Canadian Industry Program for Energy Conservation
CIPEC


# Case Study:
# BITUMAR INC.
## Energy-Efficient Asphalt Production

### Highlights

- Annual natural gas consumption reduced by 36 percent as a result of improved insulation
- Enhanced asphalt storage
- Greenhouse gas (GHG) emissions reduced by more than 2 kilotonnes of carbon dioxide equivalent (kt $CO_2e$)

Natural Resources Canada's Office of Energy Efficiency offers a financial incentive through the Canadian Industry Program for Energy Conservation (CIPEC) to help companies find ways to improve their energy efficiency and production processes, as well as to reduce their costs. The incentive helps to defray the cost of hiring a professional contractor to conduct an energy audit and covers up to 50 percent of the audit cost, to a maximum of $5,000.

Under the Industrial Energy Audit Incentive program, Bitumar Inc., a manufacturer of liquid asphalt, had an audit of its Montréal plant carried out in 2003. The energy-saving measures identified in the study focus on reducing the plant's overall natural gas consumption. They mainly involve upgrading the insulation on some equipment and recovering heat from flue gases.

By implementing the proposed measures, which reduce heat loss caused by the inadequate insulation of the asphalt storage tanks and the thermal oil system, the company has reduced its natural gas consumption by 36 percent. In fact, the savings will keep increasing because the company plans to do additional insulation work in 2005.

## Sector characteristics

In Canada in 2002, the asphalt paving, roofing and saturated materials manufacturing industry (NAICS 32412) had 163 businesses with sales of $30,000 or more. The total value of its manufactured shipments was $1.5 billion, while its fuel and electricity costs were $66 million, or 6 percent of total manufacturing costs (source: Statistics Canada, 2002).

## Plant profile

Bitumar Inc. specializes in the manufacture of liquid asphalt for the paving and roofing industries. The company employs over 100 people, including chemical, process and mechanical engineers, chemists, plant operators and technicians, and administrative personnel. Bitumar Inc. operates production plants in Montréal, Quebec, in Hamilton, Ontario, and in Baltimore, Maryland, United States. Its Montréal plant produces a wide range of grades of paving and roofing asphalt for markets in Quebec, Ontario, the Atlantic provinces and the northeastern United States. The Baltimore plant serves the states along the central and southern Atlantic seaboard of the United States.

Liquid bitumen is delivered to the Montréal plant and stored in huge tanks. From these tanks, it is pumped to various processes for the production of concentrates of bitumen, oxidized bitumen and rubberized bitumen. (The latter product is produced by adding polymers to the bitumen.) These concentrates are then blended in the required proportions designed to produce the desired grade of asphalt. The final product is stored in heated reservoirs. This manufacturing process is very energy intensive because the product must be kept hot.

Natural gas is the main energy source for the plant's processes. In 2001–2002, Bitumar Inc. consumed more than 3 million cubic metres ($m^3$) of natural gas. Electricity is also used to run pumps, motors, controls and other support equipment.

## Energy audit

Fintex Mechanical & Process Inc., an engineering consulting firm specializing in energy audits, conducted the audit of the Montréal plant. The ultimate goal of the audit, which focused solely on equipment using natural gas, was to lead to the implementation of energy-conservation measures that would reduce natural gas use. Bitumar Inc. received financial support from the Office of Energy Efficiency and Gaz Métro, which combined to cover 71 percent of Fintex's professional fees.

The proposed energy-saving measures involved mainly upgrading the insulation on some equipment and recovering heat from flue gases.

Insulation upgrades were proposed for the following equipment:

- the asphalt storage tanks
- the thermal oil system used to heat the tanks
- the boiler that is used mainly to provide the steam needed to heat pipes in the bitumen-pumping system

The proposed heat recovery initiatives were:

- recovery of heat from the incinerator's flue gases to preheat combustion air (the incinerator burns reactor gases to comply with environmental regulations)
- recovery of heat from the furnace exhaust to preheat combustion air (the furnace heats the thermal oil)

The plant chose the measures that it would implement based on the payback period. For example, the proposed heat recovery from the incinerator and furnace exhaust had payback periods of 22 and 25 months, respectively; and the boiler insulation upgrade had a payback period of 22 months. As these are significant time periods, these three projects were not selected.

Instead, the insulation upgrades of the asphalt storage tanks and the associated heating systems were deemed to be the most cost-effective energy-saving projects. The average payback periods were 18 months for insulating the tanks and one month for insulating the thermal oil pipes. Most of these upgrades have already been done.

The asphalt is stored in outdoor tanks dispersed over a very large yard. The tank capacities range from 200 to 10 000 tonnes. The asphalt must be stored at a high temperature prior to delivery. A thermal oil system heated by a furnace is connected to most of the tanks and ensures a constant temperature, in spite of heat loss caused by distance and weather conditions.

Bitumar Inc. had already identified the energy problem with the tanks and the associated heating systems. Some of the goals of the study were to quantify the heat loss caused by inadequate insulation, select the best insulating material for reducing the loss, and estimate the insulation installation payback period. An analysis of the monthly natural gas use profile clearly showed the effect of outside temperature on the plant's energy use: the lower the temperature, the higher the energy use per unit of production. A significant portion of the energy used by the plant was related to heat loss during manufacturing operations, including asphalt storage. The loss was higher in cooler weather.

The study also identified the storage tanks with sub-optimal protection against heat loss because of a lack of insulation or inadequate insulation. Their covers had not been insulated, and the insulation on the walls of some tanks was damaged. The covers of 20 tanks were insulated, as well as the walls of two tanks. Mineral-fibre insulation, 4 inches (10 cm) thick and composed of basalt and steel slag, was installed and then covered with aluminum.

Thermal oil pipes with no insulation or damaged insulation were properly insulated. A 2 inch (5 cm) layer of mineral-fibre insulation was applied and covered with aluminum. The heat losses and the optimum insulation thickness were calculated with the 3E Plus software developed by the North American Insulation Manufacturers Association (NAIMA), which is available free of charge at www.pipeinsulation.org.

The approximate costs of the insulation upgrades were:

- tank roofs – $15 per square foot
- tank walls – $10 per square foot
- oil pipes – $15 per linear foot

The insulation was installed by a team of subcontractors under the direction of the operations supervisor at the Bitumar Inc. plant. Starting in 2003, the work was done gradually, one tank at a time. It did not affect production or finished product storage. The plant is planning to follow up this project by insulating the covers on the other tanks.

## Results

By implementing the measures identified in the energy audit, Bitumar Inc. has reduced its annual natural gas bill by 36 percent. Annual natural gas consumption has dropped by 1 million $m^3$, resulting in an annual GHG emissions reduction of more than 2 kt $CO_2e$. A further addition of insulation is expected to generate even greater savings, and annual natural gas use could decline by a total of more than 45 percent.

The solution proposed by the auditors turned out to be highly cost-effective, given the relatively short payback period and the longevity of the insulation (about 20 years).

In addition to the savings resulting directly from reduced natural gas consumption, upgrading the insulation on the tanks and thermal oil pipes made it easier to store the finished asphalt and reduce storage costs.

Before the upgrade, the inadequate insulation on the storage tanks and heating systems caused significant heat loss, and the tank heating systems could not maintain the asphalt at the required storage temperature. The asphalt thus had to be pumped from the tanks to a heat exchanger for reheating to the right temperature and then pumped back to the tanks.There was also a risk of contaminating the asphalt during this process. With the insulation upgrade, this additional step has been eliminated.

The main factor contributing to the successful outcome of the audit was Bitumar Inc.'s commitment to enhancing the energy efficiency of its manufacturing operations by improving the insulation of its tanks and heating systems.

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