Waste water discharged from the coal and coke yards is likely to contain fine particulate of coal, and acidic substance which give acidity. Thus, a neutralization plant adding alkaline to waste water and a settlement facility to remove fine particulate are required. Fig. 7–5 shows a conceptual diagram of the process.

(4) Environmental impacts of water pollutants and evaluation of control measures

The effluent from the coke plant will be discharged through two routes, the combined process effluent from the north side of the plant and the yard water from the south side, both off the wharf accommodating the coal carrier. Discharge pipes are 1m in diameter, from which water is directly discharged to the lake. As shown in table 10–11, BOD in effluent water shall be about 10 ppm.
The effluent is carried by tide and moves southward at high tide and northward at low tide, creating a risk of polluting lake water.

So far, CORPOZULIA engineers have explained that direct discharge of effluent from the plant would not present any problem so long as emission standards are complied with.
If this is true, effluent from the coke plant will be able to meet emission standards applied to Lake Maracaibo and surrounding waters. It will not bring significant environmental impacts on the lake and its surrounding areas.

Although the lake is connected to the sea through the Gulf of Venezuela, it is essentially a closed water area and does not have the ability to dilute pollutants. Thus, once polluted, it is difficult to restore the lake to its original state.

Local newspapers often report about the lake's pollution, and some people claim that a fish catch on the lake decreases due to water contamination.

On the other hand, CORPOZULIA's engineers explain that major causes for the pollution are crude oil spilled from oil wells, loading facilities, and tankers, as well as untreated sewage from the city and its surrounding areas. So, it is assumed that water contamination of Lake Maracaibo is three main causes as shown in figure 10–13.

Also, the fish catch has decreased due to excessive fishing, and the fish size caught in the lake becomes smaller. Recently, various fishing restrictions have been introduced, and the use of fishing nets with larger meshes is expected to work as a deterrent for reckless fishing.

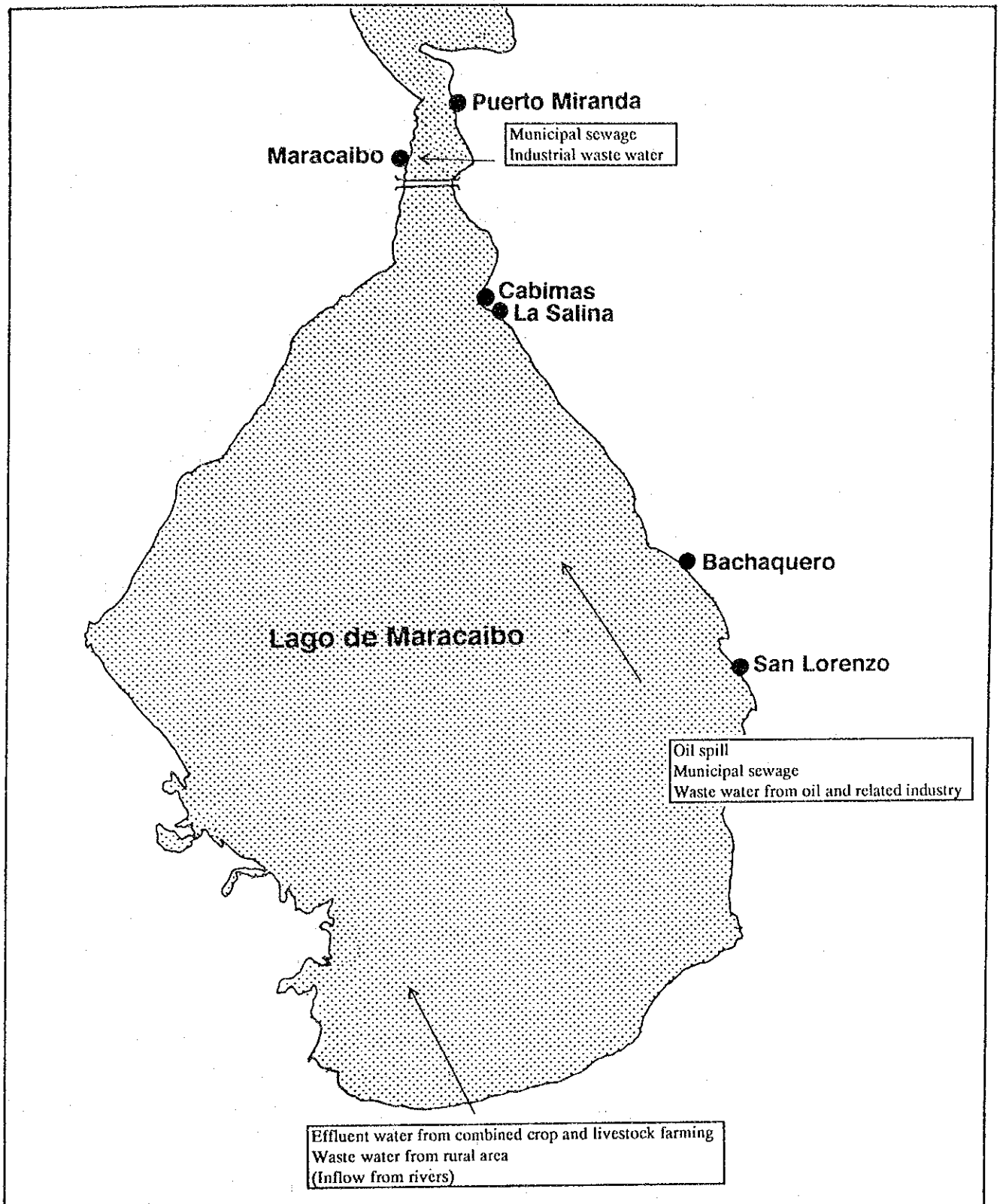


Fig.10-13 MAIN CAUSES OF WATER CONTAMINATION FOR LAKE MARACAIBO

It is the fact that there have been no emission standards in Venezuela, including Lake Maracaibo, and waste water from households and industrial effluent have been discharged without treatment to the lake. Starting in April 1994, however, effluents from petroleum refining and other industrial facilities are restricted by new regulations. Also, a public sewage treatment plant for the city is under construction. As a result, the discharge of water pollutants which deteriorate the lake's water quality will be significantly reduced in the near future.

The study team attempted to obtain background data which indicate how the lake water is contaminated by which pollutant. Furnished data by CORPOZULIA, as shown in Table 10-5, and ICALM's report which published Jan, 1994 do not contain COD, SS and other items associated with water pollution by organic matters.

ICLAM's report above mentioned is summarized as follows.
Surface water of Lake Maracaibo contains a large amount of dissolved oxygen and shows a low BOD level. BOD, which is 5.2ppm at the mouth of the lake, is shown max. 3.7ppm in the lake. Other measuring points are less than 3.0ppm. On the other hand, dissolved oxygen ranges between 6ppm and 7ppm on average. Thus, lake water seems to be clean on the surface.

However, dissolved oxygen content in the bottom of the lake decreased to one half the level near the surface, while BOD exceeds 10ppm and reaches 20 – 30ppm at many measuring points. Where surface water is relatively clean, the near anaerobic condition prevails deep into the bottom. This is because organic matters carried to the bottom are hard to be decomposed.

The above analysis suggests that Lake Maracaibo may be highly susceptible to contamination by organic matters.

Therefore, preserving the lake environment is an important issue to be carefully dealt with, and more data need to be collected to determine the quality of the lake water system, followed by detailed analysis and evaluation. Table 10-12 lists is one of the proposed study and research to be conducted for the purpose.

Table 10-12 PROPOSED STUDY AND RESEARCH RELATED TO WATER QUALITY OF LAKE MARACAIBO AND ENVIRONMENTAL IMPROVEMENT

(1) Understanding of tide current conditions in Lake Maracaibo
(literature survey, hearing, and field survey)

(2) Field investigation on water contamination sources
(manufacturing, agriculture and livestock farming, oil drilling and transportation, urban sewerage, etc.)

(3) Monitoring of lake water contamination
(comparison of simulation results and actual conditions)

(4) Effects of water contamination on industries and local residents
(fishery, water transportation, tourism, recreation, etc.)

(5) Analysis of ongoing measures to control water contamination, and development and evaluation of possible measures
(effect of present water quality standards applied to the sake, and proposing and evaluation of other measures)

(6) Forecasting and evaluation of future water quality
(based on the above results, desirable water quality in the future is discussed and established)

10.4 Noise and Vibration

(1) Current state

At present, a major industrial activity in the La Cañada industrial park is the loading of Tachira and Colombian coals to ships through the wharf.

Coal is brought into the site by trucks and is unloaded at a specific location, where fork-lifts equipped with large buckets pile up the coal.

When a barge comes alongside the berth, the fork-lifts carry the piled coal to a makeshift belt conveyor through which the coal is loaded onto the barge.

During these operations, noise and vibration are limited to those produced by trucks, fork-lifts, and belt conveyor, which are not very high.

(2) Target levels of noise and vibration control

The plant is designed to comply with existing noise standards which are set forth in Decree No.2217 dated April 23, 1992. Table 10-13 summarizes noise standards applied to the battery limit.

Table 10-13 NOISE STANDARDS

	Continuous Noise		Intermittent Noise	
	Daytime	Nighttime	Daytime	Nighttime
	6:30 a.m. - 9:30 p.m.	9:31 p.m. - 6:29 a.m.	6:30 a.m. - 9:30 p.m.	9:31 p.m. - 6:29 a.m.
Zone 1	55 dBA	45 dBA	60 dBA	50 dBA
Zone 2	60	50	65	55
Zone 3	65	55	70	60
Zone 4	70	60	75	65
Zone 5	75	65	80	70

Note that Zone 1 requires very quiet environment such as detached houses and hospitals. Zone 2 also covers residential areas with a lower level of noise control, mainly consisting of attached houses. Zone 3 is applied to mixed-use areas including houses, commercial facilities, and schools. Zone 4 is the commercial and industrial district where no school and hospital is allowed. Zone 5 represents marginal zones around airports and highways.
The industrial estate belongs to Zone 4.

Since there is no standard to regulate vibration in Venezuela, target levels of vibration control at the battery limit are tentatively set on the basis of applicable standards in Japan, as follows:

Table 10-14 TARGET LEVELS OF VIBRATION CONTROL

	Daytime	Nighttime
Zone 1	65dB	60dB
Zone 2	70dB	65dB

Note that Zone 1 covers residential areas, and Zone 2 commercial/industrial or industrial areas.

(3) Estimation of noise and vibration sources at the plant and evaluation of proposed control measures

Machinery and equipment which produce noise and vibration at the coke making plant are machine tools (repair shop), compressors, blowers, coal crushers, coke graders and screening equipment. Also, combustion in boilers and other heating equipment produces some noise. In addition, mobile equipment around the coke oven makes large buzzer sounds.
Noise and vibration sources during the plant construction period are bulldozers, pile driving equipment, concrete breakers, and trucks and fork-lifts.

Noise Levels of major noise sources summarized as follows:

Table 10-15 MAJOR NOISE SOURCES AND NOISE LEVELS

Type	Distance from source	Noise level
Trucks and construction equipment	30m	50 – 78 dBA
Crushers and screening equipment	1m	80 –100 dBA
Compressors	1m	70 – 88 dBA
Blowers	1m	75 – 80 dBA
Burners and boilers	1m	70 – 88 dBA
Machine tools	1m	70 – 90 dBA

A major vibration source will be pile driving operation during the plant construction period.

Noise control measures are described as follows. First of all, crushers, screening equipment, and machine tools which produce large noise will be installed in buildings. Other noise-generating machinery and equipment will be provided with sound and vibration insulation measures for their installation bases, in addition to accommodation inside the building. Note that many sound insulation measures also work for vibration. Also, the sound insulation effect is affected by presence of openings.

As for plant layout, facilities not generating noise, such as parking facilities and office buildings, are arranged in sections facing public roads. 50m wide green belts are provided around the battery limit. As a result, major noise sources will be 60m – 100m away from the battery limit. It is said that noise abates by 3dBA at 10m from a point source, the layout is considered as effective measures to insulate noise and vibration from the surrounding area.

The above control measures are expected to satisfy noise standards at the battery limit. Also, piling work during the construction period will produce vibration and should be conducted in selected working hours.

Basically, there is no residence nor factory around the site, so that a risk of noise pollution to the surrounding area is minimal, and proposed noise control measures will suffice even after the surrounding are is developed.

10.5 Solid Waste

(1) Possible sources

Solid wastes produced from operation of the coke plant include bottoms in distillation towers, residual matters in decanters and tanks, surplus sludges in the ASM process, and sludge sediments in waste water from the coal and coke yards.

Also, around 700 workers at the plant will produce a variety of household wastes as well as raw sewage, which are estimated to amount to 200kg – 300kg per day. (Note that a person living in Japan reportedly produces 1kg of solid waste per day)

(2) Target levels of solid waste control

Various measures will be introduced to minimize the amount of solid waste produced from the plant.

(3) Estimation of solid waste sources and evaluation of control measures

Solid wastes produced from plant operation include bottoms in distillation towers, residues in decanters and tanks, and surplus sludges in the ASM process, and sludge sediments in waste water discharged from the coal and coke yards. The project plan envisages that these solid wastes will be all returned to the coke oven or related facilities for recycling, thus none of them will be disposed to the environment as they are.

Residues in decanters and tanks, and surplus sludges in the ASM process, and sludge sediments in waste water from the coal and coke yards mainly contain carbonaceous and hydrocarbons. They can be carbonized in the coke oven to produce coke, although it contains relatively large amounts of impurities. Thus, these solid wastes will be charged with coal to the coke oven.
Bottoms in distillation towers are sent to the decanter to remove water. Also, sludge sediments in waste water from the coal and coke yards can be used as a raw material for briquette. Thus, the proposed plant will adopt self–sufficient solid waste disposal measures as far as possible to minimize environmental impacts.

On the other hand, household wastes and waste paper produced from cafeterias and offices need to be disposed carefully. One method is to burn them in a small incinerator within the

plant. It requires full-time workers but offers an advantage in keeping confidentiality. Another method is to hire a reliable outside contractor. This way, solid wastes can be economically disposed by incineration or reclamation, according to local conditions.
It is important to dispose all the solid wastes properly so as not to create undue environmental impacts.

Raw sewage will be treated in a septic tank installed at each source. The treated water is expected to have minimal environmental impacts.

Thus, proposed disposal methods will minimize the amount of solid waste discharged to the environment.

10.6 Malorder

(1) Current state

Since Venezuela has not regulation to control Malorder, control measures are tentatively established on the basis of Japanese standards, which cover the following 12 substances. Among them, ammonia, hydrogen sulfide, and styrene are produced in the coke oven.

TABLE 10-16 SUBSTANCES SUBJECT TO JAPANESE REGULATION DUE TO MALORDER

Ammonia, methyl mercaptan, hydrogen sulfide, methyl sulfide, methyl disulfide, tri-methyl amine, acetic aldehyde, styrene, propione acid, normal butanoic acid, normal valeric acid, isovaleric acid

In addition, the light oil fraction – a major by-product produced in large quantities – contains benzene, toluene, and tar, which produce characteristic smells.

(2) Target levels of malorder control

Target control levels for 4 substances – ammonia, methyl mercaptan, hydrogen sulfide, and styrene – in terms of concentration are tentatively established on the basis of applicable Japanese standards as follows.

TABLE 10-17 TARGET CONTROL LEVELS FOR SMELL-PRODUCING SUBSTANCES

	Upper Limit for Concentration
Ammonia	1 – 5
Methyl mercaptan	0.002 – 0.01
Hydrogen sulfide	0.02 – 0.2
Styrene	0.4 – 2

In addition, benzene produces strong odor and is a carcinogen. Its concentration should be controlled below 1ppm (a level no smell is detected) within the plant. Also, the concentration at the battery limit should be controlled at a level similar to that of styrene.

Thus, the plant is required to control concentrations of 4 odor-producing substances, namely ammonia, hydrogen sulfide, benzene, and styrene.

(3) Estimation of smell sources and evaluation of control measures

At the coke oven, while each carbonization chamber is operated in batch, other equipment is operated as the continuous process. Also, the plant is designed and/or operated to prevent intermediate products from escaping outside from enclosed equipment, except for the pushing operation to take out red-hot coke. As a result, there is little risk of releasing the smell-producing substances to the air.

Ammonia in ammonia liquor is gasified with other dissolved gas constituents at the ammonia distillation plant, is separated from dissolved salts and returned to COG. Hydrogen sulfide is absorbed by an alkali solution and is converted to sulfur through the liquid-phase air oxidation process, finally to sulfuric acid. Sulfuric acid and ammonia are used to produce ammonium sulfate. Thus, these smell-producing substances are deodorized and taken out of the process.

There are a limited number of locations where smell-producing substances may find way to the outside, such as axles of motors, and sludge removal ports of the decanter. These locations will be provided with cover to protect workers from offensive smell. As a result, no odor will not leak to the outside.

Thus, all the smell-producing substances will be contained within the battery limit and will be maintained at the concentration level which does not have an adverse effect on the surrounding environment.

10.7 Protection of Natural Environment (including wild animals and plants, and landscapes)

(1) Current state

The La Cañada industrial park is covered with the sparse forest made up of dry weather-resistive small bushes, grasslands, dotted with cactuses, which are typically found in the savanna under the dry and tropical climate zone.
Compared to other areas around Maracaibo, the area has less trees which are relatively small, giving an impression that the land has once been cleared for development, and the nature is coming back as it has been left intact more than a decade.

Nearby buildings are a thermal power plant, petroleum refineries, and tank yards.

The industrial park is virtually unused and gives a look of wasteland. There are not data on wild animals and plants residing in the area, which is not habitable for large carnivorous animals.

(2) Estimation of impacts on natural environment and evaluation of preventive measures

The La Cañada site has land area of 6,800ha. It was originally selected and prepared as the site for an integrated steelmaking plant using blast furnace. The vast land was acquired to build the plant having annual production capacity of 5 million tons, a 2.5 million plant in the first phase and another 2.5 million plant in the second phase, including a coke plant.

The project will use 830,000m^2, accounting for 1.22% of the entire site. Even if construction of access roads is added, the percentage will not exceed 1.5%. Thus, most of the site will be preserved as it is.
50m wide green belts will be provided along the battery limit by planting local trees, if desired. Thus, the project is not like to create significant impacts on natural environment including wild animals and plants in the surrounding area.

As for landscape, a large plant including a 120m high smokestack and a coke oven which is 200m long and 50m high (coal tower) will be constructed in the vacant site.
It can be viewed from the city of Maracaibo, General Urdaneta bridge, and/or Santa Lita on the opposite side of the lake, as well as airplanes landing and taking off the La Chinita Airport.

Thus, the plant can become a new landmark in the area, although its aesthetic value has to be determined in the future.

10.8 Impacts on Traffic Conditions

(1) Current state

Within the La Cañada industrial park, a main road (one-lane on each side) runs in a north-south direction, 1.5km west of the lake shore. The road is paved and connected at the northern end of the site to National Highway Route 252 which connects Maracaibo and Rosario.
From the main road to the plant site, there is an access road which is not in good condition.

Highway 252 is two lanes on each side between Maracaibo and Rosario, but one lane in a Rosario - La Fria section which will be used to transport raw coal from mines to the coke plant.

The La Cañada industrial park contains the port of Puerto Siderurgico along Lake Maracaibo, which has a 243m long wharf with water depth of 3m, and off-shore navigation channels are dredged to 12m. The port does not have any handling facility and equipment. At present, Tachira and Colombian coals are shipped through the wharf to a 2,000-ton barge. The coal carried on the barge is transshipped to a Panamax-class (60,000 tons) ship anchoring off the shore.

(2) Estimation of impacts on traffic conditions and consideration of improvement measures

The coke plant will affect local traffic conditions on road and sea, accompanied by environmental impacts.

First of all, an access road connecting the main road in the industrial park and the plant site needs to be built or at least paved.

Traffic conditions between La Fria and Maracaibo, and future demand forecast, according to CORPOZULIA, are discussed in Chapter 6(6.8.1).

As discussed before, if Tachira and Colombian coals are produced at full capacity of 520,000 tons annually and transported by 50-ton trucks, traffic volume will increase at a rate of 33 vehicles per day, which is equivalent to a 3.5% increase in the degree of congestion. If all the imported coal is converted to domestic coal or Colombian coal, traffic volume will increase by 94 vehicles per day (9.9% in degree of congestion).

Theoretically, the coal can be transported via Highway 252 until year 2020. If the degree of congestion required to maintain smooth traffic is 80% or below, and if the coke plant starts operation in 2010, trucks carrying coal will increase by 33 vehicles per day, and the degree of congestion will soon exceed 80%. Note that the above figures do not include passenger cars used for commuting. Thus, traffic congestion will occur on the highway and may bring adverse environmental impacts if no improvement measures are taken.

There are several improvement measures to reduce traffic volume due to the start of plant operation. One method is to widen the highway between Rosario and La Fria for increase traffic capacity. The second method is to construct a railroad between La Fria and Maracaibo. The third method is coal transportation by barge from a port planned to construct near La Concha. Each of the cases involves new construction which is planned and implemented as early as possible.

In any case, traffic improvement measures should be considered as part of infrastructure development which would require the higher cost than the proposed project.

Chapter 11 Conclusion and Recommendation

Chapter 11 Conclusions and Recommendations

Conclusions

The present study is designed to evaluate feasibility of the proposed investment project to produce blast furnace coke by using coking coal available in the state of Tachira. The project is proposed in line with the national policy of Venezuela to decrease the dependency of the Venezuelan economy on oil, while serving the interests of fostering regional development.
The present study has examined the proposed project for two cases; one based on availability of coal and other relevant conditions confirmed at present, and the other based on conditions expected to be satisfied in the future. In addition, the case to use Guasare coal produced in the state of Zulia has been evaluated, although not included in the original study plan. Basic assumptions and considerations common to all these cases are as follows:

1) Venezuela does not have a blast furnace to produce pig iron, nor have any plan to build one in the foreseeable future. On the other hand, demand for blast furnace coke in the U.S., which is expected to decline in absolute terms, will grow relative to supply capacity that will decrease at a faster rate since many coke ovens will shut down due to increasingly strict environmental standards. This creates a good export opportunity for the proposed coking plant, provided that it has international competitiveness. Another market opportunity is identified in Brazil where coke demand is expected to arise in order to replace charcoal for pig iron production. Thus, coke produced by the project is assumed to be entirely exported .
   Also, it is assumed that most of by-products will be exported. In this connection, the price of coke oven gas is evaluated to equivalent of natural gas.
2) The coke oven will be of chamber type that is widely used worldwide from the viewpoint of ensuring the level of coke quality suitable for the U.S. market. The production capacity is set at 1 million tons annually with consideration of the economic scale.
3) The plant site has been selected in Maracaibo among three candidate areas including Santo Domingo and Puerto Ordaz, on the basis of comparison of locational conditions including transportation costs for coal and coke, sales opportunity for coke oven gas, and government regulations.
4) The plant design incorporates environmental considerations based on strict standards applied to Lake Maracaibo, as well as those in Japan and Clean Air Act in the U.S. Environmental assessment related to air pollution was conducted and revealed that the plant would produce a minimum environmental load.

Case 1 Evaluation of feasibility based on verified resource conditions

In Tachira, there are 5 coal deposits, namely FNO, SAN, LOB, HAT, and LAS. Among them, coal from two deposits are considered to be suitable at present, FNO containing medium volatile coal and LAS high volatile coal. Coal reserves in FNO are smaller than expected. Boyaca coal in Colombia is low volatile coking coal, but its production is limited. As a result, U.S. coal must be blended in quite proportion.

Transportation of the Tachira and Colombian coals to Maracaibo is assumed to be done by truck that shows the highest economic advantage.

Finally, the price of coke in the U.S. is currently at US$100 or less. However, supply is expected to become tight in the near future for the reason stated above, so that it is assumed to be US$135 which is the highest level experienced during the previous supply shortage.

Based on the above assumptions, the FIRR is −1.37% to make the project unjustifiable.

Case 2 Evaluation of feasibility based on resource conditions expected in future

In Tachira, coal exploration surveys are under way and the development of medium volatile coal seems to be viable. If the prospect becomes reality, coke for the U.S. market can be produced from Tachira coal as well as the low volatile Colombian coal. Thus, the case assumes that the U.S. coal in Case 1 will be entirely replaced with the Tachira and Colombian coals. (Domestic coal 80%, Colombian coal 20%)

As a result, the FIRR has improved to 5.54%. Nevertheless, it is not sufficient to justify the project.

Clearly, the development of coal deposits in Tachira is not a satisfactory condition to justify investment in the coking plant. There are several favorable prospects, however. If a railroad construction project planned between Tachira and Maracaibo is constructed, the coal transportation cost for the Tachira, as well as Colombian coal will decline by around US$2.

Secondly, the coke price in the U.S. – assumed to be US$135 in Case 1 – may go up to US$150 if supply shortage becomes more serious than expected.

If these factors are timely realized, the FIRR may rise to a feasible level.

Case 3 Evaluation of feasibility based on the use of the Guasare coal available in Zulia.

The Guasare coal is found near Maracaibo. It has large reserves, can be exploited economically by open mining, and has relatively low ash and sulfur contents. From the viewpoint of coke production, however, Guasare coal has a low coking capacity and a very high volatile content. Evaluation on the use of Guasare coal to a maximum extent in response to the request of the state of Zulia is made.

1) Experiments have been conducted to find the maximum practicable blending ratio of the Guasare coal to replace U.S. coal in Case 1, which is estimated at 10%.
2) If the blending ratio is raised to 15% as proposed by the Venezuelan side, the required quality of coal can be maintained by using a sufficient amount of the HAT coal in place of the LAS coal.
3) The maximum blending ratio of Guasare coal, obtained by reducing or replacing the Tachira coal where necessary, is estimated at 23%.

The FIRRs for above three cases are 0.19%, 0.94%, and 2.78% respectively. One reason for the low FIRRs is relatively a small difference in price between coking and non-coking coal. In the third case, the FIRR does not improve significantly because of an increased percentage of U.S. coal to compensate for the high volatile Guasare coal.

Recommendations

The study has examined financial feasibility of the coke oven project using coal available in Tachira. The result shows that the project is not suitable for investment under the currently confirmed resource conditions. There are various reasons for this: the need for exporting all the projects; a large percentage of U.S. coal to secure the required coke quality; and the high construction cost partly due to strict environmental considerations.

However, if coal resources in Tachira are developed as expected, and other conditions are improved simultaneously, the financial prospect for the project will improve, possibly to an acceptable level. Thus, it is desirable to conduct an additional feasibility study when the development of coal resources in Tachira reaches a commercial level.

Although Guasare coal has advantages in availability, quality, and price, it has very low coking capacity and high volatile content, not suitable for coke production at the conventional coke oven. The development of the process to produce blast furnace coke by using non- or light coking coal has been carried out worldwide. The continuous formed process has been developed from such development efforts. In Japan, production tests have been conducted at a 200-ton/day pilot plant, and formed coke produced from the plant has been used in a 4,500m3 blast furnace. Also, the feasibility of commercial production at 3,000 tons daily (equivalent to 1 million tons annually) has been successfully evaluated. The analysis of the technology and its applicability to the project, therefore, will be one promisting area to be examined in more detail.

Appendix-1 FINANCIAL AND ECONOMIC STATEMENTS FOR BASE CASE

*** COKE PLANT PROJECT IN VENEZUELA ***
PRODUCTION AND SALES PLAN
- BASE CASE (DOMESTIC/IMPORTED COAL) - (US$, MILLION)

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
RATED CAPACITY (TOTAL COKE)	0.0	0.0	0.0	1000.000	1000.000	1000.000	1000.000	1000.000	1000.000	1000.000
CAPACITY UTILIZATION	0.0	0.0	0.0	0.800	1.000	1.000	1.000	1.000	1.000	1.000
BF COKE PRODUCTION (1000TPY)	0.0	0.0	0.0	680.000	850.000	850.000	850.000	850.000	850.000	850.000
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0	85.000	21.250	0.0	0.0	0.0	0.0	0.0
BF COKE TO EXPORT (1000TPY)	0.0	0.0	0.0	595.000	828.750	850.000	850.000	850.000	850.000	850.000
UNIT SALES PRICE (US$/T)	0.0	0.0	0.0	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000
SALES REVENUE	0.0	0.0	0.0	71.400	99.450	102.000	102.000	102.000	102.000	102.000
BREEZE PRODUCTION (1000TPY)	0.0	0.0	0.0	120.000	150.000	150.000	150.000	150.000	150.000	150.000
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0	10.000	2.500	0.0	0.0	0.0	0.0	0.0
BREEZE TO EXPORT (1000TPY)	0.0	0.0	0.0	110.000	147.500	150.000	150.000	150.000	150.000	150.000
UNIT SALES PRICE (US$/T)	0.0	0.0	0.0	40.0000	40.0000	40.0000	40.0000	40.0000	40.0000	40.0000
SALES REVENUE	0.0	0.0	0.0	4.400	5.900	6.000	6.000	6.000	6.000	6.000
RATED CAPACITY (TOTAL COAL)	0.0	0.0	0.0	1332.268	1332.268	1332.268	1332.268	1332.268	1332.268	1332.268
CAPACITY UTILIZATION	0.0	0.0	0.0	0.800	1.000	1.000	1.000	1.000	1.000	1.000
TAR PRODUCTION (1000TPY)	0.0	0.0	0.0	31.974	39.968	39.968	39.968	39.968	39.968	39.968
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0	3.997	0.999	0.0	0.0	0.0	0.0	0.0
TAR TO EXPORT (1000TPY)	0.0	0.0	0.0	27.978	38.969	39.968	39.968	39.968	39.968	39.968
UNIT SALES PRICE (US$/T)	0.0	0.0	0.0	50.0000	50.0000	50.0000	50.0000	50.0000	50.0000	50.0000
SALES REVENUE	0.0	0.0	0.0	1.399	1.948	1.998	1.998	1.998	1.998	1.998
BENZENE PRODUCTION (1000TPY)	0.0	0.0	0.0	10.658	13.323	13.323	13.323	13.323	13.323	13.323
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0	2.665	0.666	0.0	0.0	0.0	0.0	0.0
BENZENE TO EXPORT (1000TPY)	0.0	0.0	0.0	7.994	12.657	13.323	13.323	13.323	13.323	13.323
UNIT SALES PRICE (US$/T)	0.0	0.0	0.0	240.0000	240.0000	240.0000	240.0000	240.0000	240.0000	240.0000
SALES REVENUE	0.0	0.0	0.0	1.918	3.038	3.197	3.197	3.197	3.197	3.197
SULFATE PRODUCTION (1000TPY)	0.0	0.0	0.0	12.406	15.508	15.508	15.508	15.508	15.508	15.508
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0	1.034	0.258	0.0	0.0	0.0	0.0	0.0
SULFATE TO EXPORT (1000TPY)	0.0	0.0	0.0	11.372	15.249	15.508	15.508	15.508	15.508	15.508
UNIT SALES PRICE (US$/T)	0.0	0.0	0.0	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
SALES REVENUE	0.0	0.0	0.0	1.137	1.525	1.551	1.551	1.551	1.551	1.551
TOTAL SALES REVENUE	0.0	0.0	0.0	80.255	111.861	114.747	114.747	114.747	114.747	114.747

PRODUCTION AND SALES PLAN

- BASE CASE (DOMESTIC/IMPORTED COAL) - (US$, MILLION)

YEAR	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
RATED CAPACITY (TOTAL COKE)	1000.000	1000.000	1000.000	1000.000	1000.000	1000.000	1000.000	1000.000	1000.000	1000.000
CAPACITY UTILIZATION	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
BF COKE PRODUCTION (1000TPY)	850.000	850.000	850.000	850.000	850.000	850.000	850.000	850.000	850.000	850.000
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BF COKE TO EXPORT (1000TPY)	850.000	850.000	850.000	850.000	850.000	850.000	850.000	850.000	850.000	850.000
UNIT SALES PRICE (US$/T)	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000
SALES REVENUE	102.000	102.000	102.000	102.000	102.000	102.000	102.000	102.000	102.000	102.000
BREEZE PRODUCTION (1000TPY)	150.000	150.000	150.000	150.000	150.000	150.000	150.000	150.000	150.000	150.000
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BREEZE TO EXPORT (1000TPY)	150.000	150.000	150.000	150.000	150.000	150.000	150.000	150.000	150.000	150.000
UNIT SALES PRICE (US$/T)	40.0000	40.0000	40.0000	40.0000	40.0000	40.0000	40.0000	40.0000	40.0000	40.0000
SALES REVENUE	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000
RATED CAPACITY (TOTAL COAL)	1332.268	1332.268	1332.268	1332.268	1332.268	1332.268	1332.268	1332.268	1332.268	1332.268
CAPACITY UTILIZATION	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
TAR PRODUCTION (1000TPY)	39.968	39.968	39.968	39.968	39.968	39.968	39.968	39.968	39.968	39.968
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TAR TO EXPORT (1000TPY)	39.968	39.968	39.968	39.968	39.968	39.968	39.968	39.968	39.968	39.968
UNIT SALES PRICE (US$/T)	50.0000	50.0000	50.0000	50.0000	50.0000	50.0000	50.0000	50.0000	50.0000	50.0000
SALES REVENUE	1.998	1.998	1.998	1.998	1.998	1.998	1.998	1.998	1.998	1.998
BENZENE PRODUCTION (1000TPY)	13.323	13.323	13.323	13.323	13.323	13.323	13.323	13.323	13.323	13.323
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BENZENE TO EXPORT (1000TPY)	13.323	13.323	13.323	13.323	13.323	13.323	13.323	13.323	13.323	13.323
UNIT SALES PRICE (US$/T)	240.0000	240.0000	240.0000	240.0000	240.0000	240.0000	240.0000	240.0000	240.0000	240.0000
SALES REVENUE	3.197	3.197	3.197	3.197	3.197	3.197	3.197	3.197	3.197	3.197
SULFATE PRODUCTION (1000TPY)	15.508	15.508	15.508	15.508	15.508	15.508	15.508	15.508	15.508	15.508
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SULFATE TO EXPORT (1000TPY)	15.508	15.508	15.508	15.508	15.508	15.508	15.508	15.508	15.508	15.508
UNIT SALES PRICE (US$/T)	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
SALES REVENUE	1.551	1.551	1.551	1.551	1.551	1.551	1.551	1.551	1.551	1.551
TOTAL SALES REVENUE	114.747	114.747	114.747	114.747	114.747	114.747	114.747	114.747	114.747	114.747

*** COKE PLANT PROJECT IN VENEZUELA ***
PRODUCTION AND SALES PLAN
- BASE CASE (DOMESTIC/IMPORTED COAL) - (US$, MILLION)

YEAR	2015	2016	2017
RATED CAPACITY (TOTAL COKE)	1000.000	1000.000	1000.000
CAPACITY UTILIZATION	1.000	1.000	1.000
BF COKE PRODUCTION (1000TPY)	850.000	850.000	850.000
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0
BF COKE TO EXPORT (1000TPY)	850.000	850.000	850.000
UNIT SALES PRICE (US$/T)	120.0000	120.0000	120.0000
SALES REVENUE	102.000	102.000	102.000
BREEZE PRODUCTION (1000TPY)	150.000	150.000	150.000
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0
BREEZE TO EXPORT (1000TPY)	150.000	150.000	150.000
UNIT SALES PRICE (US$/T)	40.0000	40.0000	40.0000
SALES REVENUE	6.000	6.000	6.000
RATED CAPACITY (TOTAL COAL)	1332.268	1332.268	1332.268
CAPACITY UTILIZATION	1.000	1.000	1.000
TAR PRODUCTION (1000TPY)	39.968	39.968	39.968
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0
TAR TO EXPORT (1000TPY)	39.968	39.968	39.968
UNIT SALES PRICE (US$/T)	50.0000	50.0000	50.0000
SALES REVENUE	1.998	1.998	1.998
BENZENE PRODUCTION (1000TPY)	13.323	13.323	13.323
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0
BENZENE TO EXPORT (1000TPY)	13.323	13.323	13.323
UNIT SALES PRICE (US$/T)	240.0000	240.0000	240.0000
SALES REVENUE	3.197	3.197	3.197
SULFATE PRODUCTION (1000TPY)	15.508	15.508	15.508
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0
SULFATE TO EXPORT (1000TPY)	15.508	15.508	15.508
UNIT SALES PRICE (US$/T)	100.0000	100.0000	100.0000
SALES REVENUE	1.551	1.551	1.551
TOTAL SALES REVENUE	114.747	114.747	114.747

*** COKE PLANT PROJECT IN VENEZUELA ***
PRODUCTION COST STATEMENTS
- BASE CASE (DOMESTIC/IMPORTED COAL) - (US$, MILLION)

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
BF COKE PRODUCTION (1000TPY)	0.0	0.0	0.0	680.000	850.000	850.000	850.000	850.000	850.000	850.000
RAW MATERIAL COST	0.0	0.0	0.0	56.074	70.093	70.093	70.093	70.093	70.093	70.093
DOMESTIC COAL	0.0	0.0	0.0	8.994	11.242	11.242	11.242	11.242	11.242	11.242
IMPORTED COAL (BOYACA)	0.0	0.0	0.0	1.406	1.757	1.757	1.757	1.757	1.757	1.757
IMPORTED COAL (U.S.A)	0.0	0.0	0.0	45.675	57.094	57.094	57.094	57.094	57.094	57.094
COKE OVEN GAS	0.0	0.0	0.0	2.386	2.983	2.983	2.983	2.983	2.983	2.983
UTILITIES COST	0.0	0.0	0.0	0.717	0.897	0.897	0.897	0.897	0.897	0.897
ELECTRICITY	0.0	0.0	0.0	0.638	0.797	0.797	0.797	0.797	0.797	0.797
WATER	0.0	0.0	0.0	0.080	0.099	0.099	0.099	0.099	0.099	0.099
CAT/CHEM	0.0	0.0	0.0	1.043	1.304	1.304	1.304	1.304	1.304	1.304
CREDITS OF BY-PRODUCTS	0.0	0.0	0.0	-5.298	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622
COKE OVEN GAS	0.0	0.0	0.0	-5.298	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622
VARIABLE COST	0.0	0.0	0.0	54.923	68.654	68.654	68.654	68.654	68.654	68.654
EMPLOYMENT COST	0.0	0.0	0.0	6.115	6.115	6.115	6.115	6.115	6.115	6.115
LABOUR COST	0.0	0.0	0.0	4.077	4.077	4.077	4.077	4.077	4.077	4.077
OVERHEAD	0.0	0.0	0.0	2.038	2.038	2.038	2.038	2.038	2.038	2.038
MAINTENANCE COST	0.0	0.0	0.0	10.607	10.607	10.607	10.607	10.607	10.607	10.607
TAX & INSURANCE	0.0	0.0	0.0	3.215	3.215	3.215	3.215	3.215	3.215	3.215
DIRECT FIXED COST	0.0	0.0	0.0	19.938	19.938	19.938	19.938	19.938	19.938	19.938
CASH FACTORY COST	0.0	0.0	0.0	74.861	88.591	88.591	88.591	88.591	88.591	88.591
DEPRECIABLE ASSETS (PLANT)	0.0	0.0	0.0	30.318	30.318	30.318	30.318	30.318	30.318	30.318
PRE-OPERATIONAL EXPENSES	0.0	0.0	0.0	0.346	0.346	0.346	0.346	0.346	0.346	0.346
INTEREST DRG CONST.	0.0	0.0	0.0	1.368	1.368	1.368	1.368	1.368	1.368	1.368
DEPRECIATION AND AMORTIZATION	0.0	0.0	0.0	32.033	32.033	32.033	32.033	32.033	32.033	32.033
TOTAL FACTORY COST	0.0	0.0	0.0	106.893	120.624	120.624	120.624	120.624	120.624	120.624
UNIT FACTORY COST	0.0	0.0	0.0	157.1958	141.9105	141.9105	141.9105	141.9105	141.9105	141.9105
SALES EXPENSES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
INTEREST ON LONG TERM DEBT	0.0	0.0	0.0	23.162	22.004	20.845	19.687	18.529	17.371	16.213
INTEREST ON SHORT TERM DEBT	0.0	0.0	0.0	0.0	1.528	2.851	3.899	4.928	5.951	6.968
TOTAL PRODUCTION COST	0.0	0.0	0.0	130.055	144.155	144.321	144.210	144.081	143.946	143.805
UNIT PRODUCTION COST	0.0	0.0	0.0	191.2570	169.5940	169.7891	169.6586	169.5075	169.3488	169.1822

*** COKE PLANT PROJECT IN VENEZUELA ***
PRODUCTION COST STATEMENTS
- BASE CASE (DOMESTIC/IMPORTED COAL) - (US$, MILLION)

YEAR	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
BF COKE PRODUCTION (1000TPY)	850.000	850.000	850.000	850.000	850.000	850.000	850.000	850.000	850.000	850.000
RAW MATERIAL COST	70.093	70.093	70.093	70.093	70.093	70.093	70.093	70.093	70.093	70.093
DOMESTIC COAL	11.242	11.242	11.242	11.242	11.242	11.242	11.242	11.242	11.242	11.242
IMPORTED COAL (BOYACA)	1.757	1.757	1.757	1.757	1.757	1.757	1.757	1.757	1.757	1.757
IMPORTED COAL (U.S.A)	57.094	57.094	57.094	57.094	57.094	57.094	57.094	57.094	57.094	57.094
COKE OVEN GAS	2.983	2.983	2.983	2.983	2.983	2.983	2.983	2.983	2.983	2.983
UTILITIES COST	0.897	0.897	0.897	0.897	0.897	0.897	0.897	0.897	0.897	0.897
ELECTRICITY	0.797	0.797	0.797	0.797	0.797	0.797	0.797	0.797	0.797	0.797
WATER	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099
CAT/CHEM	1.304	1.304	1.304	1.304	1.304	1.304	1.304	1.304	1.304	1.304
CREDITS OF BY-PRODUCTS	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622
COKE OVEN GAS	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622
VARIABLE COST	68.654	68.654	68.654	68.654	68.654	68.654	68.654	68.654	68.654	68.654
EMPLOYMENT COST	6.115	6.115	6.115	6.115	6.115	6.115	6.115	6.115	6.115	6.115
LABOUR COST	4.077	4.077	4.077	4.077	4.077	4.077	4.077	4.077	4.077	4.077
OVERHEAD	2.038	2.038	2.038	2.038	2.038	2.038	2.038	2.038	2.038	2.038
MAINTENANCE COST	10.607	10.607	10.607	10.607	10.607	10.607	10.607	10.607	10.607	10.607
TAX & INSURANCE	3.215	3.215	3.215	3.215	3.215	3.215	3.215	3.215	3.215	3.215
DIRECT FIXED COST	19.938	19.938	19.938	19.938	19.938	19.938	19.938	19.938	19.938	19.938
CASH FACTORY COST	88.591	88.591	88.591	88.591	88.591	88.591	88.591	88.591	88.591	88.591
DEPRECIABLE ASSETS (PLANT)	30.318	30.318	30.318	30.318	30.318	30.318	30.318	30.318	30.318	30.318
PRE-OPERATIONAL EXPENSES	0.346	0.346	0.346	0.346	0.346	0.346	0.346	0.346	0.346	0.346
INTEREST DRG CONST.	1.368	1.368	1.368	1.368	1.368	1.368	1.368	1.368	1.368	1.368
DEPRECIATION AND AMORTIZATION	32.033	32.033	32.033	32.033	32.033	32.033	32.033	32.033	32.033	32.033
TOTAL FACTORY COST	120.624	120.624	120.624	120.624	120.624	120.624	120.624	120.624	120.624	120.624
UNIT FACTORY COST	141.9105	141.9105	141.9105	141.9105	141.9105	141.9105	141.9105	141.9105	141.9105	141.9105
SALES EXPENSES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
INTEREST ON LONG TERM DEBT	15.055	13.897	12.739	11.581	10.423	9.265	8.107	6.948	5.790	4.632
INTEREST ON SHORT TERM DEBT	7.977	8.979	9.973	10.959	11.936	12.905	13.864	14.812	15.751	16.678
TOTAL PRODUCTION COST	143.656	143.500	143.336	143.164	142.983	142.793	142.594	142.385	142.165	141.934
UNIT PRODUCTION COST	169.0072	168.8235	168.6306	168.4281	168.2154	167.9921	167.7577	167.5115	167.2530	166.9816

*** COKE PLANT PROJECT IN VENEZUELA ***
PRODUCTION COST STATEMENTS
- BASE CASE (DOMESTIC/IMPORTED COAL) - (US$, MILLION)

YEAR	2015	2016	2017
BF COKE PRODUCTION (1000TPY)	850.000	850.000	850.000
RAW MATERIAL COST	70.093	70.093	70.093
DOMESTIC COAL	11.242	11.242	11.242
IMPORTED COAL (BOYACA)	1.757	1.757	1.757
IMPORTED COAL (U.S.A)	57.094	57.094	57.094
COKE OVEN GAS	2.983	2.983	2.983
UTILITIES COST	0.897	0.897	0.897
ELECTRICITY	0.797	0.797	0.797
WATER	0.099	0.099	0.099
CAT/CHEM	1.304	1.304	1.304
CREDITS OF BY-PRODUCTS	-6.622	-6.622	-6.622
COKE OVEN GAS	-6.622	-6.622	-6.622
VARIABLE COST	68.654	68.654	68.654
EMPLOYMENT COST	6.115	6.115	6.115
LABOUR COST	4.077	4.077	4.077
OVERHEAD	2.038	2.038	2.038
MAINTENANCE COST	10.607	10.607	10.607
TAX & INSURANCE	3.215	3.215	3.215
DIRECT FIXED COST	19.938	19.938	19.938
CASH FACTORY COST	88.591	88.591	88.591
DEPRECIABLE ASSETS (PLANT)	30.318	30.318	30.318
PRE-OPERATIONAL EXPENSES	0.346	0.346	0.346
INTEREST DRG CONST.	1.368	1.368	1.368
DEPRECIATION AND AMORTIZATION	32.033	32.033	32.033
TOTAL FACTORY COST	120.624	120.624	120.624
UNIT FACTORY COST	141.9105	141.9105	141.9105
SALES EXPENSES	0.0	0.0	0.0
INTEREST ON LONG TERM DEBT	3.474	2.316	1.158
INTEREST ON SHORT TERM DEBT	17.594	18.498	19.389
TOTAL PRODUCTION COST	141.692	141.438	141.171
UNIT PRODUCTION COST	166.6966	166.3974	166.0832

*** COKE PLANT PROJECT IN VENEZUELA ***
WORKING CAPITAL STATEMENTS
- BASE CASE (DOMESTIC/IMPORTED COAL) - (US$, MILLION)

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
CURRENT ASSETS	0.0	0.0	0.0	26.848	32.832	33.073	33.073	33.073	33.073	33.073
ACCOUNT RECEIVABLE	0.0	0.0	0.0	6.688	9.321	9.562	9.562	9.562	9.562	9.562
INVENTORIES	0.0	0.0	0.0	20.160	23.511	23.511	23.511	23.511	23.511	23.511
PRODUCT INVENTORY	0.0	0.0	0.0	13.901	15.686	15.686	15.686	15.686	15.686	15.686
PRODUCT INVENTORY (BF COKE)	0.0	0.0	0.0	11.812	13.329	13.329	13.329	13.329	13.329	13.329
PRODUCT INVENTORY (BREEZE)	0.0	0.0	0.0	0.312	0.352	0.352	0.352	0.352	0.352	0.352
PRODUCT INVENTORY (TAR)	0.0	0.0	0.0	0.227	0.256	0.256	0.256	0.256	0.256	0.256
PRODUCT INVENTORY (BENZENE)	0.0	0.0	0.0	1.470	1.659	1.659	1.659	1.659	1.659	1.659
PRODUCT INVENTORY (SULFATE)	0.0	0.0	0.0	0.080	0.090	0.090	0.090	0.090	0.090	0.090
MATERIAL INVENTORY	0.0	0.0	0.0	6.260	7.825	7.825	7.825	7.825	7.825	7.825
DOMESTIC COAL INVENTORY	0.0	0.0	0.0	0.375	0.468	0.468	0.468	0.468	0.468	0.468
IMPORTED COAL INVENTORY	0.0	0.0	0.0	5.885	7.356	7.356	7.356	7.356	7.356	7.356
OPERATING CASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CURRENT LIABILITIES W/O DEBT	0.0	0.0	0.0	4.577	5.721	5.721	5.721	5.721	5.721	5.721
ACCOUNT PAYABLE	0.0	0.0	0.0	4.577	5.721	5.721	5.721	5.721	5.721	5.721
PERMANENT WORKING CAPITAL	0.0	0.0	0.0	22.271	27.111	27.352	27.352	27.352	27.352	27.352
CHANGE IN WORKING CAPITAL	0.0	0.0	0.0	22.271	4.840	0.240	0.0	0.0	0.0	0.0

*** COKE PLANT PROJECT IN VENEZUELA ***
WORKING CAPITAL STATEMENTS
- BASE CASE (DOMESTIC/IMPORTED COAL) - (US$, MILLION)

YEAR	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CURRENT ASSETS	33.073	33.073	33.073	33.073	33.073	33.073	33.073	33.073	33.073	33.073
ACCOUNT RECEIVABLE	9.562	9.562	9.562	9.562	9.562	9.562	9.562	9.562	9.562	9.562
INVENTORIES	23.511	23.511	23.511	23.511	23.511	23.511	23.511	23.511	23.511	23.511
PRODUCT INVENTORY	15.686	15.686	15.686	15.686	15.686	15.686	15.686	15.686	15.686	15.686
PRODUCT INVENTORY (BF COKE)	13.329	13.329	13.329	13.329	13.329	13.329	13.329	13.329	13.329	13.329
PRODUCT INVENTORY (BREEZE)	0.352	0.352	0.352	0.352	0.352	0.352	0.352	0.352	0.352	0.352
PRODUCT INVENTORY (TAR)	0.256	0.256	0.256	0.256	0.256	0.256	0.256	0.256	0.256	0.256
PRODUCT INVENTORY (BENZENE)	1.659	1.659	1.659	1.659	1.659	1.659	1.659	1.659	1.659	1.659
PRODUCT INVENTORY (SULFATE)	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090
MATERIAL INVENTORY	7.825	7.825	7.825	7.825	7.825	7.825	7.825	7.825	7.825	7.825
DOMESTIC COAL INVENTORY	0.468	0.468	0.468	0.468	0.468	0.468	0.468	0.468	0.468	0.468
IMPORTED COAL INVENTORY	7.356	7.356	7.356	7.356	7.356	7.356	7.356	7.356	7.356	7.356
OPERATING CASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CURRENT LIABILITIES W/O DEBT	5.721	5.721	5.721	5.721	5.721	5.721	5.721	5.721	5.721	5.721
ACCOUNT PAYABLE	5.721	5.721	5.721	5.721	5.721	5.721	5.721	5.721	5.721	5.721
PERMANENT WORKING CAPITAL	27.352	27.352	27.352	27.352	27.352	27.352	27.352	27.352	27.352	27.352
CHANGE IN WORKING CAPITAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

*** COKE PLANT PROJECT IN VENEZUELA ***
WORKING CAPITAL STATEMENTS
- BASE CASE (DOMESTIC/IMPORTED COAL) - (US$, MILLION)

YEAR	2015	2016	2017
CURRENT ASSETS	33.073	33.073	33.073
ACCOUNT RECEIVABLE	9.562	9.562	9.562
INVENTORIES	23.511	23.511	23.511
PRODUCT INVENTORY	15.686	15.686	15.686
PRODUCT INVENTORY (BF COKE)	13.329	13.329	13.329
PRODUCT INVENTORY (BREEZE)	0.352	0.352	0.352
PRODUCT INVENTORY (TAR)	0.256	0.256	0.256
PRODUCT INVENTORY (BENZENE)	1.659	1.659	1.659
PRODUCT INVENTORY (SULFATE)	0.090	0.090	0.090
MATERIAL INVENTORY	7.825	7.825	7.825
DOMESTIC COAL INVENTORY	0.468	0.468	0.468
IMPORTED COAL INVENTORY	7.356	7.356	7.356
OPERATING CASH	0.0	0.0	0.0
CURRENT LIABILITIES W/O DEBT	5.721	5.721	5.721
ACCOUNT PAYABLE	5.721	5.721	5.721
PERMANENT WORKING CAPITAL	27.352	27.352	27.352
CHANGE IN WORKING CAPITAL	0.0	0.0	0.0

*** COKE PLANT PROJECT IN VENEZUELA *** PAGE 1

INCOME STATEMENTS

- BASE CASE (DOMESTIC/IMPORTED COAL) - (US$, MILLION)

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
OPERATING INCOME	0.0	0.0	0.0	80.255	111.861	114.747	114.747	114.747	114.747	114.747
TOTAL SALES REVENUE	0.0	0.0	0.0	80.255	111.861	114.747	114.747	114.747	114.747	114.747
COST OF SALES	0.0	0.0	0.0	92.993	118.838	120.624	120.624	120.624	120.624	120.624
VARIABLE COST	0.0	0.0	0.0	54.923	68.654	68.654	68.654	68.654	68.654	68.654
DIRECT FIXED COST	0.0	0.0	0.0	19.938	19.938	19.938	19.938	19.938	19.938	19.938
DEPRECIATION AND AMORTIZATION	0.0	0.0	0.0	32.033	32.033	32.033	32.033	32.033	32.033	32.033
INC. IN PRODUCT INVENTORY	0.0	0.0	0.0	13.901	1.786	0.0	0.0	0.0	0.0	0.0
GROSS PROFIT ON SALES	0.0	0.0	0.0	-12.738	-6.977	-5.877	-5.877	-5.877	-5.877	-5.877
SALES EXPENSES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OPERATING PROFIT	0.0	0.0	0.0	-12.738	-6.977	-5.877	-5.877	-5.877	-5.877	-5.877
NON-OPERATING EXPENSES	0.0	0.0	0.0	23.162	23.531	23.697	23.586	23.457	23.323	23.181
INTEREST ON LONG TERM DEBT	0.0	0.0	0.0	23.162	22.004	20.845	19.687	18.529	17.371	16.213
INTEREST ON SHORT TERM DEBT	0.0	0.0	0.0	0.0	1.528	2.851	3.899	4.928	5.951	6.968
NET PROFIT OR (LOSS) BEFORE TAX	0.0	0.0	0.0	-35.900	-30.508	-29.574	-29.463	-29.335	-29.200	-29.058
INCOME TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NET PROFIT OR (LOSS) AFTER TAX	0.0	0.0	0.0	-35.900	-30.508	-29.574	-29.463	-29.335	-29.200	-29.058
DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RETAINED EARNINGS	0.0	0.0	0.0	-35.900	-30.508	-29.574	-29.463	-29.335	-29.200	-29.058

*** COKE PLANT PROJECT IN VENEZUELA ***
INCOME STATEMENTS
- BASE CASE (DOMESTIC/IMPORTED COAL) - (US$, MILLION)

YEAR	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
OPERATING INCOME	114.747	114.747	114.747	114.747	114.747	114.747	114.747	114.747	114.747	114.747
TOTAL SALES REVENUE	114.747	114.747	114.747	114.747	114.747	114.747	114.747	114.747	114.747	114.747
COST OF SALES	120.624	120.624	120.624	120.624	120.624	120.624	120.624	120.624	120.624	120.624
VARIABLE COST	68.654	68.654	68.654	68.654	68.654	68.654	68.654	68.654	68.654	68.654
DIRECT FIXED COST	19.938	19.938	19.938	19.938	19.938	19.938	19.938	19.938	19.938	19.938
DEPRECIATION AND AMORTIZATION	32.033	32.033	32.033	32.033	32.033	32.033	32.033	32.033	32.033	32.033
INC. IN PRODUCT INVENTORY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GROSS PROFIT ON SALES	-5.877	-5.877	-5.877	-5.877	-5.877	-5.877	-5.877	-5.877	-5.877	-5.877
SALES EXPENSES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OPERATING PROFIT	-5.877	-5.877	-5.877	-5.877	-5.877	-5.877	-5.877	-5.877	-5.877	-5.877
NON-OPERATING EXPENSES	23.032	22.876	22.712	22.540	22.359	22.169	21.970	21.761	21.541	21.310
INTEREST ON LONG TERM DEBT	15.055	13.897	12.739	11.581	10.423	9.265	8.107	6.948	5.790	4.632
INTEREST ON SHORT TERM DEBT	7.977	8.979	9.973	10.959	11.936	12.905	13.864	14.812	15.751	16.678
NET PROFIT OR (LOSS) BEFORE TAX	-28.910	-28.753	-28.589	-28.417	-28.237	-28.047	-27.847	-27.638	-27.418	-27.188
INCOME TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NET PROFIT OR (LOSS) AFTER TAX	-28.910	-28.753	-28.589	-28.417	-28.237	-28.047	-27.847	-27.638	-27.418	-27.188
DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RETAINED EARNINGS	-28.910	-28.753	-28.589	-28.417	-28.237	-28.047	-27.847	-27.638	-27.418	-27.188

*** COKE PLANT PROJECT IN VENEZUELA ***
INCOME STATEMENTS
- BASE CASE (DOMESTIC/IMPORTED COAL) - (US$, MILLION)

YEAR	2015	2016	2017
OPERATING INCOME	114.747	114.747	114.747
TOTAL SALES REVENUE	114.747	114.747	114.747
COST OF SALES	120.624	120.624	120.624
VARIABLE COST	68.654	68.654	68.654
DIRECT FIXED COST	19.938	19.938	19.938
DEPRECIATION AND AMORTIZATION	32.033	32.033	32.033
INC. IN PRODUCT INVENTORY	0.0	0.0	0.0
GROSS PROFIT ON SALES	-5.877	-5.877	-5.877
SALES EXPENSES	0.0	0.0	0.0
OPERATING PROFIT	-5.877	-5.877	-5.877
NON-OPERATING EXPENSES	21.068	20.814	20.547
INTEREST ON LONG TERM DEBT	3.474	2.316	1.158
INTEREST ON SHORT TERM DEBT	17.594	18.498	19.389
NET PROFIT OR (LOSS) BEFORE TAX	-26.946	-26.691	-26.424
INCOME TAX	0.0	0.0	0.0
NET PROFIT OR (LOSS) AFTER TAX	-26.946	-26.691	-26.424
DIVIDENDS	0.0	0.0	0.0
RETAINED EARNINGS	-26.946	-26.691	-26.424

*** COKE PLANT PROJECT IN VENEZUELA ***

FUNDS FLOW STATEMENTS

- BASE CASE (DOMESTIC/IMPORTED COAL) - (US$, MILLION)

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
SOURCE OF FUNDS	66.176	330.880	264.704	49.845	82.083	104.127	124.719	145.183	165.512	185.699
CASH GENERATED FROM OPERATION	0.0	0.0	0.0	19.294	25.055	26.155	26.155	26.155	26.155	26.155
PROFIT AFT. TAX, BFR INT.	0.0	0.0	0.0	-12.738	-6.977	-5.877	-5.877	-5.877	-5.877	-5.877
DEPRECIATION AND AMORTIZATION	0.0	0.0	0.0	32.033	32.033	32.033	32.033	32.033	32.033	32.033
FINANCIAL RESOURCES	66.176	330.880	264.704	30.550	57.028	77.971	98.564	119.028	139.356	159.544
SHARE CAPITAL	19.853	99.264	79.411	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LONG TERM DEBT	46.323	231.616	185.293	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SHORT TERM DEBT	0.0	0.0	0.0	30.550	57.028	77.971	98.564	119.028	139.356	159.544
USES OF FUNDS	64.301	321.505	257.204	68.594	82.083	104.127	124.719	145.183	165.512	185.699
FIXED CAPITAL EXPENDITURE	64.301	321.505	257.204	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NON-DEPRECIABLE ASSETS	0.236	1.180	0.944	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DEPRECIABLE FIXED ASSETS	61.328	306.640	245.312	0.0	0.0	0.0	0.0	0.0	0.0	0.0
INTEREST DURING CONSTRUCTION	2.737	13.685	10.948	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHANGE IN WORKING CAPITAL	0.0	0.0	0.0	22.271	4.840	0.240	0.0	0.0	0.0	0.0
DEBT SERVICES	0.0	0.0	0.0	46.323	77.243	103.886	124.719	145.183	165.512	185.699
REPAYMENT OF LONG TERM DEBT	0.0	0.0	0.0	23.162	23.162	23.162	23.162	23.162	23.162	23.162
REPAYMENT OF SHORT TERM DEBT	0.0	0.0	0.0	0.0	30.550	57.028	77.971	98.564	119.028	139.356
INTEREST ON LONG TERM DEBT	0.0	0.0	0.0	23.162	22.004	20.845	19.687	18.529	17.371	16.213
INTEREST ON SHORT TERM DEBT	0.0	0.0	0.0	0.0	1.528	2.851	3.899	4.928	5.951	6.968
DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CASH INCREASE OR (DECREASE)	1.875	9.375	7.500	-18.750	0.0	0.0	0.0	0.0	0.0	0.0
BEGINNING CASH BALANCE	0.0	1.875	11.250	18.750	0.0	0.0	0.0	0.0	0.0	0.0
ENDING CASH BALANCE	1.875	11.250	18.750	0.0	0.0	0.0	0.0	0.0	0.0	0.0

*** COKE PLANT PROJECT IN VENEZUELA ***
FUNDS FLOW STATEMENTS
- BASE CASE (DOMESTIC/IMPORTED COAL) - (US$, MILLION)

YEAR	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
SOURCE OF FUNDS	205.738	225.620	245.339	264.885	284.251	303.426	322.403	341.170	359.718	378.035
CASH GENERATED FROM OPERATION	26.155	26.155	26.155	26.155	26.155	26.155	26.155	26.155	26.155	26.155
PROFIT AFT. TAX. BFR INT.	-5.877	-5.877	-5.877	-5.877	-5.877	-5.877	-5.877	-5.877	-5.877	-5.877
DEPRECIATION AND AMORTIZATION	32.033	32.033	32.033	32.033	32.033	32.033	32.033	32.033	32.033	32.033
FINANCIAL RESOURCES	179.582	199.465	219.183	238.730	258.095	277.271	296.248	315.015	333.563	351.879
SHARE CAPITAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LONG TERM DEBT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SHORT TERM DEBT	179.582	199.465	219.183	238.730	258.095	277.271	296.248	315.015	333.563	351.879
USES OF FUNDS	205.738	225.620	245.339	264.885	284.251	303.426	322.403	341.170	359.718	378.035
FIXED CAPITAL EXPENDITURE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NON-DEPRECIABLE ASSETS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DEPRECIABLE FIXED ASSETS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
INTEREST DURING CONSTRUCTION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHANGE IN WORKING CAPITAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DEBT SERVICES	205.738	225.620	245.339	264.885	284.251	303.426	322.403	341.170	359.718	378.035
REPAYMENT OF LONG TERM DEBT	23.162	23.162	23.162	23.162	23.162	23.162	23.162	23.162	23.162	23.162
REPAYMENT OF SHORT TERM DEBT	159.544	179.582	199.465	219.183	238.730	258.095	277.271	296.248	315.015	333.563
INTEREST ON LONG TERM DEBT	15.055	13.897	12.739	11.581	10.423	9.265	8.107	6.948	5.790	4.632
INTEREST ON SHORT TERM DEBT	7.977	8.979	9.973	10.959	11.936	12.905	13.864	14.812	15.751	16.678
DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CASH INCREASE OR (DECREASE)	0.0	0.0	0.0	0.0	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
BEGINNING CASH BALANCE	0.0	0.0	0.0	0.0	0.0	-0.000	-0.000	-0.000	-0.000	-0.000
ENDING CASH BALANCE	0.0	0.0	0.0	0.0	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000

*** COKE PLANT PROJECT IN VENEZUELA ***
FUNDS FLOW STATEMENTS
- BASE CASE (DOMESTIC/IMPORTED COAL) - (US$, MILLION)

YEAR	2015	2016	2017
SOURCE OF FUNDS	396.109	413.929	431.483
CASH GENERATED FROM OPERATION	26.155	26.155	26.155
PROFIT AFT. TAX, BFR INT.	-5.877	-5.877	-5.877
DEPRECIATION AND AMORTIZATION	32.033	32.033	32.033
FINANCIAL RESOURCES	369.954	387.774	405.327
SHARE CAPITAL	0.0	0.0	0.0
LONG TERM DEBT	0.0	0.0	0.0
SHORT TERM DEBT	369.954	387.774	405.327
USES OF FUNDS	396.109	413.929	431.483
FIXED CAPITAL EXPENDITURE	0.0	0.0	0.0
NON-DEPRECIABLE ASSETS	0.0	0.0	0.0
DEPRECIABLE FIXED ASSETS	0.0	0.0	0.0
INTEREST DURING CONSTRUCTION	0.0	0.0	0.0
CHANGE IN WORKING CAPITAL	0.0	0.0	0.0
DEBT SERVICES	396.109	413.929	431.483
REPAYMENT OF LONG TERM DEBT	23.162	23.162	23.162
REPAYMENT OF SHORT TERM DEBT	351.879	369.954	387.774
INTEREST ON LONG TERM DEBT	3.474	2.316	1.158
INTEREST ON SHORT TERM DEBT	17.594	18.498	19.389
DIVIDENDS	0.0	0.0	0.0
CASH INCREASE OR (DECREASE)	-0.000	-0.000	-0.000
BEGINNING CASH BALANCE	-0.000	-0.000	-0.000
ENDING CASH BALANCE	-0.000	-0.000	-0.000

*** COKE PLANT PROJECT IN VENEZUELA ***

BALANCE SHEET

- BASE CASE (DOMESTIC/IMPORTED COAL) - (US$. MILLION)

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
ASSETS	66.176	397.056	661.760	637.826	611.777	579.985	547.953	515.920	483.888	451.855
CURRENT ASSETS	0.0	0.0	0.0	26.848	32.832	33.073	33.073	33.073	33.073	33.073
OPERATING CASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ACCOUNT RECEIVABLE	0.0	0.0	0.0	6.688	9.321	9.562	9.562	9.562	9.562	9.562
INVENTORIES	0.0	0.0	0.0	20.160	23.511	23.511	23.511	23.511	23.511	23.511
ACC. EXCESS CASH	1.875	11.250	18.750	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NET FIXED ASSETS	64.301	385.806	643.010	610.978	578.945	546.913	514.880	482.848	450.815	418.783
INVESTMENT	64.301	385.806	643.010	643.010	643.010	643.010	643.010	643.010	643.010	643.010
NON-DEPR. ASSETS	0.236	1.416	2.360	2.360	2.360	2.360	2.360	2.360	2.360	2.360
DEPRECIABLE ASSETS	61.328	367.968	613.280	613.280	613.280	613.280	613.280	613.280	613.280	613.280
AMORTIZATION	2.737	16.422	27.370	27.370	27.370	27.370	27.370	27.370	27.370	27.370
LESS: ACC. DEPRECIATION	0.0	0.0	0.0	32.033	64.065	96.098	128.130	160.163	192.195	224.228
LIABILITIES	46.323	277.939	463.232	475.197	479.657	477.439	474.870	472.172	469.340	466.366
CURRENT LIABILITIES	0.0	0.0	23.162	58.288	85.910	106.854	127.446	147.910	168.239	188.426
ACCOUNT PAYABLE	0.0	0.0	0.0	4.577	5.721	5.721	5.721	5.721	5.721	5.721
CURRENT PORTION OF L/T DEBT	0.0	0.0	23.162	23.162	23.162	23.162	23.162	23.162	23.162	23.162
SHORT TERM DEBT	0.0	0.0	0.0	30.550	57.028	77.971	98.564	119.028	139.356	159.544
FIXED LIABILITIES	46.323	277.939	440.070	416.909	393.747	370.586	347.424	324.262	301.101	277.939
LONG TERM DEBT BALANCE	46.323	277.939	440.070	416.909	393.747	370.586	347.424	324.262	301.101	277.939
OTHER FIXED LIABILITIES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
STOCK HOLDERS EQUITY	19.853	119.117	198.528	162.628	132.120	102.546	73.083	43.748	14.548	-14.510
SHARE CAPITAL	19.853	119.117	198.528	198.528	198.528	198.528	198.528	198.528	198.528	198.528
ACC. RETAINED EARNINGS	0.0	0.0	0.0	-35.900	-66.408	-95.982	-125.445	-154.780	-183.980	-213.038
LIABILITIES & S/H EQUITY	66.176	397.056	661.760	637.826	611.777	579.985	547.953	515.920	483.888	451.855

*** COKE PLANT PROJECT IN VENEZUELA ***

BALANCE SHEET

- BASE CASE (DOMESTIC/IMPORTED COAL) - (US$, MILLION)

YEAR	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
ASSETS	419.823	387.790	355.758	323.725	291.693	259.660	227.628	195.595	163.563	131.530
CURRENT ASSETS	33.073	33.073	33.073	33.073	33.073	33.073	33.073	33.073	33.073	33.073
OPERATING CASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ACCOUNT RECEIVABLE	9.562	9.562	9.562	9.562	9.562	9.562	9.562	9.562	9.562	9.562
INVENTORIES	23.511	23.511	23.511	23.511	23.511	23.511	23.511	23.511	23.511	23.511
ACC. EXCESS CASH	0.0	0.0	0.0	0.0	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
NET FIXED ASSETS	386.750	354.718	322.685	290.653	258.620	226.588	194.555	162.523	130.490	98.458
INVESTMENT	643.010	643.010	643.010	643.010	643.010	643.010	643.010	643.010	643.010	643.010
NON-DEPR. ASSETS	2.360	2.360	2.360	2.360	2.360	2.360	2.360	2.360	2.360	2.360
DEPRECIABLE ASSETS	613.280	613.280	613.280	613.280	613.280	613.280	613.280	613.280	613.280	613.280
AMORTIZATION	27.370	27.370	27.370	27.370	27.370	27.370	27.370	27.370	27.370	27.370
LESS: ACC. DEPRECIATION	256.260	288.293	320.325	352.358	384.390	416.423	448.455	480.488	512.520	544.553
LIABILITIES	463.243	459.964	456.520	452.905	449.109	445.123	440.938	436.544	431.930	427.085
CURRENT LIABILITIES	208.465	228.347	248.066	267.612	286.978	306.154	325.130	343.898	362.445	380.762
ACCOUNT PAYABLE	5.721	5.721	5.721	5.721	5.721	5.721	5.721	5.721	5.721	5.721
CURRENT PORTION OF L/T DEBT	23.162	23.162	23.162	23.162	23.162	23.162	23.162	23.162	23.162	23.162
SHORT TERM DEBT	179.582	199.465	219.183	238.730	258.095	277.271	296.248	315.015	333.563	351.879
FIXED LIABILITIES	254.778	231.616	208.455	185.293	162.131	138.970	115.808	92.647	69.485	46.323
LONG TERM DEBT BALANCE	254.778	231.616	208.455	185.293	162.131	138.970	115.808	92.647	69.485	46.323
OTHER FIXED LIABILITIES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
STOCK HOLDERS EQUITY	-43.420	-72.173	-100.763	-129.180	-157.416	-185.463	-213.311	-240.949	-268.367	-295.555
SHARE CAPITAL	198.528	198.528	198.528	198.528	198.528	198.528	198.528	198.528	198.528	198.528
ACC. RETAINED EARNINGS	-241.948	-270.701	-299.291	-327.708	-355.944	-383.991	-411.839	-439.477	-466.895	-494.083
LIABILITIES & S/H EQUITY	419.823	387.790	355.758	323.725	291.693	259.660	227.628	195.595	163.563	131.530

*** COKE PLANT PROJECT IN VENEZUELA ***
BALANCE SHEET
- BASE CASE (DOMESTIC/IMPORTED COAL) - (US$. MILLION)

YEAR	2015	2016	2017
ASSETS	99.498	67.465	35.433
CURRENT ASSETS	33.073	33.073	33.073
OPERATING CASH	0.0	0.0	0.0
ACCOUNT RECEIVABLE	9.562	9.562	9.562
INVENTORIES	23.511	23.511	23.511
ACC. EXCESS CASH	-0.000	-0.000	-0.000
NET FIXED ASSETS	66.425	34.393	2.360
INVESTMENT	643.010	643.010	643.010
NON-DEPR. ASSETS	2.360	2.360	2.360
DEPRECIABLE ASSETS	613.280	613.280	613.280
AMORTIZATION	27.370	27.370	27.370
LESS: ACC. DEPRECIATION	576.585	608.618	640.650
LIABILITIES	421.998	416.657	411.049
CURRENT LIABILITIES	398.836	416.657	411.048
ACCOUNT PAYABLE	5.721	5.721	5.721
CURRENT PORTION OF L/T DEBT	23.162	23.162	0.0
SHORT TERM DEBT	369.954	387.774	405.327
FIXED LIABILITIES	23.162	0.000	0.000
LONG TERM DEBT BALANCE	23.162	0.000	0.000
OTHER FIXED LIABILITIES	0.0	0.0	0.0
STOCK HOLDERS EQUITY	-322.501	-349.192	-375.616
SHARE CAPITAL	198.528	198.528	198.528
ACC. RETAINED EARNINGS	-521.029	-547.720	-574.144
LIABILITIES & S/H EQUITY	99.498	67.465	35.433

*** COKE PLANT PROJECT IN VENEZUELA ***
LONG TERM DEBT
- BASE CASE (DOMESTIC/IMPORTED COAL) - (US$, MILLION)

AMOUNT OF DEBT 463.232

INTEREST RATE 5.000 PER CENT/YEAR

REPAYMENT 20 YEAR-EQUAL-INSTALLMENT-REPAYMENT (ANNUAL REPAYMENT)

YEAR	SER.NO	PRINCIPAL	INTEREST	DEBT SERVICE	BALANCE AFT. PAYMENT
1995	1	0.0	0.0	0.0	46.323
1996	2	0.0	0.0	0.0	277.939
1997	3	0.0	0.0	0.0	463.232
1998	4	23.162	23.162	46.323	440.070
1999	5	23.162	22.004	45.165	416.909
2000	6	23.162	20.845	44.007	393.747
2001	7	23.162	19.687	42.849	370.585
2002	8	23.162	18.529	41.691	347.424
2003	9	23.162	17.371	40.533	324.262
2004	10	23.162	16.213	39.375	301.101
2005	11	23.162	15.055	38.217	277.939
2006	12	23.162	13.897	37.059	254.777
2007	13	23.162	12.739	35.900	231.616
2008	14	23.162	11.581	34.742	208.454
2009	15	23.162	10.423	33.584	185.293
2010	16	23.162	9.265	32.426	162.131
2011	17	23.162	8.107	31.268	138.969
2012	18	23.162	6.948	30.110	115.808
2013	19	23.162	5.790	28.952	92.646
2014	20	23.162	4.632	27.794	69.485
2015	21	23.162	3.474	26.636	46.323
2016	22	23.162	2.316	25.478	23.161
2017	23	23.162	1.158	24.320	0.0
TOTAL		463.230	243.197	706.427	0.0

*** COKE PLANT PROJECT IN VENEZUELA ***
PROFITABILITY AND FINANCIAL INDICATORS
- BASE CASE (DOMESTIC/IMPORTED COAL) - (US$, MILLION)

YEAR	(1) AFT TAX PROFIT -TO- SALES REV (PCT)	(2) AFT TAX PROFIT -TO- S/H EQUITY (PCT)	(3) BFR TAX PROFIT -TO- INVESTMENT (PCT)	(4) AFT TAX PROFIT -TO- S/CAPITAL (PCT)	(5) CURRENT RATIO	(6) QUICK RATIO	(7) DEBT SERVICE RATIO	(8) L/T DEBT -TO- S/H EQUITY	(9)* PROFIT B.E.P. CAPACITY UTILIZE (PCT)	(10)* CASH B.E.P. SALES PRICE (PRICE)	(11)* CASH B.E.P. CAPACITY UTILIZE (PCT)
1998	-44.7	-22.1	-5.6	-18.1	0.46	0.11	0.42	72 / 28	237.3	203.7	177.9
1999	-27.3	-23.1	-4.7	-15.4	0.38	0.11	0.52	75 / 25	174.7	163.2	131.1
2000	-25.8	-28.8	-4.6	-14.9	0.31	0.09	0.53	78 / 22	164.2	159.4	123.2
2001	-25.7	-40.3	-4.6	-14.8	0.26	0.08	0.52	83 / 17	163.9	159.2	123.0
2002	-25.6	-67.1	-4.6	-14.8	0.22	0.06	0.51	88 / 12	163.6	159.1	122.7
2003	-25.4	-200.7	-4.5	-14.7	0.20	0.06	0.50	95 / 5	163.4	158.9	122.5
2004	-25.3	200.3	-4.5	-14.6	0.18	0.05	0.49	106 / -6	163.0	158.7	122.2
2005	-25.2	66.6	-4.5	-14.6	0.16	0.05	0.48	121 / -21	162.7	158.6	122.0
2006	-25.1	39.8	-4.5	-14.5	0.14	0.04	0.46	145 / -45	162.4	158.4	121.7
2007	-24.9	28.4	-4.4	-14.4	0.13	0.04	0.45	194 / -94	162.0	158.2	121.4
2008	-24.8	22.0	-4.4	-14.3	0.12	0.04	0.44	330 / ***	161.7	158.0	121.0
2009	-24.6	17.9	-4.4	-14.2	0.12	0.03	0.42	*** / ***	161.3	157.8	120.7
2010	-24.4	15.1	-4.4	-14.1	0.11	0.03	0.41	*** / 399	160.8	157.6	120.4
2011	-24.3	13.1	-4.3	-14.0	0.10	0.03	0.39	*** / 219	160.4	157.3	120.0
2012	-24.1	11.5	-4.3	-13.9	0.10	0.03	0.38	-62 / 162	160.0	157.1	119.6
2013	-23.9	10.2	-4.3	-13.8	0.09	0.03	0.36	-35 / 135	159.5	156.8	119.2
2014	-23.7	9.2	-4.2	-13.7	0.09	0.03	0.34	-19 / 119	159.0	156.5	118.8
2015	-23.5	8.4	-4.2	-13.6	0.08	0.02	0.32	-8 / 108	158.5	156.3	118.3
2016	-23.3	7.6	-4.2	-13.4	0.08	0.02	0.30	-0 / 100	157.9	156.0	117.9
2017	-23.0	7.0	-4.1	-13.3	0.08	0.02	0.28	-0 / 100	157.3	155.6	117.4
AVERAGE1	-25.7	3.7	-4.5	-14.5	0.17	0.05	0.43	214 / ***	165.7	160.3	124.0
AVERAGE2	-25.4	30.2	-4.1	-13.3	0.13	0.04	0.44	167 / -67			

(AVERAGE1) : SUM OF ANNUAL FIGURES OF PERCENTAGE AND RATIO IS DIVIDED BY NO. OF YEARS(SIMPLE AVERAGE)
(AVERAGE2) : AVERAGE FIGURES ARE CALCULATED BY ACTUAL VALUES ACCUMULATED OVER THE PROJECT LIFE(WEIGHTED AVERAGE)
* NOTE FOR (9)(10)(11)
WHEN THERE ARE TWO OR MORE PRODUCTS, AND DURING THE YEARS WHEN ALL OF PRODUCTS ARE NOT PRODUCED AT THE SAME RATE OF CAPACITY UTILIZATION, ABOVE BREAK-EVEN-POINTS CANNOT GIVE CORRECT FIGURES.

*** COKE PLANT PROJECT IN VENEZUELA ***
FINANCIAL RATE OF RETURN (IN '93 FIXED PRICE)
- BASE CASE (DOMESTIC/IMPORTED COAL) - (US$. MILLION)

YEAR	FIXED CAPITAL EXPEND.	CHANGE IN WORKING CAPITAL	(1) GROSS CAPITAL EXPENDTR	OPERATING PROFIT	DEPRECIATN	(2) GROSS CASH IN-FLOW	(3) INCOME TAX	(4) BFR-TAX NET IN-FLOW (2)-(1)	(5) AFT-TAX NET IN-FLOW (4)-(3)
1995	61.564	0.0	61.564	0.0	0.0	0.0	0.0	-61.564	-61.564
1996	307.820	0.0	307.820	0.0	0.0	0.0	0.0	-307.820	-307.820
1997	246.256	0.0	246.256	0.0	0.0	0.0	0.0	-246.256	-246.256
1998	0.0	22.271	22.271	-12.738	32.033	19.294	0.0	-2.977	-2.977
1999	0.0	4.840	4.840	-6.977	32.033	25.055	0.0	20.215	20.215
2000	0.0	0.240	0.240	-5.877	32.033	26.155	0.0	25.915	25.915
2001	0.0	0.0	0.0	-5.877	32.033	26.155	0.0	26.155	26.155
2002	0.0	0.0	0.0	-5.877	32.033	26.155	0.0	26.155	26.155
2003	0.0	0.0	0.0	-5.877	32.033	26.155	0.0	26.155	26.155
2004	0.0	0.0	0.0	-5.877	32.033	26.155	0.0	26.155	26.155
2005	0.0	0.0	0.0	-5.877	32.033	26.155	0.0	26.155	26.155
2006	0.0	0.0	0.0	-5.877	32.033	26.155	0.0	26.155	26.155
2007	0.0	0.0	0.0	-5.877	32.033	26.155	0.0	26.155	26.155
2008	0.0	0.0	0.0	-5.877	32.033	26.155	0.0	26.155	26.155
2009	0.0	0.0	0.0	-5.877	32.033	26.155	0.0	26.155	26.155
2010	0.0	0.0	0.0	-5.877	32.033	26.155	0.0	26.155	26.155
2011	0.0	0.0	0.0	-5.877	32.033	26.155	0.0	26.155	26.155
2012	0.0	0.0	0.0	-5.877	32.033	26.155	0.0	26.155	26.155
2013	0.0	0.0	0.0	-5.877	32.033	26.155	0.0	26.155	26.155
2014	0.0	0.0	0.0	-5.877	32.033	26.155	0.0	26.155	26.155
2015	0.0	0.0	0.0	-5.877	32.033	26.155	0.0	26.155	26.155
2016	0.0	0.0	0.0	-5.877	32.033	26.155	0.0	26.155	26.155
2017	-2.360	-27.352	-29.712	-5.877	32.033	26.155	0.0	55.867	55.867
	613.280	-0.000	613.279	-125.507	640.650	515.141	0.0	-98.135	-98.135

INTERNAL RATE OF RETURN

ON (4) BFR-TAX NET IN-FLOW (2)-(1) -1.37 PER CENT

ON (5) AFT-TAX NET IN-FLOW (4)-(3) -1.37 PER CENT

*** COKE PLANT PROJECT IN VENEZUELA ***
FOREIGN CURRENCY EARNINGS (IN '93 FIXED PRICE)
- BASE CASE (DOMESTIC/IMPORTED COAL) - (US$, MILLION)

YEAR	(1) IN-FLOW FROM SALES	ACC. IN-FLOW	IMPORT COAL & MATERIALS	INTEREST ON L/T	REPAYMENT ON L/T	(2) TOTAL OUT-FLOW	ACC. OUT-FLOW	(3) NET IN-FLOW (1)-(2)	ACC.NET IN-FLOW
1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	80.255	80.255	55.549	23.162	23.162	101.872	101.872	-21.617	-21.617
1999	111.861	192.116	67.580	22.004	23.162	112.745	214.617	-0.884	-22.501
2000	114.747	306.862	67.580	20.845	23.162	111.587	326.203	3.160	-19.341
2001	114.747	421.609	67.580	19.687	23.162	110.429	436.632	4.318	-15.023
2002	114.747	536.355	67.580	18.529	23.162	109.270	545.902	5.476	-9.547
2003	114.747	651.102	67.580	17.371	23.162	108.112	654.014	6.634	-2.913
2004	114.747	765.848	67.580	16.213	23.162	106.954	760.969	7.792	4.880
2005	114.747	880.595	67.580	15.055	23.162	105.796	866.765	8.950	13.830
2006	114.747	995.342	67.580	13.897	23.162	104.638	971.403	10.108	23.939
2007	114.747	1110.088	67.580	12.739	23.162	103.480	1074.883	11.267	35.205
2008	114.747	1224.835	67.580	11.581	23.162	102.322	1177.205	12.425	47.630
2009	114.747	1339.581	67.580	10.423	23.162	101.164	1278.369	13.583	61.213
2010	114.747	1454.328	67.580	9.265	23.162	100.006	1378.375	14.741	75.953
2011	114.747	1569.074	67.580	8.107	23.162	98.848	1477.222	15.899	91.852
2012	114.747	1683.821	67.580	6.948	23.162	97.690	1574.912	17.057	108.909
2013	114.747	1798.568	67.580	5.790	23.162	96.532	1671.444	18.215	127.124
2014	114.747	1913.314	67.580	4.632	23.162	95.373	1766.817	19.373	146.497
2015	114.747	2028.061	67.580	3.474	23.162	94.215	1861.032	20.531	167.029
2016	114.747	2142.808	67.580	2.316	23.162	93.057	1954.090	21.689	188.718
2017	114.747	2257.554	67.580	1.158	23.162	91.899	2045.989	22.847	211.565
	2257.554		1339.557	243.197	463.230	2045.987		211.565	

(ECONOMIC) *** COKE PLANT PROJECT IN VENEZUELA ***
ECONOMIC RATE OF RETURN (IN '93 FIXED PRICE)
- BASE CASE (DOMESTIC/IMPORTED COAL) - (US$. MILLION)

YEAR	FIXED CAPITAL EXPEND.	CHANGE IN WORKING CAPITAL	(1) GROSS CAPITAL EXPENDTR	OPERATING PROFIT	DEPRECIATN	(2) GROSS CASH IN-FLOW	(3) INCOME TAX	(4) BFR-TAX NET IN-FLOW (2)-(1)	(5) AFT-TAX NET IN-FLOW (4)-(3)
1995	59.381	0.0	59.381	0.0	0.0	0.0	0.0	-59.381	-59.381
1996	296.905	0.0	296.905	0.0	0.0	0.0	0.0	-296.905	-296.905
1997	237.524	0.0	237.524	0.0	0.0	0.0	0.0	-237.524	-237.524
1998	0.0	21.720	21.720	-9.052	29.572	20.520	0.0	-1.200	-1.200
1999	0.0	4.840	4.840	-2.741	29.572	26.832	0.0	21.992	21.992
2000	0.0	0.240	0.240	-1.641	29.572	27.932	0.0	27.691	27.691
2001	0.0	0.0	0.0	-1.641	29.572	27.932	0.0	27.932	27.932
2002	0.0	0.0	0.0	-1.641	29.572	27.932	0.0	27.932	27.932
2003	0.0	0.0	0.0	-1.641	29.572	27.932	0.0	27.932	27.932
2004	0.0	0.0	0.0	-1.641	29.572	27.932	0.0	27.932	27.932
2005	0.0	0.0	0.0	-1.641	29.572	27.932	0.0	27.932	27.932
2006	0.0	0.0	0.0	-1.641	29.572	27.932	0.0	27.932	27.932
2007	0.0	0.0	0.0	-1.641	29.572	27.932	0.0	27.932	27.932
2008	0.0	0.0	0.0	-1.641	29.572	27.932	0.0	27.932	27.932
2009	0.0	0.0	0.0	-1.641	29.572	27.932	0.0	27.932	27.932
2010	0.0	0.0	0.0	-1.641	29.572	27.932	0.0	27.932	27.932
2011	0.0	0.0	0.0	-1.641	29.572	27.932	0.0	27.932	27.932
2012	0.0	0.0	0.0	-1.641	29.572	27.932	0.0	27.932	27.932
2013	0.0	0.0	0.0	-1.641	29.572	27.932	0.0	27.932	27.932
2014	0.0	0.0	0.0	-1.641	29.572	27.932	0.0	27.932	27.932
2015	0.0	0.0	0.0	-1.641	29.572	27.932	0.0	27.932	27.932
2016	0.0	0.0	0.0	-1.641	29.572	27.932	0.0	27.932	27.932
2017	-2.360	-26.801	-29.161	-1.641	29.572	27.932	0.0	57.093	57.093
	591.450	-0.000	591.449	-41.323	591.447	550.126	0.0	-41.320	-41.320

INTERNAL RATE OF RETURN

ON (4) BFR-TAX NET IN-FLOW (2)-(1) -0.58 PER CENT

ON (5) AFT-TAX NET IN-FLOW (4)-(3) -0.58 PER CENT

Appendix-2 FINANCIAL AND ECONOMIC STATEMENTS FOR ALT. CASE

*** COKE PLANT PROJECT IN VENEZUELA ***

PRODUCTION AND SALES PLAN

- ALT. CASE (DOMESTIC COAL INC.BOYACA) - (US$, MILLION)

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
RATED CAPACITY (TOTAL COKE)	0.0	0.0	0.0	1000.000	1000.000	1000.000	1000.000	1000.000	1000.000	1000.000
CAPACITY UTILIZATION	0.0	0.0	0.0	0.800	1.000	1.000	1.000	1.000	1.000	1.000
BF COKE PRODUCTION (1000TPY)	0.0	0.0	0.0	680.000	850.000	850.000	850.000	850.000	850.000	850.000
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0	85.000	21.250	0.0	0.0	0.0	0.0	0.0
BF COKE TO EXPORT (1000TPY)	0.0	0.0	0.0	595.000	828.750	850.000	850.000	850.000	850.000	850.000
UNIT SALES PRICE (US$/T)	0.0	0.0	0.0	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000
SALES REVENUE	0.0	0.0	0.0	71.400	99.450	102.000	102.000	102.000	102.000	102.000
BREEZE PRODUCTION (1000TPY)	0.0	0.0	0.0	120.000	150.000	150.000	150.000	150.000	150.000	150.000
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0	10.000	2.500	0.0	0.0	0.0	0.0	0.0
BREEZE TO EXPORT (1000TPY)	0.0	0.0	0.0	110.000	147.500	150.000	150.000	150.000	150.000	150.000
UNIT SALES PRICE (US$/T)	0.0	0.0	0.0	40.0000	40.0000	40.0000	40.0000	40.0000	40.0000	40.0000
SALES REVENUE	0.0	0.0	0.0	4.400	5.900	6.000	6.000	6.000	6.000	6.000
RATED CAPACITY (TOTAL COAL)	0.0	0.0	0.0	1345.895	1345.895	1345.895	1345.895	1345.895	1345.895	1345.895
CAPACITY UTILIZATION	0.0	0.0	0.0	0.800	1.000	1.000	1.000	1.000	1.000	1.000
TAR PRODUCTION (1000TPY)	0.0	0.0	0.0	32.301	40.377	40.377	40.377	40.377	40.377	40.377
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0	4.038	1.009	0.0	0.0	0.0	0.0	0.0
TAR TO EXPORT (1000TPY)	0.0	0.0	0.0	28.264	39.367	40.377	40.377	40.377	40.377	40.377
UNIT SALES PRICE (US$/T)	0.0	0.0	0.0	50.0000	50.0000	50.0000	50.0000	50.0000	50.0000	50.0000
SALES REVENUE	0.0	0.0	0.0	1.413	1.968	2.019	2.019	2.019	2.019	2.019
BENZENE PRODUCTION (1000TPY)	0.0	0.0	0.0	10.767	13.459	13.459	13.459	13.459	13.459	13.459
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0	2.692	0.673	0.0	0.0	0.0	0.0	0.0
BENZENE TO EXPORT (1000TPY)	0.0	0.0	0.0	8.075	12.786	13.459	13.459	13.459	13.459	13.459
UNIT SALES PRICE (US$/T)	0.0	0.0	0.0	240.0000	240.0000	240.0000	240.0000	240.0000	240.0000	240.0000
SALES REVENUE	0.0	0.0	0.0	1.938	3.069	3.230	3.230	3.230	3.230	3.230
SULFATE PRODUCTION (1000TPY)	0.0	0.0	0.0	12.533	15.666	15.666	15.666	15.666	15.666	15.666
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0	1.044	0.261	0.0	0.0	0.0	0.0	0.0
SULFATE TO EXPORT (1000TPY)	0.0	0.0	0.0	11.489	15.405	15.666	15.666	15.666	15.666	15.666
UNIT SALES PRICE (US$/T)	0.0	0.0	0.0	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
SALES REVENUE	0.0	0.0	0.0	1.149	1.541	1.567	1.567	1.567	1.567	1.567
TOTAL SALES REVENUE	0.0	0.0	0.0	80.300	111.928	114.816	114.816	114.816	114.816	114.816

*** COKE PLANT PROJECT IN VENEZUELA ***
PRODUCTION AND SALES PLAN
- ALT. CASE (DOMESTIC COAL INC.BOYACA) - (US$, MILLION)

YEAR	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
RATED CAPACITY (TOTAL COKE)	1000.000	1000.000	1000.000	1000.000	1000.000	1000.000	1000.000	1000.000	1000.000	1000.000
CAPACITY UTILIZATION	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
BF COKE PRODUCTION (1000TPY)	850.000	850.000	850.000	850.000	850.000	850.000	850.000	850.000	850.000	850.000
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BF COKE TO EXPORT (1000TPY)	850.000	850.000	850.000	850.000	850.000	850.000	850.000	850.000	850.000	850.000
UNIT SALES PRICE (US$/T)	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000
SALES REVENUE	102.000	102.000	102.000	102.000	102.000	102.000	102.000	102.000	102.000	102.000
BREEZE PRODUCTION (1000TPY)	150.000	150.000	150.000	150.000	150.000	150.000	150.000	150.000	150.000	150.000
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BREEZE TO EXPORT (1000TPY)	150.000	150.000	150.000	150.000	150.000	150.000	150.000	150.000	150.000	150.000
UNIT SALES PRICE (US$/T)	40.0000	40.0000	40.0000	40.0000	40.0000	40.0000	40.0000	40.0000	40.0000	40.0000
SALES REVENUE	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000
RATED CAPACITY (TOTAL COAL)	1345.895	1345.895	1345.895	1345.895	1345.895	1345.895	1345.895	1345.895	1345.895	1345.895
CAPACITY UTILIZATION	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
TAR PRODUCTION (1000TPY)	40.377	40.377	40.377	40.377	40.377	40.377	40.377	40.377	40.377	40.377
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TAR TO EXPORT (1000TPY)	40.377	40.377	40.377	40.377	40.377	40.377	40.377	40.377	40.377	40.377
UNIT SALES PRICE (US$/T)	50.0000	50.0000	50.0000	50.0000	50.0000	50.0000	50.0000	50.0000	50.0000	50.0000
SALES REVENUE	2.019	2.019	2.019	2.019	2.019	2.019	2.019	2.019	2.019	2.019
BENZENE PRODUCTION (1000TPY)	13.459	13.459	13.459	13.459	13.459	13.459	13.459	13.459	13.459	13.459
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BENZENE TO EXPORT (1000TPY)	13.459	13.459	13.459	13.459	13.459	13.459	13.459	13.459	13.459	13.459
UNIT SALES PRICE (US$/T)	240.0000	240.0000	240.0000	240.0000	240.0000	240.0000	240.0000	240.0000	240.0000	240.0000
SALES REVENUE	3.230	3.230	3.230	3.230	3.230	3.230	3.230	3.230	3.230	3.230
SULFATE PRODUCTION (1000TPY)	15.666	15.666	15.666	15.666	15.666	15.666	15.666	15.666	15.666	15.666
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SULFATE TO EXPORT (1000TPY)	15.666	15.666	15.666	15.666	15.666	15.666	15.666	15.666	15.666	15.666
UNIT SALES PRICE (US$/T)	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
SALES REVENUE	1.567	1.567	1.567	1.567	1.567	1.567	1.567	1.567	1.567	1.567
TOTAL SALES REVENUE	114.816	114.816	114.816	114.816	114.816	114.816	114.816	114.816	114.816	114.816

*** COKE PLANT PROJECT IN VENEZUELA ***
PRODUCTION AND SALES PLAN
- ALT. CASE (DOMESTIC COAL INC.BOYACA) - (US$, MILLION)

YEAR	2015	2016	2017
RATED CAPACITY (TOTAL COKE)	1000.000	1000.000	1000.000
CAPACITY UTILIZATION	1.000	1.000	1.000
BF COKE PRODUCTION (1000TPY)	850.000	850.000	850.000
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0
BF COKE TO EXPORT (1000TPY)	850.000	850.000	850.000
UNIT SALES PRICE (US$/T)	120.0000	120.0000	120.0000
SALES REVENUE	102.000	102.000	102.000
BREEZE PRODUCTION (1000TPY)	150.000	150.000	150.000
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0
BREEZE TO EXPORT (1000TPY)	150.000	150.000	150.000
UNIT SALES PRICE (US$/T)	40.0000	40.0000	40.0000
SALES REVENUE	6.000	6.000	6.000
RATED CAPACITY (TOTAL COAL)	1345.895	1345.895	1345.895
CAPACITY UTILIZATION	1.000	1.000	1.000
TAR PRODUCTION (1000TPY)	40.377	40.377	40.377
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0
TAR TO EXPORT (1000TPY)	40.377	40.377	40.377
UNIT SALES PRICE (US$/T)	50.0000	50.0000	50.0000
SALES REVENUE	2.019	2.019	2.019
BENZENE PRODUCTION (1000TPY)	13.459	13.459	13.459
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0
BENZENE TO EXPORT (1000TPY)	13.459	13.459	13.459
UNIT SALES PRICE (US$/T)	240.0000	240.0000	240.0000
SALES REVENUE	3.230	3.230	3.230
SULFATE PRODUCTION (1000TPY)	15.666	15.666	15.666
INCREASE IN INVENTORY (1000TPY)	0.0	0.0	0.0
SULFATE TO EXPORT (1000TPY)	15.666	15.666	15.666
UNIT SALES PRICE (US$/T)	100.0000	100.0000	100.0000
SALES REVENUE	1.567	1.567	1.567
TOTAL SALES REVENUE	114.816	114.816	114.816

*** COKE PLANT PROJECT IN VENEZUELA ***
PRODUCTION COST STATEMENTS
- ALT. CASE (DOMESTIC COAL INC.BOYACA) - (US$, MILLION)

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
BF COKE PRODUCTION (1000TPY)	0.0	0.0	0.0	680.000	850.000	850.000	850.000	850.000	850.000	850.000
RAW MATERIAL COST	0.0	0.0	0.0	32.181	40.226	40.226	40.226	40.226	40.226	40.226
DOMESTIC COAL	0.0	0.0	0.0	22.714	28.393	28.393	28.393	28.393	28.393	28.393
IMPORTED COAL (BOYACA)	0.0	0.0	0.0	9.466	11.833	11.833	11.833	11.833	11.833	11.833
IMPORTED COAL (U.S.A)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COKE OVEN GAS	0.0	0.0	0.0	2.386	2.983	2.983	2.983	2.983	2.983	2.983
UTILITIES COST	0.0	0.0	0.0	0.717	0.897	0.897	0.897	0.897	0.897	0.897
ELECTRICITY	0.0	0.0	0.0	0.638	0.797	0.797	0.797	0.797	0.797	0.797
WATER	0.0	0.0	0.0	0.080	0.099	0.099	0.099	0.099	0.099	0.099
CAT/CHEM	0.0	0.0	0.0	1.043	1.304	1.304	1.304	1.304	1.304	1.304
CREDITS OF BY-PRODUCTS	0.0	0.0	0.0	-5.298	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622
COKE OVEN GAS	0.0	0.0	0.0	-5.298	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622
VARIABLE COST	0.0	0.0	0.0	31.030	38.787	38.787	38.787	38.787	38.787	38.787
EMPLOYMENT COST	0.0	0.0	0.0	6.115	6.115	6.115	6.115	6.115	6.115	6.115
LABOUR COST	0.0	0.0	0.0	4.077	4.077	4.077	4.077	4.077	4.077	4.077
OVERHEAD	0.0	0.0	0.0	2.038	2.038	2.038	2.038	2.038	2.038	2.038
MAINTENANCE COST	0.0	0.0	0.0	10.607	10.607	10.607	10.607	10.607	10.607	10.607
TAX & INSURANCE	0.0	0.0	0.0	3.215	3.215	3.215	3.215	3.215	3.215	3.215
DIRECT FIXED COST	0.0	0.0	0.0	19.938	19.938	19.938	19.938	19.938	19.938	19.938
CASH FACTORY COST	0.0	0.0	0.0	50.967	58.725	58.725	58.725	58.725	58.725	58.725
DEPRECIABLE ASSETS (PLANT)	0.0	0.0	0.0	30.318	30.318	30.318	30.318	30.318	30.318	30.318
PRE-OPERATIONAL EXPENSES	0.0	0.0	0.0	0.346	0.346	0.346	0.346	0.346	0.346	0.346
INTEREST DRG CONST.	0.0	0.0	0.0	1.368	1.368	1.368	1.368	1.368	1.368	1.368
DEPRECIATION AND AMORTIZATION	0.0	0.0	0.0	32.033	32.033	32.033	32.033	32.033	32.033	32.033
TOTAL FACTORY COST	0.0	0.0	0.0	83.000	90.757	90.757	90.757	90.757	90.757	90.757
UNIT FACTORY COST	0.0	0.0	0.0	122.0586	106.7732	106.7732	106.7732	106.7732	106.7732	106.7732
SALES EXPENSES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
INTEREST ON LONG TERM DEBT	0.0	0.0	0.0	22.982	21.833	20.684	19.534	18.385	17.236	16.087
INTEREST ON SHORT TERM DEBT	0.0	0.0	0.0	0.0	0.463	0.193	0.000	0.000	0.000	0.000
TOTAL PRODUCTION COST	0.0	0.0	0.0	105.982	113.053	111.633	110.292	109.143	107.994	106.844
UNIT PRODUCTION COST	0.0	0.0	0.0	155.8552	133.0031	131.3334	129.7549	128.4031	127.0512	125.6993

*** COKE PLANT PROJECT IN VENEZUELA ***
PRODUCTION COST STATEMENTS
- ALT. CASE (DOMESTIC COAL INC.BOYACA) - (US$. MILLION)

YEAR	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
BF COKE PRODUCTION (1000TPY)	850.000	850.000	850.000	850.000	850.000	850.000	850.000	850.000	850.000	850.000
RAW MATERIAL COST	40.226	40.226	40.226	40.226	40.226	40.226	40.226	40.226	40.226	40.226
DOMESTIC COAL	28.393	28.393	28.393	28.393	28.393	28.393	28.393	28.393	28.393	28.393
IMPORTED COAL (BOYACA)	11.833	11.833	11.833	11.833	11.833	11.833	11.833	11.833	11.833	11.833
IMPORTED COAL (U.S.A)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COKE OVEN GAS	2.983	2.983	2.983	2.983	2.983	2.983	2.983	2.983	2.983	2.983
UTILITIES COST	0.897	0.897	0.897	0.897	0.897	0.897	0.897	0.897	0.897	0.897
ELECTRICITY	0.797	0.797	0.797	0.797	0.797	0.797	0.797	0.797	0.797	0.797
WATER	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099
CAT/CHEM	1.304	1.304	1.304	1.304	1.304	1.304	1.304	1.304	1.304	1.304
CREDITS OF BY-PRODUCTS	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622
COKE OVEN GAS	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622	-6.622
VARIABLE COST	38.787	38.787	38.787	38.787	38.787	38.787	38.787	38.787	38.787	38.787
EMPLOYMENT COST	6.115	6.115	6.115	6.115	6.115	6.115	6.115	6.115	6.115	6.115
LABOUR COST	4.077	4.077	4.077	4.077	4.077	4.077	4.077	4.077	4.077	4.077
OVERHEAD	2.038	2.038	2.038	2.038	2.038	2.038	2.038	2.038	2.038	2.038
MAINTENANCE COST	10.607	10.607	10.607	10.607	10.607	10.607	10.607	10.607	10.607	10.607
TAX & INSURANCE	3.215	3.215	3.215	3.215	3.215	3.215	3.215	3.215	3.215	3.215
DIRECT FIXED COST	19.938	19.938	19.938	19.938	19.938	19.938	19.938	19.938	19.938	19.938
CASH FACTORY COST	58.725	58.725	58.725	58.725	58.725	58.725	58.725	58.725	58.725	58.725
DEPRECIABLE ASSETS (PLANT)	30.318	30.318	30.318	30.318	30.318	30.318	30.318	30.318	30.318	30.318
PRE-OPERATIONAL EXPENSES	0.346	0.346	0.346	0.346	0.346	0.346	0.346	0.346	0.346	0.346
INTEREST DRG CONST.	1.368	1.368	1.368	1.368	1.368	1.368	1.368	1.368	1.368	1.368
DEPRECIATION AND AMORTIZATION	32.033	32.033	32.033	32.033	32.033	32.033	32.033	32.033	32.033	32.033
TOTAL FACTORY COST	90.757	90.757	90.757	90.757	90.757	90.757	90.757	90.757	90.757	90.757
UNIT FACTORY COST	106.7732	106.7732	106.7732	106.7732	106.7732	106.7732	106.7732	106.7732	106.7732	106.7732
SALES EXPENSES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
INTEREST ON LONG TERM DEBT	14.938	13.789	12.640	11.491	10.342	9.193	8.044	6.895	5.745	4.596
INTEREST ON SHORT TERM DEBT	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL PRODUCTION COST	105.695	104.546	103.397	102.248	101.099	99.950	98.801	97.652	96.503	95.354
UNIT PRODUCTION COST	124.3475	122.9956	121.6437	120.2919	118.9400	117.5882	116.2363	114.8844	113.5326	112.1807

*** COKE PLANT PROJECT IN VENEZUELA ***
PRODUCTION COST STATEMENTS
- ALT. CASE (DOMESTIC COAL INC.BOYACA) - (US$, MILLION)

YEAR	2015	2016	2017
BF COKE PRODUCTION (1000TPY)	850.000	850.000	850.000
RAW MATERIAL COST	40.226	40.226	40.226
DOMESTIC COAL	28.393	28.393	28.393
IMPORTED COAL (BOYACA)	11.833	11.833	11.833
IMPORTED COAL (U.S.A)	0.0	0.0	0.0
COKE OVEN GAS	2.983	2.983	2.983
UTILITIES COST	0.897	0.897	0.897
ELECTRICITY	0.797	0.797	0.797
WATER	0.099	0.099	0.099
CAT/CHEM	1.304	1.304	1.304
CREDITS OF BY-PRODUCTS	-6.622	-6.622	-6.622
COKE OVEN GAS	-6.622	-6.622	-6.622
VARIABLE COST	38.787	38.787	38.787
EMPLOYMENT COST	6.115	6.115	6.115
LABOUR COST	4.077	4.077	4.077
OVERHEAD	2.038	2.038	2.038
MAINTENANCE COST	10.607	10.607	10.607
TAX & INSURANCE	3.215	3.215	3.215
DIRECT FIXED COST	19.938	19.938	19.938
CASH FACTORY COST	58.725	58.725	58.725
DEPRECIABLE ASSETS (PLANT)	30.318	30.318	30.318
PRE-OPERATIONAL EXPENSES	0.346	0.346	0.346
INTEREST DRG CONST.	1.368	1.368	1.368
DEPRECIATION AND AMORTIZATION	32.033	32.033	32.033
TOTAL FACTORY COST	90.757	90.757	90.757
UNIT FACTORY COST	106.7732	106.7732	106.7732
SALES EXPENSES	0.0	0.0	0.0
INTEREST ON LONG TERM DEBT	3.447	2.298	1.149
INTEREST ON SHORT TERM DEBT	0.000	0.000	0.000
TOTAL PRODUCTION COST	94.205	93.055	91.906
UNIT PRODUCTION COST	110.8288	109.4770	108.1251

*** COKE PLANT PROJECT IN VENEZUELA ***
WORKING CAPITAL STATEMENTS
- ALT. CASE (DOMESTIC COAL INC.BOYACA) - (US$, MILLION)

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
CURRENT ASSETS	0.0	0.0	0.0	19.625	23.803	24.043	24.043	24.043	24.043	24.043
ACCOUNT RECEIVABLE	0.0	0.0	0.0	6.691	9.327	9.568	9.568	9.568	9.568	9.568
INVENTORIES	0.0	0.0	0.0	12.934	14.476	14.476	14.476	14.476	14.476	14.476
PRODUCT INVENTORY	0.0	0.0	0.0	10.804	11.814	11.814	11.814	11.814	11.814	11.814
PRODUCT INVENTORY (BF COKE)	0.0	0.0	0.0	9.161	10.017	10.017	10.017	10.017	10.017	10.017
PRODUCT INVENTORY (BREEZE)	0.0	0.0	0.0	0.242	0.265	0.265	0.265	0.265	0.265	0.265
PRODUCT INVENTORY (TAR)	0.0	0.0	0.0	0.176	0.193	0.193	0.193	0.193	0.193	0.193
PRODUCT INVENTORY (BENZENE)	0.0	0.0	0.0	1.162	1.271	1.271	1.271	1.271	1.271	1.271
PRODUCT INVENTORY (SULFATE)	0.0	0.0	0.0	0.062	0.068	0.068	0.068	0.068	0.068	0.068
MATERIAL INVENTORY	0.0	0.0	0.0	2.130	2.662	2.662	2.662	2.662	2.662	2.662
DOMESTIC COAL INVENTORY	0.0	0.0	0.0	0.947	1.183	1.183	1.183	1.183	1.183	1.183
IMPORTED COAL INVENTORY	0.0	0.0	0.0	1.183	1.479	1.479	1.479	1.479	1.479	1.479
OPERATING CASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CURRENT LIABILITIES W/O DEBT	0.0	0.0	0.0	2.586	3.232	3.232	3.232	3.232	3.232	3.232
ACCOUNT PAYABLE	0.0	0.0	0.0	2.586	3.232	3.232	3.232	3.232	3.232	3.232
PERMANENT WORKING CAPITAL	0.0	0.0	0.0	17.039	20.571	20.811	20.811	20.811	20.811	20.811
CHANGE IN WORKING CAPITAL	0.0	0.0	0.0	17.039	3.531	0.241	0.0	0.0	0.0	0.0

*** COKE PLANT PROJECT IN VENEZUELA ***
WORKING CAPITAL STATEMENTS
- ALT. CASE (DOMESTIC COAL INC.BOYACA) - (US$. MILLION)

YEAR	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CURRENT ASSETS	24.043	24.043	24.043	24.043	24.043	24.043	24.043	24.043	24.043	24.043
ACCOUNT RECEIVABLE	9.568	9.568	9.568	9.568	9.568	9.568	9.568	9.568	9.568	9.568
INVENTORIES	14.476	14.476	14.476	14.476	14.476	14.476	14.476	14.476	14.476	14.476
PRODUCT INVENTORY	11.814	11.814	11.814	11.814	11.814	11.814	11.814	11.814	11.814	11.814
PRODUCT INVENTORY (BF COKE)	10.017	10.017	10.017	10.017	10.017	10.017	10.017	10.017	10.017	10.017
PRODUCT INVENTORY (BREEZE)	0.265	0.265	0.265	0.265	0.265	0.265	0.265	0.265	0.265	0.265
PRODUCT INVENTORY (TAR)	0.193	0.193	0.193	0.193	0.193	0.193	0.193	0.193	0.193	0.193
PRODUCT INVENTORY (BENZENE)	1.271	1.271	1.271	1.271	1.271	1.271	1.271	1.271	1.271	1.271
PRODUCT INVENTORY (SULFATE)	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068
MATERIAL INVENTORY	2.662	2.662	2.662	2.662	2.662	2.662	2.662	2.662	2.662	2.662
DOMESTIC COAL INVENTORY	1.183	1.183	1.183	1.183	1.183	1.183	1.183	1.183	1.183	1.183
IMPORTED COAL INVENTORY	1.479	1.479	1.479	1.479	1.479	1.479	1.479	1.479	1.479	1.479
OPERATING CASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CURRENT LIABILITIES W/O DEBT	3.232	3.232	3.232	3.232	3.232	3.232	3.232	3.232	3.232	3.232
ACCOUNT PAYABLE	3.232	3.232	3.232	3.232	3.232	3.232	3.232	3.232	3.232	3.232
PERMANENT WORKING CAPITAL	20.811	20.811	20.811	20.811	20.811	20.811	20.811	20.811	20.811	20.811
CHANGE IN WORKING CAPITAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

*** COKE PLANT PROJECT IN VENEZUELA ***
WORKING CAPITAL STATEMENTS
- ALT. CASE (DOMESTIC COAL INC.BOYACA) - (US$, MILLION)

YEAR	2015	2016	2017
CURRENT ASSETS	24.043	24.043	24.043
ACCOUNT RECEIVABLE	9.568	9.568	9.568
INVENTORIES	14.476	14.476	14.476
PRODUCT INVENTORY	11.814	11.814	11.814
PRODUCT INVENTORY (BF COKE)	10.017	10.017	10.017
PRODUCT INVENTORY (BREEZE)	0.265	0.265	0.265
PRODUCT INVENTORY (TAR)	0.193	0.193	0.193
PRODUCT INVENTORY (BENZENE)	1.271	1.271	1.271
PRODUCT INVENTORY (SULFATE)	0.068	0.068	0.068
MATERIAL INVENTORY	2.662	2.662	2.662
DOMESTIC COAL INVENTORY	1.183	1.183	1.183
IMPORTED COAL INVENTORY	1.479	1.479	1.479
OPERATING CASH	0.0	0.0	0.0
CURRENT LIABILITIES W/O DEBT	3.232	3.232	3.232
ACCOUNT PAYABLE	3.232	3.232	3.232
PERMANENT WORKING CAPITAL	20.811	20.811	20.811
CHANGE IN WORKING CAPITAL	0.0	0.0	0.0

*** COKE PLANT PROJECT IN VENEZUELA *** PAGE 1
INCOME STATEMENTS
- ALT. CASE (DOMESTIC COAL INC.BOYACA) - (US$, MILLION)

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
OPERATING INCOME	0.0	0.0	0.0	80.300	111.928	114.816	114.816	114.816	114.816	114.816
TOTAL SALES REVENUE	0.0	0.0	0.0	80.300	111.928	114.816	114.816	114.816	114.816	114.816
COST OF SALES	0.0	0.0	0.0	72.196	89.748	90.757	90.757	90.757	90.757	90.757
VARIABLE COST	0.0	0.0	0.0	31.030	38.787	38.787	38.787	38.787	38.787	38.787
DIRECT FIXED COST	0.0	0.0	0.0	19.938	19.938	19.938	19.938	19.938	19.938	19.938
DEPRECIATION AND AMORTIZATION	0.0	0.0	0.0	32.033	32.033	32.033	32.033	32.033	32.033	32.033
INC. IN PRODUCT INVENTORY	0.0	0.0	0.0	10.804	1.010	0.0	0.0	0.0	0.0	0.0
GROSS PROFIT ON SALES	0.0	0.0	0.0	8.104	22.180	24.058	24.058	24.058	24.058	24.058
SALES EXPENSES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OPERATING PROFIT	0.0	0.0	0.0	8.104	22.180	24.058	24.058	24.058	24.058	24.058
NON-OPERATING EXPENSES	0.0	0.0	0.0	22.982	22.295	20.876	19.534	18.385	17.236	16.087
INTEREST ON LONG TERM DEBT	0.0	0.0	0.0	22.982	21.833	20.684	19.534	18.385	17.236	16.087
INTEREST ON SHORT TERM DEBT	0.0	0.0	0.0	0.0	0.463	0.193	0.000	0.000	0.000	0.000
NET PROFIT OR (LOSS) BEFORE TAX	0.0	0.0	0.0	-14.878	-0.115	3.182	4.524	5.673	6.822	7.971
INCOME TAX	0.0	0.0	0.0	0.0	0.0	0.955	1.357	1.702	2.047	2.391
NET PROFIT OR (LOSS) AFTER TAX	0.0	0.0	0.0	-14.878	-0.115	2.228	3.167	3.971	4.775	5.580
DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RETAINED EARNINGS	0.0	0.0	0.0	-14.878	-0.115	2.228	3.167	3.971	4.775	5.580

*** COKE PLANT PROJECT IN VENEZUELA ***
INCOME STATEMENTS
- ALT. CASE (DOMESTIC COAL INC.BOYACA) - (US$, MILLION)

YEAR	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
OPERATING INCOME	114.816	114.816	114.816	114.816	114.816	114.816	114.816	114.816	114.816	114.816
TOTAL SALES REVENUE	114.816	114.816	114.816	114.816	114.816	114.816	114.816	114.816	114.816	114.816
COST OF SALES	90.757	90.757	90.757	90.757	90.757	90.757	90.757	90.757	90.757	90.757
VARIABLE COST	38.787	38.787	38.787	38.787	38.787	38.787	38.787	38.787	38.787	38.787
DIRECT FIXED COST	19.938	19.938	19.938	19.938	19.938	19.938	19.938	19.938	19.938	19.938
DEPRECIATION AND AMORTIZATION	32.033	32.033	32.033	32.033	32.033	32.033	32.033	32.033	32.033	32.033
INC. IN PRODUCT INVENTORY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GROSS PROFIT ON SALES	24.058	24.058	24.058	24.058	24.058	24.058	24.058	24.058	24.058	24.058
SALES EXPENSES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OPERATING PROFIT	24.058	24.058	24.058	24.058	24.058	24.058	24.058	24.058	24.058	24.058
NON-OPERATING EXPENSES	14.938	13.789	12.640	11.491	10.342	9.193	8.044	6.895	5.745	4.596
INTEREST ON LONG TERM DEBT	14.938	13.789	12.640	11.491	10.342	9.193	8.044	6.895	5.745	4.596
INTEREST ON SHORT TERM DEBT	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NET PROFIT OR (LOSS) BEFORE TAX	9.120	10.269	11.418	12.568	13.717	14.866	16.015	17.164	18.313	19.462
INCOME TAX	2.736	3.081	3.426	3.770	4.115	4.460	4.804	5.149	5.494	5.839
NET PROFIT OR (LOSS) AFTER TAX	6.384	7.189	7.993	8.797	9.602	10.406	11.210	12.015	12.819	13.623
DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RETAINED EARNINGS	6.384	7.189	7.993	8.797	9.602	10.406	11.210	12.015	12.819	13.623

*** COKE PLANT PROJECT IN VENEZUELA ***
INCOME STATEMENTS
- ALT. CASE (DOMESTIC COAL INC.BOYACA) - (US$, MILLION)

YEAR	2015	2016	2017
OPERATING INCOME	114.816	114.816	114.816
TOTAL SALES REVENUE	114.816	114.816	114.816
COST OF SALES	90.757	90.757	90.757
VARIABLE COST	38.787	38.787	38.787
DIRECT FIXED COST	19.938	19.938	19.938
DEPRECIATION AND AMORTIZATION	32.033	32.033	32.033
INC. IN PRODUCT INVENTORY	0.0	0.0	0.0
GROSS PROFIT ON SALES	24.058	24.058	24.058
SALES EXPENSES	0.0	0.0	0.0
OPERATING PROFIT	24.058	24.058	24.058
NON-OPERATING EXPENSES	3.447	2.298	1.149
INTEREST ON LONG TERM DEBT	3.447	2.298	1.149
INTEREST ON SHORT TERM DEBT	0.000	0.000	0.000
NET PROFIT OR (LOSS) BEFORE TAX	20.611	21.760	22.909
INCOME TAX	6.183	6.528	6.873
NET PROFIT OR (LOSS) AFTER TAX	14.428	15.232	16.036
DIVIDENDS	0.0	0.0	0.0
RETAINED EARNINGS	14.428	15.232	16.036

*** COKE PLANT PROJECT IN VENEZUELA ***
FUNDS FLOW STATEMENTS
- ALT. CASE (DOMESTIC COAL INC.BOYACA) - (US$, MILLION)

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
SOURCE OF FUNDS	65.662	328.310	262.648	49.393	58.065	55.136	54.734	54.389	54.044	53.699
CASH GENERATED FROM OPERATION	0.0	0.0	0.0	40.137	54.213	55.136	54.734	54.389	54.044	53.699
PROFIT AFT. TAX, BFR INT.	0.0	0.0	0.0	8.104	22.180	23.104	22.701	22.356	22.012	21.667
DEPRECIATION AND AMORTIZATION	0.0	0.0	0.0	32.033	32.033	32.033	32.033	32.033	32.033	32.033
FINANCIAL RESOURCES	65.662	328.310	262.648	9.256	3.852	0.0	0.0	0.0	0.0	0.0
SHARE CAPITAL	19.699	98.493	78.794	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LONG TERM DEBT	45.963	229.817	183.854	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SHORT TERM DEBT	0.0	0.0	0.0	9.256	3.852	0.0	0.0	0.0	0.0	0.0
USES OF FUNDS	64.301	321.505	257.204	63.003	58.065	47.950	42.516	41.367	40.218	39.069
FIXED CAPITAL EXPENDITURE	64.301	321.505	257.204	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NON-DEPRECIABLE ASSETS	0.236	1.180	0.944	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DEPRECIABLE FIXED ASSETS	61.328	306.640	245.312	0.0	0.0	0.0	0.0	0.0	0.0	0.0
INTEREST DURING CONSTRUCTION	2.737	13.685	10.948	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHANGE IN WORKING CAPITAL	0.0	0.0	0.0	17.039	3.531	0.241	0.0	0.0	0.0	0.0
DEBT SERVICES	0.0	0.0	0.0	45.963	54.533	47.710	42.516	41.367	40.218	39.069
REPAYMENT OF LONG TERM DEBT	0.0	0.0	0.0	22.982	22.982	22.982	22.982	22.982	22.982	22.982
REPAYMENT OF SHORT TERM DEBT	0.0	0.0	0.0	0.0	9.256	3.852	0.0	0.0	0.0	0.0
INTEREST ON LONG TERM DEBT	0.0	0.0	0.0	22.982	21.833	20.684	19.534	18.385	17.236	16.087
INTEREST ON SHORT TERM DEBT	0.0	0.0	0.0	0.0	0.463	0.193	0.000	0.000	0.000	0.000
DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CASH INCREASE OR (DECREASE)	1.361	6.805	5.444	-13.610	0.0	7.186	12.218	13.022	13.826	14.631
BEGINNING CASH BALANCE	0.0	1.361	8.166	13.610	0.0	0.0	7.186	19.403	32.425	46.251
ENDING CASH BALANCE	1.361	8.166	13.610	0.0	0.0	7.186	19.403	32.425	46.251	60.882

*** COKE PLANT PROJECT IN VENEZUELA ***
FUNDS FLOW STATEMENTS
- ALT. CASE (DOMESTIC COAL INC.BOYACA) - (US$. MILLION)

YEAR	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
SOURCE OF FUNDS	53.355	53.010	52.665	52.321	51.976	51.631	51.286	50.942	50.597	50.252
CASH GENERATED FROM OPERATION	53.355	53.010	52.665	52.321	51.976	51.631	51.286	50.942	50.597	50.252
PROFIT AFT. TAX, BFR INT.	21.322	20.978	20.633	20.288	19.943	19.599	19.254	18.909	18.564	18.220
DEPRECIATION AND AMORTIZATION	32.033	32.033	32.033	32.033	32.033	32.033	32.033	32.033	32.033	32.033
FINANCIAL RESOURCES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SHARE CAPITAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LONG TERM DEBT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SHORT TERM DEBT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
USES OF FUNDS	37.920	36.771	35.622	34.473	33.323	32.174	31.025	29.876	28.727	27.578
FIXED CAPITAL EXPENDITURE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NON-DEPRECIABLE ASSETS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DEPRECIABLE FIXED ASSETS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
INTEREST DURING CONSTRUCTION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHANGE IN WORKING CAPITAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DEBT SERVICES	37.920	36.771	35.622	34.473	33.323	32.174	31.025	29.876	28.727	27.578
REPAYMENT OF LONG TERM DEBT	22.982	22.982	22.982	22.982	22.982	22.982	22.982	22.982	22.982	22.982
REPAYMENT OF SHORT TERM DEBT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
INTEREST ON LONG TERM DEBT	14.938	13.789	12.640	11.491	10.342	9.193	8.044	6.895	5.745	4.596
INTEREST ON SHORT TERM DEBT	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CASH INCREASE OR (DECREASE)	15.435	16.239	17.044	17.848	18.652	19.457	20.261	21.066	21.870	22.674
BEGINNING CASH BALANCE	60.882	76.317	92.556	109.600	127.448	146.101	165.557	185.819	206.884	228.754
ENDING CASH BALANCE	76.317	92.556	109.600	127.448	146.101	165.557	185.819	206.884	228.754	251.428

*** COKE PLANT PROJECT IN VENEZUELA ***
FUNDS FLOW STATEMENTS
- ALT. CASE (DOMESTIC COAL INC.BOYACA) - (US$, MILLION)

YEAR	2015	2016	2017
SOURCE OF FUNDS	49.908	49.563	49.218
CASH GENERATED FROM OPERATION	49.908	49.563	49.218
PROFIT AFT. TAX, BFR INT.	17.875	17.530	17.186
DEPRECIATION AND AMORTIZATION	32.033	32.033	32.033
FINANCIAL RESOURCES	0.0	0.0	0.0
SHARE CAPITAL	0.0	0.0	0.0
LONG TERM DEBT	0.0	0.0	0.0
SHORT TERM DEBT	0.0	0.0	0.0
USES OF FUNDS	26.429	25.280	24.131
FIXED CAPITAL EXPENDITURE	0.0	0.0	0.0
NON-DEPRECIABLE ASSETS	0.0	0.0	0.0
DEPRECIABLE FIXED ASSETS	0.0	0.0	0.0
INTEREST DURING CONSTRUCTION	0.0	0.0	0.0
CHANGE IN WORKING CAPITAL	0.0	0.0	0.0
DEBT SERVICES	26.429	25.280	24.131
REPAYMENT OF LONG TERM DEBT	22.982	22.982	22.982
REPAYMENT OF SHORT TERM DEBT	0.0	0.0	0.0
INTEREST ON LONG TERM DEBT	3.447	2.298	1.149
INTEREST ON SHORT TERM DEBT	0.000	0.000	0.000
DIVIDENDS	0.0	0.0	0.0
CASH INCREASE OR (DECREASE)	23.479	24.283	25.087
BEGINNING CASH BALANCE	251.428	274.907	299.190
ENDING CASH BALANCE	274.907	299.190	324.277

*** COKE PLANT PROJECT IN VENEZUELA *** PAGE 1

BALANCE SHEET

- ALT. CASE (DOMESTIC COAL INC.BOYACA) - (US$. MILLION)

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
ASSETS	65.662	393.972	656.620	630.603	602.748	578.142	558.327	539.316	521.110	503.708
CURRENT ASSETS	0.0	0.0	0.0	19.625	23.803	24.043	24.043	24.043	24.043	24.043
OPERATING CASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ACCOUNT RECEIVABLE	0.0	0.0	0.0	6.691	9.327	9.568	9.568	9.568	9.568	9.568
INVENTORIES	0.0	0.0	0.0	12.934	14.476	14.476	14.476	14.476	14.476	14.476
ACC. EXCESS CASH	1.361	8.166	13.610	0.0	0.0	7.186	19.403	32.425	46.251	60.682
NET FIXED ASSETS	64.301	385.806	643.010	610.978	578.945	546.913	514.880	482.848	450.815	418.783
INVESTMENT	64.301	385.806	643.010	643.010	643.010	643.010	643.010	643.010	643.010	643.010
NON-DEPR. ASSETS	0.236	1.416	2.360	2.360	2.360	2.360	2.360	2.360	2.360	2.360
DEPRECIABLE ASSETS	61.328	367.968	613.280	613.280	613.280	613.280	613.280	613.280	613.280	613.280
AMORTIZATION	2.737	16.422	27.370	27.370	27.370	27.370	27.370	27.370	27.370	27.370
LESS: ACC. DEPRECIATION	0.0	0.0	0.0	32.033	64.065	96.098	128.130	160.163	192.195	224.228
LIABILITIES	45.963	275.780	459.634	448.494	420.755	393.921	370.939	347.958	324.976	301.994
CURRENT LIABILITIES	0.0	0.0	22.982	34.824	30.066	26.214	26.214	26.214	26.214	26.214
ACCOUNT PAYABLE	0.0	0.0	0.0	2.586	3.232	3.232	3.232	3.232	3.232	3.232
CURRENT PORTION OF L/T DEBT	0.0	0.0	22.982	22.982	22.982	22.982	22.982	22.982	22.982	22.982
SHORT TERM DEBT	0.0	0.0	0.0	9.256	3.852	0.0	0.0	0.0	0.0	0.0
FIXED LIABILITIES	45.963	275.780	436.652	413.671	390.689	367.707	344.726	321.744	298.762	275.780
LONG TERM DEBT BALANCE	45.963	275.780	436.652	413.671	390.689	367.707	344.726	321.744	298.762	275.780
OTHER FIXED LIABILITIES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
STOCK HOLDERS EQUITY	19.699	118.192	196.986	182.108	181.993	184.221	187.387	191.358	196.134	201.714
SHARE CAPITAL	19.699	118.192	196.986	196.986	196.986	196.986	196.986	196.986	196.986	196.986
ACC. RETAINED EARNINGS	0.0	0.0	0.0	-14.878	-14.993	-12.765	-9.599	-5.628	-0.852	4.728
LIABILITIES & S/H EQUITY	65.662	393.972	656.620	630.603	602.748	578.142	558.327	539.316	521.110	503.708

*** COKE PLANT PROJECT IN VENEZUELA ***
BALANCE SHEET
- ALT. CASE (DOMESTIC COAL INC.BOYACA) - (US$, MILLION)

YEAR	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
ASSETS	487.111	471.317	456.329	442.144	428.764	416.188	404.417	393.450	383.287	373.929
CURRENT ASSETS	24.043	24.043	24.043	24.043	24.043	24.043	24.043	24.043	24.043	24.043
OPERATING CASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ACCOUNT RECEIVABLE	9.568	9.568	9.568	9.568	9.568	9.568	9.568	9.568	9.568	9.568
INVENTORIES	14.476	14.476	14.476	14.476	14.476	14.476	14.476	14.476	14.476	14.476
ACC. EXCESS CASH	75.317	92.556	109.600	127.448	146.101	165.557	185.819	206.884	228.754	251.428
NET FIXED ASSETS	386.750	354.718	322.685	290.653	258.620	226.588	194.555	162.523	130.490	98.458
INVESTMENT	643.010	643.010	643.010	643.010	643.010	643.010	643.010	643.010	643.010	643.010
NON-DEPR. ASSETS	2.360	2.360	2.360	2.360	2.360	2.360	2.360	2.360	2.360	2.360
DEPRECIABLE ASSETS	613.280	613.280	613.280	613.280	613.280	613.280	613.280	613.280	613.280	613.280
AMORTIZATION	27.370	27.370	27.370	27.370	27.370	27.370	27.370	27.370	27.370	27.370
LESS: ACC. DEPRECIATION	256.260	288.293	320.325	352.358	384.390	416.423	448.455	480.488	512.520	544.553
LIABILITIES	279.013	256.031	233.049	210.068	187.086	164.104	141.122	118.141	95.159	72.177
CURRENT LIABILITIES	26.214	26.214	26.214	26.214	26.214	26.214	26.214	26.214	26.214	26.214
ACCOUNT PAYABLE	3.232	3.232	3.232	3.232	3.232	3.232	3.232	3.232	3.232	3.232
CURRENT PORTION OF L/T DEBT	22.982	22.982	22.982	22.982	22.982	22.982	22.982	22.982	22.982	22.982
SHORT TERM DEBT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FIXED LIABILITIES	252.799	229.817	206.835	183.854	160.872	137.890	114.909	91.927	68.945	45.964
LONG TERM DEBT BALANCE	252.799	229.817	206.835	183.854	160.872	137.890	114.909	91.927	68.945	45.964
OTHER FIXED LIABILITIES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
STOCK HOLDERS EQUITY	208.098	215.286	223.279	232.077	241.678	252.084	263.295	275.309	288.128	301.752
SHARE CAPITAL	196.986	196.986	196.986	196.986	196.986	196.986	196.986	196.986	196.986	196.986
ACC. RETAINED EARNINGS	11.112	18.300	26.293	35.091	44.692	55.098	66.308	78.323	91.142	104.766
LIABILITIES & S/H EQUITY	487.111	471.317	456.329	442.144	428.764	416.188	404.417	393.450	383.287	373.929

*** COKE PLANT PROJECT IN VENEZUELA ***
BALANCE SHEET
- ALT. CASE (DOMESTIC COAL INC.BOYACA) - (US$, MILLION)

YEAR	2015	2016	2017
ASSETS	365.375	357.626	350.680
CURRENT ASSETS	24.043	24.043	24.043
OPERATING CASH	0.0	0.0	0.0
ACCOUNT RECEIVABLE	9.568	9.568	9.568
INVENTORIES	14.476	14.476	14.476
ACC. EXCESS CASH	274.907	299.190	324.277
NET FIXED ASSETS	66.425	34.393	2.360
INVESTMENT	643.010	643.010	643.010
NON-DEPR. ASSETS	2.360	2.360	2.360
DEPRECIABLE ASSETS	613.280	613.280	613.280
AMORTIZATION	27.370	27.370	27.370
LESS: ACC. DEPRECIATION	576.585	608.618	640.650
LIABILITIES	49.196	26.214	3.232
CURRENT LIABILITIES	26.214	26.214	3.232
ACCOUNT PAYABLE	3.232	3.232	3.232
CURRENT PORTION OF L/T DEBT	22.982	22.982	0.0
SHORT TERM DEBT	0.0	0.0	0.0
FIXED LIABILITIES	22.982	0.000	0.000
LONG TERM DEBT BALANCE	22.982	0.000	0.000
OTHER FIXED LIABILITIES	0.0	0.0	0.0
STOCK HOLDERS EQUITY	316.179	331.412	347.448
SHARE CAPITAL	196.986	196.986	196.986
ACC. RETAINED EARNINGS	119.193	134.426	150.462
LIABILITIES & S/H EQUITY	365.375	357.626	350.680

*** COKE PLANT PROJECT IN VENEZUELA ***
LONG TERM DEBT
- ALT. CASE (DOMESTIC COAL INC.BOYACA) - (US$, MILLION)

AMOUNT OF DEBT 459.634

INTEREST RATE 5.000 PER CENT/YEAR

REPAYMENT 20 YEAR-EQUAL-INSTALLMENT-REPAYMENT (ANNUAL REPAYMENT)

YEAR	SER.NO	PRINCIPAL	INTEREST	DEBT SERVICE	BALANCE AFT. PAYMENT
1995	1	0.0	0.0	0.0	45.963
1996	2	0.0	0.0	0.0	275.780
1997	3	0.0	0.0	0.0	459.634
1998	4	22.982	22.982	45.963	436.652
1999	5	22.982	21.833	44.814	413.670
2000	6	22.982	20.684	43.665	390.689
2001	7	22.982	19.534	42.516	367.707
2002	8	22.982	18.385	41.367	344.725
2003	9	22.982	17.236	40.218	321.744
2004	10	22.982	16.087	39.069	298.762
2005	11	22.982	14.938	37.920	275.780
2006	12	22.982	13.789	36.771	252.799
2007	13	22.982	12.640	35.622	229.817
2008	14	22.982	11.491	34.473	206.835
2009	15	22.982	10.342	33.323	183.854
2010	16	22.982	9.193	32.174	160.872
2011	17	22.982	8.044	31.025	137.890
2012	18	22.982	6.895	29.876	114.908
2013	19	22.982	5.745	28.727	91.927
2014	20	22.982	4.596	27.578	68.945
2015	21	22.982	3.447	26.429	45.963
2016	22	22.982	2.298	25.280	22.982
2017	23	22.982	1.149	24.131	0.0
TOTAL		459.634	241.308	700.940	0.0

*** COKE PLANT PROJECT IN VENEZUELA ***
PROFITABILITY AND FINANCIAL INDICATORS
- ALT. CASE (DOMESTIC COAL INC.BOYACA) - (US$, MILLION)

YEAR	(1) AFT TAX PROFIT -TO- SALES REV (PCT)	(2) AFT TAX PROFIT -TO- S/H EQUITY (PCT)	(3) BFR TAX PROFIT -TO- INVESTMENT (PCT)	(4) AFT TAX PROFIT -TO- S/CAPITAL (PCT)	(5) CURRENT RATIO	(6) QUICK RATIO	(7) DEBT SERVICE RATIO	(8) L/T DEBT -TO- S/H EQUITY	(9)* PROFIT B.E.P. CAPACITY UTILIZE (PCT)	(10)* CASH B.E.P. SALES PRICE (PRICE)	(11)* CASH B.E.P. CAPACITY UTILIZE (PCT)
1998	-18.5	-8.2	-2.3	-7.6	0.56	0.19	0.87	69 / 31	121.7	162.9	91.0
1999	-0.1	-0.1	-0.0	-0.1	0.79	0.31	1.20	68 / 32	101.5	125.5	75.8
2000	1.9	1.2	0.5	1.1	0.92	0.36	1.26	67 / 33	95.8	120.7	71.3
2001	2.8	1.7	0.7	1.6	0.92	0.36	1.29	65 / 35	94.0	119.1	69.8
2002	3.5	2.1	0.9	2.0	0.92	0.36	1.31	63 / 37	92.5	117.8	68.5
2003	4.2	2.4	1.1	2.4	0.92	0.36	1.34	60 / 40	91.0	116.4	67.3
2004	4.9	2.8	1.2	2.8	0.92	0.36	1.37	58 / 42	89.5	115.1	66.0
2005	5.6	3.1	1.4	3.2	0.92	0.36	1.41	55 / 45	88.0	113.7	64.7
2006	6.3	3.3	1.6	3.6	0.92	0.36	1.44	52 / 48	86.5	112.3	63.4
2007	7.0	3.6	1.8	4.1	0.92	0.36	1.48	48 / 52	85.0	111.0	62.1
2008	7.7	3.8	2.0	4.5	0.92	0.36	1.52	44 / 56	83.5	109.6	60.8
2009	8.4	4.0	2.1	4.9	0.92	0.36	1.56	40 / 60	82.0	108.3	59.5
2010	9.1	4.1	2.3	5.3	0.92	0.36	1.60	35 / 65	80.4	106.9	58.3
2011	9.8	4.3	2.5	5.7	0.92	0.36	1.65	30 / 70	78.9	105.6	57.0
2012	10.5	4.4	2.7	6.1	0.92	0.36	1.71	25 / 75	77.4	104.2	55.7
2013	11.2	4.4	2.8	6.5	0.92	0.36	1.76	19 / 81	75.9	102.9	54.4
2014	11.9	4.5	3.0	6.9	0.92	0.36	1.82	13 / 87	74.4	101.5	53.1
2015	12.6	4.6	3.2	7.3	0.92	0.36	1.89	7 / 93	72.9	100.2	51.8
2016	13.3	4.6	3.4	7.7	0.92	0.36	1.96	0 / 100	71.4	98.8	50.6
2017	14.0	4.6	3.6	8.1	7.44	2.96	2.04	0 / 100	69.9	97.5	49.3
AVERAGE1	6.3	2.8	1.7	3.8	1.22	0.48	1.52	41 / 59	85.6	112.5	62.5
AVERAGE2	6.7	2.9	1.6	3.5	0.89	0.35	1.47	48 / 52			

(AVERAGE1) : SUM OF ANNUAL FIGURES OF PERCENTAGE AND RATIO IS DIVIDED BY NO. OF YEARS(SIMPLE AVERAGE)
(AVERAGE2) : AVERAGE FIGURES ARE CALCULATED BY ACTUAL VALUES ACCUMULATED OVER THE PROJECT LIFE(WEIGHTED AVERAGE)
* NOTE FOR (9)(10)(11)
WHEN THERE ARE TWO OR MORE PRODUCTS, AND DURING THE YEARS WHEN ALL OF PRODUCTS ARE NOT PRODUCED AT THE SAME RATE OF CAPACITY UTILIZATION, ABOVE BREAK-EVEN-POINTS CANNOT GIVE CORRECT FIGURES.

*** COKE PLANT PROJECT IN VENEZUELA ***
FINANCIAL RATE OF RETURN (IN '93 FIXED PRICE)
- ALT. CASE (DOMESTIC COAL INC.BOYACA) - (US$, MILLION)

YEAR	FIXED CAPITAL EXPEND.	CHANGE IN WORKING CAPITAL	(1) GROSS CAPITAL EXPENDTR	OPERATING PROFIT	DEPRECIATN	(2) GROSS CASH IN-FLOW	(3) INCOME TAX	(4) BFR-TAX NET IN-FLOW (2)-(1)	(5) AFT-TAX NET IN-FLOW (4)-(3)
1995	61.564	0.0	61.564	0.0	0.0	0.0	0.0	-61.564	-61.564
1996	307.820	0.0	307.820	0.0	0.0	0.0	0.0	-307.820	-307.820
1997	246.256	0.0	246.256	0.0	0.0	0.0	0.0	-246.256	-246.256
1998	0.0	17.039	17.039	8.104	32.033	40.137	0.0	23.097	23.097
1999	0.0	3.531	3.531	22.180	32.033	54.213	0.0	50.681	50.681
2000	0.0	0.241	0.241	24.058	32.033	56.091	0.955	55.850	54.896
2001	0.0	0.0	0.0	24.058	32.033	56.091	1.357	56.091	54.734
2002	0.0	0.0	0.0	24.058	32.033	56.091	1.702	56.091	54.389
2003	0.0	0.0	0.0	24.058	32.033	56.091	2.047	56.091	54.044
2004	0.0	0.0	0.0	24.058	32.033	56.091	2.391	56.091	53.699
2005	0.0	0.0	0.0	24.058	32.033	56.091	2.736	56.091	53.355
2006	0.0	0.0	0.0	24.058	32.033	56.091	3.081	56.091	53.010
2007	0.0	0.0	0.0	24.058	32.033	56.091	3.426	56.091	52.665
2008	0.0	0.0	0.0	24.058	32.033	56.091	3.770	56.091	52.321
2009	0.0	0.0	0.0	24.058	32.033	56.091	4.115	56.091	51.976
2010	0.0	0.0	0.0	24.058	32.033	56.091	4.460	56.091	51.631
2011	0.0	0.0	0.0	24.058	32.033	56.091	4.804	56.091	51.286
2012	0.0	0.0	0.0	24.058	32.033	56.091	5.149	56.091	50.942
2013	0.0	0.0	0.0	24.058	32.033	56.091	5.494	56.091	50.597
2014	0.0	0.0	0.0	24.058	32.033	56.091	5.839	56.091	50.252
2015	0.0	0.0	0.0	24.058	32.033	56.091	6.183	56.091	49.908
2016	0.0	0.0	0.0	24.058	32.033	56.091	6.528	56.091	49.563
2017	-2.360	-20.811	-23.171	24.058	32.033	56.091	6.873	79.262	72.389
	613.280	-0.000	613.279	463.332	640.650	1103.984	70.909	490.706	419.796

INTERNAL RATE OF RETURN

ON (4) BFR-TAX NET IN-FLOW (2)-(1) 5.54 PER CENT

ON (5) AFT-TAX NET IN-FLOW (4)-(3) 4.95 PER CENT

*** COKE PLANT PROJECT IN VENEZUELA ***
FOREIGN CURRENCY EARNINGS (IN '93 FIXED PRICE)
- ALT. CASE (DOMESTIC COAL INC.BOYACA) - (US$, MILLION)

YEAR	(1) IN-FLOW FROM SALES	ACC. IN-FLOW	IMPORT COAL & MATERIALS	INTEREST ON L/T	REPAYMENT ON L/T	(2) TOTAL OUT-FLOW	ACC. OUT-FLOW	(3) NET IN-FLOW (1)-(2)	ACC.NET IN-FLOW
1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	80.300	80.300	17.935	22.982	22.982	63.898	63.898	16.402	16.402
1999	111.928	192.228	20.562	21.833	22.982	65.376	129.274	46.551	62.953
2000	114.816	307.043	20.562	20.684	22.982	64.227	193.502	50.588	113.542
2001	114.816	421.859	20.562	19.534	22.982	63.078	256.580	51.737	165.279
2002	114.816	536.674	20.562	18.385	22.982	61.929	318.509	52.887	218.166
2003	114.816	651.490	20.562	17.236	22.982	60.780	379.289	54.036	272.201
2004	114.816	766.306	20.562	16.087	22.982	59.631	438.920	55.185	327.386
2005	114.816	881.121	20.562	14.938	22.982	58.482	497.401	56.334	383.719
2006	114.816	995.937	20.562	13.789	22.982	57.333	554.734	57.483	441.202
2007	114.816	1110.752	20.562	12.640	22.982	56.184	610.918	58.632	499.834
2008	114.816	1225.568	20.562	11.491	22.982	55.035	665.952	59.781	559.615
2009	114.816	1340.384	20.562	10.342	22.982	53.885	719.838	60.930	620.545
2010	114.816	1455.199	20.562	9.193	22.982	52.736	772.574	62.079	682.625
2011	114.816	1570.015	20.562	8.044	22.982	51.587	824.162	63.228	745.853
2012	114.816	1684.831	20.562	6.895	22.982	50.438	874.600	64.377	810.230
2013	114.816	1799.646	20.562	5.745	22.982	49.289	923.889	65.526	875.757
2014	114.816	1914.462	20.562	4.596	22.982	48.140	972.029	66.676	942.432
2015	114.816	2029.277	20.562	3.447	22.982	46.991	1019.020	67.825	1010.257
2016	114.816	2144.093	20.562	2.298	22.982	45.842	1064.862	68.974	1079.231
2017	114.816	2258.908	20.562	1.149	22.982	44.693	1109.555	70.123	1149.354
	2258.906		408.613	241.308	459.634	1109.553		1149.352	

(ECONOMIC) *** COKE PLANT PROJECT IN VENEZUELA ***
ECONOMIC RATE OF RETURN (IN '93 FIXED PRICE)
- ALT. CASE (DOMESTIC COAL INC.BOYACA) - (US$, MILLION)

YEAR	FIXED CAPITAL EXPEND.	CHANGE IN WORKING CAPITAL	(1) GROSS CAPITAL EXPENDTR	OPERATING PROFIT	DEPRECIATN	(2) GROSS CASH IN-FLOW	(3) INCOME TAX	(4) BFR-TAX NET IN-FLOW (2)-(1)	(5) AFT-TAX NET IN-FLOW (4)-(3)
1995	59.381	0.0	59.381	0.0	0.0	0.0	0.0	-59.381	-59.381
1996	296.905	0.0	296.905	0.0	0.0	0.0	0.0	-296.905	-296.905
1997	237.524	0.0	237.524	0.0	0.0	0.0	0.0	-237.524	-237.524
1998	0.0	16.488	16.488	11.789	29.572	41.362	0.0	24.874	24.874
1999	0.0	3.531	3.531	26.417	29.572	55.989	0.0	52.458	52.458
2000	0.0	0.241	0.241	28.295	29.572	57.868	0.0	57.627	57.627
2001	0.0	0.0	0.0	28.295	29.572	57.868	0.0	57.868	57.868
2002	0.0	0.0	0.0	28.295	29.572	57.868	0.0	57.868	57.868
2003	0.0	0.0	0.0	28.295	29.572	57.868	0.0	57.868	57.868
2004	0.0	0.0	0.0	28.295	29.572	57.868	0.0	57.868	57.868
2005	0.0	0.0	0.0	28.295	29.572	57.868	0.0	57.868	57.868
2006	0.0	0.0	0.0	28.295	29.572	57.868	0.0	57.868	57.868
2007	0.0	0.0	0.0	28.295	29.572	57.868	0.0	57.868	57.868
2008	0.0	0.0	0.0	28.295	29.572	57.868	0.0	57.868	57.868
2009	0.0	0.0	0.0	28.295	29.572	57.868	0.0	57.868	57.868
2010	0.0	0.0	0.0	28.295	29.572	57.868	0.0	57.868	57.868
2011	0.0	0.0	0.0	28.295	29.572	57.868	0.0	57.868	57.868
2012	0.0	0.0	0.0	28.295	29.572	57.868	0.0	57.868	57.868
2013	0.0	0.0	0.0	28.295	29.572	57.868	0.0	57.868	57.868
2014	0.0	0.0	0.0	28.295	29.572	57.868	0.0	57.868	57.868
2015	0.0	0.0	0.0	28.295	29.572	57.868	0.0	57.868	57.868
2016	0.0	0.0	0.0	28.295	29.572	57.868	0.0	57.868	57.868
2017	-2.360	-20.260	-22.620	28.295	29.572	57.868	0.0	80.487	80.487
	591.450	-0.000	591.449	547.516	591.447	1138.965	0.0	547.518	547.518

INTERNAL RATE OF RETURN

ON (4) BFR-TAX NET IN-FLOW (2)-(1) 6.27 PER CENT

ON (5) AFT-TAX NET IN-FLOW (4)-(3) 6.27 PER CENT

Annex-1 Utilization of Guasare Coal for Coke

Utilization of Guasare Coal for Coke

1. Forward

The study on Guasare coal produced from Zulia state is not the part of this feasibility study. However,strong requests from Corpozulia,one of counterpart of this study,the team studied Guasare coal using the sample provided from them on July 1993 and the result of the study is included in the main report. In here possible blending ratio of Guasare coal are shown using new data.

2. Property of New Guasare Coal

It was informed during second field survey that the coal sample provided from Corpozulia on July 1993 was weathered one. Therefore new sample were taken from the seam no.4 in the Guasare coal mine together with counterpart. This sample was analyzed at INZIT·CICASI for total sulfur content,dilatation measured by dilatometer,maximum fluidity by Gieseler plastometer and maceral analysis. In order to differentiate and clarify between new and old sample it is defined for convenience as;

Weathered coal..... The coal sample provided at July 1993
New coal ..... Coal sample collected and analyzed at Feb.1994

Table 1 show the comparison of the property value of the two.

Table 1 PROPERTY VALUES OF NEW GUASARE COAL

Sample	Ash (%, d.)	Volatile (%, d.)	Total Sulfur (%, d.)	Dilatation (%)	Fluidity (logD)	SI	CBI	CSR
New Guasare Coal	2.9	39.8	0.55	32	1.99	2.7	0.5	30 *
Weathered Guasare Coal	1.0	39.2	0.41	0	0.48	2.7	0.6	25 *

Note: * Estimated value

The new Guasare coal contains 39.8(%,d) volatile matters which is more or less the same as that of the weathered coal, and is classified as high-volatile coal.Coking capacity

indicate by 32% dilatation and fluidity of 1.99(LogDDPM),compared to 0% and 0.48(LogDDPM),respectively,for the weathered coal. From those data,the new Guasare coal is classified as high-volatile,weak coking coal. CSR in the Table is estimated at 30 from the result of maceral analysis.

3. Basic Conditions in Order to Estimate the Coke Quality

3.1 Basic Data

In order to determine the blending amounts with different coal,the data tabulated in Table-2 are used. For Guasare coal it is used the new data and others are quoted from main report.

Table 2 PROPERTY VALUES OF COALS USED FOR ESTIMATION OF COKE QUALITY

Name	Ash Content (%, d.)	Volatile Matter (%, d.)	Total Sulfur (%, d.)	Total Dilatation (%)	Fluidity (logD)	SI	CBI	CSR
FNO	7.6	23.2	0.85	124	2.96	5.06	2.39	70
LAS	3.9	37.9	0.59	203	4.10	2.86	0.85	41
HAT	1.7	31.8	1.15	310	4.31	3.75	0.78	45*
Boyaca	7.5	21.4	0.95	41	1.04	6.91	4.91	70
Pinnacle	5.6	16.7	0.76	42	0.60	7.28	5.66	47
Blue Cr.	8.9	25.4	0.85	239	3.60	4.60	0.63	60
Saraji	10.5	18.8	0.57	62	1.70	6.93	3.58	74
New-GUA	2.9	39.8	0.55	32	1.99	2.77	0.59	30*

* Estimated value

3.2 Target Quality Requirement

The target quality of the coke are set at the level sufficient to export in the international market. Table- 3 are those required items and qualitative value. However each quality of the coking coal is varies and quality of blending coal is different depending on the selection of the coal and operation process, therefore required property of the blending coal,and quality of coke are set as shown in Table-4.

Table 3 TARGET QUALITY OF COKE

Standard Quality	
Moisture (%)	4 – 5
Ash (%)	10.5 (Max.)
Volatile matters (%, d.)	1.0 (Max.)
Fixed carbon (%, d.)	88.5 (Min.)
Total sulfur (%, d.)	0.8 (Max)
TI_{25} 59 (Min)	
Coke breeze ratio(–25mm)(%)	5.0 (Max.)
Others important characteristic values	
CSR	53 – 60
P (%, d.)	0.04
K20 + Na20 (%, d.)	0.2 – 0.25
Mean size (inch)	2

Table 4 REQUIRED PROPERTY OF THE BLENDING COAL AND TARGET QUALITY OF COKE

Ash (%, d)	: 10.3	TI25	: 61
Total Sulfur (%,d.)	: 0.76	CSR	: 58

3.3 The Property of Blending Coal and Estimation of Quality of Coke.

The property of blending coal and quality of coke is estimated by Mitsui Mining Co.s own method.

4. Consideration of Coal Blending Conditions for Maximum Use of New Guasare Coal

To determine the coal blending ratio to allow the maximum use of the Guasare coal the following three cases are considered:

(1) Replace U.S. coal by Guasare coal as much as possible.(It is found that blending ration of Las 27%,Boyaca 5%, FNO 5%, US coal 65% satisfy all conditions and coke quality was verified by box test and SCO test. Basic consideration of this

blending ratio was based on the coal production capacity from Tachira state, and annual coke production is one million ton per year.

(2) Blending ratio proposed by the counterpart

(3) Without consideration of availability from Tachira state, but use maximum Guasare coal according to the quality of raw coal

4.1 Replacement of US Coal by Guasare Coal

Since Guasare coal characterize the high volatile character it is most favorably exchanged with Blue Creek which is the coal with medium volatile matter.

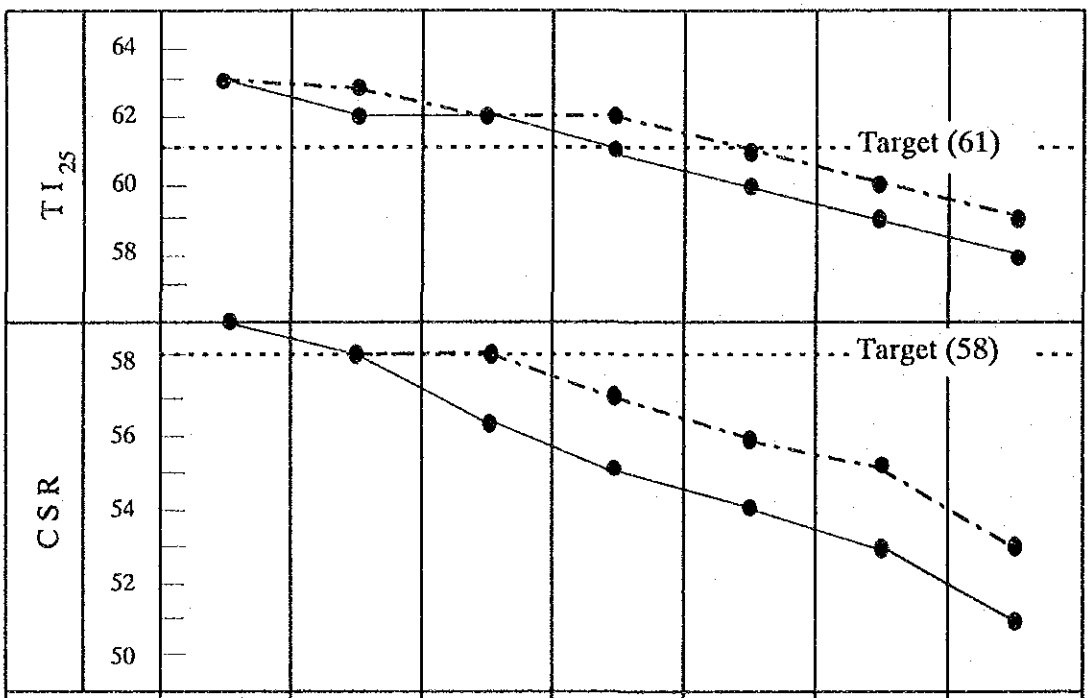
As shown in the Table-5 it is found that maximum blending ration of Guasare coal is at 10% and this is the limit to satisfy CSR and TI25 requirement.

The reason to be able to increase the blending ration from 5% to 10% is because of the increase of capacity of coking. It is considered that only 10% of blending is caused by Guasare coal which has high volatile content(39.8%,d),while CSR is low(30)and coking capacity measured by total dilatation is low(32%)

Table 5 CONDITION OF BLENDING LIMIT FOR GUASARE COAL

(COKE PRODUCTION - 1 MILLION TONS PER YEAR)

Coal Blend No.		1	2	3	4	5	6	7
Blending Ratio of Coal (%)	FNO (Venezuela)	5	5	5	5	5	5	5
	LAS (Venezuela)	27	27	27	27	27	27	27
	Boyaca (Colombia)	3	3	3	3	3	3	3
	Pinnacle (U.S.)	25	25	25	25	25	25	25
	Blue Creek (U.S.)	40	35	30	25	20	15	10
	New-Guasare (Venezuela)	0	5	10	15	20	25	30
Properties of Coal Charge	Ash (%, d.)	6.6	6.3	6.0	5.7	5.4	5.1	4.8
	Volatile Matter (%, d.)	27.0	27.1	27.8	28.6	29.3	30.0	30.7
	Total Sulfur (%, d.)	0.76	0.75	0.73	0.72	0.70	0.69	0.67
	Total Dilation (%)	168	158	148	137	127	117	106
	Max. Fluidity (log DDPM)	2.88	2.80	2.72	2.63	2.55	2.47	2.39
	SI	4.89	4.80	4.71	4.62	4.53	4.44	4.34
	CBI	2.16	2.16	2.16	2.16	2.16	2.15	2.15
	Σ CSR	52	51	49	48	47	45	44
Coke Quality	Ash (%, d.)	8.9	8.7	8.4	8.2	8.0	7.7	7.5
	Total Sulfur (%, d.)	0.66	0.65	0.64	0.63	0.62	0.60	0.59
	TI25	63	63	62	62	61	60	59
	CSR	59	58	58	57	56	55	53



Name	Blending ratio (%)						
FNO–LC30	5	5	5	5	5	5	5
LAS–LC25	27	27	27	27	27	27	27
BOYACA	3	3	3	3	3	3	3
PINNACLE	25	25	25	25	25	25	25
BLUE. C.	40	35	30	25	20	15	10
GUASARE	0	5	10	15	20	25	30

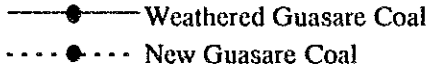


Fig.-1 RELATIONSHIP BETWEEN CONSUMPTION OF GUASARE COAL AND COKE QUALITY

4.2 Coal Blending Proportions for 15% Blending of the New Guasare Coal (Proposed by the Venezuela Counterpart)

1) Coal blending conditions based on present production volumes
Blending proportions required to use the new Guasare coal at a proportion proposed by the Venezuelan counterpart with the Fax dated March 8, 1994 are 32% Tachira coal and 15% Guasare coal, as shown in Table 7.

Table 7 COAL BLENDING PROPORTIONS FOR 15% BLENDING OF THE NEW GUASARE COAL (PROPOSED BY THE VENEZUELA COUNTERPART)

Coal Type	Blending Ratio (%)
Tachira	32
Zulia	15
Colombia	3
U.S.	50

Venezuela's proposal does not specify brands for each coal type. Since coke quality cannot be estimated without knowing specific brands, brands of Tachira and U.S. coals and their blending proportions have been determined by the following method.

First of all, blending proportions of Tachira coals are estimated from potential production in the state, namely FNO 5% and LAS 27%. Then, those of U.S. coal have been determined from the viewpoint of securing the required CSR level in produced coke, namely Pinnacle 10% and Blue Creek 40%.

Table 8 shows estimated blending proportions by brand, on the basis of Venezuela's proposal. From these blending proportions, property values of coal blend and coke are estimated as shown in Table 9.

From Table 9, the coal blend proposed by the Venezuelan side has sufficient coking capacity (dilatation of 167%), but is not sufficient in rank of coalification, judging from volatile content 31.84 (%, d.a.f.) and the average reflectivity 1.09 (%, oil).

As shown in the column showing coke qualities in Table 9, therefore, TI_{25} meets the

target level (61) whereas CSR is 56, slightly short of 58. It is concluded that the coal blend cannot produce blast-furnace coke exportable to the international market.

Table 8 BLENDING PROPORTIONS BY BRAND, AS PROPOSED BY THE VENEZUELAN COUNTERPART

Bland	Blending Ratio (%)
FNO	5
LAS	27
Boyaca	3
Pinnacle	10
Blue Creek	40
Guasare	15

Table 9 ESTIMATED QUALITIES BASED ON BLENDING PROPORTIONS PROPOSED BY THE VENEZUELAN COUNTERPART

Estimated property values of coal blend		Estimated property values of coke	
Ash	6.22 (%,d.)	Ash	9.00 (%, d.)
Volatile matter	31.84 (%, d.a.f.)	Sulfur	0.64 (%, d.)
Sulfur	0.73 (%, d.)	TI_{25}	61
Average reflectivity	1.09 (%, oil)	CSR	56
Dilatation	167 (%)		

2) Replacement of HAT coal with LAS coal

The result of simulation to estimate coke quality based on the above blending proportions reveals that the target quality levels have been achieved for TI_{25}, but not for CSR. A major reason for this seems to come from the rank of coalification is low for the coal brand.

To maximize the rank of coalification while the blending ratio of the new Guasare coal is held at 15%, the LAS coal with high volatility has to be eliminated and replaced with Boyaca or FNO coal that shows low volatile content and high CSR.

However, production of Boyaca and FNO coals is limited, and thus an attempt is made to use HAT coal which seems to show a higher rank of coalification than LAS coal.

In this alternative, the blending ratio of HAT coal is assumed to be 27% to totally replace LAS coal, as shown in Table 10. This way, the rank of coalification for the coal brand improves apparently: as shown in Table 11, volatile content is 29.88 (%, d.a.f.)and the average reflectivity 1.14 (%, oil), compared to 31.84 (%, d.a.f.) and 1.09 (%, d.) for the 27% LAS blend shown in Table 9.

However, total sulfur content in the coal brand amounts to 0.88 (%, d.), up 0.15 (%, d.) from 0.73 (%, d.)for the 27% LAS blend, because sulfur content of HAT coal is 1.15 (%, d.)in Table 2.

As for estimated coke qualities, while ash content decreases slightly to 8.02 (%, d.), sulfur content is 0.76 (%, d.), closer to the upper limit.

Target levels for TI_{25} and CSR are satisfied, 62 and 58 respectively.
The above analysis indicates that, by replacing LAS coal with HAT coal in whole amount, the rank of coalification for the coal brand rises to satisfy quality requirements for coke, although total sulfur barely clears the upper limit.

Table 10 BLENDING PROPORTIONS WHEN LAS COAL IS REPLACED WITH HAT COAL

Bland	Blending Ratio (%)
FNO	5
HAT	27
Boyaca	3
Pinnacle	10
Blue Creek	40
Guasare	15

Table 11 ESTIMATED QUALITIES BASED ON BLENDING PROPORTIONS PROPOSED BY THE VENEZUELAN COUNTERPART (REPLACEMENT OF LAS COAL WITH HAT COAL)

Estimated property values of coal blend		Estimated property values of coke	
Ash	5.62 (%,d.)	Ash	8.02 (%, d.)
Volatile matter	29.88 (%, d.a.f.)	Sulfur	0.76 (%, d.)
Sulfur	0.88 (%, d.)	TI_{25}	62
Average reflectivity	1.14 (%, oil)	CSR	58
Dilatation	196 (%)		

4.3 Blending Limits for Guasare Coal

To use the new Guasare coal as much as possible, it is necessary to blend coal that can compensate for high volatility, low CSR, and low coking capacity which Guasare coal has.

Among coals produced in Venezuela and Colombia, 2 brands are considered to serve the purpose; Boyaca coal which is effective in improving CSR and controlling volatile matters and FNO coal which can be used to reduce volatility and supplement coking capacity.

If Boyaca coal with low coking capacity is used to reduce volatility, coking capacity of the resultant coal blend decreases. As seen in Table 2, the imported coal, Blue Creek, can compensate for coking capacity without scarifying CSR.

Thus, the maximum use of Guasare coal is estimated when four brands, Boyaca, FNO, Blue Creek, and Guasare are blended.

Note that volatile content indicates that FNO and Blue Creek are classified as medium-volatile coal, namely 23.2(%, d.) and 25.4(%, d.) . On the other hand, they show highly opposite data in CSR and coking capacity. While FNO coal shows high CSR and low coking capacity, Blue Creek shows low CSR and high coking capacity. To complement deficiency in CSR and coking capacity, the two medium-volatile brands are blended by the ratio of 1:1.

The maximum blending ratio for the new Guasare coal is estimated by using a triangular graph which consisting of three elements, the Boyaca coal having low volatile content and high CSR, a mixture of FNO and Blue Creek which are medium-volatile, high coking, and high CSR coals, and the new Guasare coal.

First of all, the optimum range of each property value is determined on the graph, which is overlaid to estimate proportions of the three raw coals to satisfy all the quality requirements.

Estimated qualities of the coal blend and coke are shown on the triangular graphs in Figures 2 through 5.

Fig.2 shows the relationship between blending proportions of the three raw coals, and distribution of volatile content in the coal blend. Since the optimum volatile content level ranges between 26 and 30(%, d.a.f.), the optimum range of blending becomes the optimum VM zone.

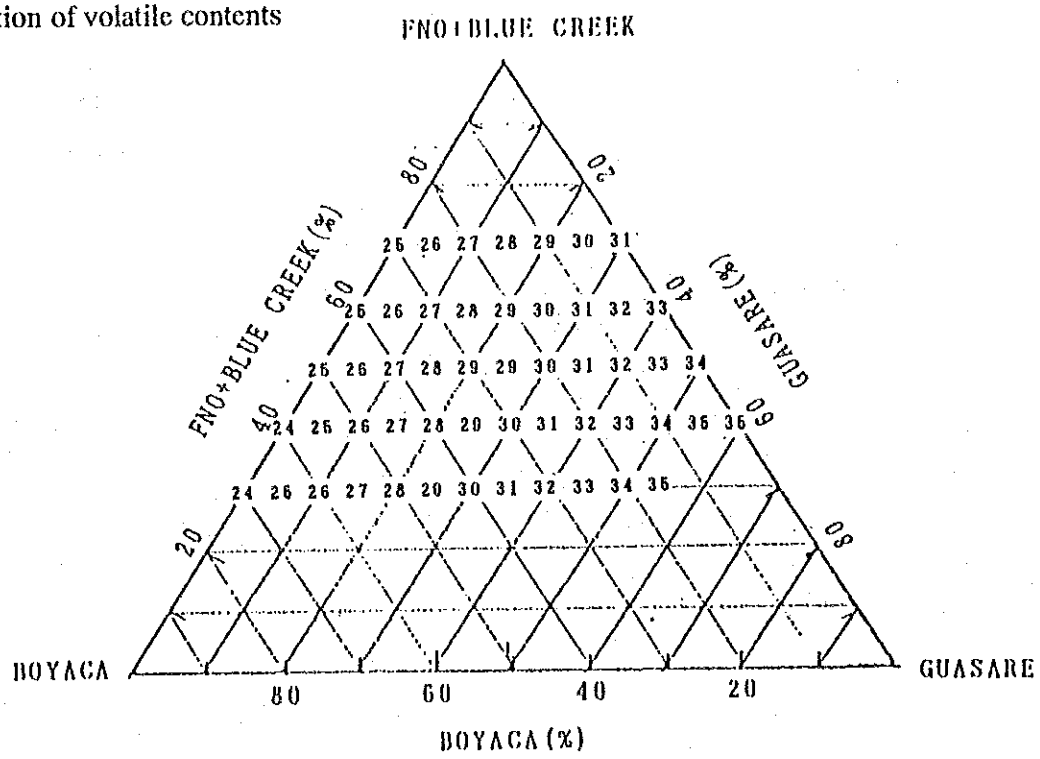
Fig.3 shows the blending proportions and distribution of total dilatation. Since dilatation of the coal blend needs to be over 85%, the optimum range of blending determined from dilatation becomes the optimum TD zone.

Fig.4 shows the blending proportions and distribution of TI_{25} which has to be at least 61. Thus, the optimum range of blending determined from TI_{25} becomes the optimum TI_{25} zone.

Fig.5 shows the blending proportions and distribution of CSR. Since CSR must be 58 or over, the optimum range of blending from CSR becomes the optimum CSR zone.

Finally, Fig.6 synthesizes Figures 2 through 5, and blending proportions satisfying all the requirements for volatile content, total dilatation, TI25 and CSR represent the optimum blending zone.

1) Distribution of volatile contents



2) Optimum volatility zone

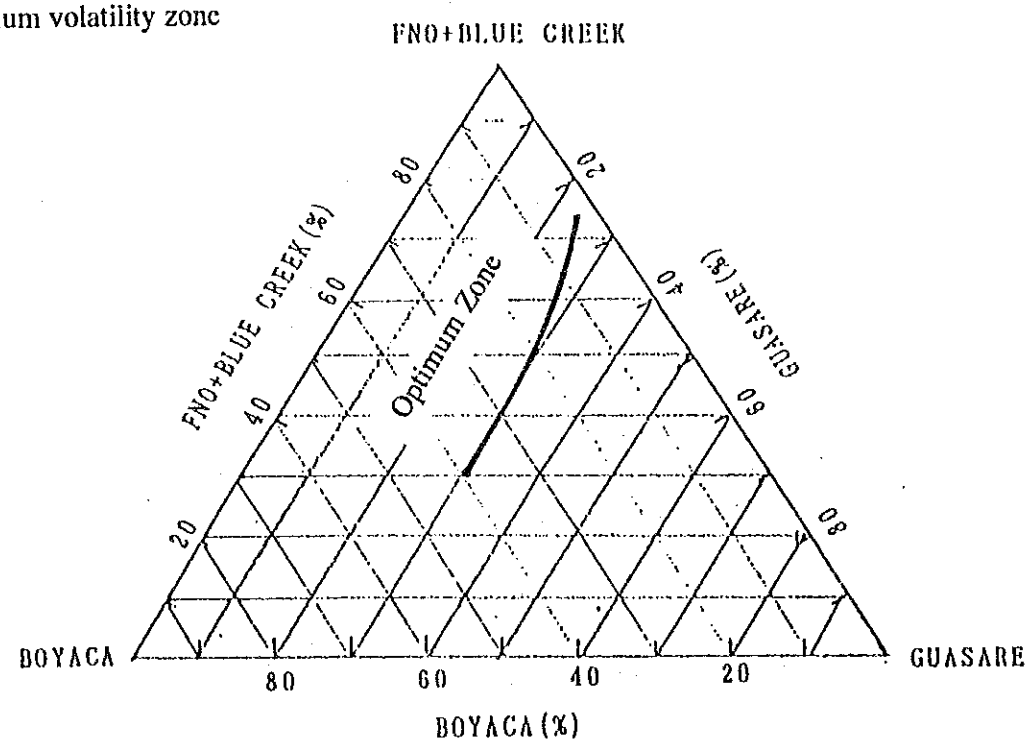
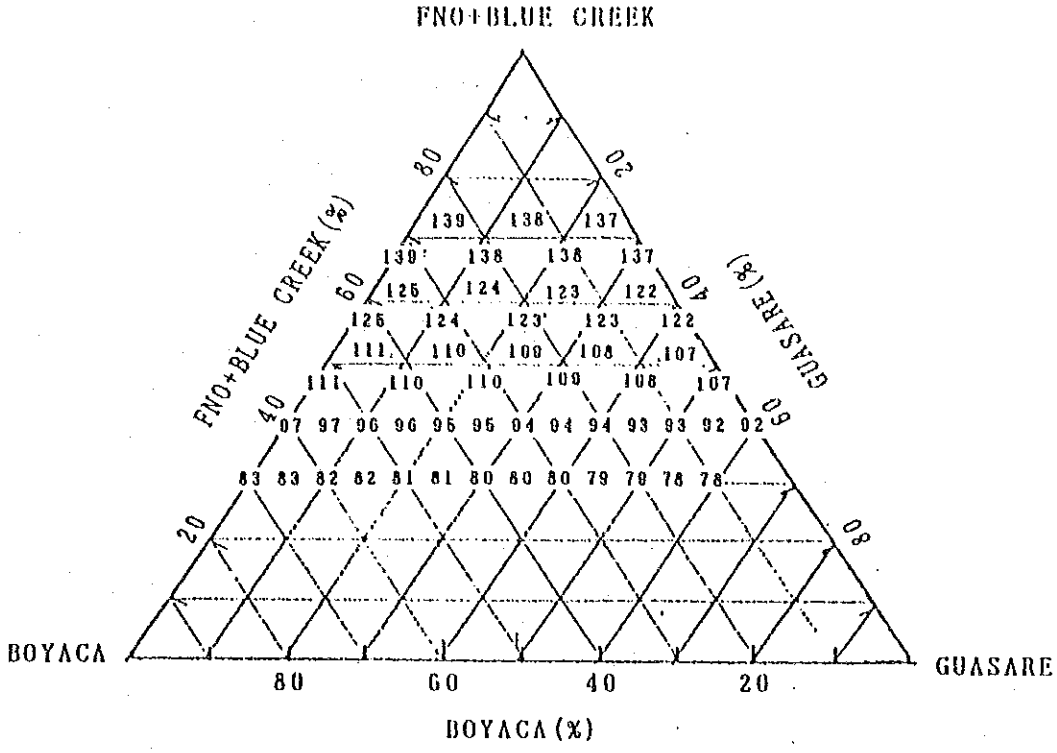


Fig.2 DISTRIBUTION OF VOLATILE CONTENTS FOR DIFFERENT COAL BLENDS ON THE TRIANGULAR GRAPH AND OPTIMUM VOLATILITY ZONE

1) Distribution of total dilation



2) Optimum dilatation zone

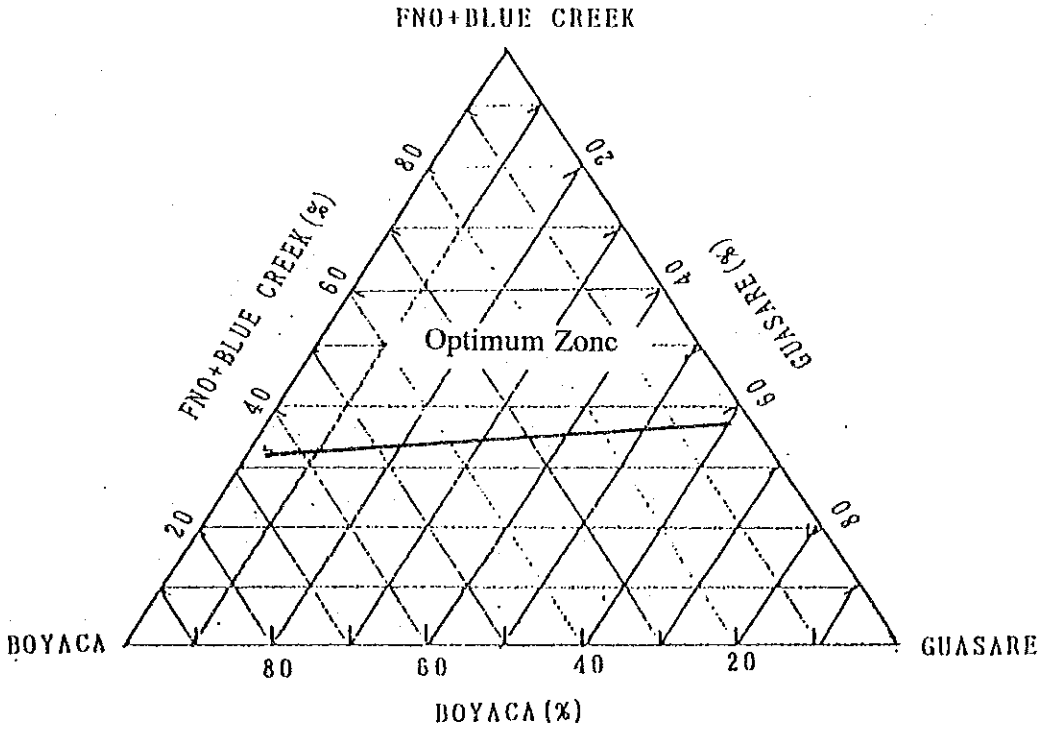
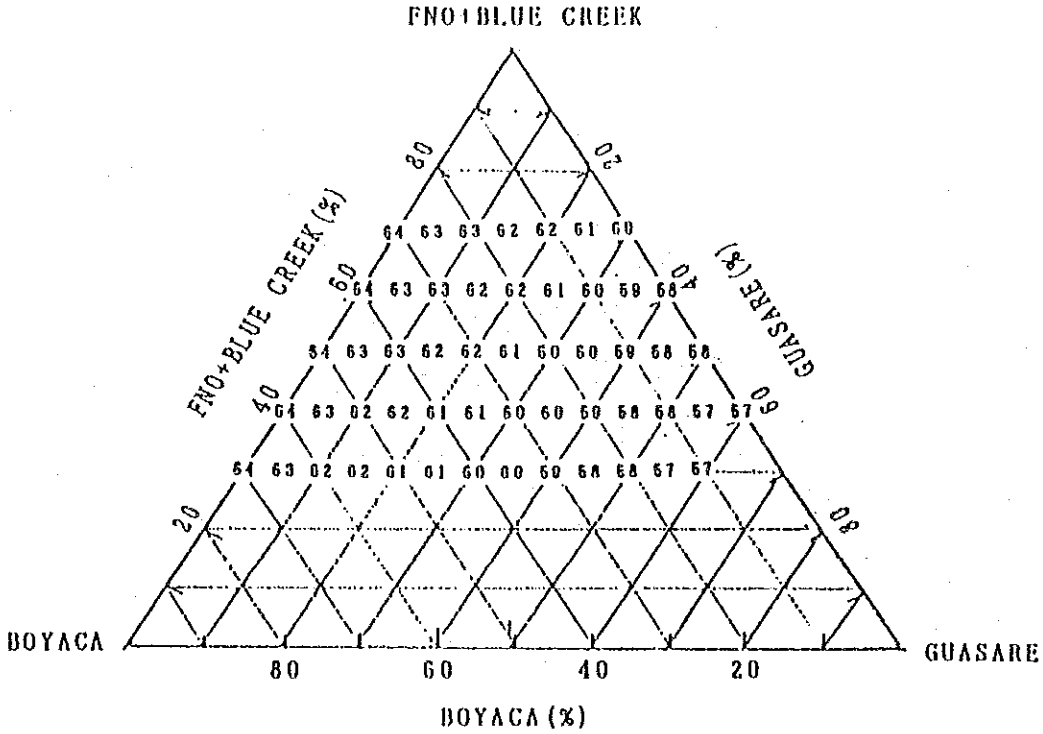


Fig.3 DISTRIBUTION OF TOTAL DILATATION FOR COAL BLENDS ON THE TRIANGULAR GRAPH AND OPTIMUM DILATATION ZONE

1) Distribution of TI_{25}



2) $TI_{25} \geq 61$ Zone

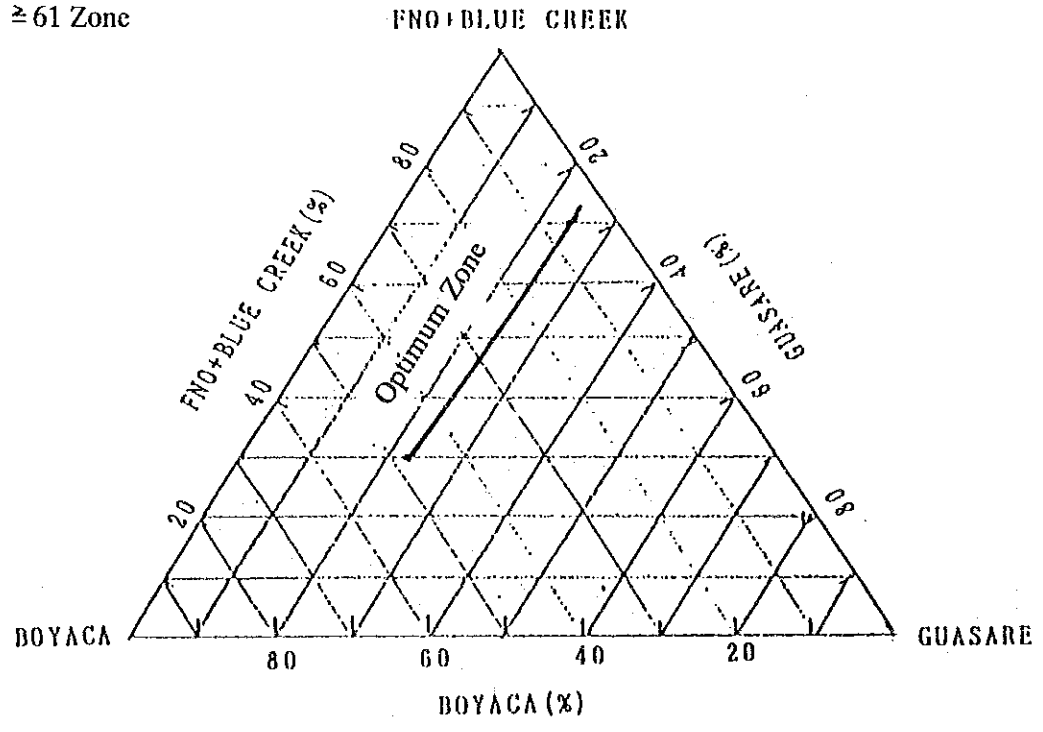
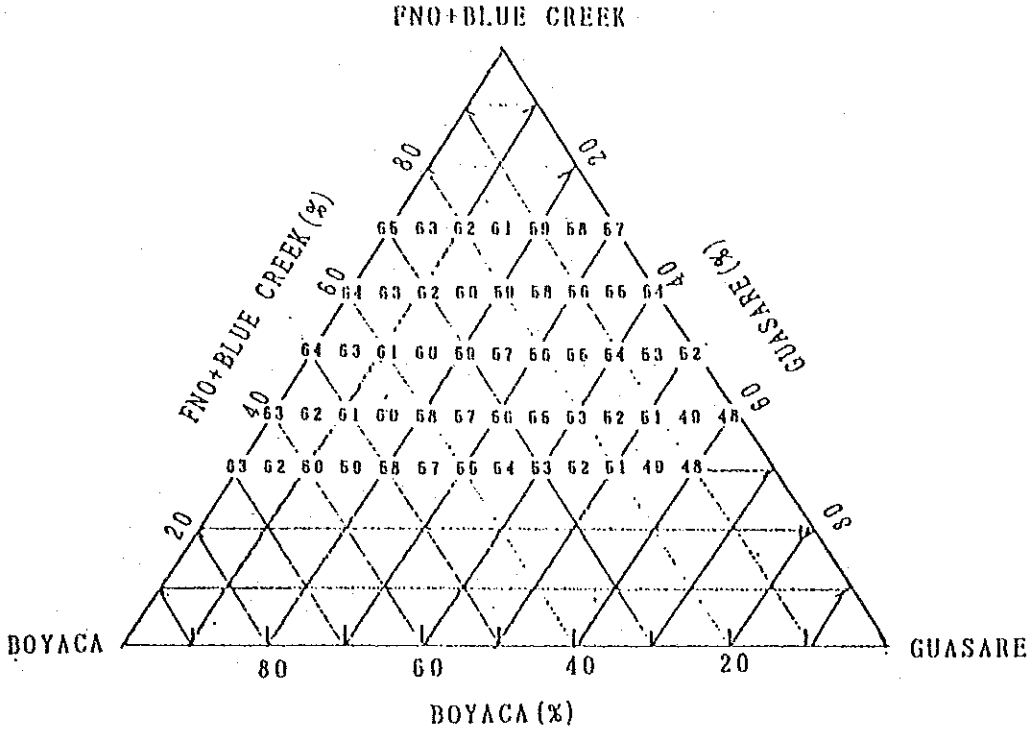


Fig.4 DISTRIBUTION OF TI_{25} FOR DIFFERENT COAL BLENDS ON THE TRIANGULAR GRAPH AND $TI_{25} \geq 61$ ZONE

1) Distribution of CSR



2) CSR ≧ 58 Zone

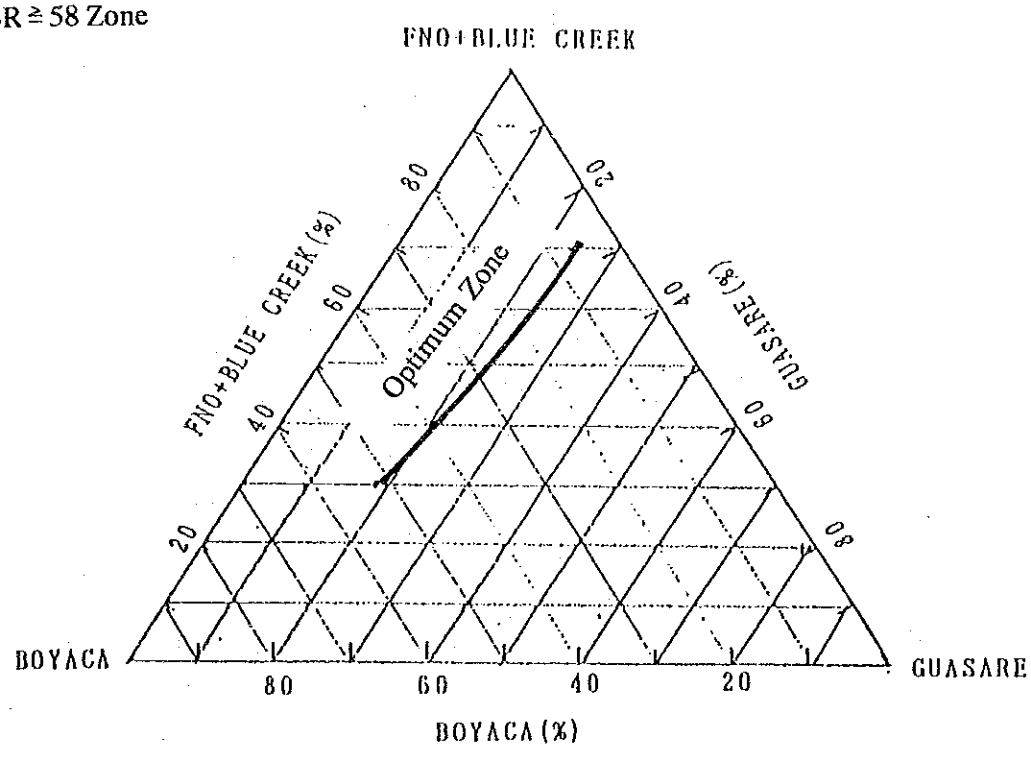


Fig.5 DISTRIBUTION OF CSR FOR DIFFERENT COAL BLENDS ON THE TRIANGULAR GRAPH AND CSR ≧ 58 ZONE

Within the optimum blending zone, the largest amount of blending for the new Guasare coal is at point P and is 23%. The blending proportion, the estimated property values of the coal blend, and estimated coke quality are summarized in Table 6.

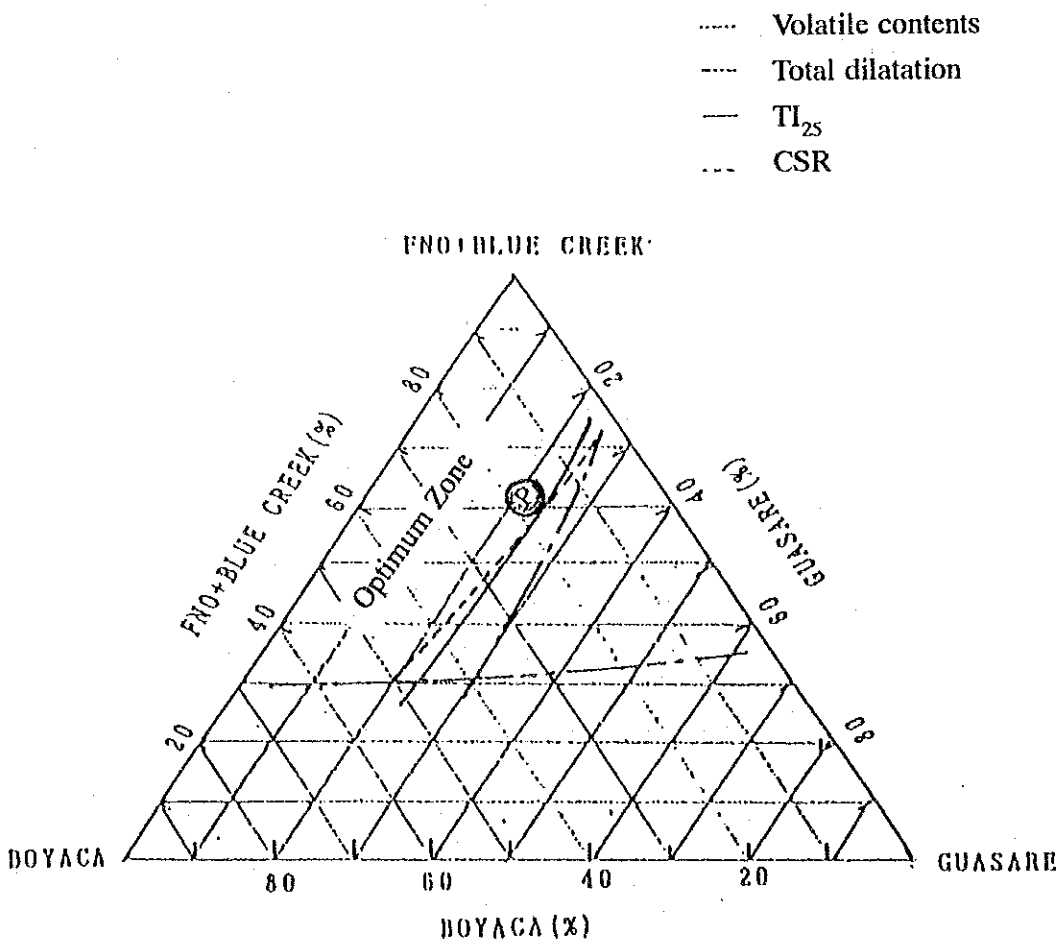


Fig.6 OPTIMUM BLENDING ZONE FOR FNO, BLUE CREEK, BOYACA, NEW GUASARE

Table 6 ESTIMATED BLENDING PROPORTIONS, AND QUALITIES OF COAL BLEND AND COKE WHEN THE MAXIMUM AMOUNT OF THE NEW GUASARE COAL IS USED

Blending proportions	
FNO	29 (%)
Blue Creek	29 (%)
Boyaca	19 (%)
Guasare	23 (%)
Property values of coal blend	
Ash	6.85 (%, d.)
Volatile	29.33 (%, d.a.f.)
Sulfur	0.80 (%, d.)
Dilatation	120 (%)
Fluidity	2.56 (logDDPM)
Average reflectivity	1.189 (%, oil)
Coke quality	
Ash	9.31 (%, d.)
Sulfur	0.70 (%, d.)
TI_{25}	61
CSR	58

In this case, ash content is 6.85 (%, d.), volatile content 29.33 (%, d.a.f.), average reflectivity 1.189 (%, oil), and dilatation 120(%). These values indicate that the coal blend is suitable for making blast-furnace coke, as measured by the rank of coalification and coking capacity.

As for quality of coke produced, ash content is 9.31 (%, d.), total sulfur 0.70 (%, d.), TI_{25} 61, and CSR 58.

Thus, the maximum blending ratio of the new Guasare coal when requirements related to the use of raw coal are neglected is estimated to be 23%.

5. Conclusion

1) The new Guasare coal is rated as high-volatile, light coking coal from its property values; ash content 2.9 (%, d.), volatile content 39.8 (%, d.), total sulfur 0.55 (%, d.) dilatation 32 (%), and Gieseler plastometer's maximum fluidity 1.99(logDDPM).

2) The upper limit for blending of the new Guasare coal is estimated as follows:
   (1) 10% in basic proportion
   (2) 23% when production the FNO coal and the Boyaca coal is neglected

3) Blending proportions for the 15% blending of the new Guasare coal, proposed by the Venezuelan side, are as follows:

FNO	:	5 %
HAT	:	27 %
Boyaca	:	3 %
Low-volatile U.S.	:	10 %
Medium-volatile U.S.	:	40 %
Guasare	:	15 %

6. Proposal of Coal Blending

As shown in Table 12, if production of Tachira and Colombian coals are taken into account and Zulia coal (Guasare coal) is blended by 15%, CSR falls below the target level of 58. Thus, the maximum allowable blending ratio of Zulia coal is limited to 10% as shown in Table-5. On the other hand, if the HAT deposit will be commercially developed to replace LAS coal, the blending ratio of Zulia coal can be increased to 15%, as shown in Case-2. Furthermore, if FNO and Boyaca coals are produced in large quantities, the blending ratio can be raised to 23%, as shown in Case-3.

Table 12 ESTIMATED COKE QUALITIES

			FIV Proposal	Case Study		
				Case-1	Case-2	Case-3
			Based on the Production Capacity	Based on the Production Capacity	LAS→HAT	Based on the Quality of Tachira Coal
Blending Ratio (%)	Tachira	FNO	5	5	5	29
		LAS	27	27		
		HAT			27	
	Zulia	New-Guasare	15	10	15	23
	Colombia	Boyaca	3	3	3	19
	U.S.A.	Pinnacle	10	25	10	
		Blue Creek	40	30	40	29
		Total	100	100	100	100
Coke Quality		Ash (%, d.)	9.00	8.40	8.02	9.31
		T-S (%, d.)	0.64	0.64	0.76	0.70
		TI25	61	62	62	61
		CSR	56	58	58	58

7. Coke and Coal Chemical Production Plan

Based on the result of the simulation on the effective use of Guasare coal, production volumes and product mix forming the basis of blending design are summarized in Table 13. Also, basic assumptions to calculate target production volumes, such as property values of coal charge and product yields, are summarized in Table 14. Note that material balance remains unchanged even if the blending ratio of Guasare coal is changed.

Table 13 PRODUCTION BALANCE

Item	Production/Amount Handled		Remarks
	Daily	Annually	
Raw coal (wet)	4,070 ton	$1,485 \times 10^3$ ton	
Coal charge (dry)	3,700 ton	$1,351 \times 10^3$ ton	
Coke in total	2,740 ton	$1,000 \times 10^3$ ton	
Lump coke	2,330 ton	850×10^3 ton	
Coke breeze	410 ton	150×10^3 ton	-25mm or less
COG	$1,241 \times 10^3$ Nm ^{3}	453×10^6 Nm^3	4,500 Kcal/Nm ^{3}
Tar	123 ton	45×10^3 ton	
Light oil	41 ton	15×10^3 ton	
Ammonium sulfate	44 ton	16×10^3 ton	
Sulfuric acid (by-product)	17 ton	6.2×10^3 ton	Raw material for ammonium sulfate

Table 14 BASIC ASSUMPTIONS FOR PROPOSED PRODUCTION VOLUMES

Item	Yield	Remarks
Moisture content of coal charge	9%	
Volatile matter of coal charge	27.6%	
Coke yield	74%	Coal basis
Lump coke yield	85%	Coke basis
COG yield	335Nm^3/t-coal	4,500kcal/Nm^3
Proportion of COG sold	55% : 45%	
Tar yield	3.3%	Coal basis
Light oil yield	1.1%	Coal basis
Ammonium sulfate yield	1.2%	Coal basis
By-product sulfuric acid yield	0.5%	Coal basis, captive private

8. Financial and Economic Analysis

The maximum possible blending ratio of Guasare coal available in Zulia State is discussed from the point of financial and economic aspect.
In this chapter, financial and economic analysis is made on the following cases as calculated in the previous chapter.

Case 1 – Blending ratio for Guasare coal is 10%
Case 2 – Guasare coal is 15% with expectation that HAT coal are available so that LAS coal to be replaceable in future.
Case 3 – Guasare coal is 23% with expectation that FNO coal and Boyaca coal are available in future.

8.1 Assumptions

The assumptions for the above cases are summarized in the Table 15, 16, and 17.
Since the assumptions on financial and economic analysis have been made in the main report, the assumptions newly established and the points to the considered are described below.

(1) Raw coal

From the results of raw coal and material balance as stated in the previous chapters, the coke yield for all the cases is 74% (in the calculation 74.019% is employed), and the blending ratio is summarized as follows:

BLENDING RATIO FOR ADDITIONAL CASES

Raw Coal	Case 1	Case 2	Case 3
Domestic coal (FNO/LAS or HAT)	32%	32%	29%
Domestic coal (Guasare)	10%	15%	23%
Colombian coal (Boyaca)	3%	3%	19%
U.S. coal (Pinnacle/Blue Creek)	55%	50%	29%
Total	100%	100%	100%

Regarding purchase price of Guasare coal, 20 US$/ton in a dry coal basis is employed in this calculation, which, the price of Guasare coal is 4 US$/ton lower than that of FNO/LAS coal. HAT coal is the same price as FNO/LAS coal because of location in Tachira.

With the above coke yield and blending ratio, production of COG, crude tar, crude benzene and ammonium sulfate will increase compared with those for the base case.

(2) Investment cost

Investment cost for the cases above excluding initial working capital is assumed the same as that for the base case of main report.

Breakdown of initial working capital is shown in Table 19.

8.2 Financial and Economic Analysis

Based on the assumptions described heretofore, the result of the analysis for the additional cases is summarized in Table 18.

The FIRR (before tax) for the case-1 is 0.19%, 0.94% for case-2, and 2.78% for case-3.

Regarding financial position, the results for case 1 and 2 shows that DSR(Debt Service Ratio) is almost 1.0 or less throughout the project life, indicating cash shortage from the first year of operation, while the result for case 3 shows DSR is less than 1.0 during the first 5 years from the start of operation and grows above 1.15 in the 9th year, indicating cash shortage for 11 years after the start of operation.

The BF coke production cost as a average in the tenth year of operation, or in 2007 is shown below.

BF COKE PRODUCTION COST

(Unit: US$/ton)

Item	Case 1	Case 2	Case 3
- Not including depreciation and interest	82.50	79.01	69.72
- Including depreciation and interest	143.29	137.92	123.63

From the above table, the costs for all the cases including depreciation and interest are higher than the sales price of BF coke (US$ 120/ton).

In addition to the above analysis, the amount of foreign currency earned from the project is calculated.
The total foreign currency earnings over the project life is US$ 386 million for case-1, US$ 474 million for case-2 and US$ 658 million for case-3. The EIRR for the case-1 is 0.95%, 1.69% for case-2, and 3.52% for case-3.

Table 15 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY FOR CASE 1 (1/3)

1. Project

Title	: Establishment of Coke Plant Project
Location	: La Canada, Venezuela
Project Case/Study Date	: Case 1/June 6, 1994
Selected Coal (Domestic)	: FNO/LAS/Guasare
(Imported)	: Pinnacle/Blue Creek (U.S.A.) Boyaca (Colombia)
Maximum Operable Days	: 365 DPY
Coke Production @100%	: 2,740 TPD x 365 DPY = 1,000,000 TPY
Yield of Coke Product	: 74.019% of Feed Coal Input
Feed Coal Input (Dry Coal Basis)	: 3,701 TPD x 365 DPY = 1,351,004 TPY
Production Start Year	: 1998
Monetary Unit	: US dollars($) in terms of fixed price in 1993
Exchange Rate for Caluculation	: 1 US$ = 115 Yen as an average in 1993 : 1 US$ = 95 Bs during site survey in 1993

2. Schedule

Contract Award	: Dec. 01, 1995
Mechanical Completion	: Feb. 28, 1997
Production Start	: May. 01, 1998
Project Phase Out	: Dec. 31, 2017
Project Life	: 20 Years from Production Start
Project Year	: May to April
Construction and Commissioning	: 29 months from Contract Award

3. Financing Required and Financing Plan in 1993 Price Base

Financing Required	US$, MM
Land/Site Development	2.36
Erected Plant Cost	606.36
– Coke Oven	(177.23)
– Coal/Coke Storage	(164.60)
– By–Products	(142.02)
– Common Facility	(46.50)
– Engineering Service, etc	(76.01)
Pre–Operational Expense	6.92
Interest during Construction	27.37
Fixed Capital Cost	643.01
Initial Working Capital	17.94
Financing Required	660.95

Financing Plan		US$, MM
Equity	: 30.0%	198.28
Foreign Soft Loan: 70.0%		462.67
– Interest	: 5.00%	
Short Term Loan:		Balance
– Interest	: 5.00%	
Financing Plan		660.95

Table 15 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY FOR CASE 1 (2/3)

4. Inputs and Pricing (CIF at the Plant in 1993 Price Base)

Inputs	Unit		Per Coal (Dry)		Per BF coke	Annual	
	Unit	Cost	Consumption	Cost	Cost	Consumption	Cost
		$/Unit	Unit/Unit	$/Unit	$/Unit	(MM, Unit)	$, MM
Raw Material exc. Moisture @9%							
– Domestic Coal(FNO/LAS)	Ton	26.37	0.320	8.44	13.41	0.4323	11.400
– Domestic Coal(Guasare)	Ton	21.98	0.100	2.20	3.49	0.1351	2.970
– Imported Coal(Boyaca)	Ton	43.96	0.030	1.32	2.10	0.0405	1.782
– Imported Coal(U.S.A)	Ton	65.93	0.550	36.26	57.63	0.7431	48.989
Coke Oven Gas	Nm^3	0.015	150.89	2.26	3.60	203.85	3.058
Utilities							
– Electricity	kwh	0.013	45.388	0.59	0.94	61.32	0.797
– Water	m^3	0.029	2.539	0.07	0.12	3.43	0.099
Cat/Chem	Ton	1.304	0.740	0.97	1.53	1.000	1.304
(1) Variable Cost	–	–	–	–	82.82	0.850	70.399
Operating Staff	M-Y	5,824			4.80	700	4.077
Overhead	Ope. Staff x 50%				2.40	–	2.038
Maintenance Cost	Plant Direct Cost x 2.0%				12.48	–	10.607
Tax & Insurance	Fixed Capital Cost x 0.5%				3.78	–	3.215
(2) Direct Fixed Cost	–	–	–	–	23.46	0.850	19.937
Credits							
– Coke Oven Gas	Nm^3	0.015	335.31	5.03	7.99	453.00	6.795
– Crude Tar	Ton	50.00	0.033	1.65	2.62	0.04458	2.229
– Crude Benzene	Ton	240.00	0.011	2.64	4.20	0.01486	3.566
– Ammonium Sulphate	Ton	100.00	0.012	1.20	1.91	0.01621	1.621
– Coke Breeze (Export)	Ton	40.00	0.11103	4.44	7.06	0.15000	6.000
(Local)	Ton	66.32	–	–	–	–	–
(3) Total Credits	–	–	–	–	23.78	0.850	20.211
(4) Production Cost = (1)+(2)–(3)					82.50	0.850	70.125

Table 15 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY FOR CASE 1 (3/3)

5. Outputs and Pricing
(FOB at the Plant with Full Capacity Utilization in 1993)

Outputs	Unit	Unit Price ($/Unit)	Annual Production (MM, Unit)	Annual Sales ($, MM)
BF Coke*	Ton	120.0	0.850	102.000

(Note) *:FOB Venezuela Price = CIF USA (135 $/t) – Ocean Freight (15 $/t)

6. Operation Schedule

	Project Year							(Unit: %)
	(–)3	(–)2	(–)1	1	2	3	..20	Total/
	95	96	97	98	99	00	2017	Avarage
– Financing Disbursement	10	50	40					
– BF Coke Production								
– Rated Capacity Utilization				80	100	100	100	1,980
– Inventory Increase				10	2	0	(–)12	0
– Inventory				10	12	12	0	0
– Sales				70	98	100	112	1,980

– Depreciation/Salvage Value 20 years straight line/Zero salvage value
– Amortization/Salvage Value 20 years straight line/Zero salvage value
– Corporate Income Tax 30%

– Debt Service

Loan Type	Maximum Grace + Maturity	Annual Interest Rate	Installments
– Long Term Loan/Foreign	3 + 20	5.00	20
– Short Term Loan/Local	0 + 1	5.00	1

– BF Coke Inventory 1.5 months
– Coke Breeze Inventory 1.0 month
– Crude Tar Inventory 1.5 months
– Crude Benzene Inventory 3.0 months
– Ammonium Sulfate Inventory 1.0 month
– Domestic Coal Inventory 0.5 months
– Imported Coal Inventory 1.5 months
– Account Receivable/Payable 1.0 month/1.0 month

Table 16 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY FOR CASE 2 (1/3)

1. Project

Title	: Establishment of Coke Plant Project
Location	: La Canada, Venezuela
Project Case/Study Date	: Case 2/June 6, 1994
Selected Coal (Domestic)	: FNO/HAT/Guasare
(Imported)	: Pinnacle/Blue Creek (U.S.A.) Boyaca (Colombia)
Maximum Operable Days	: 365 DPY
Coke Production @100%	: 2,740 TPD x 365 DPY = 1,000,000 TPY
Yield of Coke Product	: 74.019% of Feed Coal Input
Feed Coal Input (Dry Coal Basis)	: 3,701 TPD x 365 DPY = 1,351,004 TPY
Production Start Year	: 1998
Monetary Unit	: US dollars($) in terms of fixed price in 1993
Exchange Rate for Caluculation	: 1 US$ = 115 Yen as an average in 1993 : 1 US$ = 95 Bs during site survey in 1993

2. Schedule

Contract Award	: Dec. 01, 1995
Mechanical Completion	: Feb. 28, 1997
Production Start	: May. 01, 1998
Project Phase Out	: Dec. 31, 2017
Project Life	: 20 Years from Production Start
Project Year	: May to April
Construction and Commissioning	: 29 months from Contract Award

3. Financing Required and Financing Plan in 1993 Price Base

Financing Required	US$, MM
Land/Site Development	2.36
Erected Plant Cost	606.36
– Coke Oven	(177.23)
– Coal/Coke Storage	(164.60)
– By–Products	(142.02)
– Common Facility	(46.50)
– Engineering Service, etc	(76.01)
Pre–Operational Expense	6.92
Interest during Construction	27.37
Fixed Capital Cost	643.01
Initial Working Capital	17.45
Financing Required	660.46

Financing Plan		US$, MM
Equity	: 30.0%	198.14
Foreign Soft Loan: 70.0%		462.32
– Interest	: 5.00%	
Short Term Loan:		Balance
– Interest	: 5.00%	
Financing Plan		660.46

Table 16 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY FOR CASE 2 (2/3)

4. Inputs and Pricing (CIF at the Plant in 1993 Price Base)

Inputs	Unit		Per Coal (Dry)		Per BF coke	Annual	
	Unit	Cost	Consumption	Cost	Cost	Consumption	Cost
		$/Unit	Unit/Unit	$/Unit	$/Unit	(MM, Unit)	$, MM
Raw Material exc. Moisture @9%							
– Domestic Coal(FNO/HAT)	Ton	26.37	0.320	8.44	13.41	0.4323	11.400
– Domestic Coal(Guasare)	Ton	21.98	0.150	3.30	5.24	0.2027	4.454
– Imported Coal(Boyaca)	Ton	43.96	0.030	1.32	2.10	0.0405	1.782
– Imported Coal(U.S.A)	Ton	65.93	0.500	32.97	52.39	0.6755	44.536
Coke Oven Gas	Nm^3	0.015	150.89	2.26	3.60	203.85	3.058
Utilities							
– Electricity	kwh	0.013	45.388	0.59	0.94	61.32	0.797
– Water	m^3	0.029	2.539	0.07	0.12	3.43	0.099
Cat/Chem	Ton	1.304	0.740	0.97	1.53	1.000	1.304
(1) Variable Cost	–	–	–	–	79.33	0.850	67.430
Operating Staff	M-Y	5,824			4.80	700	4.077
Overhead	Ope. Staff x 50%				2.40	–	2.038
Maintenance Cost	Plant Direct Cost x 2.0%				12.48	–	10.607
Tax & Insurance	Fixed Capital Cost x 0.5%				3.78	–	3.215
(2) Direct Fixed Cost	–	–	–	–	23.46	0.850	19.937
Credits							
– Coke Oven Gas	Nm^3	0.015	335.31	5.03	7.99	453.00	6.795
– Crude Tar	Ton	50.00	0.033	1.65	2.62	0.04458	2.229
– Crude Benzene	Ton	240.00	0.011	2.64	4.20	0.01486	3.566
– Ammonium Sulphate	Ton	100.00	0.012	1.20	1.91	0.01621	1.621
– Coke Breeze (Export)	Ton	40.00	0.11103	4.44	7.06	0.15000	6.000
(Local)	Ton	66.32	–	–	–	–	–
(3) Total Credits	–	–	–	–	23.78	0.850	20.211
(4) Production Cost = (1)+(2)–(3)					79.01	0.850	67.156

Table 16 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY FOR CASE 2 (3/3)

5. Outputs and Pricing
(FOB at the Plant with Full Capacity Utilization in 1993)

Outputs	Unit	Unit Price ($/Unit)	Annual Production (MM, Unit)	Annual Sales ($, MM)
BF Coke*	Ton	120.0	0.850	102.000

(Note) *:FOB Venezuela Price = CIF USA (135 $/t) – Ocean Freight (15 $/t)

6. Operation Schedule

(Unit: %)

	Project Year (-)3	(-)2	(-)1	1	2	3	..20	Total/
	95	96	97	98	99	00	2017	Avarage
– Financing Disbursement	10	50	40					
– BF Coke Production								
– Rated Capacity Utilization				80	100	100	100	1,980
– Inventory Increase				10	2	0	(–)12	0
– Inventory				10	12	12	0	0
– Sales				70	98	100	112	1,980

– Depreciation/Salvage Value 20 years straight line/Zero salvage value
– Amortization/Salvage Value 20 years straight line/Zero salvage value
– Corporate Income Tax 30%

– Debt Service

Loan Type	Maximum Grace + Maturity	Annual Interest Rate	Installments
– Long Term Loan/Foreign	3 + 20	5.00	20
– Short Term Loan/Local	0 + 1	5.00	1

– BF Coke Inventory 1.5 months
– Coke Breeze Inventory 1.0 month
– Crude Tar Inventory 1.5 months
– Crude Benzene Inventory 3.0 months
– Ammonium Sulfate Inventory 1.0 month
– Domestic Coal Inventory 0.5 months
– Imported Coal Inventory 1.5 months
– Account Receivable/Payable 1.0 month/1.0 month

Table 17 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY FOR CASE 3 (1/3)

1. Project

Title	: Establishment of Coke Plant Project
Location	: La Canada, Venezuela
Project Case/Study Date	: Case 3/June 6, 1994
Selected Coal (Domestic)	: FNO/Guasare
(Imported)	: Blue Creek (U.S.A.) Boyaca (Colombia)
Maximum Operable Days	: 365 DPY
Coke Production @100%	: 2,740 TPD x 365 DPY = 1,000,000 TPY
Yield of Coke Product	: 74.019% of Feed Coal Input
Feed Coal Input (Dry Coal Basis)	: 3,701 TPD x 365 DPY = 1,351,004 TPY
Production Start Year	: 1998
Monetary Unit	: US dollars($) in terms of fixed price in 1993
Exchange Rate for Caluculation	: 1 US$ = 115 Yen as an average in 1993 : 1 US$ = 95 Bs during site survey in 1993

2. Schedule

Contract Award	: Dec. 01, 1995
Mechanical Completion	: Feb. 28, 1997
Production Start	: May. 01, 1998
Project Phase Out	: Dec. 31, 2017
Project Life	: 20 Years from Production Start
Project Year	: May to April
Construction and Commissioning	: 29 months from Contract Award

3. Financing Required and Financing Plan in 1993 Price Base

Financing Required	US$, MM	Financing Plan		US$, MM
Land/Site Development	2.36	Equity	: 30.0%	197.79
Erected Plant Cost	606.36	Foreign Soft Loan:	70.0%	461.52
- Coke Oven	(177.23)	- Interest	: 5.00%	
- Coal/Coke Storage	(164.60)	Short Term Loan:		Balance
- By-Products	(142.02)	- Interest	: 5.00%	
- Common Facility	(46.50)			
- Engineering Service, etc	(76.01)	Financing Plan		659.31
Pre-Operational Expense	6.92			
Interest during Construction	27.37			
Fixed Capital Cost	643.01			
Initial Working Capital	16.30			
Financing Required	659.31			

Table 17 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY FOR CASE 3 (2/3)

4. Inputs and Pricing (CIF at the Plant in 1993 Price Base)

Inputs	Unit		Per Coal (Dry)		Per BF coke	Annual	
	Unit	Cost	Consumption	Cost	Cost	Consumption	Cost
		$/Unit	Unit/Unit	$/Unit	$/Unit	(MM, Unit)	$, MM
Raw Material exc. Moisture @9%							
- Domestic Coal(FNO)	Ton	26.37	0.290	7.65	12.15	0.3918	10.332
- Domestic Coal(Guasare)	Ton	21.98	0.230	5.06	8.03	0.3107	6.830
- Imported Coal(Boyaca)	Ton	43.96	0.190	8.35	13.28	0.2567	11.284
- Imported Coal(U.S.A)	Ton	65.93	0.290	19.12	30.39	0.3918	25.831
Coke Oven Gas	Nm^3	0.015	150.89	2.26	3.60	203.85	3.058
Utilities							
- Electricity	kwh	0.013	45.388	0.59	0.94	61.32	0.797
- Water	m^3	0.029	2.539	0.07	0.12	3.43	0.099
Cat/Chem	Ton	1.304	0.740	0.97	1.53	1.000	1.304
(1) Variable Cost	-	-	-	-	70.04	0.850	59.535
Operating Staff	M-Y	5,824			4.80	700	4.077
Overhead	Ope. Staff x 50%				2.40	-	2.038
Maintenance Cost	Plant Direct Cost x 2.0%				12.48	-	10.607
Tax & Insurance	Fixed Capital Cost x 0.5%				3.78	-	3.215
(2) Direct Fixed Cost	-	-	-	-	23.46	0.850	19.937
Credits							
- Coke Oven Gas	Nm^3	0.015	335.31	5.03	7.99	453.00	6.795
- Crude Tar	Ton	50.00	0.033	1.65	2.62	0.04458	2.229
- Crude Benzene	Ton	240.00	0.011	2.64	4.20	0.01486	3.566
- Ammonium Sulphate	Ton	100.00	0.012	1.20	1.91	0.01621	1.621
- Coke Breeze (Export)	Ton	40.00	0.11103	4.44	7.06	0.15000	6.000
(Local)	Ton	66.32	-	-	-	-	-
(3) Total Credits	-	-	-	-	23.78	0.850	20.211
(4) Production Cost = (1)+(2)-(3)					69.72	0.850	59.261

Table 17 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY FOR CASE 3 (3/3)

5. Outputs and Pricing
(FOB at the Plant with Full Capacity Utilization in 1993)

Outputs	Unit	Unit Price ($/Unit)	Annual Production (MM, Unit)	Annual Sales ($, MM)
BF Coke*	Ton	120.0	0.850	102.000

(Note) *:FOB Venezuela Price = CIF USA (135 $/t) – Ocean Freight (15 $/t)

6. Operation Schedule

(Unit: %)

	Project Year (–)3	(–)2	(–)1	1	2	3	..20	Total/
	95	96	97	98	99	00	2017	Avarage
– Financing Disbursement	10	50	40					
– BF Coke Production								
– Rated Capacity Utilization				80	100	100	100	1,980
– Inventory Increase				10	2	0	(–)12	0
– Inventory				10	12	12	0	0
– Sales				70	98	100	112	1,980

– Depreciation/Salvage Value 20 years straight line/Zero salvage value
– Amortization/Salvage Value 20 years straight line/Zero salvage value
– Corporate Income Tax 30%

– Debt Service

Loan Type	Maximum Grace + Maturity	Annual Interest Rate	Installments
– Long Term Loan/Foreign	3 + 20	5.00	20
– Short Term Loan/Local	0 + 1	5.00	1

– BF Coke Inventory 1.5 months
– Coke Breeze Inventory 1.0 month
– Crude Tar Inventory 1.5 monthsth
– Crude Benzene Inventory 3.0 months
– Ammonium Sulfate Inventory 1.0 month
– Domestic Coal Inventory 0.5 months
– Imported Coal Inventory 1.5 months
– Account Receivable/Payable 1.0 month/1.0 month

Table 18 PROJECT CASES COMPARISON SUMMARY ON COKE PLANT PROJECT

			Case 1	Case 2	Case 3
	Coke production	(tons/year)	1,000,000	1,000,000	1,000,000
	Coke yield	(%)	74.02	74.02	74.02
	Coal blending ratio				
	- Domestic coal (FNO/LAS or HAT)	(%)	32.00	32.00	29.00
	- Domestic coal (Guasare)	(%)	10.00	15.00	23.00
	- Imported coal (Boyaca)	(%)	3.00	3.00	19.00
	- Imported coal (U.S.A)	(%)	55.00	50.00	29.00
	B.F. coke sales volume for export	(tons/year)	850,000	850,000	850,000
1)	Capital Investment Cost	(million dollars)	660.95	660.46	659.31
2)	Financing Plan	(million dollars)			
	Equity	(30%)	198.28	198.14	197.79
	Long-term loans	(70%)	462.67	462.32	461.52
	Total		660.95	660.46	659.31
3)	Major Assumptions for Plant Operation				
	Sales prices for export	(FOB)			
	- B.F. cokes	($/ton)	120.0	120.0	120.0
	- Coke breeze	($/ton)	40.0	40.0	40.0
	Coal for coke making	(CIF, Dry base)			
	- Domestic coals (FNO/LAS)	($/ton)	26.37	26.37	26.37
	- Domestic coals (Guasare)	($/ton)	21.98	21.98	21.98
	- Imported coals (Boyaca)	($/ton)	43.96	43.96	43.96
	- Imported coals (U.S.A)	($/ton)	65.93	65.93	65.93
	Operating staff		700	700	700
	Service life on depreciation		20	20	20
	Interest rate on loan	(%)	5.0	5.0	5.0
	Repayment period		20	20	20
4)	Results of Financial Economic Analysis				
	Financial internal rate of return(FIRR)	(before tax, %)	0.19	0.94	2.78
		(after tax, %)	0.19	0.94	2.66
	Debt service ratio	(DSR)			
	- 1st year of operation		0.50	0.55	0.67
	- 2nd year of operation		0.65	0.72	0.89
	- 3rd year of operation		0.67	0.75	0.94
	Average production cost	(per B.F. cokes, $/tons)			
	- Cost not including depreciation and interest		82.50	79.01	69.72
	- Cost including depreciation and interest		143.29	137.92	123.63
	Sensitivity analysis on FIRR	(before tax, %)			
	- Sales price including Breeze	(up 20%)	4.97	5.54	7.00
	- Coal prices	(down 20%)	3.25	3.76	5.04
	- Investment cost	(down 20%)	2.86	3.65	5.61
	Economic internal rate of return	(EIRR, %)	0.95	1.69	3.52
	Foreign currency earnings	(million, dollars)			
	- Whole project life		385.55	474.26	657.69

Note Exchange rate: $1 = 115 yen = 95Bs
Pricing lebel: US$ in terms of fixed price in 1993
Project life: 23 years including 3 years of construction

Table 19 BREAKDOWN OF INITIAL WORKING CAPITAL

(Unit: 1,000US$)

Item	Amount Case 1	Case 2	Case 3	Remarks
- Inventory of products	8,930	8,631	7,834	1.51 months of the production cost in the initial year, not including depreciation (Note)
- Inventory of imported coal	5,077	4,632	3,721	1.5 months of the imported coal cost in the initial year
- Inventory of domestic coal	479	529	572	0.5 months of the omestic coal cost in the initial year
- Account receivable	7,694	7,694	7,694	1 month of sales including By products except COG in the initial year
- Account payable	▲4,240	▲4,041	▲3,516	1 month of variable cost in the initial year
Total	17,940	17,445	16,296	

(Note) The inventories of products including BF coke and by-products except COG are taken into account as follows.

- BF coke : 1.5 months
- Coke Breeze : 1.0 month
- Crude Tar : 1.5 months
- Crude Benzene : 3.0 months
- Ammonium Sulfate : 1.0 month

Allocating the costs on the base of the above inventory period and sales revenue (deemed to correspond to cost) by each product, the average inventory period becomes 1.51 months.

9. The Formed-coke Process

It is essential to use coking coal in order to obtain required coke strength for blust furnace use. But unfortunately reserve of coking coal is limited in comparison with non-coking coal. Many studies have been conducted to use non-coking coal into formed coke, which can be used as the principal fuel source for blust furnaces. And now the formed coke process is considered as the alternate process to be replaceable to conventional chamber type process.

In Japan steel industry has started their work for developing the utilization of the non-coking coal into formed coke since 1979. In 1986 pilot plan which produces 200 ton per day by continuous manufacturing process has start operation. The formed coke were tested in the blust furnace with the capacity of 4,000 ton per day though only 20 to 40% are blended. It is reported the test was successful.

The feasibility study of formed coke production plant with the capacity of 3,000 ton per day have completed. But until now commercial production has not materialized yet.

In Close 10, information pertaining the formed coke process are attached.

10. Information Pertaining the Formed Coke Process

(1) Pamphlet of the Japan Iron and Steel Federation, "
THE FORMED-COKE PROCESS"

(2) T. Okamura, Y. Izumiya, Y. Kondo, "Development of Formed Coke Process", Coke Making International, Vol.2, 1990 p9-p16

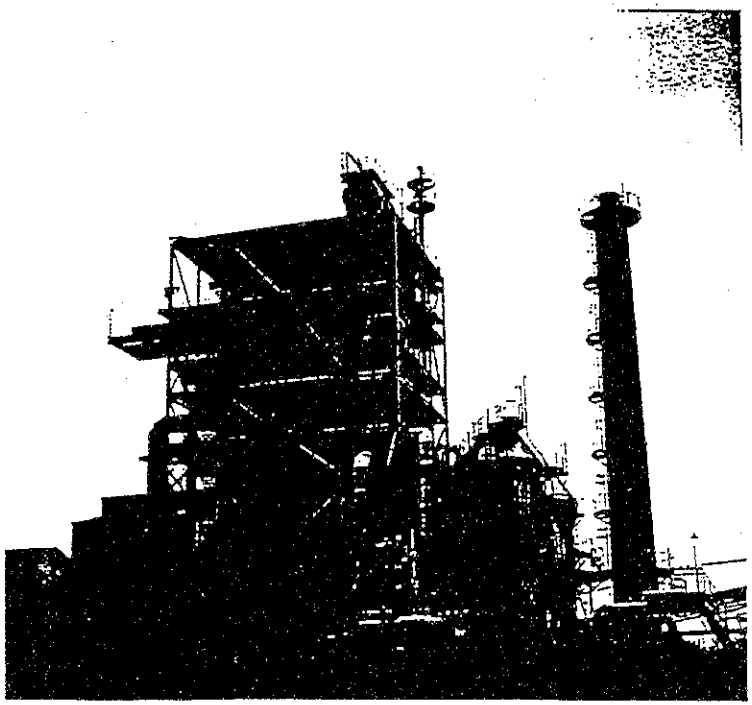
(3) S.Kubo, et al., "Result of the Test with Formed Coke at Tobata No.4 Blust Furnace", 1990 Ironmaking Conference Processing p405-p412

(4) I. Komaki, et al., "Development of Advanced Formcoke Process", The First International Congress of Science and Technology of Ironmaking, 1994

Information 1

Pamphlet of the Japan Iron and Steel Federation,
"THE FORMED-COKE PROCESS"

THE FORMED-COKE PROCESS



The Japan Iron and Steel Federation

Introduction

The manufacturing of pig iron requires the melting of iron ore and, for this, large amounts of coke are used as a fuel for blast furnaces. The steel industry's consumption of coke totalled 36 million tons, or 482 kilograms of coke per ton of pig iron produced in 1986.

The type of coal that can be used is limited. Coke destined for ironmaking must be high quality, so coking coal is used in existing coke ovens. Cheap non-coking coal, which is popularly used as a fuel for power generation, is of little use because it deteriorates coke quality. Moreover, while coal is the most abundant energy source on the earth, with recoverable reserves estimated at 670 billion tons, some 75 percent of these reserves is non-coking coal.

After years of studying how to use these abundant reserves of non-coking coal, Japan's steel industry recently developed a continuous manufacturing process that processes non-coking coal into formed coke, which can be used as the principal fuel source for blast furnaces.

The project was carried out by four steelmakers under the auspices of the Committee for Research and Development on the Formed Coke Process, which was created by the Japan Iron and Steel Federation in 1978. The four companies are Kawasaki Steel, Kobe Steel, Nippon Steel and Nippon Kokan.

A pilot plant with a capacity of 200 tons/day was constructed at the Yawata Works of Nippon Steel Corporation in 1984. For the next three years, R & D was carried out on formed coke manufactering technology, including the running of demonstration tests on the use of the experimentally produced formed coke in a large blast furnace.

The result was the epoch-making discovery of technology for the manufacture, and use of formed coke from 100-percent non-coking coal feedstock.

Today, the manufacture of formed coke and its use as the principal fuel source in blast furnaces is about to be commercialized.

For the steel industry, this breakthrough will translate into two important benefits: the effective utilization of resources and the reduction of cost of raw materials and fuel.

1 Features of Formed-Coke Process

Coke not only serves as a thermal energy source for reducing and melting iron ore, it also plays a key role in keeping spaces through which gas flows up and pig iron drips down in blast furnace.

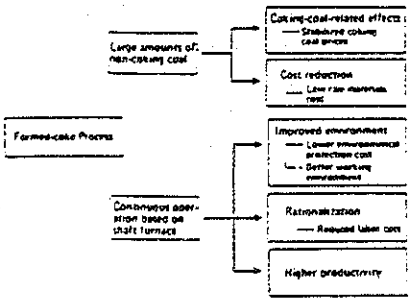
At present, ironmaking coke is manufactured from coking coal by being fed into a coke oven, where carbonizing takes place. Coking coal softens and begins to melt at around 350°C then resolidifies into a solid at approximately 500°C. The resolidification of non-coking coal is essential to the process of manufacturing coke.

The newly developed continuous formed-coke manufacturing process consists of a series of processes including the prior treatment of feedstock, briquetting, and carbonizing and cooling.

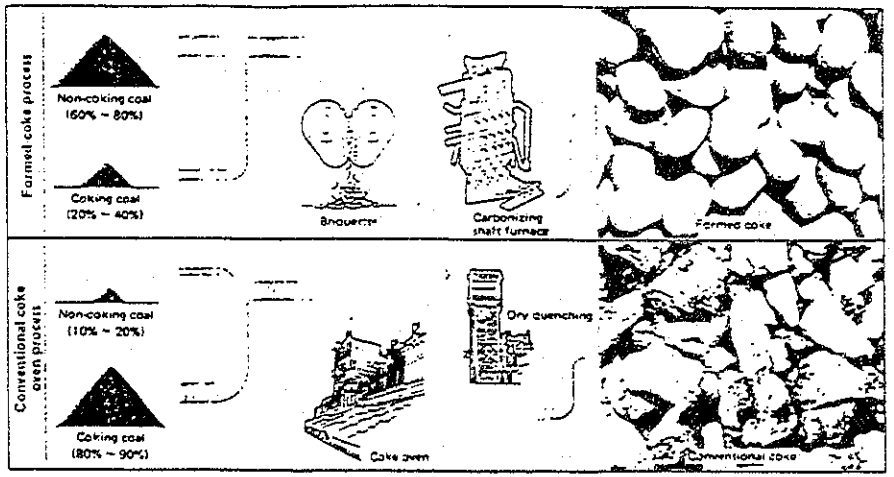
To make formed coke, non-coking coal, the principal raw material, is made into briquettes with the use of a bonding agent (binder) and then fed along a shaft furnace to undergo carbonizing treatment. The process has the advantage of enabling the use of conventional coke ovens.

Carbonizing and cooling are carried out, however, in a closed-system continuous shaft furnace, which is superior to conventional coke ovens in terms of a better working environment, improved labor productivity, easier start-up/suspension of operation, and limited needs for space.

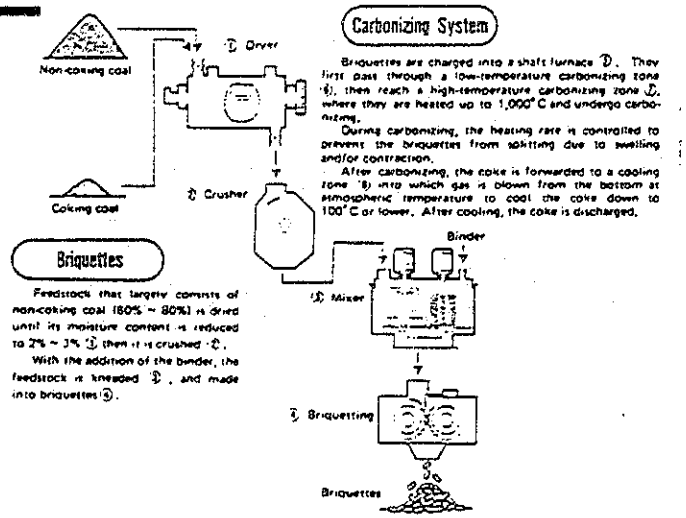
Sophisticated blast furnace equipment is used throughout the process, including the shaft furnace's charger and gas circulation system.



(Comparison Between Formed-Coke Process and Conventional Coke Oven Processes)



2 Flow of Formed-Coke Process



Briquettes

Feedstock that largely consists of non-coking coal (60% ~ 80%) is dried until its moisture content is reduced to 2% ~ 3% ①, then it is crushed ②.

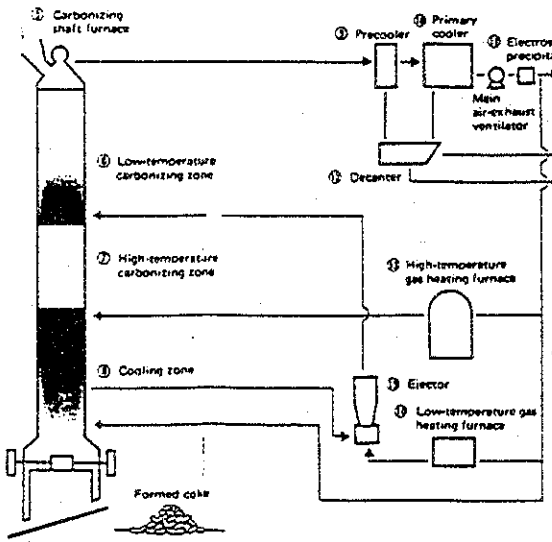
With the addition of the binder, the feedstock is kneaded ③, and made into briquettes ④.

Carbonizing System

Briquettes are charged into a shaft furnace ⑤. They first pass through a low-temperature carbonizing zone ⑥, then reach a high-temperature carbonizing zone ⑦, where they are heated up to 1,000°C and undergo carbonizing.

During carbonizing, the heating rate is controlled to prevent the briquettes from splitting due to swelling and/or contraction.

After carbonizing, the coke is forwarded to a cooling zone ⑧ into which gas is blown from the bottom at atmospheric temperature to cool the coke down to 100°C or lower. After cooling, the coke is discharged.



Exhaust Gases

Coke oven gas (300°C ~ 350°C) from the top of the oven is cooled down while passing through a precooler ⑨ and a primary cooler ⑩. After tar mist is removed by an electrostatic precipitator ⑪, the greater part of the coke oven gas is recirculated. Surplus gas is removed from the system to be refined and desulfurized, producing a clean fuel having a high calorific value (3,300 kcal/Nm³).

By-products

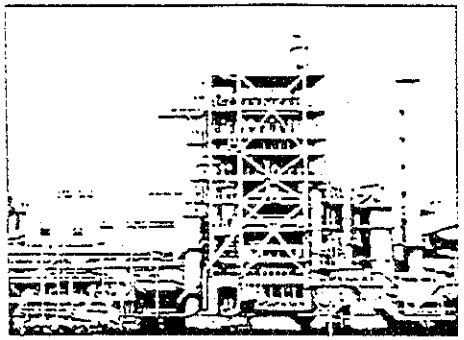
Liquids contained in the gases are led to a decanter, where tar and gas liquor are separated by sedimentation for additional processing. Processed tar is reused as the binder for briquettes.

Gas Circulation

Gases from which tar mist is removed by the electrostatic precipitator are heated to about 1,000°C in a high-temperature gas heating furnace ⑬, then blown into the high-temperature carbonizing zone. Some gases heated to 450°C in a low-temperature gas heating furnace ⑮ help drive an ejector ⑭, which absorbs high-temperature gases used in cooling the coke, blowing them into the low-temperature carbonizing zone at a temperature of around 600°C.

3 200-T/D Pilot Plant

The 200-tons-per-day pilot plant, constructed at the Yawata Works of Nippon Steel Corporation, produced 93,000 tons of formed coke during 580 days of operation between June 1984 and December 1986. The shaft furnace of the plant is 6.45 meters long, 1.25 meters wide and 14 meters high.



The successful technical results achieved at the plant are summarized as follows:

Major Equipment

	Equipment	No. of units	Specifications
Briquetting	Wet-coal surge hopper	1	50t
	Dryer	1	14t/h (dry)
	Crusher	1	14t/h (dry)
	Mixer	1	1.5t/charge (dry)
	Briquetter	1	18t/h (wet)
	Product tank	1	100t
	Returning-feed-stock pulverizer	1	2t/h
Carbonizing	Carbonizing shaft furnace	1	200t/d
	Chargers	4	max. 200kg/charge/unit
	Dischargers	4	max. 8t/h/unit
	Precooler	1	30,150Nm³/h
	Primary cooler	2	15,100Nm³/h
	Ejecter	2	9,400Nm³/h (wet)
	High-temperature gas heating furnace	2	5,800Nm³/h (wet)
	Low-temperature gas heating furnace	1	13,000Nm³/h (wet)
	Main Blower	1	30,150Nm³/h
	Electrostatic precipitator	1	30,150Nm³/h
Height of plant			36m

① Formed coke manufactured from 100-percent non-coking coal

A blended feedstock consisting of 70-percent non-coking coal and 30-percent coking coal was used for ordinary operation. The manufacturing of formed coke from 100-percent non-coking coal was demonstrated successfully.

② Stable operating and engineering technologies

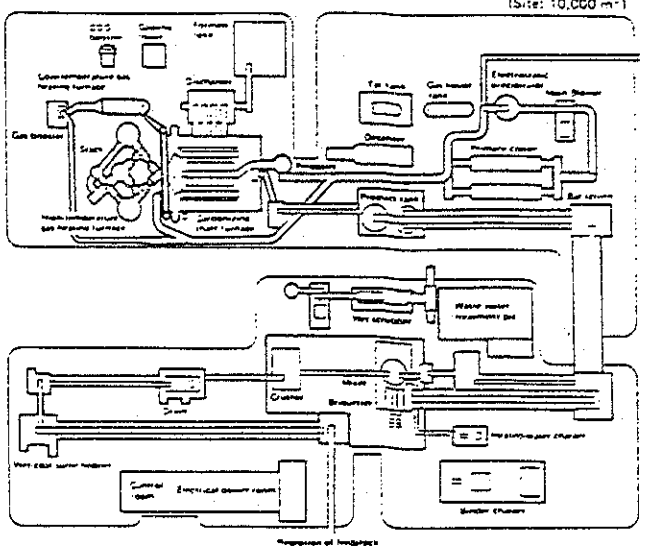
The pilot plant operated normally at its designed capacity of 200 t/d, but also achieved a test production level of 300 t/d. Moreover, the plant achieved a heat consumption of 320 megacalories per ton of formed coke.

③ Large blast furnace continuously charged with formed coke for 74 days

The Tobata No. 4 blast furnace was continuously charged with 20-percent formed coke for 74 days, from October 22, 1986 to January 3, 1987. The furnace has an inner volume of 4,250 m³ and a capacity of 8,000 t/d. During the test, the furnace was normally charged with 20-percent formed coke, but a maximum of 30-percent formed coke also was successfully demonstrated. The tests confirmed that formed coke can be used in the same manner as coke-oven coke.

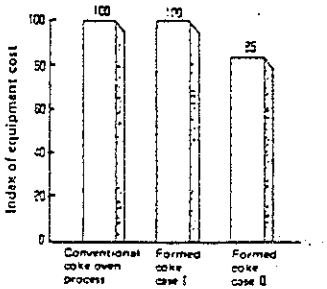
Layout of Pilot Plant

(Site: 10,000 m²)

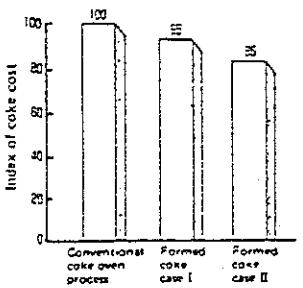


4 Economical Specification of Formed-Coke Process

A case study was conducted successfully at a 3,000 t/d plant, based on the pilot-plant test results. The study substantiated that the continuous formed-coke manufacturing process is fully competitive with the conventional coke oven process, though costs of equipment and manufacturing can vary depending on the coal blending (see charts below).



Equipment Cost Comparison



Coke Cost Comparison

Information 2

T. Okamura, Y. Izumiya, Y. Kondo,
"Development of Formed Coke Process",
Coke Making International, Vol.2, 1990 p9–p16

Development of Formed Coke Process

T. Okuhara*, Y. Izumiya* and Y. Konno**

1. Introduction

The manufacture of blast furnace coke by the conventional chamber oven process requires coking coal with caking properties as the principal raw material. The maximum proportion of noncoking coal that can be used in the chamber oven process is 20 to 30% of the coal charge, even when the briquette blend coking process and preheated coal charging process are applied as coal preparation techniques. Use of noncoking coal, claimed to account for three-fourths to four-fifths of the world's hard coal reserves, as the principal raw material in the manufacture of blast furnace coke is an important issue for coal resource conservation and coke production cost reduction. The coke-oven battery is composed of many coking chambers and involves many problems associated with automation and labor saving, as well as air pollution and a poor working environment.

To solve these problems of the chamber oven process, the development of various formed coke processes has been undertaken by many countries in the world [1]. Formed coke for blast furnaces has a history of over 40 years of research and development, but it has not yet been manufactured on a commercial basis. Nippon Steel developed a new formed coke process after many years of research [2]. To commercialize the formed coke process, Nippon Steel conducted joint research with three other steelmakers using a pilot plant [3 to 5] and succeeded in the development of the techniques required for the process. This report introduces the new formed coke process, with emphasis placed on the research and development work with the pilot plant.

2. History of Research and Development

As shown in Figure 1, research in this process was conducted over nine years from 1978 to 1986. A pilot plant was constructed in four years from 1980 to 1983, followed by three years of test operation. Formed coke produced by the pilot plant was tested in a blast furnace in 1986. Various improvements on the process were studied in parallel with the pilot plant study.

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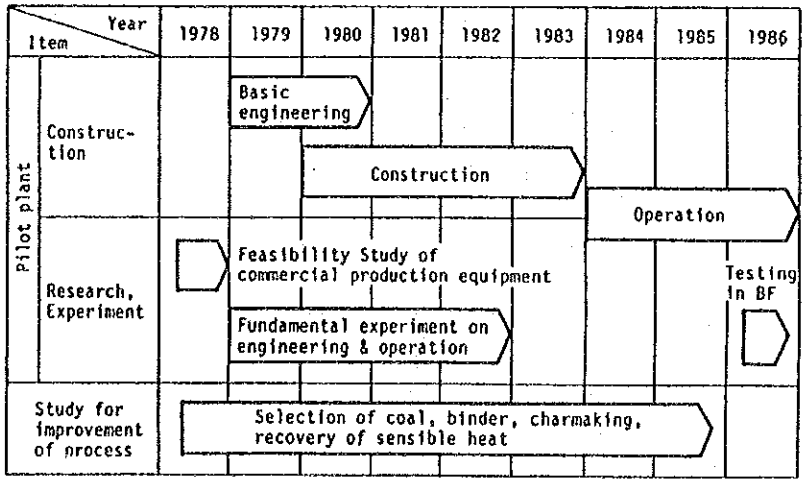

Figure 1. Development schedule.

3. Pilot Plant with Production Capacity of 200 t/d

Process Flow. In the formed coke process, cold briquettes are continuously carbonized in a shaft furnace using gas as the heating medium. The process is based on the research undertaken by Nippon Steel [2]. The pilot plant is designed to produce 200 tons of formed coke per day. It consists of a series of processes, such as coal preparation, coal briquetting, briquette carbonization and gas cooling as shown in **Figure 2.** In the briquetting process, coal is dried in advance and soft pitch is used as the binder. The pilot plant is entirely continuous, except for the kneading step in which the coal is mixed with the binder on a batch basis.

The formed coke process has a number of innovative features in the carbonizing process. The basic principle of the carbonizing process is that cold briquettes are continuously carbonized in a shaft furnace by controlling the carbonization behavior of cold briquettes according to the heat pattern concerned [2]. The carbonizing temperature pattern based on the principle in schematically shown in **Figure 3.** The key innovations tried for the first time in the carbonization process are as follows:

1) The briquettes are heated by two rows of tuyeres to impart a heat pattern required to control their carbonization behavior, such as collapsing, sticking, swelling and cracking.
2) For carbonizer simplification, all operations from carbonization to cooling are continuously performed in a single carbonizer.
3) For high-calorie gas recovery, the generated gas is indirectly preheated and recirculated as the heating gas.
4) To utilize the sensible heat of coke for heating briquettes, the gas used for cooling is withdrawn from the carbonizer and recirculated to the low-temperature tuyeres.

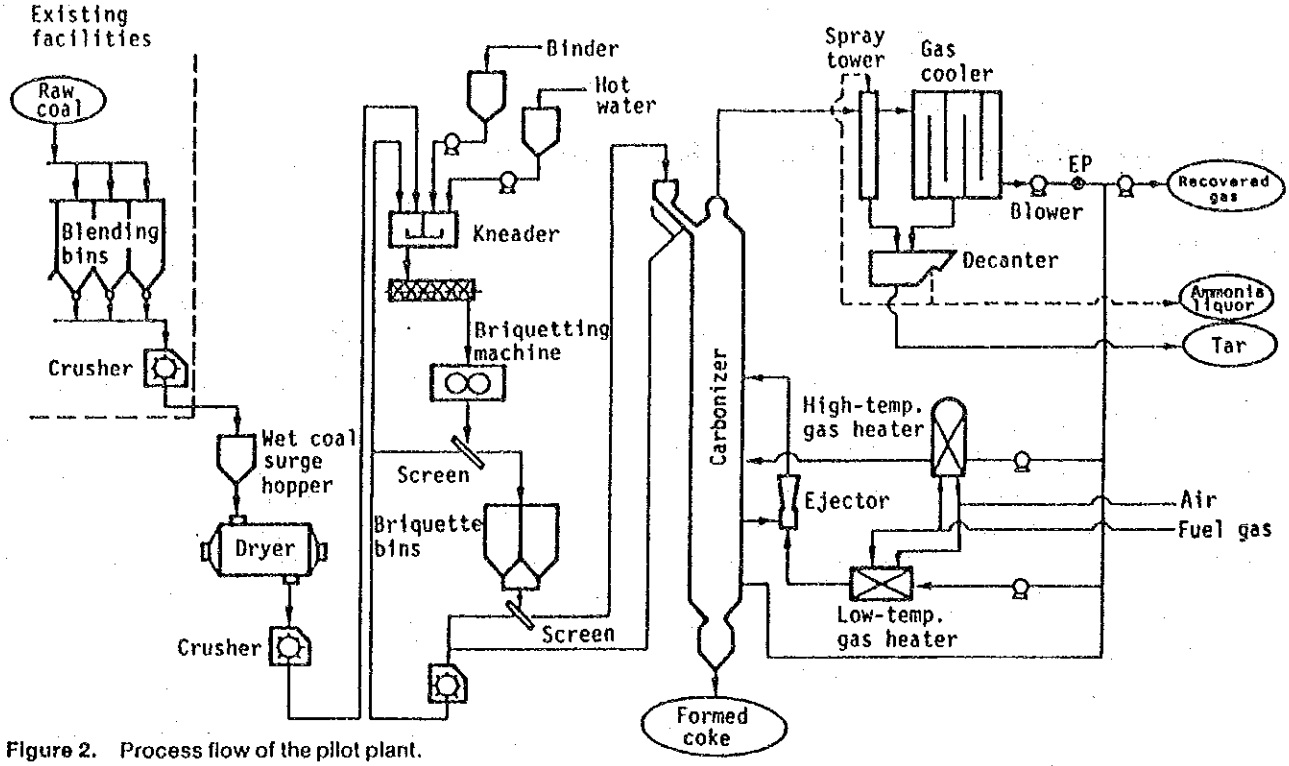

Figure 2. Process flow of the pilot plant.

The pilot plant was built in the coke plant of Yawata Works. The supply of raw materials and utilities needed and the treatment of products obtained depended entirely on the coke plant. The raw coals blended and crushed at the coke plant were transported by belt conveyors to the pilot plant. The recovered gas was piped to the generated gas main of the coke plant where it was mixed with the gas generated there and fed into the gas refining process.

Features of Carbonizing Equipment. The carbonizer is schematically illustrated in Figure 4. The carbonizer has a rectangular cross section. To avoid the scale-up problem, the carbonizer of the pilot plant has the same width and height as those of commercial carbonizers but its length is less than that of the latter. Four charging devices and four discharging devices are installed along the length of the carbonizer. Five tuyeres are installed along each header pipe for moving the heating gas and cooling gas in and out of the carbonizer. An ejector is provided on each side of the carbonizer to remove and circulate the gas used for cooling the formed coke. The low-temperature heating gas is indirectly preheated by a recuperator, while the high-temperature heating gas is preheated by hot stoves. The pyrolysis of hydrocarbons in the circulating gas forms carbon, which

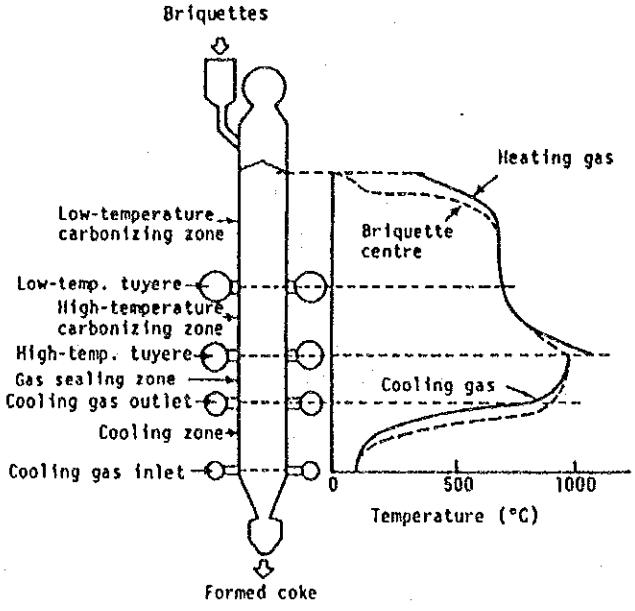

Figure 3. Profile of a carbonizer.

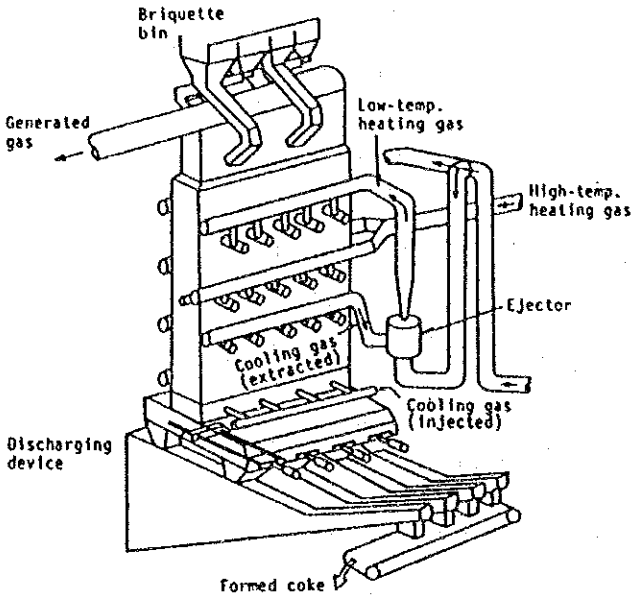

Figure 4. Schematic illustration of carbonizer.

builds up in the high-temperature gas circulation system. The deposited carbon is burned off by air introduced during the changing of the hot stoves.

4. Test Operation of Pilot Plant

Outline of Test Operation. The pilot plant was operated for two years and six months from June 1984 to December 1986 in nine stages as initially planned. During this period, the pilot plant operated for 579 days and produced a total of 93,000 tons of formed coke, 61,000 tons of which were tested in a blast furnace. The formed coke was tested in the blast furnace in the last half of 1986.

Stable Operating Technology. The changes in the production rate and operating rate of the pilot plant during the test operation are shown in Figure 5. In the fifth to eighth stages of test operation in which formed coke samples for testing in a blast furnace were produced, the pilot plant was continuously run for a minimum of 70 days and a maximum of 110 days. The carbonizer was shut down due to troubles for less than 1% of each of the test periods (The low operating rate in the fifth stage was attributable to troubles in the briquetting process).

The pilot plant gradually increased the production of formed coke and accomplished as average daily production rate of 197 tons, just short of the designed capacity of 200 t/d, for 110 days of continuous operation in the eighth stage. A maximum daily production rate of 313 tons was recorded in the ninth stage. In the seventh stage, the pilot plant ran at the designed production rate of 200 t/d for 61 consecutive days, as shown in Figure 6. It was thus confirmed that the pilot plant was fully stable in the production quantity and quality of formed coke.

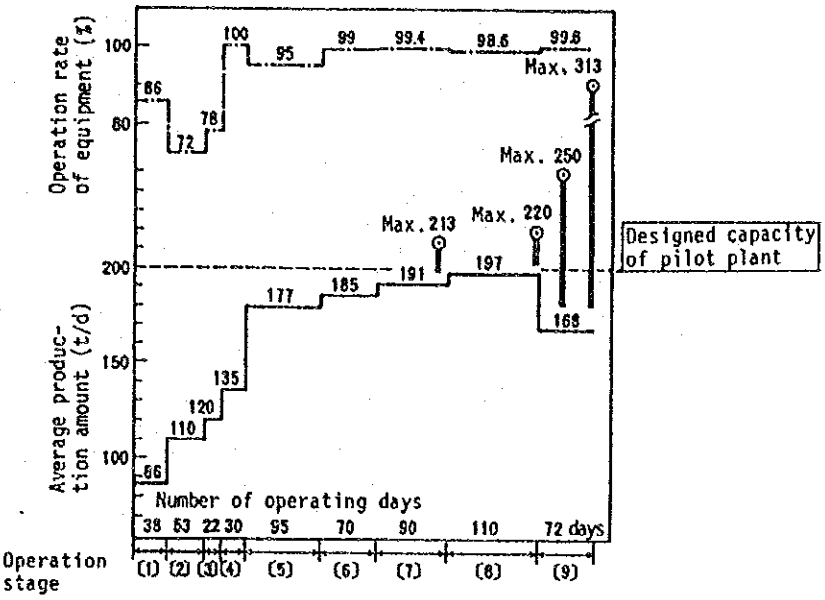

Figure 5. Transitions of production amount and operation rate.

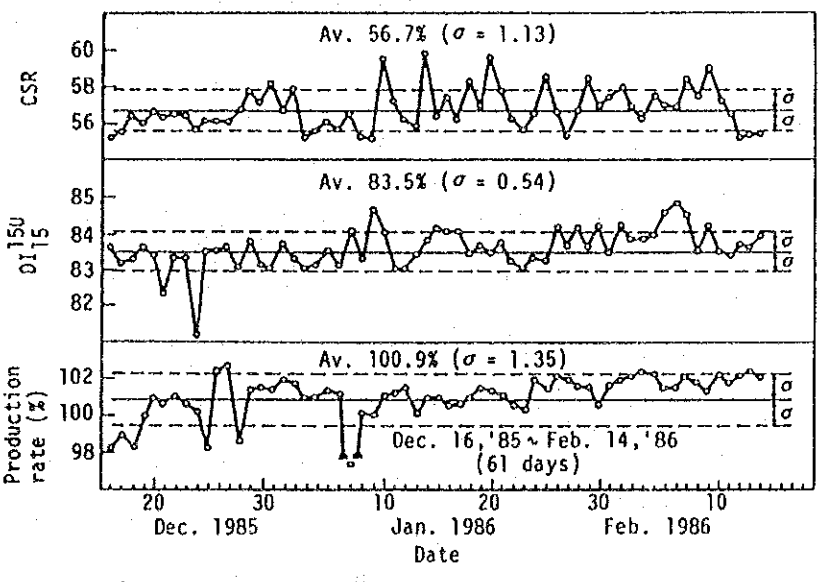

Figure 6. Operating results at 100% production rate.

The automation and sealing of devices for charging and discharging briquettes and formed coke, and for circulating the heating gas were as initially expected. In the shutdown periods in the nine stages of test operation, all devices but the hot stoves were cooled to ambient temperature. No troubles occurred in the equipment and operation of the pilot plant. The carbonizing equipment took four days each to shut down and restart. These figures proved that the carbonizing equipment was flexible enough to meet any production adjustments required.

Formed Coke Manufacturing Conditions. It was made clear that the carbonization conditions required to ensure the smooth descent of briquettes in the carbonizer and stabilize the quality of formed coke can be established by adjusting the top gas temperature and low-temperature tuyere gas temperature. The properties of the coal blend were found to exert a great effect on the top gas temperature and low-temperature tuyere gas temperature. For coal blends with high caking properties, it is desirable to raise the top gas temperature and lower the low-temperature tuyere gas temperature, as shown in Figure 7. The top gas temperature should be lowered to reduce heat consumption for carbonization but must not be lower than about 270°C, lest the tar vapor in the gas should condense.

It was found that the desired strength of formed coke can be maintained even if the high-temperature tuyere gas temperature is lowered to 850°C – 900°C, as shown in Figure 8. The amount of binder that must be added to form briquettes was successfully decreased to about 6.5%.

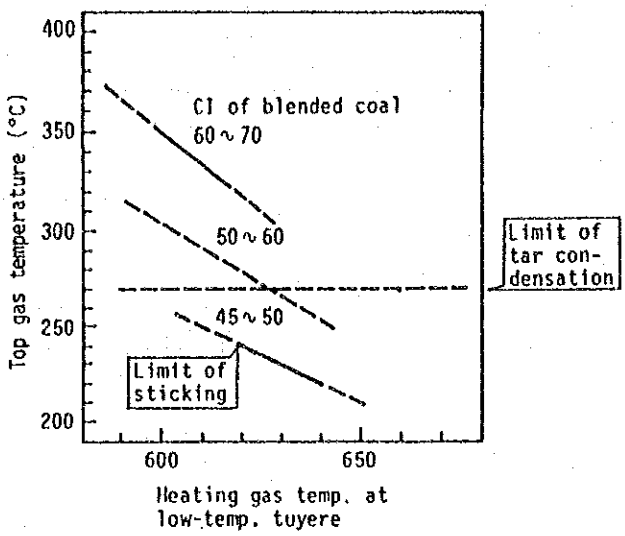

Figure 7. Relation between properties of blended coal and optimum carbonizing conditions.

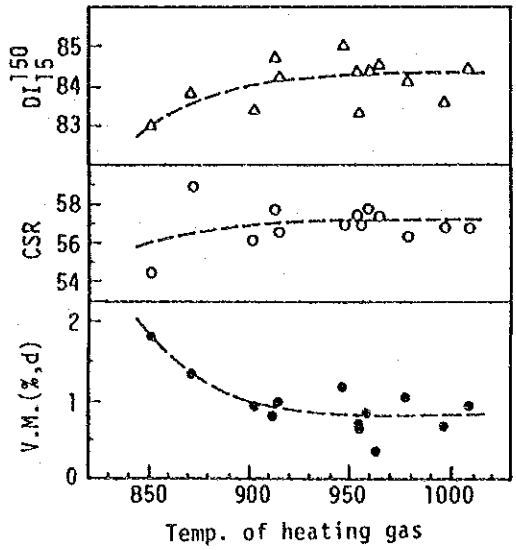

Figure 8. Relation between the heating gas temperature at high temperature tuyere and coke qualities.

		Samples	I	II	III	IV	V
Blending conditions	Blending ratio (%,d)	Non-coking coal	65	68	78	100	75
		Caking coal	35	32	22	0	25
		Binder	8.0	7.4	7.4	7.4	7.0
	Coking property	V.M. (%,d)	26.7	25.8	25.0	24.8	34.4
		C.I.	69.9	65.7	56.5	52.4	68.4
Quality of formed coke	Size distribution (%)	+50 (mm)	9.2	6.4	3.1	1.9	4.1
		50 ∿ 25 (mm)	83.8	87.0	90.4	93.9	83.3
		-25 (mm)	8.0	6.6	6.1	4.5	12.6
	Strength	DI^{150}_{15}	84.1	83.9	84.4	86.3	81.2
		CSR	56.7	56.8	55.8	56.1	47.5
	Porosity (%)		38.5	40.1	34.0	29.6	42.4

Table 1. Typical blending conditions and qualities of formed coke.

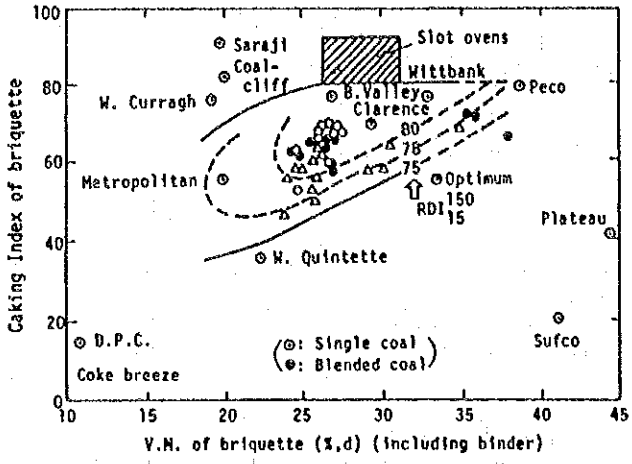

Figure 9. Properties of coal, blended coal and coke.

Coal Blending Conditions and Formed Coke Quality. The coals and coal blending conditions used in the test operation of the pilot plant are shown in Figure 9. The noncoking coals (caking index < 80) ranged from 19 to 45% (d) in volatile matter. The coal blends containing the binder ranged from 24 to 38% (d) in volatile matter and from 45 to 72 in the caking index. Several examples of coal blending conditions and formed coke quality are given in Table 1. When the blending ratio of noncoking coals was 65 to 100%, strength of formed coke produced was high enough as blast furnace coke. This result confirmed that the formed coke process can use noncoking coal as the principal raw material and can produce blast furnace coke from noncoking coal of suitable nature.

The particle size of formed coke is mostly in the range of 50 to 25 mm and the porosity of formed coke is smaller than that of coke made by the conventional chamber oven process.

Mass and Heat Balances in Carbonizing Process. The production yields of coke, tar and gas in the carbonizing process of the pilot plant are compared with those in the conventional coke-making process in Figure 10. The formed coke process has a tar yield about twice that of the chamber oven process but a far lower gas yield than that of the latter process. The calorific value of gas recovered from the formed coke process was about 3,700 kcal/Nm^3, as shown in Table 2. This value is low compared with that of the conventional chamber oven process but is exceptionally high for a formed coke process. The tar produced in the new formed coke process exhibits properties of low-temperature tar of low weight and small condensation degree, because it is not subjected to secondary pyrolysis at high temperatures as in the chamber oven process.