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VARIOUS FACTORS (MARKET, DEPOSITS, ENERGY, FINANCE ETC.) AFFECTING LOCATION OF IRON AND STEEL PLANTS [1]

by

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SUMMARY

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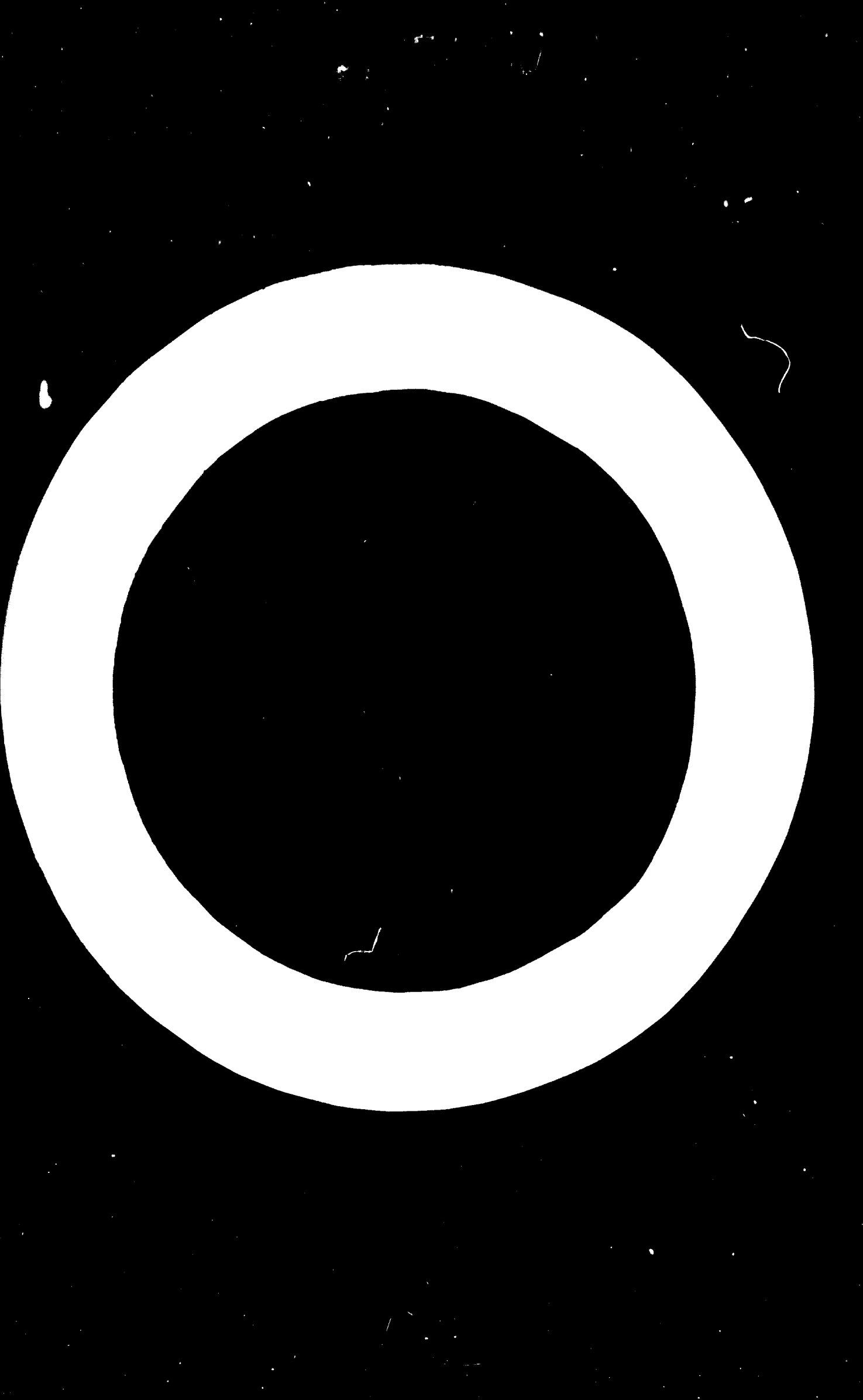
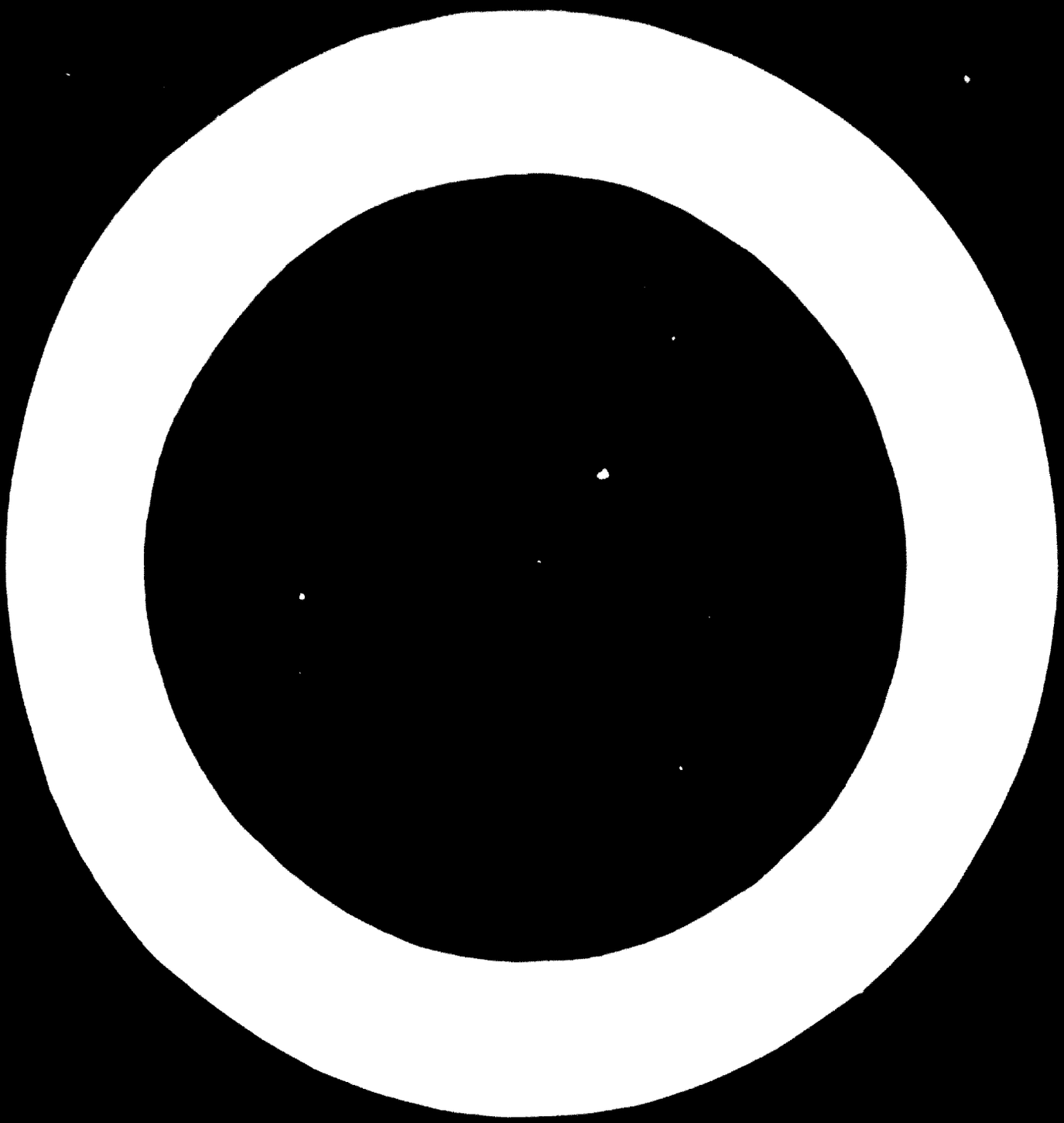




Prior to taking the final decision upon the location of an iron and steel plant it is necessary to finalise the principal matters related to the construction of the plant, volume of production, specialization and range of produce, production engineering, raw materials and fuel supplying sources.

The location of a plant is done in two stages:

1. Determining the area of location.
2. Selecting the site for construction of the plant.

Iron and steel requirements present an important factor in locating the plants. It is also necessary to study advantages and disadvantages of the geographical location, and metal requirements in various areas of the country. It is a practice in the USSR to work out long-term balances of consumption and production of rolled products for various economic regions. The expected deficiency of rolled products in one of the regions finally determines the new plant's location.

Large quantities of materials, especially iron ore, lime stone and fuel are required for normal operation of a plant. Consumption of iron ore is the largest in the metal manufacturing process, hence - the importance of iron ore fields location. Iron ore transportation scope and cost constitute the most significant part of the plant's loads circulation.

It is worth noting that as the engineering process advances the importance of iron ore and coal deposits location lessens.

At present special attention is paid to the preparation of iron ore for the melting. The bulk of iron ore is dressed, and with the use of up-to-date methods of dressing even deposits of low iron ore content can be exploited nowadays.

Therefore, in order to reduce transportation losses, dressing plants are now built in the mines areas, and it is the concentrate of smaller size that is supplied to iron and steel manufacturing plants. If there is small concentrate available pelletizing plants may be installed at the mines, and then, only pellets are delivered to the iron and steel plants. Thus, not only the geographical location of iron ore fields, but the quality and preparation level of the iron ore too are equally decisive in making the final choice of the construction site location.

A serious consideration is also given to that how far from the metallurgical plant proposed for construction, coal fields are situated.

Good preparation of iron ore for the production process provides for the reduction of specific coke rate. Employment of natural gas and fuel oil in the blast furnace process still further reduces requirements for coke, and hence the demand for coking coal.

So far as non-integrated plants are concerned, the major factors to be considered, when their location is selected, are scrap available in the area as well as permanent scrap supplying sources, for example, machine building factories; and possible conditions for generating cheap electric power required for operating electric arc furnaces.

In certain cases non-integrated plants are located depending upon the idea of establishing a cooperation with another similar iron and steel plant situated, in the same vicinity, with the aim of arranging the exchange of various production materials, e.g. slabs for strip plates or other semi-finished products, between the two plants.

Much consideration is also given, when the location is selected, to transport and communications, the availability of railroads and waterways, and to what extent they are loaded.

In Japan, for instance, the iron and steel industry is accomodated close to the sea-coast as iron ore and fuel are supplied at a low cost by sea vessels.

Extensive hot processes of an iron and steel plant require large quantity of water for consumption, and this fact is also considered carefully when the construction site of such a plant is selected.

More detailed economic and technical information is required to make the choice of a plant's construction site as compared with the matter of selecting the area of it location.

The site sizing should correspond, for the first thing, to the plant's make-up being designed and allow, too, for the future extension of the enterprise. Land topography and the scope of earthwork to be fulfilled affect the amount of capital investment and transport maintenance costs. Engineering geology conditions also reflect on the cost of construction.

In some cases water supplying arrangements may prove to be decisive for the site selection, especially if these are not sufficient in the area. The choice of the site very often depends upon electric power sufficiency in the area, particularly in the case of large power consuming plants. Conditions for the supply of construction materials, sufficient personnel and living accomodation, transport arrangements good for the delivery of raw materials and fuel, and the disposal of the plant's produce - those are the factors to consider and estimate at siting the plant, as they all bear the influence on the economy of the plant's construction and operation.

In the majority of cases, it is always more feasible, judging by the scope of transportation, to site iron and steel plants near iron ore fields, for the consumption rate of iron ore per 1 ton of rolled products is usually higher than that of coking coal.

It is necessary, however, that in every instance the importance of various factors as well as their influence on the proposed plant economy are carefully studied and estimated. It is always worth considering alternative areas of locating and siting, for such comparison usually provides for making the better choice from the point view of both capital and operation costs.

The principal factors of location are thus as follows:

1. Domestic market capacity and conditions for export.
2. Closeness to raw materials and fuel sources.
3. Availability of good transport communication.
4. Reliable supplying sources of water and cheap electric power.
5. Availability of personnel, training facilities and provisions for accomodating personnel in the plant's vicinity.

VARIOUS FACTORS (MARKET, DEPOSITS, ENERGY, FINANCE ETC.) AFFECTING LOCATION OF IRON AND STEEL PLANTS

Prior to taking the final decision upon the location of a new iron and steel plant it is necessary to finalize the principal matters related to the establishment and construction of the plant, namely, the output, the products assortment, the specialization of the plant, its co-operation with other works, approximate technological constitution, the financing of the project and, finally, the economic efficiency of the investments. All these factors are closely interconnected and greatly influence each other.

Two basic groups of factors influence the locating an industrial enterprise, namely, natural conditions (geographic environment) and social conditions. In turn the second group may be divided as follows: 1) forms of production management; 2) transportation; 3) level of industrial progress; 4) energetics.

All the conditions mentioned are closely interrelated. The effect of identical natural conditions on the location of industrial enterprises considerably changes depending on forms and level of production management, as well as on the level of industrial development and transportation.

The influence of transport conditions on the location of an enterprise changes in accordance with the level of industrial progress and with forms of social production management. On the other hand, reasonable limits of specialization and optimum size of enterprises may depend on the technical level of transportation.

The constitution of an enterprise may change with the growth of industrial progress as well as the existing relation between material and labour expenditures, which have a direct influence on the location of an enterprise.

The effects of all these conditions are changing with the advances made by the society. Thus the effect of individual factors are to be considered in their development and in close connection with the growth of the national economy of the country.

The demand for metal is a major factor affecting the construction of a new plant.

In the report dealing with total technical and economic grounds for developing the iron and steel industry, means and methods for studying long-term demand for metal are considered as they are determinant for the construction of a new plant.

The determination of an expediency for constructing a new plant requires studying the demand for metal all over the country, the need of major steel consumers, considering types and sizes of rolled products, and the quality of metal, meanwhile to solve the problems of this new plant location it is quite important to study the demand for metal in separate

economic regions.

In the Soviet Union the long-term demand for metal in different regions is determined on the base of studying actual metal consumption, the sources of metal supply and the major consumers of the metal in its different types and assortments.

The long-term demand for metal in the region is established according to the available data concerning metal [illegible] enterprises and industries on the base of long-term predictions, plans and [illegible].

The demand for metal and the [illegible] can be [illegible] complete assortment of the operating iron and steel plant [illegible] period of [illegible] the future plant are considered in the total long-term [illegible] of demand and [illegible] the role of products in an economic region. The balance [illegible] the same in separate types of the rolled products is shown, which can [illegible] eliminated through the construction of a new plant and supplying the metal production [illegible] the consumers. When estimating the demand for metal it is very important to take into account the possible export of metal, which can serve a source of currency. The demand for metal in a given region is one of the factors determining the location of a new plant, and when estimating this factor it is important to consider the cost of metal produced at the new plant and supplied to the consumer in comparison with the cost of metal supplied from other possible sources.

The demand for metal and the availability of raw materials and fuel resources determine to a great extent the size of a new plant.

The output of an integrated iron and steel plant is usually high. The location of the plants are determined not only by meeting the demand for metal but by the location of iron ore and coal deposits as well. The extent of the deposit, the grade of iron ore and coal, methods of mining and preparing them for use, as well as expences connected with the ore and fuel transportation are important factors, influencing the location of an iron and steel plant. From 1.5 to 2.5 tons of rich iron ore, sinter or pellets and from 0.5 to 1.0 ton of coke (depending on their grade) are needed to produce one ton of iron.

If one has to construct an iron and steel plant producing about 3,000,000 tons of steel it is necessary to produce at this plant about 2,500,000 tons of iron (without goods iron) and this means the conveyance of 3,750,000 - 6,250,000 tons of high grade iron ore, concentrates or pellets.

The character of a deposit, the iron ore grade as well as methods of ore mining and processing for use greatly influence the dependence of a plant location from iron ore fields.

An iron and steel plant can be supplied with iron ore from one or several iron ore deposits. This depends on the output of the future plant, on the extent of the deposit and on the ore grade. If iron ore is supplied to the plant from several deposits the plant has usually to be located nearer to the greatest and the richest of them. However there can be other alternatives depending on the conditions of mining and preparing ores at the mines.

High-grade ores can be used at the iron and steel plant without benefication, using only preliminary crushing and grading, for which purpose crushing plants are constructed at the mines. Low-grade ores containing less than 50% Fe are at present widely used in iron-making. These are usually beneficated.

To decrease the volume of ore transportation the dressing plants are usually constructed at the mines. If a large-sized concentrate is received after benification then its transportation to the iron and steel works creates no difficulty.

At the iron and steel works the concentrate is delivered to the sintering plant to produce sinter, from which iron is made. If the concentrate is fine, its transportation is rather a difficult task, as it is weathered and thus great losses of ore occur. In such a case it is ne-

economy to consider the possibility and the expediency of a pelletizing plant being constructed directly at the mine, and the product of this plant would then be transported to the works and used there for the iron-making.

It was stated above that the transportation of the iron ore raw materials is very extensive, therefore the properties of the ore material transported and the cost of transportation greatly influence the cost of [illegible] and the economics of the works. The higher the iron content in the transported iron ore fitting in [illegible] and the losses during transportation), the less attention is paid to [illegible] between mine and works, when considering the location of the works. This takes [illegible] losses suffered in the course of transportation that are may not prove to be most profitable type of raw materials. The high technical level of [illegible] industry allows at present to get prepared ore with a high iron content, and very low [illegible] than that of rich ores. This makes it possible to decrease the volume of transportation, but this however does not solve the problem.

The necessity and the degree of [illegible] and separation of ore are determined each time by special technical and economic investigations in which the major factors are production cost and the volume of investments [illegible] iron, including production costs at the works and capital investments for mining and preparing the ore at the mine.

These final results are of decisive importance for solving the problem of locating a new works. A prominent role in these investigations is played by the cost of transporting iron ore necessary for making 1 ton of iron and the capital investments needed for it. Very often the deposits of iron ore and fuel are located in barely accessible districts. In such a case methods and costs of transportation acquire a prime importance.

It is quite necessary to determine the conditions of construction and cost of approach lines connecting the mine with the existing railway system or with the iron and steel plant and the necessity to improve existing ways when the volume of transported iron ore loads grows.

If the iron ore is transported by railroad, type of trains and trucks is of prime importance. The ore transportation in hoppers and railroad tankers is much cheaper than in box cars, as this facilitates the mechanisation of unloading them and thus makes the transportation cheaper.

In the USSR when studying the problem of locating iron and steel plant very often they take into consideration the possibility of use of empty railroad cars when they return from the steel plant to the mine, as this makes an economy of 30-40 per cent of the transportation cost. This factor may greatly influence the decision of locating an iron and steel plant. When considering the problems of location an iron and steel plant the transportation of all types of raw materials, fuel and allied products are to be analysed considering not only the physical volume of transportation, by also their cost, as this greatly influence the steel plant location. Apart from iron ore raw materials an iron and steel plant requires a considerable amount of limestone, which is used in blast-furnace and steelmaking plants. For a works having 3,000,000 tons annual capacity as much as 1,000,000 - 1,500,000 tons of limestone is needed. Limestone is occured more often than iron ore. Therefore the location of their deposits influence the location of an iron and steel plant to a more little extent. However in some countries the limestone deposits occur quite infrequently, and in such a case they are a major factor in determining the question of locating a new steel plant.

Manganese ore is added to the blast-furnace burden in small amounts and therefore the location of its deposits is insignificant for locating a new iron and steel plant.

A factor of prime importance appears to be the location of coal fields. A specific coke rate is 0.6 - 1.0 ton per ton of iron for which 1 or 2 tons of coking coal is needed respectively. For a works producing annualy 3,000,000 tons of steel it is necessary to transport

2,500,000 - 5,000,000 tons of coking coal. Therefore in volume of transporting raw materials and fuel to an iron and steel plant coking coals are the second after iron ore. Apart from coking coals an iron and steel works requires energetic coals for power plants and other needs. The demand in such coals of a plant of 4,000,000 tons annual capacity is about 720,000 tons.

This makes the location of coal fields an important factor for the decision of a new iron and steel plant building. The availability and location of coking coals are of particular importance for the iron and steel industry (coking coals - coals of special grades, having a high caking ability). The sulphur content is detrimental for iron making and therefore it must be as low as possible.

To improve the grade of coals they are usually dressed. Often the strata of coking coals are intermitted with non-coking ones and it complicates the extraction of coking coals and raises the price of the process. In the course of dressing a semi-product is produced, the use of which at the works requiring it or other consumers is to be decided.

To decrease the volume of transportation the coal dressing plants are usually constructed at the mines. However when locating an iron and steel plant near a coal field a coal dressing plant may be included into the iron and steel works complex or constructed near it with the use of the intermediate product at the works. Such is practised in the Soviet Union.

In the coke and by-product industry the volume of coal transportation will be the least when locating the coke plant near coal fields. On the other hand, when a coke and by-product plant is included into the iron and steel works complex the rich coke-oven gas is widely used in production processes, while for the heating of coke ovens a more lean blast-furnace gas is used and the waste heat of the coke and by-product industry is utilized. Coke breeze is used in iron ore sintering. During transportation coke grade lowers and such tight relations between coke-making and iron and steel production provide benefits of such significance that these benefits upset the economy got in transporting coal, when locating coke-making plants near coal fields.

Good preparation of raw materials for blast-furnace operation provides for a lower coke rate per 1 ton of iron. The preparation of raw materials includes crushing and screening lump ore and fluxes, beneficating low grade ores, increasing Fe content in concentrates and producting self-fluxing sinter or pellets with complete eliminating the use of raw flux in the blast-furnace burden.

The use of natural gas in the blast-furnace process is one of the major technical achievements in recent years. This allows the volume of coking coal transportation to the steel plant to be decreased. Thus the improvement of production processes makes a steelmaking plant less dependent on the coal fields location.

The improvement of knowledge in geology of the country opens many possibilities for the use of new iron ore deposits and coal fields. New methods of ore and coal mining lower their cost and allow to make a wider use of mineral resources. The process of beneficiation allows for an effective use of low-grade ores with low content of valuable matter. In the iron and steel industry, for instance, the process of beneficiation makes it possible to use not only high-grade ores with 55 - 60 per cent of Fe, but low-grade ores too and in particular ferriferous quartzites (contains 25 - 30 and even 16 - 18 per cent of Fe (Kach-Khanar titaniferous iron ores in the Urals, for example).

The base for coking coals has been greatly expanded.

Metallurgical coke can be produced from coals containing 25 - 30 per cent of ash and 5-6 per cent of sulphur, these coals being pre-beneficated. In the USSR the development of a number of fields for coking coal became possible due to the improvement of the methods of beneficiation. As a result of beneficiation the coke grade is improved and the specific coke

rate lowered due to increasing its carbon content and correspondent decreasing the ash content. The specific coke rate is decreased by 1,0 - 1,5 per cent and by 2,0 - 2,5 per cent when its sulphur content is lowered by 0,1 per cent and by 1,0 per cent respectively. Raising the iron content of the concentrate would secure not only the decrease of its specific consumption but also the decrease of coke rate per operation.

The expansion of the raw materials and fuel base is [illegible] the choice of regions for constructing a [illegible] and steel plant [illegible] into account [illegible] favourable combination of the main factors affecting it.

The rate of consumption of different types of raw materials and fuel is not uniform. To produce 1 ton of iron in the XIX century about 4,5-5,0 tons of coal and 1,5-2,0 tons of high-grade ore was needed, that is the coal rate outlitted that of iron ore by 3,0 times. This meant that an iron and steel plant had to be located nearer to coal fields than to iron ore ones, as this provided for lower total transport costs. And it was actually so.

As a result of the developments in metallurgical production, the specific coke rate in the Soviet Union averages at present 0,7 - 0,8 tons per ton of iron and makes 0.420 tons at the best furnaces. Besides, the total coal consumption with losses during beneficiation, is 1,2 - 1,5 tons per ton of iron, and at the best furnaces it was decreased to about 1 ton. The specific consumption of iron ore concentrate is 1,5 - 1,7 tons and more.

Thus the previous proportion between iron ore and fuel consumption has greatly changed. The iron ore rate exceeds the coke rate. Consequently locating an iron and steel plant near an iron ore deposit is much more economically advantageous than locating it near a coal base, as the volume of transportation is considerably less in the first case.

The availability of natural gas and the possibility of using fuel oil can also influence the location of an iron and steel plant, as these can partially substitute coke.

Above, the influence of raw materials and fuel factors on an integrated iron and steel plant location was considered. When constructing a steel plant using a direct iron ore reduction process without the use of a blast furnace, the importance of these factors changes depending on the volume of ore and fuel transportation. The availability of coking coal fields loses its significance as this process does not require coke. However depending on type and character of the process the demand for other types of fuel arises, and the location of its fields, the distance and the method of supply can influence locating a steel plant.

An iron and steel plant by its character of production is a great consumer of water. This can be explained by the fact that it includes a series of cooling operations, for which water is the main cooler. With direct flow system of water supply about 300 cu m of it is consumed per ton of steel produced, and when recirculating system is used, allowing to re-use waste water after cleaning, the consumption of fresh water is only about 30 cu m.

To receive such amount of water it is necessary to have reliable sources of supply. When choosing a site for constructing an iron and steel plant it is quite important to take into consideration the possibility of water supply. Sometimes the erection of reservirs, channels etc. may be required.

As mentioned above the production of iron and steel is connected with receiving huge amounts of raw materials and fuel. The external freight turnover of an iron and steel plant producing 3,000,000 tons of steel annually is about 18,000,000 - 20,000,000 tons. The share of transportation cost in the total cost of steel products is 25-30 per cent. Therefore the transport conditions are of great importance for the location of an iron and steel plant. In Japan, for instance, iron and steel plants are accomodated close to the seashore as iron ore and fuel are supplied at a low cost by sea vessels. In Turkey an integrated iron and steel plant was constructed in 1965 in Eyerly on the Black Sea shore. The choice of this site was

justified by the convenience of delivering iron ore and coal to the plant and dispatching products to the customers by sea. The plant is not connected with the railroad system. The coal is supplied by sea too from the distance of 30 kilometers.

The solid base for the choice of a site for constructing a new iron and steel plant may be the presence of railroad junction and a well developed system of highway roads, as transportation problem is very important for the profitability of an iron and steel plant.

Factors governing the location of a non-integrated steel plant are quite different from those governing the location of an integrated plant. The annual capacity of such plants is much less. A non-integrated plant producing 200,000 - 300,000 tons of steel annually is considered a significant one. For countries and regions with moderate demand for metal a non-integrated plant of a considerably low output can meet this demand.

Non-integrated plants can be constructed with two main processes - steelmaking and rolling or one of them. The type of the process influences the need for raw materials and fuel, and this in turn influences the location of such a plant.

Non-integrated plants with steelmaking are usually equipped with electric arc and open-hearth furnaces. The charge of electric arc-furnaces consists of 90 per cent of iron and steel scrap, and that of open hearth furnaces working with cold charge consists of 50 - 60 per cent. A non-integrated plant with an annual capacity of 300,000tons of steel needs about 300,000tons of scrap. Of this amount about 75,000 tons can be get at the plant as return scrap consisting of the waste originating in rolling and steelmaking shops. The rest is received from outside. The scrap of metal-working and machine-building industry, the scrap of old cars and equipment, of railroad, transport ships and cars and at last domestic scrap - all of them can be a source of getting iron and steel scrap.

The supply of a non-integrated plant with iron and steel scrap is to be established in such a way as to consider not only the available stocks but also the possible sources allowing their continuous replenishment. These are industry, transport, mechanized agriculture etc.

Usually industrial regions are the main consumers of metal, which allows to locate non-integrated plants at the places, where factors of consumption and of raw materials are combined, that is make it possible to get cheap metal. This condition is usually the reason for locating such plants near metal consumers.

The location of non-integrated plants may also be based on co-operation with another plant locating near-by from which they can get or to which they can send billets for re-rolling or other types of semi-finished products. Such co-operation is of great importance when having one or several small plants.

The availability of fuel is of little significance for locating non-integrated plants, as its consumption is quite small. A determining factor influencing the location of non-integrated plants with electric arc furnaces, consuming much electric power, may be the possibility of getting cheaper power from a large power station.

To make a plant work many experienced workers, engineers, technicians and employees are needed. The possibility to getting such personnel for the plant in the region chosen for constructing an iron and steel plant is also quite significant a factor for locating a plant. The efficiency of constructing an iron and steel plant and its profitability are to a great extent connected with the character of the site, selected after the determination of the region for locating an iron and steel plant.

The choice of a site for constructing an iron and steel plant requires more detailed economic and technical data as compared to the determination of the region of location.

First of all a site for construction an iron and steel plant is to be chosen taking into consideration locating all necessary shops and services, systems of water and power supply

and transport communications. International experience as a whole, and that of the Soviet Union in particular, shows that an iron and steel plant is developing continuously, and as time passes the erection of new shops can be needed, the adoption of new processes can be required, and shortage of spare space may create great difficulties. Therefore it essential to reserve such spare space in addition to those given in the design. For the capacity of 1,000,000 tons of steel a site of 150 hectares is needed. Thus, a site of 450 - 500 hectares is required for an iron and steel plant with the annual capacity of 3,000,000 tons of steel.

Huge quantities of loads are being brought to an iron and steel plant. Therefore it is very important that the site would be as flat as possible, having no sharp slopes up and down so as different shops would not have to be constructed at different levels. As a rule the site is to be artificially levelled. The cost of building depends on the volume of excavation work for ground digging and filling. The amount of the necessary excavation work is usually compared for alternative sites considered for constructing an iron and steel plant.

The engineering and geological condition of the site include the quality of ground. The condition and cost of the project is also greatly influenced by the availability and level of subsurface waters as well as by the ground stability.

The climate and the meteorological conditions of a given area, that is absolute minimum and maximum temperatures, their gradient, humidity, direction of winds etc., are of great importance for constructing and operating an iron and steel plant.

As the input and output of an iron and steel plant is large it is quite important when choosing the site for such a plant to take into account the access to the railroad, the possibility of a harbour building etc.

When choosing a site it is necessary to consider the actual conditions of water supply, such as the acceptability of the source of water, the height of water feeding, the need for a water reservoir building, the quality of water etc. It is also necessary to consider the conditions of electric power supply, particularly, in the case of great power consumption. If a power station is situated near-by, it is possible to decrease power losses in the power supply systems. The availability of heating units at the power station makes it possible to supply the plant with steam and hot water.

Many building materials are needed for constructing an iron and steel plant. The availability in the area of enterprises producing building materials and the conditions of their supply to the site are of major importance for decreasing cost and time of construction. The close vicinity of a town or some inhibited point and the possibility of engaging of workers and engineering and technical personnel for construction and operating the steel plant are factors of major importance for choosing a site for an iron and steel plant. The close vicinity of an iron and steel plant to a town is of great importance for constructing it, as it facilietes finding dwellings for building and operating personnel. On the other hand, the constructing an iron and steel plant requires the creation of a new town, as the number of workers is so great that it is quite difficult to place them all in the existing town. Meanwhile, an iron and steel plant is to be situated at a certain distance from the town (the so-called sanitary zone) as a great quantity of toxic gases are discharged into air when a steel plant is operating.

The share of transportation costs for raw materials and products in the operating cost of metal is very significant. As the consumption of ore per ton of rolled products is greater than that of other raw materials and fuel in the volume of transportation it is better to locate an iron and steel plant near iron ore deposits. However, it is quite necessary to consider separately for every individual case the importance and the degree of influence of separate factors on the economics of the future iron and steel plant. It is essential to con-

sider a number of alternate locations, which may differ from each other not only in the economic effect but also in terms of realisation. Therefore costs of these alternate locations are to be carefully estimated. The practice of locating iron and steel plants in the Soviet Union, based upon comparison of indices, permits to choose such alternatives of location, the realisation of which under the same expenditures provides the utmost increase of social labour, thus creating the maximum saving of the necessary social expenditure for manufacturing a unit of production. In the Soviet Union the criterion of an economic estimate, when comparing the alternatives of location, are the terms of the investments return that is the ratio of the differences of investments and the difference of the costs of goods products per year in different alternatives. The return is calculated in years.

The conception of efficiency index is also used. This is defined as the ratio of difference between the wholesale price of the finished products and their production cost and the total capital investments. The most advantageous alternative is that, the realisation of which provides the minimum time of capital investment return or the highest efficiency index.

The following standards for the 7 years time of investment return and efficiency index of 0,14 are established in the iron and steel industry of the USSR.

When several(more than two) alternatives of location are available the total index is considered to be the index of equated expenditures, widely used in the Soviet Union, namely:

$$S = K + E_n$$

where S - the cost price;

K - the capital investments per each alternative;

E_n - the standard efficiency coefficient.

When defining the economic indices of different alternatives of an iron and steel plant location it is necessary to consider possible time of completion of construction in the alternatives considered as this would influence the profitability of the plant. In the Soviet Union the time factor is estimated as follows:

$$K_{eq} = \frac{K}{(1 + E)^t}$$

where K_{eq} - the capital investments equated to the present time,

K - the capital investments,

E - the standard coefficient,

t - the time of construction.

When estimating the alternatives of a steel plant location it is necessary to consider the cost of the metal delivery to the customer.

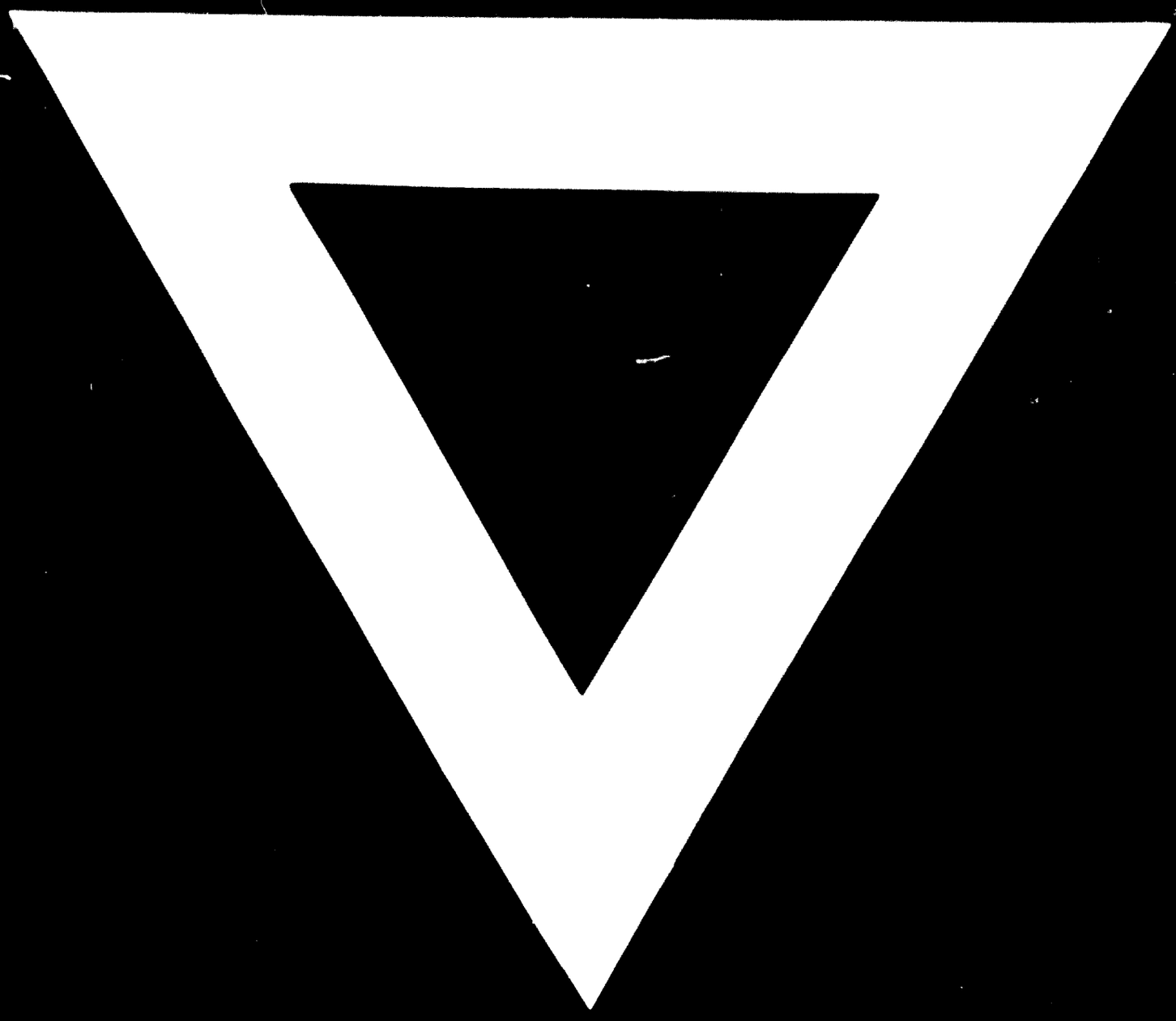
It is possible to estimate the alternatives of an iron and steel plant location in accordance with the profits received under different alternatives with the same output.

Estimating the efficiency of a steel plant constructing one has to compare the economics of import of metal with its production at the works planned.

The principal factors of a new iron and steel plant location are thus as follows:

1. The possibilities and convenience of the product marketing;
2. Closeness to raw materials and fuel sources;
3. Availability of good transport communication;
4. Reliable sources of water supply and cheap electric power;
5. Availability of personnel, training facilities and provisions for accomodating personnel in the plant's vicinity.

As a result of estimating all the above factors when comparing several alternatives of an iron and steel plant location, the best region for the plant is chosen, providing for the highest profitability of the plant construction and operation.



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