

DEVELOPMENT OF STEEL INDUSTRY IN PAKISTAN

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At the time of partition Pakistan's share of Steel Industries was two production units. North-Western Railway, Moghalpura in the public sector and Mukand Iron & Steel Works, Badami Bagh, Lahore in the private sector. North Western Railway Steel Works consists of a 3 tons Arc Furnace and an 18 century Bridge Crane used for transporting hot metal, the later renamed as BATALA Engineering Company was comprised of a 5 tons Arc Furnace and a 6 inch rolling mill powered by a Rustin type slow speed diesel engine and some other allied units and a machine shop. Total production capacity of steel by the two Arc Furnaces was about 12,000 to 13,000 tons/year.

In Gujranawala, Duska, Wazirabad and in Sialkot some small industries were using steel amounting to a few tons/year to cope with requirement of tools for farmers and for cutting knives. The rest of the country including East Pakistan had no steel industry worth the name except the type mentioned above. Among the steel users were Machine Tool Manufactures around Brandreth Road, Lahore and Fabricators of Agricultural implements at various places.

While announcing its first industrial policy in 1947 to 1948 the Government of Pakistan reserved 27 industries including iron and steel for control by the centre. Development of Industries (Federal Control) Act was enacted in 1949 and iron and steel was included under the schedule of industries under the central control.

In September, 1949 the Hon. Minister for Finance and Economic Affairs, Government of Pakistan, invited the United States Steel Export Company to recommend to the Government of Pakistan the most effective method of obtaining the kinds and qualities of steel required for Pakistan economy. The U.S. Export Steel Mission consisting of 17 experts submitted a report to the Government in 1950 recommending detailed specifications of the various plants to be installed. By the end of 1951 PIDC appointed Messrs. Koppers Company, Pittsburg, U.S.A., to draw up a detailed scheme. At the same time PIDC had appointed Demag of Duisburg, Germany, to undertake the primary investigations of iron ore of Chitral and of other indicated areas of Pakistan. The results were very encouraging, as they proved that the setting up of an integrated iron and steel plant, based on the raw material sources of Pakistan, was possible. The first prospecting work was launched at Kalabagh and its surrounding areas

and the probable and possible reserves of iron ore to the extent of 18,000,000 tons were established.

In 50's war in Korea proved boom period and Pakistan earned substantial amount of foreign exchange, liberal licences were issued to the importers of iron and steel into Pakistan which is evident from the following figures :—

Import of Iron and Steel

YEARS							
1948	1949	1950	1951	1952	1953	1954	1955
tons	tons	tons	tons	tons	tons	tons	tons
31,938	83,982	1,45,703	2,10,488	3,00,132	1,27,604	1,03,821	1,32,060

As a result a few additional rolling mills were installed.

By 1954 very little by way of foreign exchange was left to feed rolling mills. Whereas PIDC in right earnest worked to find the avenue for a moderate start towards a steel mill, the others began planning to instal Arc Furnaces to utilise the available steel scrap. In public sector construction on Iron & Steel **Foundry in Wah** started at the end of 1954 and round about the same time, the plan for **Karachi Shipyard Foundry** was finalised and execution began about 1956.

In the meantime based on the Krupp's report, the PIDC submitted a scheme for Government's approval in 1955. This scheme was criticized by the Planning Board on the grounds that the Krupp-Renn process was not industrially sound and feasible and that the scheme was not economically viable.

A revised proposal meeting the criticism against the old scheme was submitted by the PIDC in 1956 in consultation with Messrs. Krupp. This proposal involved the installation of a plant at Piran Ghaib near Multan for the production of 50,000 to 70,000 tons of billets to be manufactured from Chichali Iron Ore with the Krupp-Renn process and electric arc melting furnaces. This proposal was again strongly criticized by the Planning Board leading to its non-acceptance by the Government.

In early 1959, the services of Mr. C. L. Austin of the World Bank were acquired by the Government to advise on the future course of action for the establishment of the iron and steel industry in Pakistan. Based on Mr. Austin's recommendations, the Central Cabinet decided that :—

- (i) exploratory work in the Chichali area to prove the reserves in depth and analysis of as many samples as possible be carried out;
- (ii) the Bureau of Mineral Resources handle the project on a priority basis ; and

(iii) the PIDC continue its prospecting operations for iron ores in the Chichali area.

In compliance of Central Cabinet decision, Bureau & Mineral Resources in 1959 assigned investigation to Messrs. Kellogg of U.S.A. who in turn proved that Chichali Iron Ore is not suitable for direct reduction. It was also later on proved that it is averse to Krupp-Renn process.

However, wheels of industries turned on with positive result. The sheer will of the people through Arc Furnaces built up steel production capacities to 63,600 tons per year till 1960.

The break-up is given below :

1. Public Sector

(i) Pakistan Ordnance Factory	..	10,500	tons/year	
(ii) Pakistan Western Railway, Lahore	..	15,000	” ”	
(iii) Karachi Shipyard & Engineering Works	..	5,400	” ”	
				30,900 tons/year

2. Private Sectors :

(i) Karimi Industries, Nowshera	..	4,500	” ”	
(ii) Steel Casting Ltd., Gujranwala	..	3,000	” ”	
(iii) Sartaj Industries Ltd., Lahore	..	3,600	” ”	
(iv) BECO Industries, Lahore	..	21,600	” ”	
				32,700 tons/year
				<hr/>
	Total	..	63,600	tons/year
				<hr/>

The PIDC was bifurcated in 1962 and EPIDC planned a steel mill based on imported pig iron and scrap and went into production in 1969 with a moderate target of 75,000 tons/year which was by 1970 increased to 150,000 tons/year and ultimately by expansion to a production capacity of 250,000 tons/year, unfortunately disturbances of 1971 brought everything to a standstill.

War with India in 1965 resulted with raw material shortage for Rolling Mills. Line Frequency Induction Furnaces due to their low cost compared to production capacity and easy manipulation became popular. By 1968 a few induction furnaces came into production. The war gave added impetus; liberal licences were issued for import of Arc Furnaces on bonus. Capacity of steel production by Arc Furnaces and Induction Furnaces reached 1,24,000 tons/year. In 1970-71 sanction to import about 40 Arc Furnaces on bonus

were issued to the private sector. If all are imported and set up, the steel production even at a conservative estimation shall reach 3,60,000 tons/year. A novel achievement by any standard but unfortunate was nearly all of them are engaged on production of steel for structural purposes *i.e.* medium and low carbon steel.

A contract was signed in 1960 by the Government of Pakistan and U.N. Pak Mineral Survey Committee for mineral investigation in Pakistan and it was proved by Geological Surveys that reserves of iron ore and other raw minerals required for iron making exist and the following deposits were confirmed later in 1961-63 by the United Nations Special Aid Fund :—

- (a) 250 million tons of uniform quality of iron ore in one block on both sides of Chichali pass, and another 150 million tons in Kutch, Ghughlan and Makerwal Mines.
- (b) 200 million tons of high grade limestone;
- (c) 900 million tons of dolomite, ample reserves of ;
- (d) high quality fireclay ; and
- (e) moulding sand.

Abundant supplies of water for cooling and industrial use are available from the river Indus.

In view of the above the United Nations Special Aid Fund arranged a pilot plant trial on 1,500 tons of Chichali Iron Ore at Ougree near Liege in Belgium in November, 1964 and found that iron could be successfully extracted from it by acid blast furnace process. This was further confirmed by a full-scale industrial test on 15,000 tons Chichali Iron Ore at Salzgitter, West Germany in June, 1966 which according to the international experts was a complete success.

A scheme prepared by WPIDC in 1966, on alloy steel production, passed on to the private sector, is now under execution as Valika Steel Mill, Karachi. The total production is about 20,000 tons/year. This, when in full production shall partially meet the need of stainless steel sheets, bars and sections and totalling to 12,000 tons/year and remainder being the defence requirement and steel castings in high alloy steel and forgings. Added to this shall be about 60,000 tons steel of various composition in forms of ingots, castings and forgings from WPIDC, Heavy Foundry & Forge Project at Taxila.

If the Government sanctions the Mini Steel Mills under consideration and allows the 34 applicants recommended by an Expert Group appointed by CIPCOC to import Arc Furnaces, Pakistan shall be self-sufficient to some extent. No country in the world ever adopted such a unique and untried method of producing ordinary steel by Arc and Induction Furnaces. By any standard Arc or Induction Furnaces steel should not be economic when

compared to Open Hearth Steel, yet West Pakistan produced cheaper than Chittagong Steel Mill.

As a result of Premier Kosygin's visit to Pakistan in April 1968, the Government decided to offer the Kalabagh Steel Mill Project to the Russians for consideration. An agreement was signed between the WPIDC and Messrs. Tiajpromexport of Moscow, in May 1968, for the preparation and submission of an economic and technical report on the Kalabagh Steel Mill Project.

The Russian experts submitted their feasibility report on the Kalabagh Steel Mill Project on 17th May, 1969. Whilst disagreeing with the technical and economic aspects of the Kalabagh project report as presented by the Salzgitter group earlier, the Russians considered that the Kalabagh project based on the use of 100% Chichali ore would suffer from extremely high capital costs and unfavourable operating economics.

To sum up from a humble beginning in 1947 with the total production capacity of steel in West Pakistan of about 12,000 to 13,000 tons/year at present the steel production capacity by Arc and Induction Furnaces totals to as given below :—

	Public Sector	Private Sector	Total
1. Existing Capacity	.. 77,500 tons	37,500 tons	1,24,000 tons
2. Under Installation (Recognised).	.. 80,000 ,,	..	80,000 ,,
3. Under Installation (Unrecognised).	32,000 ,,	32,000 ,,
			<u>2,36,000 tons</u>

Proposal under consideration of the Government

1. Capacity applied (total 34 applicants).	.. 7,24,600 tons/year	
2. Capacity recommended by Expert Group appointed by CIPCOC.	.. 4,24,800 tons/year	
		<u>4,24,800 ,,</u>
	Total ..	<u>6,60,000 ,,</u>

Presently three standard units for steel production are used throughout the world they are :—

1. Arc Furnace.
2. Open Hearth, and
3. Converter.

Two units mentioned in my paper are Arc Furnace and Open Hearth.

From the facts and figures given already it appears that a sizeable production capacity for steel making by arc furnaces and induction furnaces exists in the country and it is a common knowledge that arc and induction furnaces of lower capacity are being manufactured and also installed.

Leaving aside the integrated coastal steel plant at Karachi to be executed with the help of USSR, other avenues open for Pakistan are :—

- (i) Mini Steel Mills based on imported scrap, sponge iron, metalloids etc. processed in arc furnaces and cast by continuous casting machine to meet the demand of indigenous rolling mill for medium and light sections in the country.
- (ii) Medium size steel plant of 150,000 to 250,000 tons capacity based on standard blast furnace and converter for pig iron and steel production, and supplemented later on with rolling mills.
- (iii) Workable small arc furnaces fed by locally generated scrap to support light capacity rolling mill.
- (iv) A duplex method of steel making from pig iron and cast iron scrap melted in coupla or reverberatory furnaces and processed by a side blown converter (Tropenus) into steel.

As far as an integrated steel mill is concerned, the history is well known to the interested people. It is very difficult to assign to anybody the cause of delay in the execution or the reason for not arriving at a right decision regarding the selection of location or whether such a plant should be based on local sources or imported basic raw materials *i.e.* iron ore, coal etc. The deciding factors are other than the technical aspects. Nevertheless the opinion of the majority of the professionals regarding the coastal steel plant is that the uncertainty regarding the basis on which this plant has been based *i.e.* sources of raw material must be eliminated.

Three schemes for Mini Steel Mills for making 75,000/150,000 tons per annum according to the interested sources, are still under the consideration of the Government, two of them are from Sind province *i.e.* Karachi area and one from the Punjab region. These schemes were comprehensive and well drawn out, the economics discussed by the applicants were alluring except one snag that steel scrap is to be imported into Pakistan and the only available source in the world is U.S.A.

Steel making by arc furnaces is being practised in Pakistan and in the course of last 25 years the technical skill has achieved a fair amount of proficiency. Not only that but small capacity *i.e.* up to 2 tons per heat induction furnaces and arc furnaces are being manufactured in the country. Considering all these factors, in my personal opinion, Mini Steel Mills should be encouraged in the country and it shall be in the interest of the Government to import steel scrap

till the generation of this basic raw material becomes enough to look after the already existing capacity or capacity so created. It shall not be a bad idea to go in for the production of reduced pellets, sponge iron, or and any other solid reduction process. Such a plant can safely be located at a suitable place to feed the Mini Steel Mills all over the country.

Coming to the economics of steel making by arc furnaces, our steel makers in West Pakistan are still running their arc furnaces for production of ingots steel, although steel in billets form is being imported into the country. Selling price of these ingots in the late Fifty's were about Rs. 500 to Rs. 700 per ton which with all the increase in the energy charges, cost of the scrap, ferro alloys, labour etc. is being sold at present in the range of Rs. 1,300 to Rs. 1,400 per ton. This when compared with the price increase of more than three times of materials with enhanced energy charges could by no means be considered an inefficient and uneconomic process. If the Government takes remedial action and forces the steel producers to instal analytical laboratories under the supervision of qualified metallurgists even good quality castings and alloy steels for the consumption of the country can be produced on these arc furnaces.

After the Kalabagh Steel Mill project was transferred to the Pakistan Steel Mills Corporation Ltd., WPIDC did not abandon their quest to find out an economic method of using local iron ore resources so that some modus operandi could be found out towards a modest start for an integrated steel plant. The latest towards that effort is our tie with the People's Republic of China and certain other agencies to investigate the production of pig iron/steel, sponge iron and such other metalloids through solid or gas reduction.

Iron ore is available at different localities in Pakistan but unfortunately good quality ore which could justify a medium sized steel plant is not so far available in West Pakistan. With the help of Chinese Experts Team who visited Pakistan in the near past and a Yugoslavian expert we preceded them and with the efforts of WPIDC experts who have been successful in discovering good quality ore in Chilghazi and Nokundi, a pig iron/steel plant based on the above sources is being suggested at some suitable location.

It is very difficult to compare the economics of such a plant with that of a plant of say one million ton capacity but this humble start towards self-sufficiency and self-reliance should not be delayed any further for reason of poor economics or location. The redeeming feature of such a plant shall be that to start with, our Cast Iron Foundries can be fed with pig iron from the local sources. This is not going to be an ordinary achievement by any standard, because the existing foundries, spread as they are right through West Pakistan, shall be in a position to meet the requirements of the cast iron castings for electric motors, electric fans, slow and high diesel engines, machine tools, agricul-

tural equipments, household utility items and incoming automotive industries. The economic of such a plant should not be divorced from all these factors when being assessed by our economists.

It shall not be out of place to mention here that there is a little bit of misunderstanding regarding the steel produced in an arc furnace. This process, through an arc furnace, can be termed as a melted unit, is not simple melting but refining and achieving the right composition of the end products. There was a time when the quality steels were made by acid open hearths only, but those furnaces are now being replaced by arc furnaces which for reasons of their versatility, easy control and adaptability for melting under controlled atmosphere, are running supreme in the world.

Process of induction furnace steel-making is similar to the arc furnace in the sense that the melting is done through the heat generated by electric energy, though in the former case it is magnetic eddies and in the later case an electric arc between the electrodes and metallic bath. Induction melting is not practised for refining because it causes excessive wear on the lining, which is difficult to repair, and the process becomes uneconomic.

Duplex method of steel-making by a copula and a side-blown converter was quite economical and was in vogue at times in some of the advanced countries for running small, steel casting foundries. Such a plant is easy to construct and is within the reach of Pakistani fabricators but its limitation outweighs its utility. The production method is new to our melters, steel produce is not of a high quality and the last but not the least the cost of basic material *i.e.* pig iron and cast iron scrap and metallurgical coke, ferro alloys are exorbitant, to make this process comparable with others.

Open hearth practice of steel-making based on cold charge of pig iron and steel scrap had faced an utter failure in East Pakistan although this was executed by the top class industrialists of the world *i.e.* Germany and Japan. Some may consider an open hearth run on Sui Gas an attractive proposition but the artificial price level of Natural Gas compared with furnace oil should not be a deciding factor, and if open hearths are going out of practice in the world even when they were running on as cheap a fuel as pitch, this should not be considered economic for Karachi area. Trained personnel in the process of open hearth steel production are not available in Pakistan, there may be some who have migrated from India.

Pakistan is at the cross-road of her history. There is a division in the thinking of the engineers and experts. Up till now there was a tendency of polarisation and the final decisions were made by the economist. Even in that aspect it was not so much the sound proposals of the sponsoring agencies but

the way they were presented to the Government which was a deciding factor for a green light. For Pakistan to achieve self-sufficiency in basic raw material like steel, economics only should never be allowed to say the last word.

Under the circumstances there are only two logical solutions to the problem :—

- (a) To feed the existing capacity of steel making in the country with the raw material *i.e.* ferro alloys, electrodes, steel scrap/sponge iron/pellets etc. in which case our contract with the supplier should be long term and on sound footing. Steel scrap before the last war was imported by certain fortunate industrialists at as low a price as \$35 to 40 per ton and major part of that scrap was doled out to small re-rolling mills and very little was used for the consumption in arc furnaces. This steel scrap which was allowed to be imported into our country was a windfall for quite a few fortunate people. To give an example even bars of larger than 3" dia. were used for rolling into smaller sections. Off grade steel billets were imported from Italy at a very low cost. Ethic is not involved in this kind of business. Even now most of the steel making concerns engaged on steel production are supplying billets and rolled material which is not in accordance with the specifications claimed by them or stipulated by civil engineers.
- (b) For a country of our resources steel mill of say one million ton or one and half million ton capacity is a luxury. If the nature is kind and we can arrange enough foreign exchange and a risk of capital investment on as large a scale as 600 to 1000 crores can be insured, there is nothing wrong in this. But is this possible when already our repayment of loan is high and debt services are eating into the vitals of the national economy?

The only solution is steel mills within the capacity of our resources. There may be objection to this solution for reason that what about the heavy sections and flats like plates, sheets etc. For that matter even one million ton plant proposed to be set up at Karachi shall not make the country self-sufficient due to diversified requirements for such items.