CADDET energy efficiency

IEA / OECD

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Smelter plant reclaims foundry sand

Reclamation of foundry sand using natural gas

Summary

The cost of sand is a significant part of the operating costs of a smelter. The concept of recycling rather than disposing of sand has been implemented in a very effective manner at the Montupet smelter. Located in Rivière-Beaudette, Québec, the Montupet smelter has installed an energy-efficient natural gas furnace which has enabled it to recycle almost 100% of its sand. Compared with the alternative (disposing of the sand), this system has resulted in a cash saving of around 90% per tonne, and a subsequent investment payback period of under two years.

Highlights

- **Payback period less than 2 years**
- **Over 90% recovery of all sand treated**
- **Significant decrease in operating costs**
- **Improved final product**

Montupet smelter, Rivière-Beaudette, Québec.

Aim of the Project

Before the reconditioning system was installed, all the sand used to manufacture moulds (inserts) had to be discharged into a landfill site because it was covered with residual binder. In view of the enormous cost of buying and dumping sand, and the fact that Montupet planned to double its production capacity in the coming years, a solution had to be found. In the interests of cost efficiency and the environment, Montupet re-examined its policy of discharging sand into a landfill site. Since the company was also anticipating an increase in the amount of materials it would process in the future, it decided to install a sand recovery system, opting for a fluidised bed furnace.

The Principle

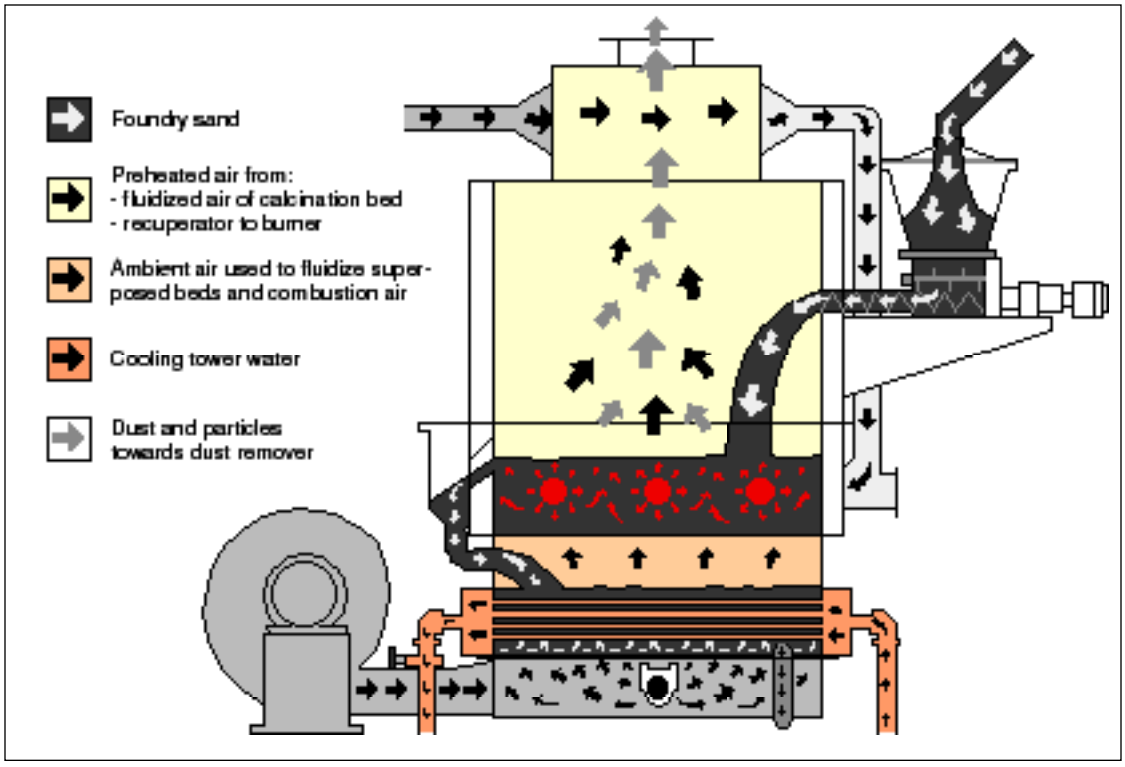
Sand to be recycled is fed directly from the storage silo, by gravity, into the furnace storage tank. From there, an auger feeds it into the heating bed at a constant rate. The sand then enters a fluidised bed chamber which is maintained at a temperature of 677°C by submerged tube burners, which produce a homogeneous mixture of combustion products and sand, thus ensuring excellent heat transfer. The air used in burner combustion is preheated by a recuperator, which recovers heat from outgoing gases, thus helping to limit fuel consumption. The newly cleaned sand is then introduced into the fluidised bed cooling chamber, where it is cooled to ambient temperature by an air-water heat exchanger. A schematic of the recycling system is shown in Figure 1.

The Situation

At Montupet, sand is used to manufacture mould inserts which create cavities inside castings. Resins are mixed with sand and a catalyst to produce a mouldable sand mass which hardens without the need for external heat.

Molten metal is transferred to a pouring ladle which is used to transport metal in the smelter and pour it into holding furnaces. The metal is then poured into moulds. Once the metal has hardened, the moulds are opened and the sand is mechanically removed from the hardened parts. The

Figure 1: Recycle system schematic.



sand is then placed in a storage silo, from where it is fed by an auger into the heating bed.

In a thermal reconditioning system, the binder is eliminated by heating the sand to a temperature close to 677°C. The organic components of the combustion gas are oxidised after a period of time at this temperature. This thermal reconditioning system is fed by natural gas and is energy efficient. At the same time, the fluidised bed creates a turbulent flow in the calcination chamber which results in a very efficient heat transfer and uniform temperature distribution.

In general, thermal reconditioning produces sand of a quality superior to that of new sand. This can be explained as follows:

- unlike new sand, reconditioned sand contains no fine particles;
- because the edges of the sand grains are more rounded, uniform embedding of the sand grains is achieved;
- thermal reconditioning stabilises the sand. With more uniform sand, the amount of binder required is easier to control, resulting in an improved product.

Sand regenerators are shown in Figure 2.

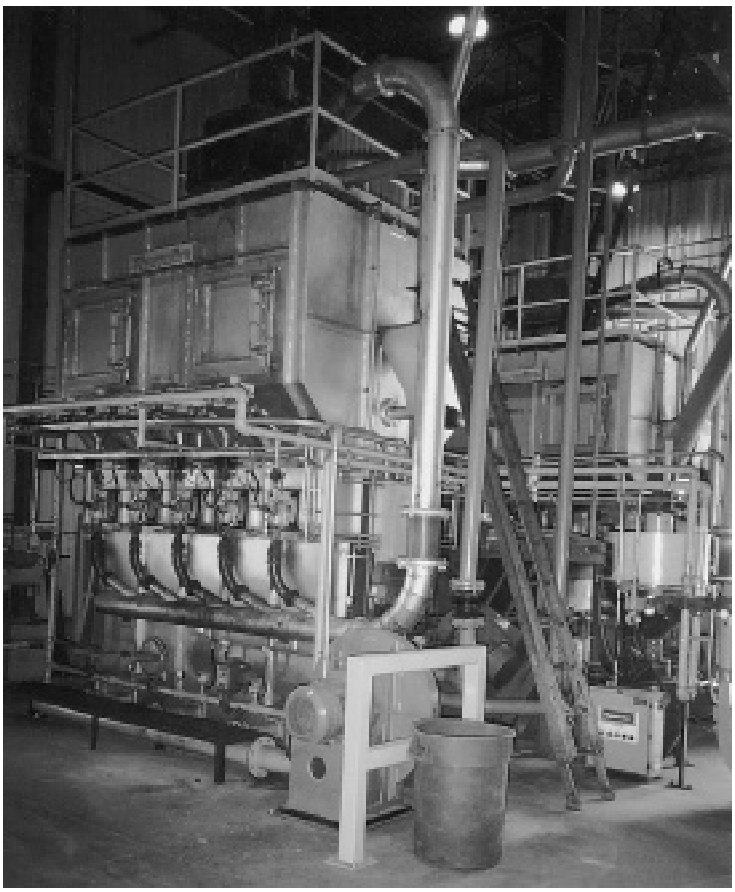
The Company

Montupet Ltd manufactures cast aluminium parts. It is General Motors' exclusive supplier of parts for the cylinder head of its Northstar engine and V-8 aluminium engine blocks for the Corvette car. Montupet Ltd, a subsidiary of the French company Montupet S.A., has operated a plant in Rivière-Beaudette, Québec, since l988. The factory has a nominal annual production capacity of 14,500 metric tonnes of aluminum parts. Almost 400 staff are employed at the Rivière-Beaudette plant.

Economics

Before the reconditioning system was installed, all sand used had to be disposed of because it was covered with residual binder. In l994, the cost of using sand totalled CAD 109/tonne: CAD 73/tonne for the purchase of new sand, plus CAD 36/tonne to dispose of the used sand. With close to 7,500 tonnes of sand disposed of in l994, the annual cost amounted to over CAD 817,000.

Figure 2: Two sand regenerators installed at Montupet.



Operating costs (CAD/tonne of sand processed)			
Without reconditioning		With reconditioning	
Cost of sand	73	Energy	6
		Operation and maintenance	4.5
Sand disposal	36	Sand disposal	1.6
Total	109	Total	12.1

In l995, two furnaces with a projected unit capacity of 2,7 metric tonnes per hour were installed at the Montupet smelter. Results were immediate: savings of around 90% were realised. In fact, the unit cost totalled only CAD 12.10/tonne of sand reclaimed (see table). Although investment costs (approximately CAD 1,634,000) were relatively substantial, the payback period for the investment was under two years.

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* IEA: International Energy Agency
OECD: Organisation for Economic Co-operation and Development

IEA

The IEA was established in 1974 within the framework of the OECD to implement an International Energy Programme. A basic aim of the IEA is to foster co-operation among the 24 IEA Participating Countries to increase energy security through energy conservation, development of alternative energy sources, new energy technology, and research and development (R&D).

This is achieved, in part, through a programme of energy technology and R&D collaboration currently within the frame-work of 40 Implementing Agreements, containing a total of over 70 separate collaboration projects.

The Scheme

CADDET functions as the IEA Centre for Analysis and Dissemination of Demonstrated Energy Technologies. Currently, the Energy Efficiency programme is active in 12 member countries and the European Commission.

This project can now be repeated in CADDET Energy Efficiency member countries. Parties interested in adopting this process can contact their National Team or CADDET Energy Efficiency.

Demonstrations are a vital link between R&D or pilot studies and the end-use market. Projects are published as a CADDET Energy Efficiency 'Demo' or 'Result' respectively, for ongoing and finalised projects.

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