FICHE TECHNIQUE

020

LE SÉCHAGE PAR RAYONNEMENT INFRAROUGE DANS L'INDUSTRIE DES PÂTES ET PAPIERS

A NATURAL GAS INFRARED RADIATION DRYING SYSTEM IS AN EFFICIENT SOLUTION.

SITUATION

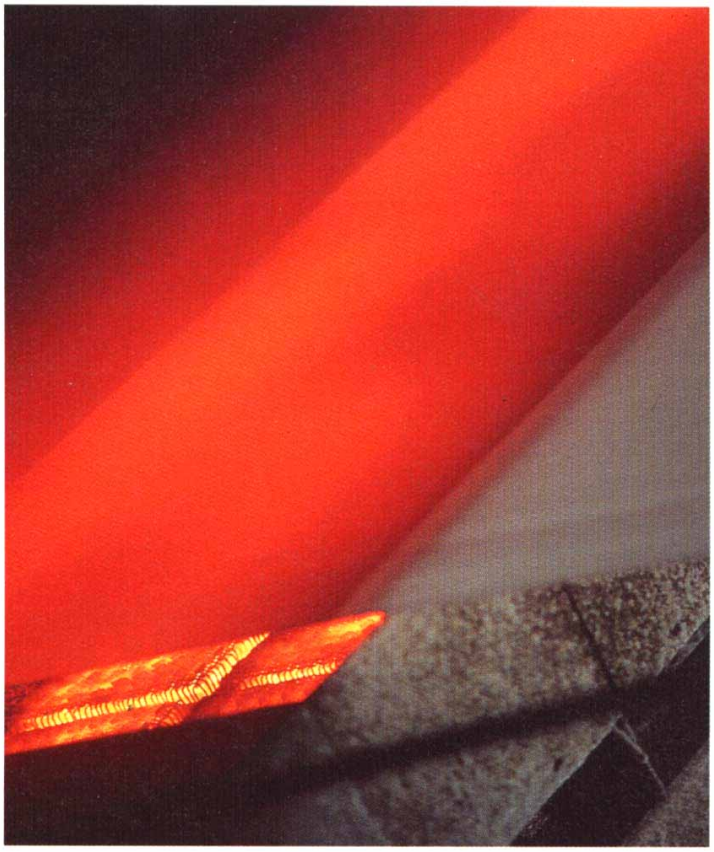
In papermills, the drying operation is often the weak link in the paper making process by limiting machine capacity.

The Natural Gas Technologies Centre has examined two solutions to these problems using infrared natural gas drying technology.

PROBLEM

One observed case involves an air dryer installed between the cylinder dryer and winders on a pulp press dryer. Here, it is difficult to maintain a constant temperature when paper passes from the cylinder dryer to the winder. The paper temperature drops by 20°C between the dryer and the hot air dryer, thereby decreasing machine productivity.

Another instance concerns paper coating. The coater operates at reduced levels because the air dryer cannot supply sufficient power to increase machine speed. One of the difficulties stems from insufficient clearance space which prevents the installation of a supplementary air dryer. Moreover, the low power of the air dryer doesn't allow for the elimination of mottling after the coating process, even at reduced speed.



Radiants infrarouges en opération.

SOLUTIONS

A HIGH-PERFORMANCE NATURAL GAS INFRARED SYSTEM

Several solutions were examined, including the installation of electric radiants. This solution was not pursued because of very high operating costs. What's more, in paper coating, electric radiants would not be able to withstand prolonged exposure to a hostile environment caused by continuous splashing from the coating sauce.

In both applications, a high-efficiency natural gas infrared radiation drying system was chosen. In the case of the pulp press, it was the first such application in the world.

CONVINCING RESULTS

Let's consider the immediate improvements and benefits of natural gas infrared drying technology on the two machines.

Natural gas infrared drying on pulp press

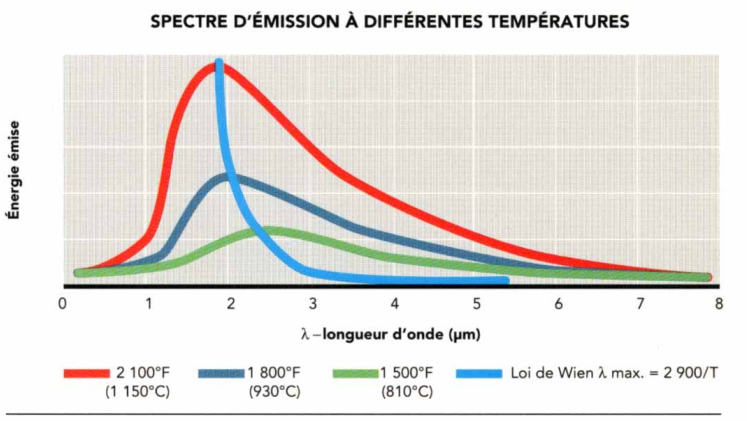
- 5% to 8% increase in productivity.
- More than 30°C increase in sheet temperature following the pass close by the radiants.
- 15°C increase in sheet temperature between the end of the dryer and the hot air dryer.
- Evaporation of humidity between radiants and dryer.
- Lower steam consumption in the hot air dryer.
- Thermal performance of 60%
- Maintenance of whiteness of product.

Natural gas infrared drying on the coater

- 20% increase in productivity.
- Improvement of profile, cross machine, "2 sigma" lowered by 32%
- Energy consumption reduced by 23% at initial speed and 13% at higher speeds.
- Improvement in paper quality, elimination of mottling.
- Energy performance of 59%.
- Possibility of further increases in machine speed by modifying the drive section and the composition of the coating sauce.
- Additional reduction in energy consumption by balancing air between the different hot air dryer hoods.
- Reliable equipment featuring strong resistance to hostile environment
- Safe operation.

FONCTIONNEMENT

Infrared drying is achieved by forcing an air-gas mixture over burners made of perforated ceramic plates. When this mixture ignites, the combustion stabilizes on the outer surfaces of the plates. The mixture burns without flaming and heats the plates to the right temperature. In this way, energy is transferred directly to the product being dried through infrared radiation.

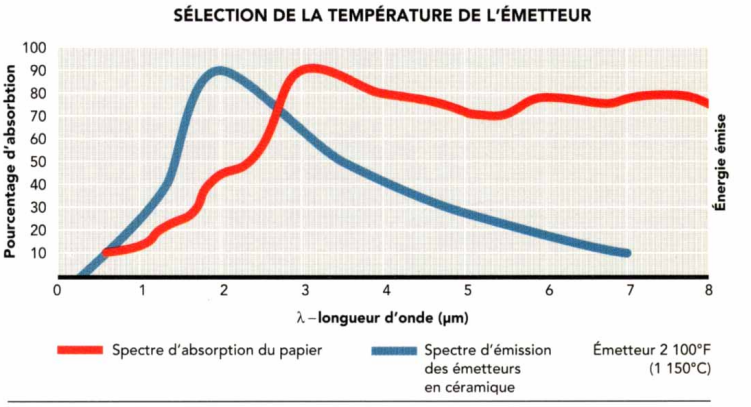


According to the Wien law, a ceramic-type transmitter operating at a temperature of 1150°C transmits maximum energy at a wavelength of 2.2 to 3 µm.

PAPER ABSORPTION SPECTRUM

Paper entering the dryer has a high water content. Its absorption band for infrared radiance basically follows that of water and is about 3 µm.

The heat emission temperatures of infrared radiation, higher and lower, result in wavelengths that are outside the maximum absorption band of paper. An emitter operating at a temperature of 1150°C thus transmits an infrared radiance at a wavelength that is within the maximum absorption range of paper.

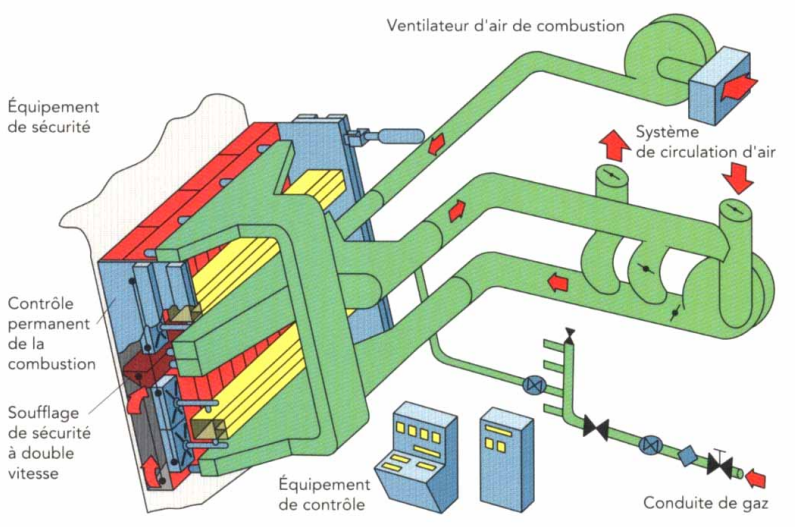


ASPECTS TECHNOLOGIQUES

NATURAL GAS INFRARED ON THE PULP PRESS

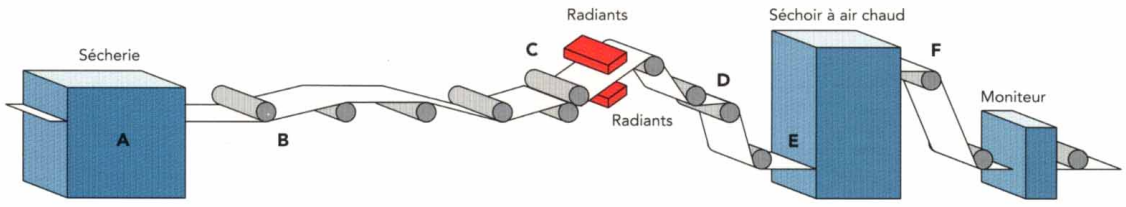
The installation consists of two hoods, each with three rows. Each row comprises 32 radiants, six of which can be turned off at will according to the width of the sheet.

The power/output is 1,344 kW. In addition to the hoods, the system includes a combustion air blower, hot and humid gas recirculation and exhaust blower, natural gas piping and a programmable automated control system to ensure smooth operation and safety.



Exemple d'installation infrarouge au gaz naturel.

The following chart shows the temperature profile, machine length. Results obtained during trials.



	A	B	C	D	E	F
Radiants en arrêt	59 °C	80 °C	66 °C	62 °C	58 °C	82 °C
Radiants en marche	59 °C	80 °C	66 °C	92 °C	73 °C	82 °C
Différence	—	—	—	30 °C	15 °C	—

Profil des températures sur presse-pâte (pâte de bois durs).

NATURAL GAS INFRARED ON COATER

Coating sauce is applied to paper at the coater, while the water, which penetrates the support, carries the binding agents. To produce good printing quality, the binding agents must be spread uniformly through the thickness and the surface of the coating sauce, which requires quick and deep dryings.

Hot air drying has a practical maximum evaporation capacity in the order of 40 kg/m^3/hour. Above this rate, a crust forms on the coating sauce or the support.

However, the heating power of infrared natural gas drying with ceramic emitters responds perfectly to the demanding needs of the coating operation, especially with regards to paper quality.

Description of installation

An infrared hood is installed at each of two coating stations. Following are the characteristics:

	Poste n°1 1 voûte de 6 rangées de 27 radiants	**Poste n°2** 1 voûte de 5 rangées de 27 radiants
Puissance installée	1 134 kW	945 kW
Longueur sens machine	1 680 mm	1 470 mm
Capacité d'évaporation	615 kg/h	550 kg/h

RÉSULTATS

Chart A shows natural gas consumption per kilogram of evaporated water by comparing the speeds with and without infrared radiants. Strikingly, total natural gas consumption decreases when the radiants are in operation. And the energy consumption of the dryer, considered alone, declines significantly at initial and accelerated speeds.

The consumption by the radiants represents only 15% of the total consumption, proving that the natural gas infrared radiants are more efficient than hot air dryer.

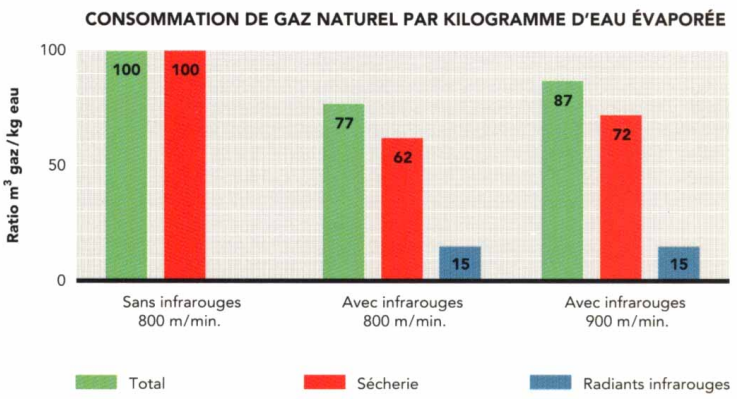


Tableau A

Chart B studies the effect of the speed on natural gas consumption; it compares a situation with the radiants turned off and one with the radiants in operation, at initial and accelerated speeds. The results indicate clearly that it is possible to increase speed while at the same time reducing energy consumption. The productivity gain with the radiants, therefore, is achieved at two levels.

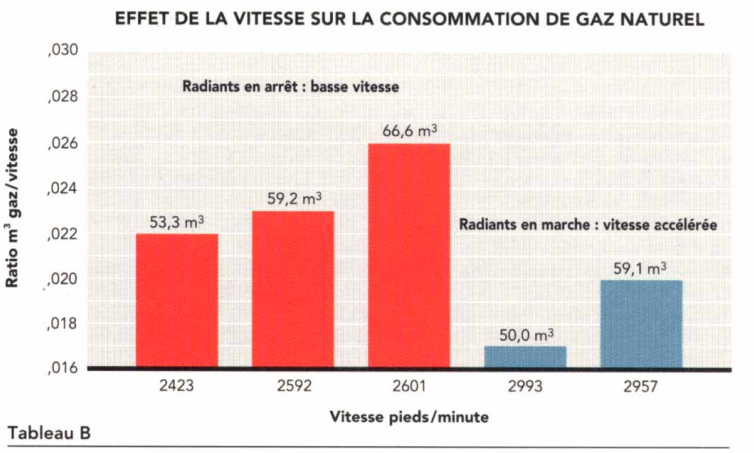


Tableau B

Chart C analyzes the effect of infrared radiants on the humidity profile; their impact is important in this respect. A 32% improvement is observed at the winter.

PROFIL DE L'HUMIDITÉ : ÉCART (2 SIGMA) DT

	Sans infrarouge Humidité	Avec infrarouge Humidité	Variation en %
Débobineuse	0,20	0,20	0
Après coucheuse 1	0,62	0,54	13
Après coucheuse 2	1,08	0,73	32

Tableau C

EN RÉSUMÉ

Natural gas infrared drying is an example of an innovative technology that's worth considering. This advanced technology offers several benefits, notably increased paper machine production capacity, while reducing energy costs. The applications for pulp press dryers and coaters, among others, are very conclusive.

By using infrared drying on the pulp press dryer, the temperature of the product can be increased while maintaining whiteness. Its use results in lower steam consumption in the hot air dryer. In addition, the process helps maintain constant temperature between the cylinder dryer and the hot air dryer. The productivity of this manufacturing Stage, therefore, is improved at several levels.

Natural gas infrared drying for coaters improves paper quality and allows higher machine speeds. Energy savings are achieved, varying according to machine speed. A 20% productivity gain is achieved in the process.

For more information, contact : **The Natural Gas technology Centre** **Tél. : (514) 449-4774**

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