flanges and joints.

Insulation of piping and equipment: Insulating pipes and equipment can generate energy savings of between 3% and 13%[15].

Steam traps: Energy losses can be reduced by using steam traps. Savings of 10% - 15% can be achieved from their correct operation[16].

Flash Steam recovery: Flash steam is released from hot condensate when its pressure is reduced. If flash steam is used, it is helpful to know how much of it will be available. The quantity is readily determined by calculation or can be read from simple tables or charts.

Improvement of condensate recovery: An effective condensate recovery system, can generate savings of 1% in fuel for every 6oC increase in boiler feed water[17].

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[14] *www.360proactiveengineer.com Tip No 15 System: Steam Boiler, 2017*
[15] *Spirax Sarco*
[16] *Spirax Sarco*
[17] *UNEP Energy Efficiency Guide for Industry in Asia, 2006*

5. Compressed air systems

Compressed air in industry is widespread and is somehow used in almost all sorts of applications. A typical compressed-air system and consists of a supply side, which includes compressors and air treatment and a demand side, which includes distribution and storage systems and end-use equipment.

Choose the most energy efficient model: Understanding the type, control, size, and number of compressors is important, especially when trying to align supply with demand. For small compressor systems with stable loads, a simple cascade may work well, but most systems benefit from some type of control system. For multiple compressors of the same type, the on-board controls can be linked together or a simple sequencing control system can be used.

Use of VSDs: VSDs can be used in compressors when air requirements vary over time of day and days of week (if fluctuations in demand for air are low, it is unlikely that the electricity savings would justify the cost of the investment).

Waste heat recovery: Around 80% and 93% of the electrical energy consumed by an air compressor is converted into heat which is released to the environment. In many cases, 50% – 90% of this heat can be recovered by properly designing a heat recovery system to take advantage of the available thermal energy and use it to heat air or water[18].

Leak detection and Repair Air Leakages: Air leaks are usually the largest cause of wasted energy in a compressed air system, often wasting 20 – 30% of compressed air production[19]. It is therefore important that production staff not only identify but also label leaks so that they can be easily and quickly repaired. The most common and effective method used is ultrasonic leak detection.

6. Motors and drives

Electric motor systems account for about 60% of global industrial electricity consumption and close to 70% of industrial electricity demand[20].

Use of High Efficient Motors:

- Motors that run continuously (typically 8,000 or more hours a year) and are considered inefficient should be replaced with efficient motors at the next available opportunity, such as during a scheduled downtime.
- Motors that are properly sized but have standard efficiency should be replaced with energy-efficient models when they fail.
- Motors that are reasonably efficient and are used less than 2,000 hours each year could be rewound or replaced with a similar motor [21]

Installation of soft starters: Motors drawn very high currents when starting. Using soft starters limit the current to a motor during start-up, allowing a smoother start and also allowing a higher maximum number of starts per hours (very useful for motors that are subject to frequent starts and stops).

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[18] *Energy Management and Efficiency for the Process Industries, A.P. Rossiter, B.P. Jones, 2015*
[19] *Energy Management and Efficiency for the Process Industries, A.P. Rossiter, B.P. Jones, 2015*
[20] *UNIDO, Energy efficiency in electric motor systems: Technology, saving potentials and policy options for developing countries, 2011*
[21] *https://www.facilitiesnet.com/powercommunication/article.aspx?id=9595*

7. Pumps and pumping systems

Pumping systems account for nearly 20% of the world's electrical energy demand. Furthermore, they range between 25-50% of the energy usage in certain industrial plant operations[22].

Selecting the right pump: In selecting the pump, suppliers try to match the system curve supplied by the user with a pump curve that satisfies these needs as closely as possible.

Controlling flow – speed variation: Controlling the pump speed is the most efficient way to control the flow, because when the pump's speed is reduced, the power consumption is also reduced. The most commonly used method to reduce pump speed is the use of a VSD.

Parallel Pumps for Varying Demand: Operating two or more pumps in parallel and turning some off when the demand is lower, can result in significant energy savings. Pumps providing different flow rates can be used. Parallel pumps are an option when the static head is more than fifty percent of the total head.

8. Industrial Refrigeration and Cooling

Refrigeration plants are not only costly in capital terms but have significant operational costs, primarily due to their own energy consumption. Refrigeration systems typically cost seven to ten times as much to run over their lifetime as they do to buy.

Condenser heat recovery: The use of heat recovery from a refrigeration system is recommended when there is hot air or water consumption for processes, cleaning or heating close to the refrigeration site and when the heat demand is simultaneous with the working time of the cooling plant. When fitting heat recovery equipment to an existing refrigeration plant, the amount of energy recovered can be up to 30% of the cooling capacity. However, the installation of such equipment is not viable below a compressor electrical load of 30 kW[23].

Reducing Refrigeration Leakage: Most refrigeration systems leak refrigerant gases. The average leakage rate in UK systems is around 20% per year, equalling to a reduction in efficiency of approximately 11%. However, it is possible to install automated permanent leak detection systems to minimise possible leaks[24].

[22] https://pwemag.co.uk/news/fullstory.php/aid/2231/Optimising_energy_consumption_in_pumping_systems.html, 2016
[23] *Carbon Trust - how to implement heat recovery in refrigeration, 2013*
[24] *Carbon Trust, Refrigeration, A guide to energy and carbon saving opportunities, 2019*

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