This project has received funding from the European Union's H2020 Coordination Support Action under Grant Agreement No. 894356.

| Best Practice | BLOW-DOWN LOSSES | STEA-02 |
|---|---|---|
| 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 | In common boilers, a certain amount of fresh water is required. In case it is not pure ($H_2O$), this means impurities like dissolved salts and other substances are added to the system. During the operation these impurities accumulate in the boiler and reduce the heat transfer which leads to an efficiency decrease.<br><br>In case any kind of impurities are added to the system, they need to be removed periodically, which is done in a blow-down step. The removed stream must be further replaced by fresh (cold) water. These two steps reduce the overall efficiency. However, when part of the blow-down heat is recovered, the losses can be reduced.<br><br>In conclusion this leads to an optimisation problem, where on one hand the impurities need to be removed (to avoid a decrease of efficiency over time because of impurities accumulation) and on the other hand it should be done as seldom as possible to avoid energy losses. The optimum blow-down frequency and duration is depending on the specific system and especially the water quality. | |
| Recommendation for optimisation | Blow-downs are required from time to time to remove the accumulating impurities of the system. In order to optimise the system, a high-water quality is of great importance as it reduces the frequency of periodic blow-downs and decreases the energy losses. In addition to high water quality, the implementation of a heat recovery system reduces the energetic losses by up to 90 % (of the blow-down-stream) and is therefore highly recommended to increase the overall efficiency<br><br>▪ Blow-down controller: Blowdowns are performed at the bottom (remove sludge and deposits) and at the top (remove salts that are collected at the surface of the boiler). Common strategies to control the blow-down process are by a fixed time interval (including duration) and, often, using a conductivity sensor. While the first system is cheaper, the second one measures the changes in conductivity and therefore only activates the blow-down valves when necessary. This saves energy as less heat is lost during the blow-down and less fresh water is required.<br><br>Depending on the average operating pressure and the blow-down rate about 2% of the boilers heat output can be saved when implementing a blow-down heat recovery system (Bosch, 2018). | |

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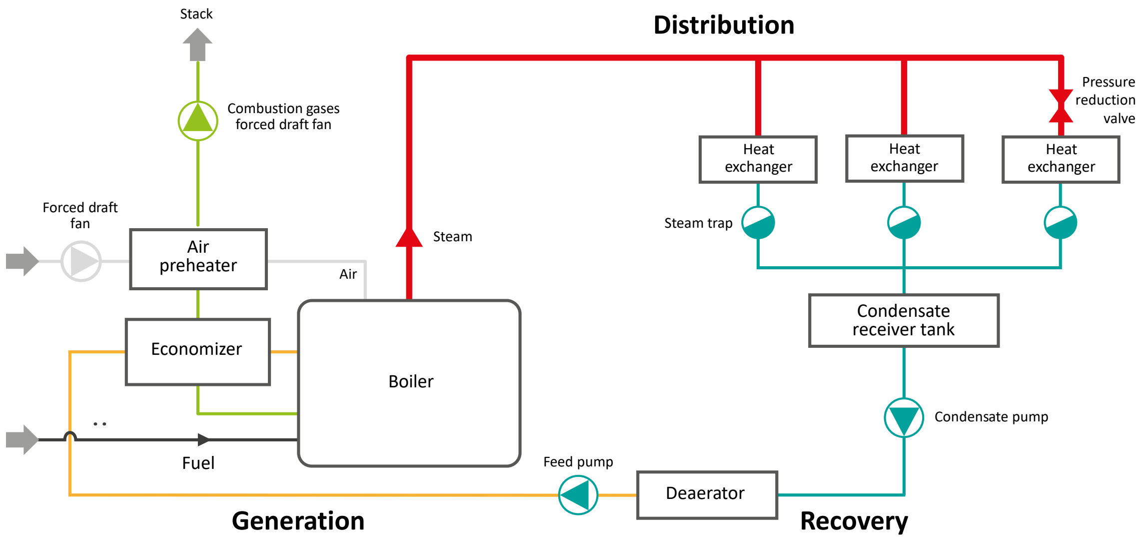
<table>
<tr><td></td><td>The detailed determination of the saving potential for steam systems is challenging and depends on several factors such as pre-water treatment, heat losses, dosing of appropriate chemicals, clean steal surfaces and interpretation of collected data. With a diligent approach to up-concentrate the boiler water, which is directly influenced by the conductivity of the feed water, saving potential can be further realised. Therefore, dosing of boiler water chemicals should be chosen in consultation of a water treatment specialist so that the maximum up-concentration factor (= Boiler water conductivity / Feed water conductivity) can be achieved.</td></tr>
<tr><td>Schemes and diagrams</td><td>

Scheme of steam generation and distribution</td></tr>
<tr><td>Economics</td><td>About 200 EUR for a blow-down valve</td></tr>
<tr><td>Energy savings</td><td>Depending on the average working pressure and blowdown range, approximately 2% of the heat produced by the boiler can be saved when applying a blowdown heat recovery system.</td></tr>
<tr><td>Economic savings</td><td>Up to 10% savings on energy bills</td></tr>
<tr><td>Average Payback Time</td><td>No average payback time can be given.<br>The replacement or optimisation of steam users must be evaluated case-by-case</td></tr>
<tr><td>Emissions</td><td>70 mg NOx/Nm$^3$<br>Exhaust-related emissions from steam generation systems</td></tr>
<tr><td>Environmental benefits</td><td>The energy savings further lead to a reduction of the $CO_2$ emissions.<br>Approximately 20% reduction in $CO_2$ emissions</td></tr>
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| Main NEBs<br>(Multiple benefits) | ☒ Environmental benefits<br>☒ Increased productivity<br>☐ Work environment/Health/Safety<br>☐ Increased competitiveness<br>☒ Maintenance | In addition to reduced energy consumption the measures lead to non-energy benefits such as an improved global performance and therefore an increase of competitiveness. Reasons can be reduced maintenance costs (and time) as well as an easier operation or reduced freshwater costs as the consumed water for steam generation can be reduced. |
| Replicability | Medium | |
| Related measures | • STEA-01: Reduction of energy demand<br>• STEA-08: Air Economizer and Pre-heaters | |
| References | Blessl and Kessler, 2017, Energieeffizienz in der Industrie, Springer Vieweg, DOI: 10.1007/978-3-662-55999-4<br>Bosch, 2018, Planungshandbuch für Dampfkesselanlagen, TT/MKT-CH_de_Planungshandbuch_Dampf_01<br>Statistik Austria, 2019, Nutzenergieanalyse für 2017 | |

This Best Practice was developed by the Impawatt Project (GA No. 785041) and adapted for the GEAR@SME Project (GA No. 894356)