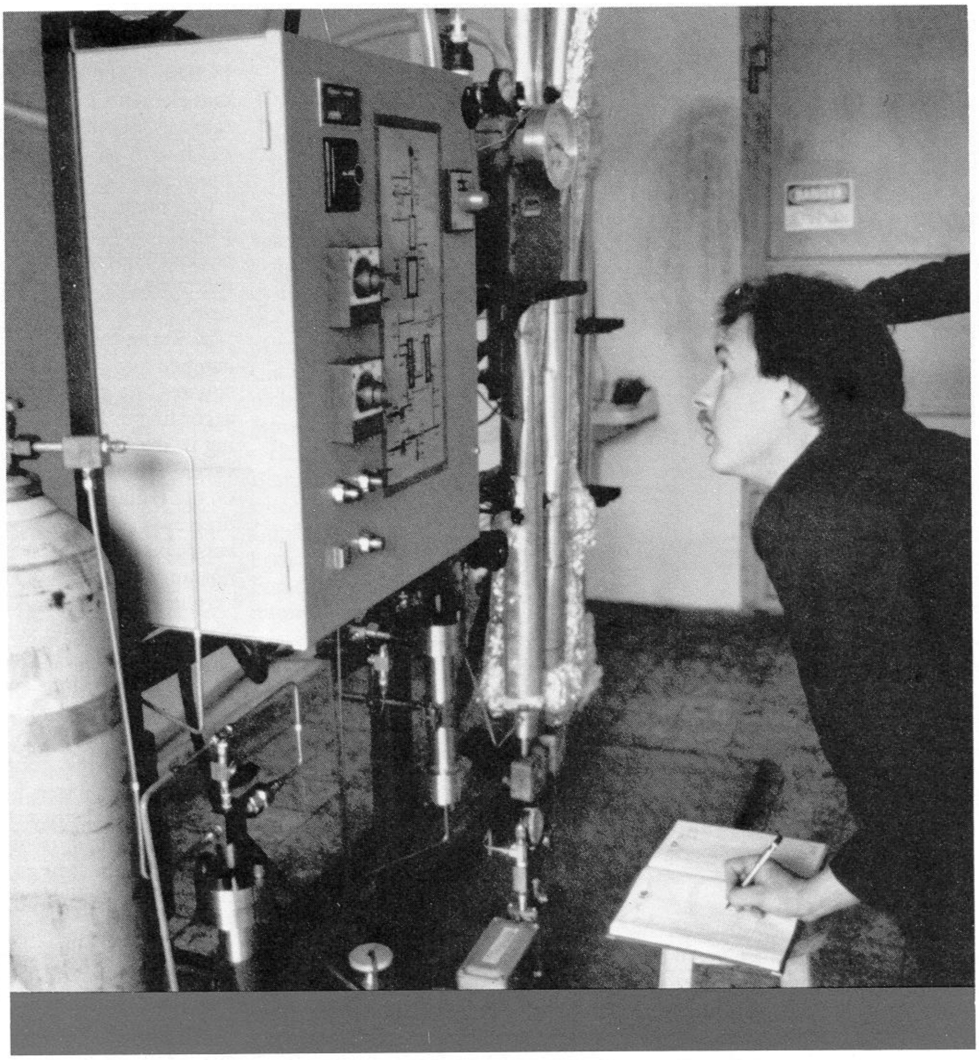
BETTER BURNING LIGNITE
FOR TURKEY'S STEEL MILLS



Photos: Robert Charbonneau / IDRC

ROBERT CHARBONNEAU

Chimneys spew out their smoke and freighters in the port are ready to unload tonnes of iron ore from Brazil and coal from Australia.

Iskenderun, on the Turkish coast, 110 kilometres to the south of Adana near the Syrian border, was but a small fishing village in 1970. Today, it houses the state-run ISDEMIR, the third largest steelworks in Turkey, which employs 13 000 workers and produces more than 2.2 million tonnes of semi-finished steel yearly.

A little white car winds its way under the 40 kilometres of conveyors connecting the grey buildings. In the vehicle is Gaye Erbatur, accompanied by her husband Oktai, who is driving. Both are chemists and teach at the University of Çukurova, on the outskirts of Adana. Mrs Erbatur heads an IDRC-supported project aimed at upgrading lignite, a low-quality brownish black coal, and finding ways to use it in the Turkish steel-making industry. Upgraded lignite will help to save on metallurgical coke.

Every day, each of the four blast furnaces uses 1190 tonnes of coke, the essential fuel for smelting ore. Coke is obtained by distilling bituminous coal (high-quality coal) in a vacuum, where the volatile substances are released. It provides an intense heat energy and is able to withstand compression in the blast furnaces, where it is placed between the layers of ore to be smelted.

All the coke is made on site from imported coal purchased on the international market at a cost of more than CA$143 million a year. This is an expense the Turkish government would like to reduce in order to improve the country's balance of payments position.

There are no deposits of high-quality coal in Turkey. Several lignite deposits, however, have been mined in the north and west of the country for use in thermal power plants or for local heating requirements. If lignite, which is a crude form of coal still containing vegetable matter, is to be used in steel making, it will be only the highest grades that are selected for processing.

Dr Esteban Chornet, of the chemical engineering department at the University of Sher-

Left, technician Senel takes a reading off the prototype reactor used to upgrade the lignite. Right, gases used in the process are analyzed by means of a gas chromatograph. Bottom, the ISDEMIR steelworks at Iskenderun, Turkey.

brooke, in Canada, has developed a technique for converting oxidized coal (which produces less heat than unoxidized coal) into metallurgical coke. The process, developed in cooperation with the Canada Centre for Mineral and Energy Technology (CANMET), is now being patented. Combustion characteristics are improved by placing the coal in a pressurized container (called an autoclave) with water and carbon monoxide.

Gaye and Oktai Erbatur want to adapt this technology to upgrade local lignite. As a first step, these researchers have installed instruments in their university laboratory for analyzing the composition (content of carbon, hydrogen, nitrogen, oxygen, and sulphur) of lignite samples from seven sites in Turkey. Since only the best lignite in the country can eventually be used to help reduce current consumption of coke, this first identification stage has been of major importance.

Next, the researchers hired a young engineering technician, Göjhan Senel, to carry out the laboratory experiments at ISDEMIR. The steelworks authorities cooperated from the beginning of the project in 1984, explains Mrs Erbatur.

The upgrading process uses gases produced by the blast furnaces, but the composition of these gases sometimes varies. For the research team's tests to be realistic and accurate, it was therefore necessary to install a small prototype reactor capable of upgrading the lignite on the actual steelworks site.

Abdullah Çorban, director of research laboratories and procedures at ISDEMIR, assisted in the experiments. The researchers were offered space and the cooperation of the plant work crews. ISDEMIR also provided the precious gas necessary to fuel the reactor.

The reactor was built in Canada by the Montreal firm THP according to plans supplied by the University of Sherbrooke, and shipped to Iskenderun in Turkey.

The reactor's purpose is to increase the carbon content of the lignite. It is loaded with 1.5 kilograms of lignite with a carbon content of about 75 percent. The operation increases that proportion by 5 to 8 percent so that the lignite can be used in the steel-making process.

The material is first heated to between 350 and 400 degrees Celsius with gas reclaimed directly from the blast furnaces. The active element, for the purposes of upgrading lignite, is carbon monoxide, constituting from 21 to 24 percent of the gas.

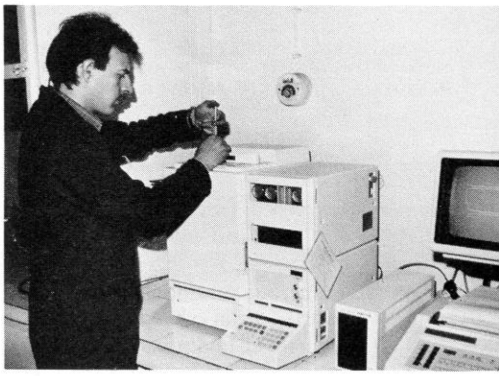
The gas is pressurized to about 2000 pounds per square inch (20 megapascals) before reaching the raw lignite. Only the pressurization process consumes energy, as the gas arriving from the blast furnaces is already very hot. This gas is normally used to heat the steelworks and will continue to be used for this purpose since it is not consumed in the upgrading process.

From a technical point of view, Mrs Erbatur would have preferred to use the gases released from the coke ovens rather than those from the blast furnaces because the former are much richer in carbon monoxide. The valuable coke oven gases, however, are already spoken for — they are sold as by products on the market. The gases from the blast furnaces, on the other hand, have no commercial value so it is these that ISDEMIR and the researchers have favoured.

At present, Mr Senel, the technician who operates the reactor, carries out two or three complete upgrading experiments weekly. Each takes two to six hours, with measurements taken at regular intervals. The treated lignite and the gases are later analyzed in the lab. The carbon content is assessed and the composition of the incoming and outgoing gases is also evaluated by means of a chromatograph supplied to the researchers as part of the project.

The reactor is a veritable bomb. The presence of gases under pressure and fuel "makes the operation perilous" and, says the technician, "the cleaning tedious". "Above all, it is very important to clean the conduits thoroughly in order to avoid pressure buildups."

Although the experiments are just beginning,



Mr and Mrs Erbatur are confident they can put a certain proportion of the upgraded lignite to good use. "The process developed with the help of Canadian technology is going to help us to use local lignite in the manufacture of steel. We will always need imported coal, but we can make better use of lignite in the Turkish steelworks," says Mr Erbatur. The upgrading process may even be useful in modifying the lignite burned to heat buildings.

Will the process be economical for such a purpose? The researchers are still silent at this stage, but they claim that energy shortages recently led the government in the capital, Ankara, into highly questionable expenditures. During the winter of 1986, half of Ankara suffered from the cold because of an energy shortage. The government therefore imported expensive anthracite (high-quality coal generally used in blast furnaces) and subsidized its use in city homes. Not only did this decision have adverse economic consequences, but it also led to increased air pollution.

Turkey's lignite will not solve all its energy problems. While coal and oil will still have to be imported from abroad, the researchers are hoping that the adaptation of Canadian technology will amplify and diversify the uses of a local resource. ■