

Iron Making and Steel Making
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Module – 11
Lecture – 59
Ironmaking and Steelmaking in India

In this lecture we will discuss about the Iron making and Steelmaking in India.

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Topics covered will include the evolution of the global vis a vis Indian steel scenario, India's potential in the steel sector, problems in India steel industry, and steel education and research in India in two lectures.

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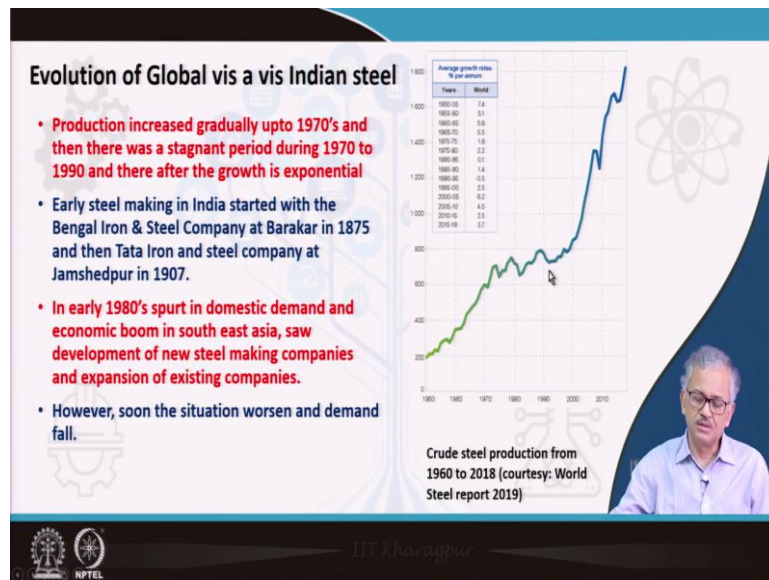


Figure 59.1 shows the evolution of world crude steel production during 1960 to 2018. The data taken from the World Steel Association report 2019.

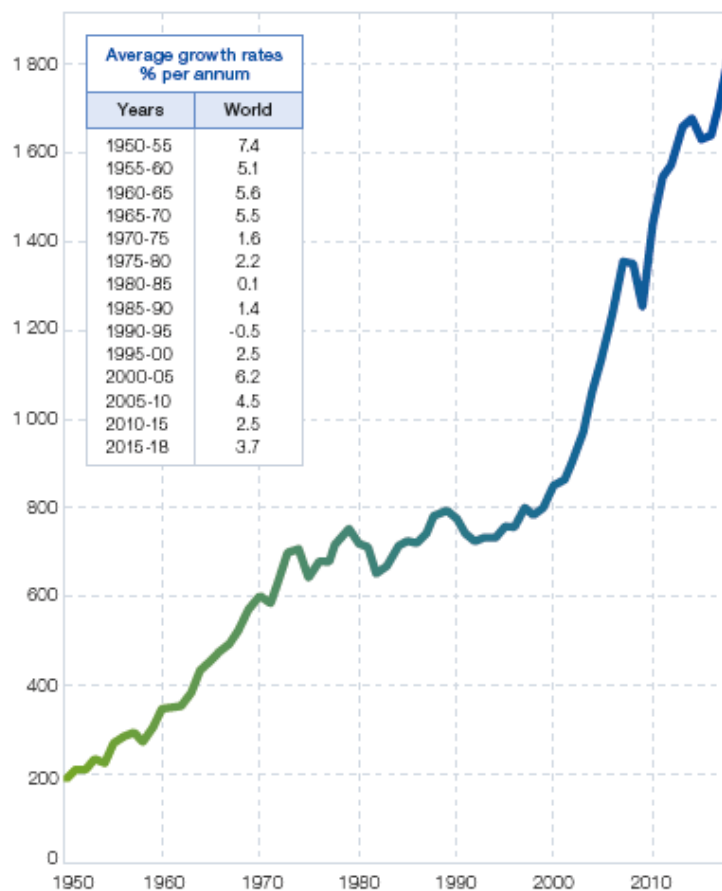
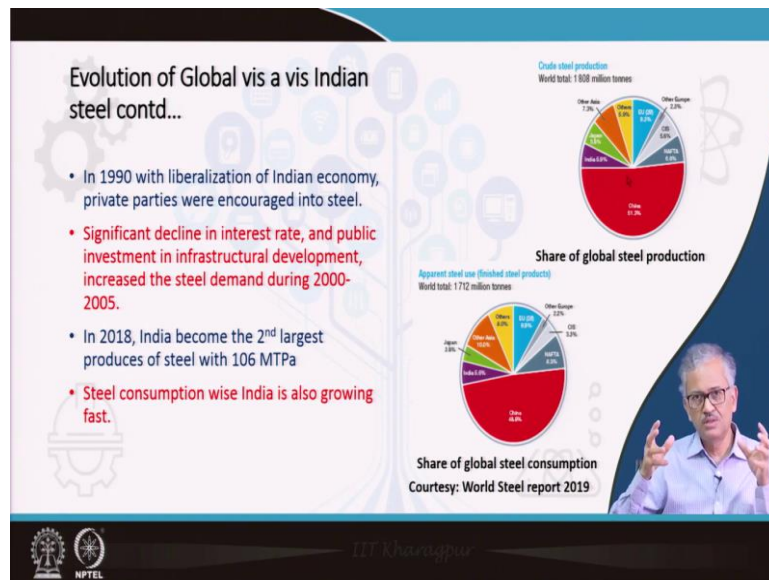


Figure 59.1: Evolution of crude steel production from 1960 to 2018

And as you can see that around 1960, world steel production was around 200 million tonne per annum. And then, it gradually increased to around 700 million tonne by around or 1970. After that there was a period between 1970 to 1990, when there was a stagnation in the growth of world steel production. Subsequently there was a rapid rise in the steel production. During this period economic recession reduced the steel demand in the world significantly, and steel was consumed by few developing countries only. And then you can see there is a steep rise in steel production and most of this production was contributed by China. And steel consumption in China also increased significantly. Economic boom in the Southeast Asia saw development of the new steelmaking companies (green field project) and expansion of the existing company (brown field projects) in early 90s.

Indian steelmaking started in Bengal Iron and Steel Company in Barakar in 1875. And then Tata Iron and Steel Company came around in 1907. In the post-independence period steel Authority of India Ltd. (SAIL) was set up and 5 SAIL plants at Bokaro, Bhilai, Rourkela, Durgapur, and Burnpur. In 1980s there was some expansion in the brown field project of these SAIL companies. Subsequently, Vizag Steel came in the name of Rashtriya Ispat Nigam limited (RINL). SAIL also set up three special alloy steel plants at Durgapur, west Bengal, Salem Steel Plant, Tamilnadu and Visvesvaraya Iron and steel Ltd, at Bhadrabati, Karnataka. Also SAI setup Chandrapur Ferro Alloy Plant during that period. During 1991-1992, India government delicensed and decontrolled steel sectors, encouraging private players in steel making. Subsequently, several private steel plants in India came into existence. Some of them are JSPL (Raigarh, Chattisgarh, and Angul, Orissa), JSW (Bellary, Karnataka, and Trarapur and Dhramatar, Maharastra), Essar Steel, Surat.

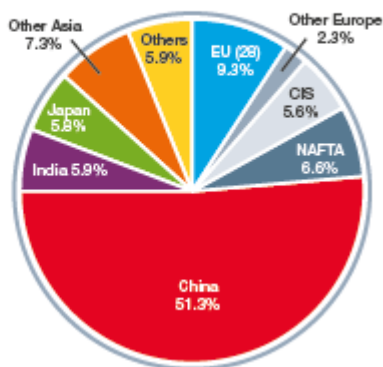
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Significant decline in the interest rate, and public investment in infrastructure development increased the domestic steel demand during 2000-2005 and increased steel production. Tata steel was made recent expansion add in a new steel plant at Kalinganagar, Orissa. So, in last two decades several brown field and green field projects cropped up and private parties were not much behind. In 2018, India became the second largest producer of steel with 106 mtpa. Today, the majority of the crude steel production (than 50 percent) is contributed by China and 50% of which is consumed by China only (Figure 59.2).

Crude steel production

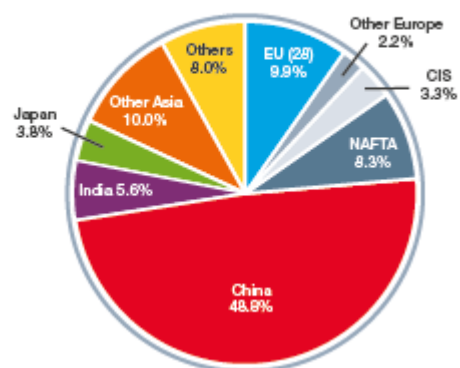
World total: 1 808 million tonnes



(a)

Apparent steel use (finished steel products)

World total: 1 712 million tonnes



(b)

Figure 59.2: (a) share of global steel production, (b) share of global steel consumption

As we have noted earlier that per capita steel consumption is a meagre 70 kg in India; while China has per capita consumption of 500 kg, and other developed countries have world average of 250 kg. But, India also has a huge domestic market, but we are crippled by the fact that rural people do not have much of purchasing power. So, India has tremendous potential to grow.

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Major steel producers in India

Name	Location	Operator	Capacity
Jindal Steel and Power Ltd.	Raigarh, Chhattisgarh Angul, Orissa	JSPL	3.6+6 MTPA Captive power plant Rail and plate mill
Tata Iron & Steel Company	Jamshedpur, Jharkhand+Kalinganagar, Orissa+BSL (Maharashtra, UP, Orissa)	Tata Steel	10 +3+5.6 MMTPA Flat products (Auto grade steel, structural steel), long products
Steel Authority of India (SAIL)	SAIL(Durgapur, Bokaro, Bhilai, IISCO, Rourkella), SSP (Durgapur, Salem, Visvesvarya), Ferro-alloy, refractory	Gol	16 MTPA Product: Rail ,structural, flat and long products, special steel
JSW Steel	Bellery, Dolvi, Salem	JSW	18 MTPA (leading steel producer in India) Leading exporter of steel in 100 countries(>3 MTPA). Conarc steel melting.
Vizag Steel	Visakhapatnam, AP	RINL	7.3 Mtpa Largest producers of bar & rods

>Secondary steel sectors (EAF, EBFs) produces about 30% of the annual steel production in India
 >A large number of such units produce easily saleable TMT bars

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So, some of the major steel producers in India is tabulated below (Table 59.1).

Table 59.1: Major steel producer in India

Name	Location	Operator	Capacity
Jindal Steel and Power Ltd.	Raigarh, Chhattisgarh Angul, Orissa	JSPL	3.6+6 MTPA Captive power plant Rail and plate mill
Tata Iron & Steel Company	Jamshedpur, Jharkhand+Kalinganagar, Orissa+BSL (Maharashtra, UP, Orissa)	Tata Steel	10 +3+5.6 MMTPA Flat products (Auto grade steel, structural steel), long products
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JSW and Tatasteel are the largest producer of steel (18 mtpa each), followed by Sail (16 mtpa), JSW (~10mtpa), RINL (7mtpa). Rest 30 mtpa is produced by secondary steel sectors operated mostly by MSMEs using EAF and IF.

JSW with its three major plants at Ballary, Karnatake and two plants in Maharastra produces 18mtpa. JSW is the leading exporter of steel in 100 countries. And they have a very unique facility called the Conarc steel melting facility, this is basically a confluence of your LD and the electric arc furnace. Such that they can utilize any charge mix into the Conarc furnace.

JSPL is the largest producer of coal based DRI in India. Their Angul plant has a coal based Midrex with capacity 1.8 mtpa and Raigarh has rotary kiln producing 2 mtpa.

Tata steel's Jamshedpur plant produces 10 mtpa and recently installed Kalinga Nagar has a capacity of 3 mtpa and Tata Steel has also acquired Bhusan steel which produces 5.6 mtpa in three plants in UP, Maharastra, and Orissa. They are famous for making auto-grade steel.

SAIL with its 5 plants produces around 16 mtpa. One of the major producers of rail.

RINL (7mtpa) is the largest producer of rods and bars.

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India's Potential in Steel

- At present India's per capita steel consumption is meager 70 kg compared to world average of 225 kg.
- This low average steel consumption of India is due to rural population (around 70% of total population) who does not have purchasing power (per capita steel consumption is about 2 kg).
- To enhance the rural steel consumption, government has taken some rural oriented policies. This has increased steel demand in rural India.
- Large availability of good quality of iron ore reserve
- Potentiality in global market. Study indicated India is the most competitive place for outsourcing metal based manufactured products.
- Already Indian is second largest producer of steel.
- There is large scope to enhance the steel production much above the present capacity.

The slide features a blue and white color scheme with a background of faint icons representing technology and industry. A small video inset in the bottom right corner shows a man with glasses speaking. Logos for IIT Kharagpur and NPTEL are visible at the bottom left.

India's potential in the steel: At present India's per capita steel consumption is a meager 70 kg compared to a world average of 225. In South Korea, this value is around 1000 kg per person.

Considering large population per capita consumption of steel at China at 500 kg of steel per person is remarkable.

So, this low average steel consumption in India is due to rural population (around 70 percent of the total population) whose per capita steel consumption is quite low. To enhance the rural steel consumption government has taken some rural oriented policies, this has increased the steel demand in rural India. National policy envisages to domestically meet the entire demand of steel and produce high grade automotive steel, electrical steel, special steel and alloys for strategic applications.

Now, we have a lot of reserve for iron ore good quality for next 50 years, we do not export any good quality iron ore in near future. So, a study in the business school in USA showed that India is the most competitive place for outsourcing metal based manufacturing product. So, FDI is likely to come in India. So, in addition to our huge domestic market, there also exit global market. India is the second largest producer of steel and national policy targets 300 mtpa steel production by 2030.

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Challenges

- Shortage of coking coal
- Infrastructure
- Ancillaries (MSMEs)
- Inefficient management (huge expenditure on social overheads, poor management, poor industrial relation, especially in public sector)
- Low labour productivity (Labour productivity in advanced countries is about 600-700 tonnes per man per year whereas in India it is only 90-100 tonnes).
- Energy efficient technology
- Global competitiveness in steel price

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Challenges: (i) Shortage of the coking coal. Blast furnace requires a minimum amount of coke (250 kg/ton of iron) to run it smoothly. We have a very limited deposit of the coking coal and that too with a very high ash content. So, we are dependent on the input of the coking coal and the process become very costly and as I said, that around 50 percent of the hot metal cost is contributed by the coke only.

So, if we want to increase the capacity, we have to think for some other alternative routes of iron making where non-coking coal could be used, for which we have plenty of reserve. So, we cannot increase the production significantly based of conventional BF-BOF route.

(ii)Infrastructure: We have to develop more efficient infrastructure like dedicated freight corridor for road, rail, such that goods transport become much more effective.

(iii) Ancillaries like MSME has to develop to form an ecosystem with the integrated steel plant and product manufactures. Any major manufacture requires day to day supporting parts from MSMEs. Similarly MSMEs can supply solid metallic to steel plants and get special steel from from the plant. Recently Governments have taken several steps towards MSME development through tax protection, performance linked incentives, and reducing and simplifying the audit compliance. MSMEs are the base of pyramid of industrial development. Without development of MSMEs holistic development is not possible.

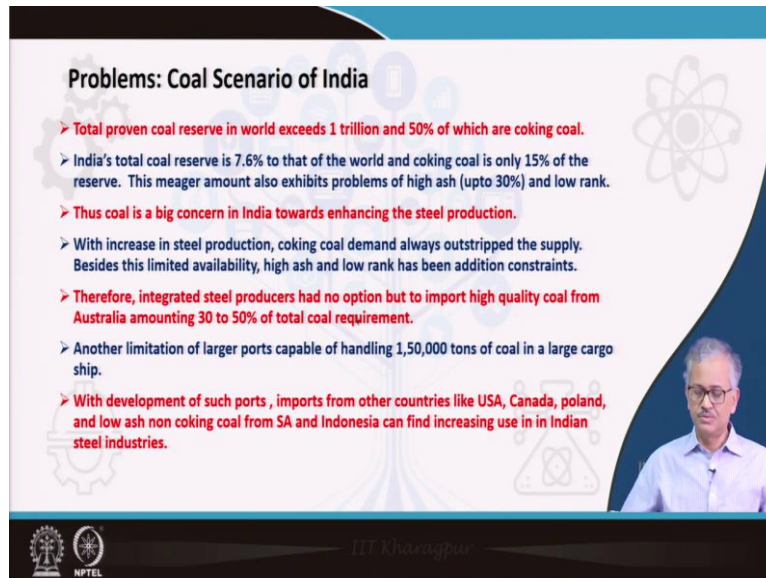
(iv) Another bottleneck is the inefficient management. Most of the public sector units are plagued by inefficiency caused by heavy investment on social overheads, poor labour relations, inefficient management, under-utilisation of capacity, etc. This hinders proper functioning of steel plants and results in heavy losses.

(iv) Low Labour productivity: We have plenty of cheap labours; but, the labour productivity is poor. In advanced countries is about 600 to 700 tonnes per man per year whereas, in India it is only 90 to 100 tonnes per man per year.

(v) Energy Efficient Technology: Energy intensive processes are not sustainable because it produces lot of CO₂ in the atmosphere. This requires upgradation/new homegrown technologies and investment in R&D.

(vi) Global competitiveness: Lack of modern technological and capital inputs and weak infrastructural facilities leads to process of steelmaking more time consuming, expensive and yields poorer quality. This compel us to export quality steel from abroad. On the other hand because of companies running in loss, or low profit margin, or policies, steel companies invest much less towards technology developments. This leads to lack of indigenous technologies. Now the time has come to invest and enhance the R& D activities towards development of indigenous technologies.

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Problems: Coal Scenario of India

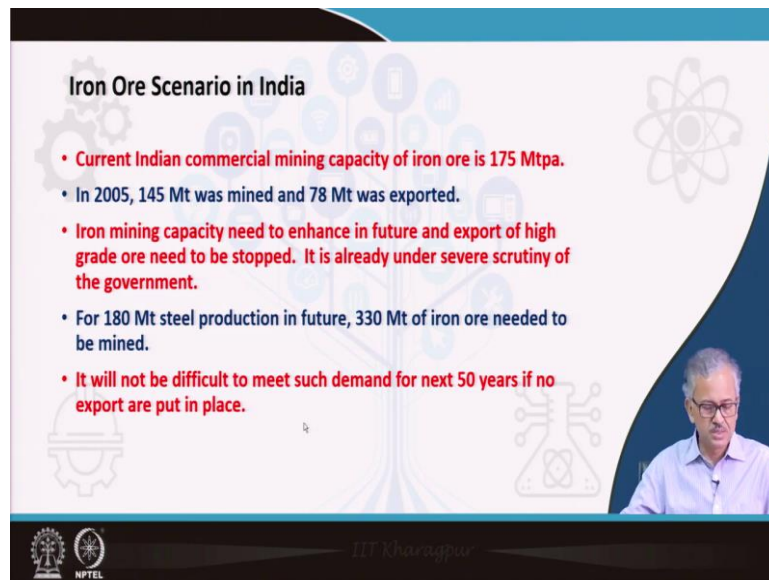
- Total proven coal reserve in world exceeds 1 trillion and 50% of which are coking coal.
- India's total coal reserve is 7.6% to that of the world and coking coal is only 15% of the reserve. This meager amount also exhibits problems of high ash (upto 30%) and low rank.
- Thus coal is a big concern in India towards enhancing the steel production.
- With increase in steel production, coking coal demand always outstripped the supply. Besides this limited availability, high ash and low rank has been addition constraints.
- Therefore, integrated steel producers had no option but to import high quality coal from Australia amounting 30 to 50% of total coal requirement.
- Another limitation of larger ports capable of handling 1,50,000 tons of coal in a large cargo ship.
- With development of such ports, imports from other countries like USA, Canada, poland, and low ash non coking coal from SA and Indonesia can find increasing use in in Indian steel industries.

DTT Khurana

NPTEL

Coal scenario in India: Total proven coal reserve in world exceeds 1 trillion and 50% of which are coking coal. India's total coal reserve is 7.6% to that of the world and coking coal is only 15% of the reserve. This meager amount also exhibits problems of high ash (upto 30%) and low rank. Thus coal is a big concern in India towards enhancing the steel production, especially through conventional BF-BOF route which requires a minimum amount of coke. With increase in steel production, coking coal demand always outstripped the supply. Besides with this limited availability, high ash and low rank has been addition constraints. Therefore, integrated steel producers had no option but to import high quality coal from Australia amounting 30 to 50% of total coal requirement. Another limitation of larger ports capable of handling 1,50,000 tons of coal in a large cargo ship. With development of such ports, imports from other countries like USA, Canada, poland, and low ash non coking coal from SA and Indonesia can find increasing use in in Indian steel industries.

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Iron Ore Scenario in India

- **Current Indian commercial mining capacity of iron ore is 175 Mtpa.**
- **In 2005, 145 Mt was mined and 78 Mt was exported.**
- **Iron mining capacity need to enhance in future and export of high grade ore need to be stopped. It is already under severe scrutiny of the government.**
- **For 180 Mt steel production in future, 330 Mt of iron ore needed to be mined.**
- **It will not be difficult to meet such demand for next 50 years if no export are put in place.**

DT Kharagpur

NPTEL

Iron Ore Scenario in India: Current Indian commercial mining capacity of iron ore is 175 Mtpa. In 2005, 145 Mt was mined and 78 Mt was exported. Iron mining capacity need to be enhanced in future and export of high grade ore need to be stopped. It is already under severe scrutiny of the government. For 180 Mt steel production in future, 330 Mt of iron ore needed to be mined. It will not be difficult to meet such demand for next 50 years if no export are put in place.

The lecture will be continued in lecture 60.