Gear@SME
Saving energy together

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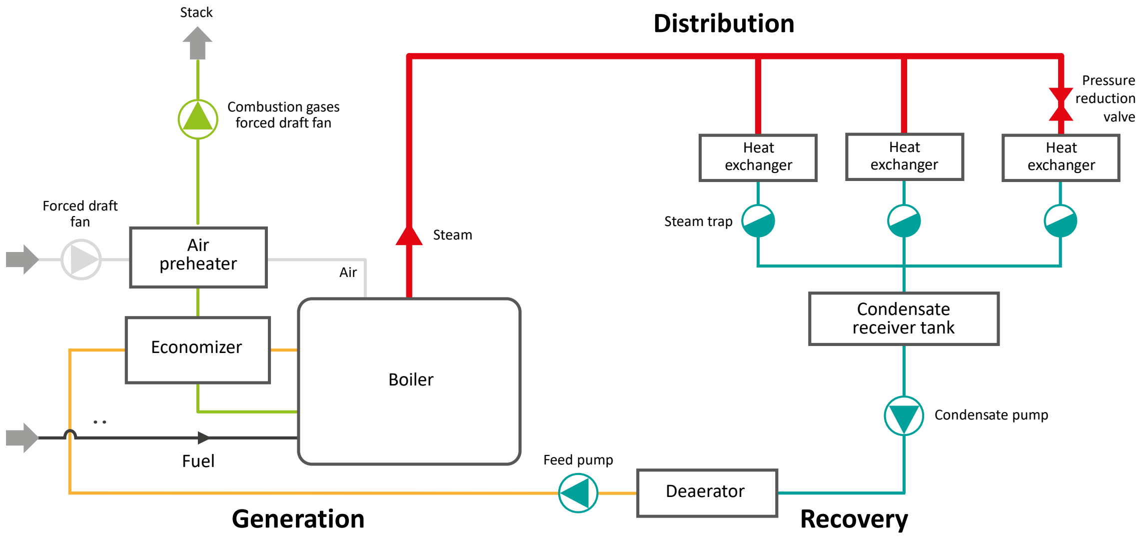
Best Practice	REDUCTION OF ENERGY DEMAND	STEA-01
Application	Steam systems	
SME sector	Processing and manufacturing industries	
SME Sub-sector	Food processing, paper, and cardboard manufacturing sectors, pharmaceutical, chemicals, distilleries, etc.	
Technical description	Heat is essential for many industrial processes and steam is often one of the preferred means of heat transfer. Steam can provide heat at different temperature levels that are physically coupled to a pressure level (an important design parameter).	
Recommendation for optimisation	• Reduction of steam consumers: an essential energy saving method is the reduction of potential steam consumers and substituting their process with more efficient alternatives (when possible). • Reduce required heat by mass and temperature difference reduction: Reducing the mass or the temperature difference of the material to be heated the most influencing parameters to reduce the required energy. • Increase precision of heat application: in some applications, heat is required at specific spots at a specific time. Therefore, alternative technologies such as microwave heating, lasers or infrared radiant heat might be a way for a more accurate targeting, timing, and control of the heat application. • Optimisation of load and production: depending on the size of the process (plant) the management of steam using- and steam producing-equipment can be a challenging task where several factors such as load-efficiency curves of boilers, load flexibility, required load over time, standby losses and more need to be considered. However, when optimised, a significant amount of energy (and operating costs) can be saved. Examples with significant saving potential are: - Turn steam production off if not needed, or at least reduce pressure setpoint for off-production periods - Plan production and reduce standby time of hot steam process, or group those production steps with same temperature level (if possible) - Efficient combination of multiple steam generators (load shifting) - Reduce the number of operating hours, especially for energy intensive operation modes with high temperatures or pressures - Reduce the number of heating and cooling-off cycles of the boiler • Heat recovery and heat integration: In terms of energy efficiency, heat recovery and therefore heat integration is of high importance. To maximise the overall efficiency, the heat of outlet streams should always be recovered. Methods like a pinch analysis are helpful tools to identify heat sources and heat sinks that might	

	be interesting to connect. This heat recovery is rather simple in terms of steam production (e.g., economiser), but can be challenging for whole process plants. However, often the energy saving potential is significant • Reduction of exchange with environment: Heat exchange with the environment is mostly seen as heat loss. To reduce it, proper insulation (of boiler and piping) is required. Identifying and fixing insufficiencies and so called "cold-bridges" is of high importance to reduce the overall heat losses. Steam systems often deliver their heat-to-heat surfaces, where the steam is condensed. If not contaminated, the condensate is recovered and returned to the boiler. Most of the times (90%) this is done in open systems where 5-15% of the condensate is lost to the environment (evaporation). This condensate loss (which is very pure and therefore high-quality water) requires an energy intensive reproduction. Moreover, in open systems the condensates adsorb oxygen and other gases from the air. Especially this additional oxygen leads to corrosion in the condensate return circle. A closed system can reduce the condensate energy losses by up to 12%. An additional energy loss is via radiation. This increases with the surface temperature level. In general, the surface temperature should not be higher than 15°C above the environmental temperature. Well-insulated boilers have a radiation heat loss in the range of 0.5-1%, depending on the load. • Reduction of process steps: Every process step such as pressure decrease, or temperature decrease comes with the cost of losses. Therefore, their number should be reduced if they are not increasing the overall efficiency such as heat recovery steps often do.
Schemes and diagrams	 Scheme of steam generation and distribution
Economics	Approx.15 EUR/m per insulation

	Cost of heat recovery from approx. 1,400 EUR	
Energy savings	Up to 10 to 20% in energy supply	
Economic savings	Up to 20% savings on energy bills	
Average Payback Time	No average payback time can be given. The replacement or optimisation of steam users must be evaluated case-by-case	
Emissions	70 mg NO_x/Nm^3 Exhaust-related emissions from steam generation systems	
Environmental benefits	Interventions often lead to a reduction in emissions of contaminants such as CO_2 as less fuel is needed	
Main NEBs (Multiple benefits)	☒ Environmental benefits ☒ Increased productivity ☒ Work environment/Health/Safety ☒ Increased competitiveness ☒ Maintenance	Depending on the measures selected, overall efficiency increases, which leads to increased competitiveness. Energy savings (e.g., reducing the heat content of wastewater) often lead to reduced emissions of pollutants such as CO_2, as less fuel is required. If this is the case, sustainability marketing can be increased. This may lead to increased sales.
Replicability	Medium	
Related measures	• STEA-05: Finding and repairing leaks • STEA-08: Air Economizer and Pre-heaters • STEA-09: Minimize/Use of vented steam	
Case study	Pressure reduction intervention, company Obersteirische Molkerei (Austria, 2015) *Link:https://www.klimaaktiv.at/dam/jcr:0e550ac1-8e4b-4766-b3d0-c1f2dcadc18d/NP_BestPracticeBeispiel_ObersteirischeMolkereieGen_FREIGEG_1611_barrierefrei.pdf* • Initial Situation: an energy audit revealed a higher than needed pressure in the steam system. Apart from that, losses of condensate through failed steam traps were identified. • Description of the optimisation: the steam pressure level was reduced by 1.5 bar, resulting in fewer losses at the production, distribution and end-use of the steam. Furthermore, the production control was optimized in a way that the steam production suits the demand. These measures yielded energy savings of 1,165 MWh per year.	

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	Apart from that, the steam traps were checked and optimized. Therefore, the amount of recovered condensate was increased significantly, resulting in less energy needed for water treatment and heating. The annual savings of this measure are 470.9 MWh. • Implementation costs: not available • Payback Time: approx. 2 years
References	Blessl and Kessler, 2017, Energieeffizienz in der Industrie, Springer Vieweg, DOI: 10.1007/978-3-662-55999-4 Bosch, 2018, Planungshandbuch für Dampfkesselanlagen, TT/MKTCH_de_Planungshandbuch_Dampf_01 Cres and Isnova, 2019, SteamUp - WP4 Training Material prepared by CRES Kulterer, K.: klimaaktiv Leitfaden für Energieaudits in Dampfsystemen, Österreichische Energieagentur im Rahmen des Programms des Lebensministeriums, Wien, 2017 Statistik Austria, 2019, Nutzenergieanalyse für 2017 Wünning, 2007, Handbuch der Brennertechnik für Industrieöfen: Grundlagen, Brennertechniken, Anwendungen, Vulkan-Verlag GmbH, ISBN: 3802729382

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