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GOING GREEN: EFFECTIVE SOLUTIONS TO MITIGATE ENVIRONMENTAL IMPACTS IN TRADITIONAL PRINTING TECHNOLOGIES

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Abstract:
To drive sustainable development in printed media and strengthen their market positions, it is becoming a crucial issue how the society and consumers can be convinced that the applied technologies have no negative impacts on the environment, but are rather in line with the general endeavours of societies to preserve and conserve the natural environment.
Relying on scientific methods, the authors analyze the environmental implications of offset and flexo printing, and propose effective solutions for the mitigation of negative impacts.
In view of air cleanliness, they recommend innovative and energy-efficient solutions for the reduction of VOC emissions, and demonstrate them in practical examples.
Furthermore, they have worked out a special procedure that allows the cleaning and reuse of washing liquids for ink rollers and blankets. An experimental model has also been set up for the analysis of environmental and economic benefits.

Keywords:
VOC emission, heat-set printing, energy-efficiency

1. AIR QUALITY PROTECTION SOLUTION IN THE HEAT-SET OFFSET PRINTING

In Alföldi Printing House, large-capacity web offset machines use “heat-set” technology for printing. The incorporated print dryers are powered with natural gas for hot-air drying. Coming from the print dryers and containing certain exhaust products, the air carries primarily VOC contaminants (2–4 g/nm³). Alföldi Printing House has deployed recuperative thermal reheating equipment for the cleaning and treatment of final gases.

The company has implemented the project within the framework of a complex program with the fundamental purpose to cut back air and noise pollution caused to the environmental with its operations considerably so that the printing house could sustain its 443-year-old activities in compliance with the relevant environmental requirements, as necessitated by the associated demands of the new millennium, with the least possible disturbances caused to the residents neighbouring its century-old business site.

This uniform approach and clean-cut corporate intent has given way to a very efficient energetic solution in several respects.

Alföldi Printing House has seen the justification for the preference of the recuperative thermal reheating procedure, which is today the most wide-spread technique in the world, in the utilization of energy and the related, additional opportunities for environmental protection, as well as the smaller investment costs. The future parts of the project will be based on this foundation.

The recuperative thermal reheating equipment is of compact design, and can be installed outdoors with the connected heat-recuperation unit.

When designating the site of installation, a condition precedent to energetic aspects has been the avoidance of further environmental loading by the operation of the equipment. For this reason, it has been installed among the plant buildings (Figure 1). Due to the high walls here and the accessory elements for noise reduction, the operation of the equipment has no negative impacts on the noise emission of Alföldi Printing House. The equipment is located approximately centrally relative to the pipelines connecting the gas dryers and the reheating unit, as well as the heat transfer station.

Figure 1: WK TNV 65 oxidizing equipment in Alföldi Printing House

2. COMPLEX SOLUTION FOR ENERGY UTILIZATION

As the company's energy management has been significantly influenced by the project, such a solution has been sought and found that allows the utilization of heat energy generated during the reheating process continuously.

The concept was borrowed from the current expansion of the municipal district heating system. Near the central site of Alföldi Printing House, the construction works of a new circuit line for the enhancement of supply safety was started, and it seemed to be a reasonable option to connect to the project. The heating system of the entire printing house was converted, modernized and connected to the municipal district heating system in a reversible manner. Jointly with the district heating supplier, such a heat transfer station was built that integrated a heat exchanger for the proper utilization of the heat released during the operation of the reheating equipment.

As a result, the generated heat has become continuously utilizable, primarily for heating and hot water supply at the company. On the other hand, the redundant heat can be fed to the municipal district heating network. It is particularly important for the company in the summer period, when considerable quantities of heat are still needed to supply Debrecen with hot water.

Obviously, due to the reversible design, Alföldi Printing House can as well purchase heat whenever the reheating equipment is not operated, or supplies less heat energy than needed.

The employed technical solution is very simple. The heating water arriving at the heat transfer stations from the primary mains line of the municipal district heating network first enters the heat exchanger of

the network serving the internal heating and hot water supply of the central site of Alföldi Printing House. Here, after delivering the necessary heat quantities, it cools down and flows over to the heat-utilizing heat exchanger of the reheating equipment, where it becomes hot again by absorbing the heat generated there. Thereafter, it returns to the secondary mains line of the city. The process is clearly shown in the system layout of Figure 2. The difference between the heat flows entering and leaving is measured by 2 heat consumption meters at the heat transfer station with respect to the direction of the heat flow. If the difference is positive (more heat flows in), heat energy is purchased, whereas if it is negative, heat energy is supplied. The two companies settle their accounts with each other on a monthly basis in view of the agreed purchase and supply prices. The operation of the system is supervised by state-of-the-art automated controls.

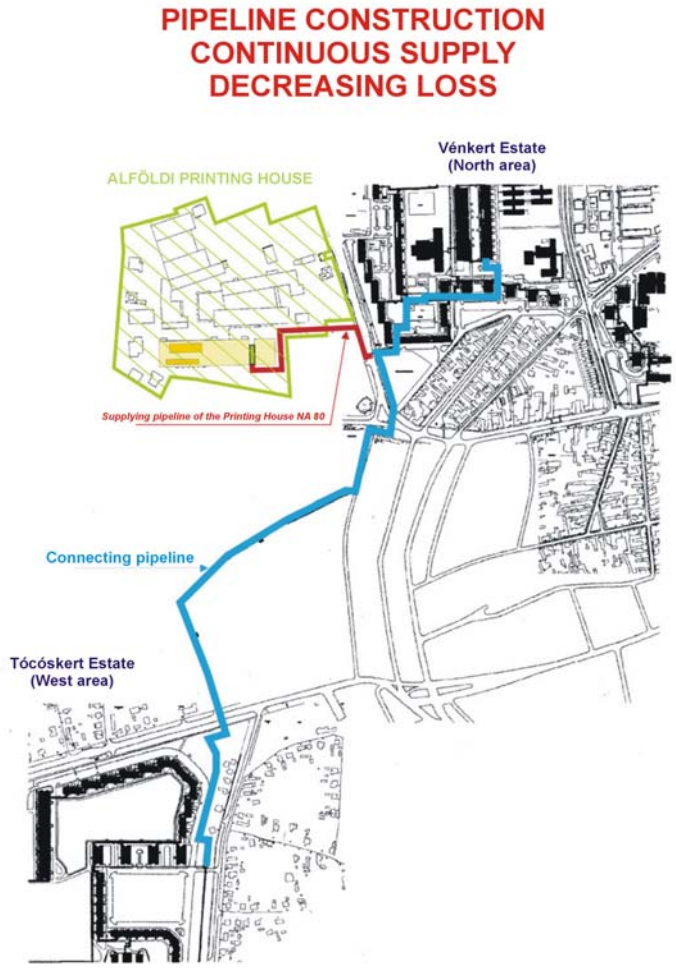

Figure 2: The planned expansion of the municipal district heating system

Earned during four years of cooperation, our experience shows that this special solution has been beneficial and cost-efficient for both parties. Apart from in-house utilization, Alföldi Printing House has been given an opportunity to sell its redundant heat energy, whereas the municipal district heating supplier has found a cheap source of energy near a focal point of residential consumption.

A specific outcome of the project is that Alföldi Printing House could close down its own, separate boiler house to reduce its noise emission to the environment.

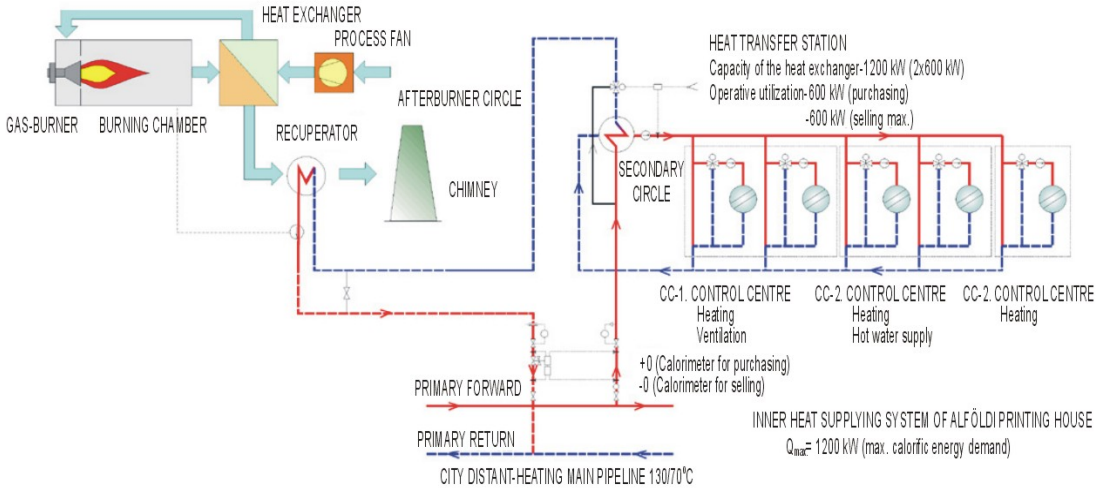

Figure 3: Energy utilization via the oxidizing equipment, system layout of the heating network and its connection to the municipal district heating system

3. ENVIRONMENTAL GAINS

This solution has several benefits in addition to Alföldi Printing House's saving approx. one-third of its former annual heating energy costs.

A general environmental benefit is – though it is still not covered in any legal regulation – that the company's heat loading on the environment has decreased substantially (cc. 10,000 GJ p.a.). With any other solution, the redundant heat should have been released to the environment, at least in the summer period.

At the same time, the boiler house having supplying heat energy so far could be stopped with all its detrimental impacts (noise and air pollution). Its decommissioning, disassembly has been one of the most positive developments – also "psychologically" – for the residential environment apart from the elimination of cc. 5.5 t air pollutants and the 6 dB noise level.

4. ENERGETIC GAINS

During the 50 months since the start-up of the system, the heat balance shown in Figure 3 has had a positive outcome. Alföldi Printing House has purchased 21,256 GJ heat from the Debrecen District Heating Company, and sold 21,852 GJ.

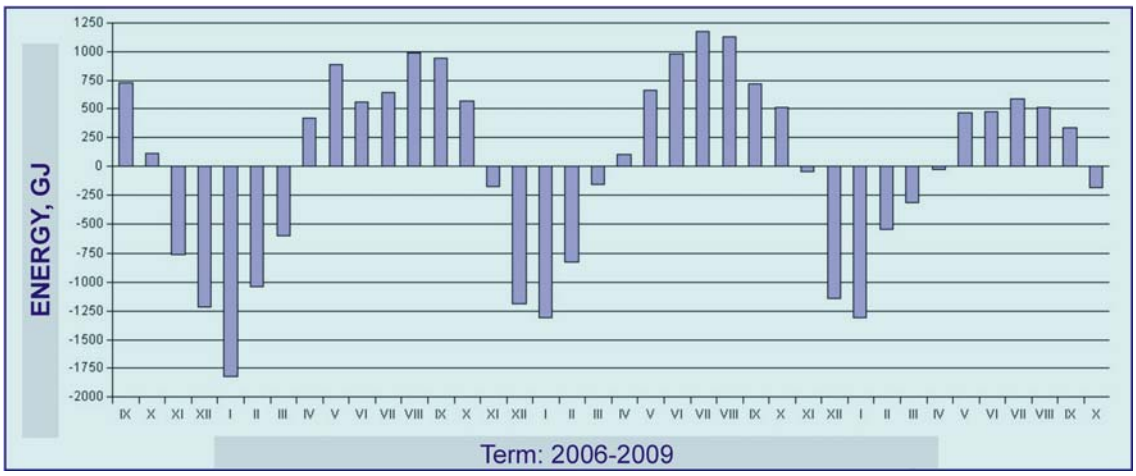

Figure 4: Alföldi Printing House's heat energy balance with the district heating supplier in the operating period of the oxidizing equipment

Naturally, a full-scaling and comparable conclusion of energy management can be drawn from the annual operating cycles. When analyzing the periods from the beginning of September to the end of August, the maximum difference between the purchased and sold heat quantities was 5%, an equivalent of the heat demand of 4–5 average heating days. If it is considered that at the central site of Alföldi Printing House the annual heating and hot water service demand used to be cc. 12,000 GJ, the efficiency of secondary energy utilization becomes evident. In practice, the company has become self-sustaining in terms of heating energy.

Equipped with appropriate automated controls, the operation of the system has proved to be safe and reliable.

5. CO-OPERANT APPROACH

The positive achievements of the project have been largely supported by the fact that in the planning and construction period the manufacturer of the reheating and heat utilization installations, the designer and adviser, as well as the investor and heating company were acting in close cooperation with each other to find and implement the best solutions.

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