

# Smart Scale Energy Solutions Steam Systems

## Monitoring the efficiency of steam boilers pays off

### Benefits

Monitoring and analyzing the steam system helps to:

- Benchmark steam boilers and optimize the steam consumption
- Gain transparency of the fuel consumption
- Identify the ideal operation load
- Identify, quantify and allocate losses in the steam system
- Verify investments in heat recovery measures



**A typical steam boiler often consumes many times the initial capital expense in fuel usage annually. The investment cost for a boiler can easily be five times lower than the yearly fuel consumption. Consequently, a difference of just a few percentage points in boiler efficiency between units will result in substantial fuel savings.**

**The Challenge** Constant monitoring of a steam boiler and the steam system is the key to improving system performance and detecting changes at a early stage.

**The Solution** Define the right KPIs which help you to evaluate:

1. Steam boiler efficiency,
2. System balancing and leakage,
3. Specific energy consumption.

This is the precondition for energy management and cost reduction. Our energy and data manager RSG40 collects, stores and displays all the required data.

### 1. Boiler Efficiency

The economic evaluation of steam boilers has to include the technical layout and features as well as the definition of the actual maintenance and fuel usage requirements. Of these criteria, the key factor to benefit from continuous cost reductions is monitoring the fuel usage or boiler efficiency. Boiler efficiency, in the simplest terms, represents the difference between energy input and output related to the steam process.

It accounts for the effectiveness of the heat exchanger as well as for the radiation, convection and blow down losses. Therefore it helps to:

- Gain transparency of the fuel and steam consumption,
- Identify, quantify and allocate losses in the system,
- Benchmark boilers, consumers and optimize their use,
- Minimize maintenance costs and downtimes,
- Verify investments in heat recovery measures,
- Evaluate most efficient operation load of boiler and production.

It starts with the determination of the actual performance for all existing boilers. This requires accurate and repeatable measurements of the steam output, the heat remaining in the feed water and the fuel supplied to the burner. Recognized standards are used for each single calorimetric calculation, the input/output method is recommended by boiler manufacturers.

Beyond the standard, Endress+Hauser multiparameter instruments provide more process information and therefore added value. Density or viscosity for liquid fuels, methane for biogas and pH/oxygen/total dissolved solids (TDS) for feed water.

## 2. Steam Balance and Leakage

Apart from the efficiency of steam generation it is important to make sure that the steam energy is used where it should be. A lot of energy is lost in steam systems due to improper insulation or leakage found at valve stems, unions, pressure regulators, equipment connection flanges, pipe joints and defect steam traps. Mass balancing by measurement at different points in the steam system helps to:

- Detect leakages in time (not at the end of year or month).
- Define ideal maintenance intervals and justify expenses.
- Find weak points in insulation.
- Quantify and reduce condensate losses and thus save valuable energy, reduce make up water and chemicals.

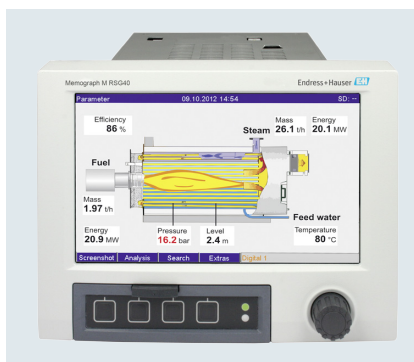
## 3. Specific Energy Consumption

The allocation of energy usage to specific areas and processes is one of the key factors for energy management systems (e.g. ISO 50001) and a precondition for transparent book-keeping. The exact measurement of steam consumption per unit of product (SEC) is also important to optimize production processes. Furthermore the data are suitable for a carbon footprint evaluation.

**RSG40 Analysis** The energy and data manager RSG40 collects, stores and displays all the required data necessary for the monitoring of a steam system. By using the intuitive Field Data Manager software (FDM) it can be accessed from the desk and processed into a user friendly and meaningful format.

**All relevant information is available:**

- Boiler efficiency
- Fuel and steam consumption
- Leakage loss
- Specific energy consumption



Memograph M RSG40 with process display

## ✓ Payback Calculation Example:

### Situation:

- Fire tube steam boiler 20 t/h (10 bar)
- Operation: 8000 hours/a
- Steam production costs: 30 €/t

### Sources of energy loss:

- Steam loss due to steam trap malfunction: 30 kg/h or 240 t/a per steam trap (Typically 25% of steam traps are defect)
- Efficiency loss due to scaling of heat transfer surface:  
0.5% = 800 t/a steam (0.5% of 20 t/h \* 8,000 h/a)  
(Typically fouling decreases efficiency by up to 5%, optimized cleaning interval can improve it)

### Payback:

Overall costs of instruments for boiler efficiency calculation and balancing: 12,000 €

1,040 t (= 800+240 t/a) \* 30 €/t  
= 31,200 €/a or 2,600 €/month;

12,000 € / 2,600 € =  
4.62 months

**!** The payback period is less than 5 months.

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