

Recovery of Energy Through Exhaust Gas Condensation: A Profitable Idea

Rémy Jeanmonod*

Abstract: Cimo SA, a company situated on the chemical site of Monthey, Switzerland, runs the thermal power station providing steam and part of the electricity required for the various production buildings of Ciba Specialty Chemicals and Novartis Crop Protection.

The boiler house includes several units; the main ones, Nos. 4 and 5, are used alternately:

– boiler No. 4, nominal capacity of 80 t/h is used mainly in summer;

– boiler No. 5, object of the present project, has a nominal rating of 160 t/h at 115 bar and 525 °C. This unit is used in winter when steam demands vary between 60 and 110 t/h.

The two boilers, equipped with back-pressure turbines, are fitted with burners for natural gas and fuel oil, gas being the main fuel (95%). The low-pressure steam is then used in the various production facilities without any return of condensate to the station. Because of this fact, the feed-water of the boilers is therefore demineralised water, which must be pre-heated by low-pressure steam before being degassed. This pre-heating represents an important part of the total energy consumption.

Keywords: Condensation · Energy · Green chemistry · Recovery · Steam

History

In 1984, an exhaust gas recuperator was installed on boiler No. 4. This heat exchanger makes it possible to reduce the temperature of the exhaust gas stream from 130 °C to approx. 45 °C, in combination with a partial condensation of the water contained in the exhaust gas. The energy recovered is used to preheat the feed-water of the degasser. The savings achieved by this heat recuperator represent the equivalent of approx. 1 million m³ (n) of fuel gas per year.

In 1986, an identical project for energy recovery on boiler No. 5 was designed, but the necessary investment, some 5 million CHF, did not show sufficient pay-back. The project was therefore postponed.

A Profitable Idea

In 1997, thanks to the constant emphasis on the reduction of production

costs, the simple idea of using the current recuperator on boiler No. 4 also for boiler No. 5, was devised. This idea was absolutely feasible as the two facilities almost never function simultaneously.

Project

Because the existing recuperator is dimensioned for an 80 t/h boiler, the project allows only partial recuperation if the full capacity of the 160 t/h boiler is used. For this reason, a 1500 mm diameter pipe was built to the entry of the heat recuperator equipment. For safety reasons during maintenance work, but also to avoid risks of corrosion inside the non-operational boiler, the connecting pipes are equipped with double valves and an air barrier coming from the combustion-air ventilator of the operating boiler. The valves used are tight guillotine valves.

When operating with fuel oil, the recuperator is bypassed to prevent corrosion due to sulphur. In this case, the connection valve is closed and the exhaust gases pass directly to the chimney.

The water circuit is linked to the feed circuit of the operating boiler *via* butterfly valves.

Construction

The construction of the piping system had to be done in stages in order to guarantee continued production of steam with one of the two boilers. Furthermore, we also replaced the entire obsolete electrical equipment and computerised the control systems (FOCLAN software). Implementation of this project started in July 1998 and, by mid-December, the facility was in service.

Results

In 1999, 1.5 million m³ (n) of natural gas were saved thanks to the implementation of this project and this without disrupting the production of steam.

The total investment for the project, including electrical updating, amounted to CHF 610 000 and was paid back after ten months of operation.

Conclusion

This project shows that even on existing facilities it is possible, despite on-going production, to find solutions that are financially attractive and less demanding in energy. This is our added value.

*Correspondence: R. Jeanmonod
CIMO SA
CH-1870 Monthey
Tel.: +41 24 470 34 23
Fax: +41 24 470 30 69
E-Mail: remy.jeanmonod@cimo-sa.ch

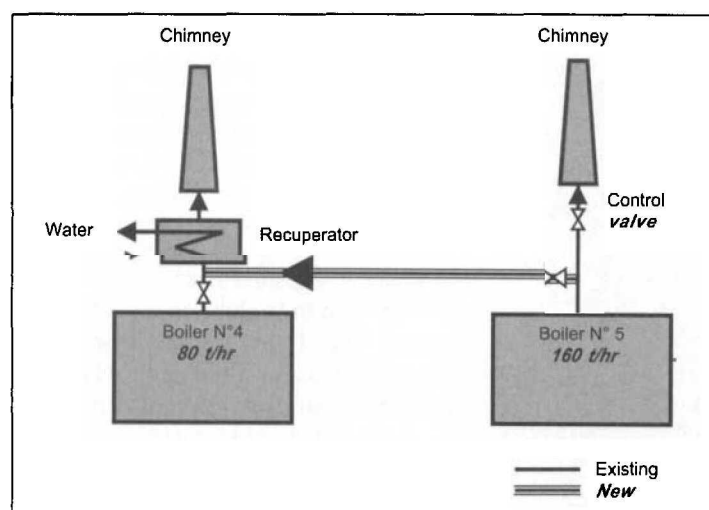


Fig. 1. Skeleton diagram

Technical data

The technical data of the recuperator, given for a maximum load, are as follows:

Heating surface	3000 m ²
Temperature of exhaust gas at entry	130 °C
Temperature of exhaust gas at exit	approx. 45 °C
Exhaust gas stream	50 000 m ³ (n)/h
Pressure loss exhaust gas stream	20 mbar
Water temperature at entry	20 °C
Water temperature at exit	approx. 60 °C
Recovered heat	3.8 MW

Received: June 13, 2000

Chimia 54 (2000) 525–528
 © Neue Schweizerische Chemische Gesellschaft
 ISSN 0009–4293

Ecotoxicological Issues and their Influence on the Development of New Dyestuffs

Reinhard Pedrazzi*, Jürgen Geiwiz, Manuel Golder, and Roland Grimm

Abstract: Up to the time of the First World War, synthetic dyes were manufactured mainly in Europe. Nowadays dyes are produced all over the world. About 50% of dyes are used in the textile industry. Some of the most urgent challenges now being faced by dyestuff manufacturers and users are those related to environmental and toxicological issues. Over the past years, tougher regulations, standards and laws have been enacted. These will exert legal pressure during the coming years, with the goal of removing critical products from the market and compelling the dye manufacturing industry to offer only ecotoxicologically sound products. The purpose of this paper is to point out certain consequences for research that might take place due to the regulations, and to describe recent developments towards overcoming this challenge, which has already led to considerable benefits for the environment.

Keywords: Azo dyes · Environment · Green chemistry · Regulations · Research

Azo Dyes

Azo dyes are compounds containing at least one azo chromophore group ($-N=N-$) which is linked to sp^2 -hybridised carbon atoms. To produce this azo chromophore, one begins with an aromatic amine which is converted into a diazonium ion. This relatively weak elec-

trophilic reagent reacts with aromatic species that carry electron donor substituents. Azo dyes account for the largest portion of all synthetic dyes in terms of number and volume of production. They include approx. 70% of all organic dyes currently on the market. Therefore, the class of azo dyestuffs plays an exceptionally important role, particularly for economic reasons.

*Correspondence: R. Pedrazzi
 Head R&D Dyestuffs
 Clariant (Switzerland) Ltd
 Rothausstrasse 61
 CH-4123 Muttenz
 Tel.: +41 61 469 79 79
 Fax: +41 61 469 70 77
 E-Mail: Reinhard.Pedrazzi@Clariant.com