Steel Making

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Module No. # 01

Lecture No. # 41

Iron and Steel Making in India

So, we now slowly get into the closure of this course and this is the last segment of the course. We have done or covered lot of topics in steel making, starting with an overview of steel making, the science based fundamentals, description of primary and secondary steel making processes, costing processes, modeling.

So, you have now a fairly good idea of the subject of a steel making. And with lot of supplemental problems, which you can concurrently solve with this course or course material - course content as the background material - you should be equipped to handle a many challenging problems on the shop floor as well as from the few parts of design and processor aliases.

Now, having said so much about the subject of steel making, perhaps the concluding lecture must give you, I would not say lecture but may be lectures, must give you some information regarding the stage of iron and steel making in India.

It is for us now to review that, how the subjects or the industry has grown in this country, how the what feature stores for us, and what are our problems, how can you address. And I think this teaching of the subject is not going to be complete, unless really we give you some background in the history of modern day iron and steel making in India.

And you must remember that, since independence this is the first and the foremost heavy industrial sector. And today we are in extremely proud nation as far as steel making is concerned, producing nearly about 55 million tons in the year of 2009, so primary and secondary processing rules.

So many terminologies that I am going to use here; you are already a customed, so you already know those terminologies; so, it will be easier for you to grass, when I say that secondary steel producer you know, electric furnace steel producers, so you know that I am referring to many steel plants or many steel sectors, which basically uses electric arc furnace and continuous castings today.

Now, the history of iron and steel making in these countries is extremely volt; I think there is indication that it goes back as far as the third millennia.

Now, most of you have seen or heard about the iron pillar, we have a very rich history of iron and steel making. I mean you go to the Mohenjo-daro civilization, even it is documented that when Alexander the great came to India, his soldiers (( )) to wind force their arrow heads; and it is the Indian you know localized steel makers, they helped alexander and his troop and provided them with the all necessary arms.

So, we are not interested in that history. There are many excellent resource material available on the subject of the history of iron and steel in this country. Professor Ranganathan of IAS Bangalore has written text books with Sagar Shrinivasan and there are compilations by the ministry of steel as well as the joint planning committee which phases; Tata steel also have some compilations and if you come across this which are there in a types today, we should get a fairly good idea of iron and steel making you know in the prehistory time, 1000, 2000, 3000 years back and so on.

Now, coming back to the modern India, I mean referring from the dates in the times of the British Raj, I would say that the first notable attempt was actually done on large scale production of iron, particularly pig iron. By a foreign national who try to do it on a very small scale basis, about 40 tonnes a week, does the rate of pig iron productions somewhere down the coast of south and the his name was a Joshua. But somehow the quality of steel pig iron produce was so inferior, that will be the competitions that were there in the market; the fellow could not compete and soon his facility were shut down; so, that this happens somewhere around 1830 along the coast of Madras.

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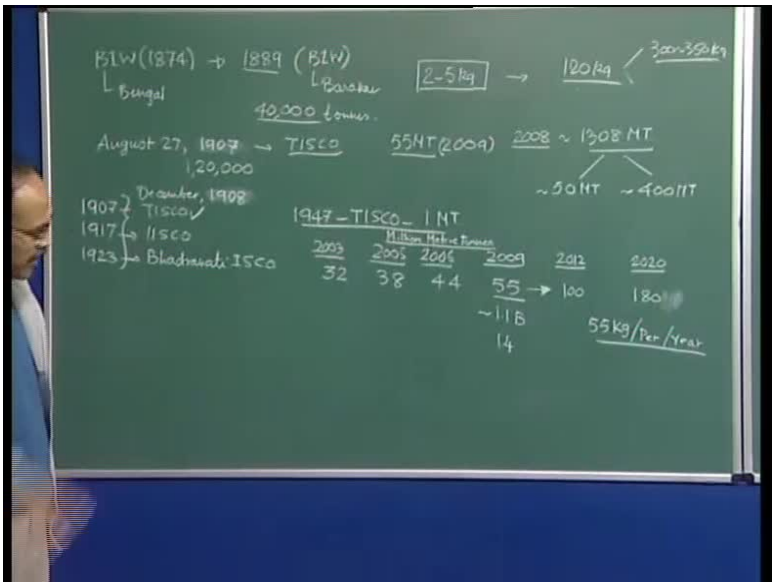

Now, after that, around 1874 or so, this the Bengal Iron Works; it started functioning Bengal Iron Works, so that is a above 1874 and where it started near the vicinity of Asansol Kulti Bankura area, but soon the iron company face some problem and it was taken over in 1889 by the Bengal iron and steel company and we are still called BIW, but this time the Barakar Iron Works.

Ultimately, so this take over there is the closure of the Bengal Iron Works and the formation of the Baraker Iron Works, so renaming of the Bengal Iron Works as the Barakar Iron works. This is Barakar Iron Works and this is Bengal Iron Works; so this was under the elegies of the Bengal iron and steel company, and then ultimately in that locality, somewhere around 1937 or so you know the IISCO Burnpur factory also came. So, how much of iron was produced somewhere around 40000, that was the rated at capacity 40000 tons; this is 1000 kg metric tons - metric tons of iron.

So, that was around the beginning of the 19 century. And then the end of the 19 century and then the regulated day in the history of iron and steel making came, which is august 27th 2007, when TISCO was launched at Jamshedpur. Of course, at that time, Jamshedpur was known as Sakchi and Jain Tata started - Jamshed Janaruddin Tata started - the TISCO factory and with a rate at capacity of 120000 iron and steel; so, this is the finished steel production.

And the first product rolled out, sometimes around december 2008, does the time when TISCO produced the first steel; and in the beginning of this is 1907, actually I am sorry this, so this is 1908.

So, TISCO actually recently a celebrated their centenary, if most of you are aware of this. So, around 1917, 1923, 1907, around that, we have three different sectors for iron and steel was produced; TISCO and then 1917 - that is the IISCO and this is the Bhadravathi iron and steel company in south India. So, that was the scenario in the post independent, about 30 40 years, before the independence; and these were the three components which are most rolling out steel.

So, actually the that - the howrah bridge - the old howrah bridge are now over the Ganges near Calcutta. We have several bridges but the oldest one which connects actually the calcutta city, which is a cantilever bridge actually; so, it is a suspension bridge, and both the ends, there is no pear at all in between; and that steel for that bridge actually, so this is the symbol of national pride actually. That in a long long time back, around 1930s or so how you could produce steel and this howrah bridge today, it stands at you know long 80 years and we must be very proud of our extremely hold a heritage.

Now, following independence, the steel sector started to grow, because Neharuji really ambition, that we have to develop and the developing society without steel perhaps cannot sustain. I mean you see everywhere, I have mentioned also that the consumption of steel is an index of the prosperity of the society; consumption of flat products is really an index of the welfare of the society, how good the people are living, what are their gross income and so on. These are integration the standard of living, I mean steel consumption standard of living, flat product consumption standard of living, these are all synonymous terms.

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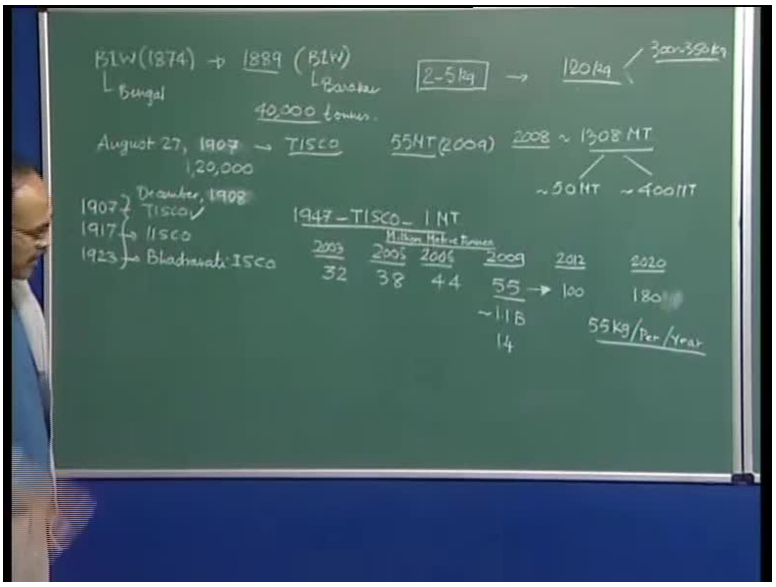

So, after independence, the steel production sector grown remarkably, so somewhere around you know 1920. So, when we were producing, you know, say I would say 1947, TISCO was rolling out around 1 million tonnes of steel per annum; that was the production. So, couple of millions or few million tonnes around the time of independence; and today where we stand? We stand at 55 million tonnes and that is the steel production in 2009. If you look at the figures, it goes like something like, I would go 32, may be 38, may be 44, 55; so, this is the figure at 2009 and this figures are all in million tons; this is the figure in 2006, this is the figure in 2005 and this is the figure in 2003 steadily. But even if you take one important thing here is, if you take this 55, these are all in million tons, million metric we are steadily growing.

Now, the projection says that, by 2012, this is the ministry of steels projection, we are going to produce around 100 of steel or 110 million tons of steel; and by 2020, we are talking about 180 millions of steel. So, that is, so these are all projections, these are the real data; and on the right 2012 and 2020 are the projections.

Now, in 2008, roughly 1308 million tons of steel was produced globally; this is the global steel production. And I have mentioned at one point of time, that steel production in the last 50 years, you know, as search from 200 million tons now; today is 1308, so which is about six volt higher; population is increasing, the society need steel for

development; we have to make bridges, we have to make roads, we have to built houses, infrastructures and so on, and everywhere we need steel.

So, the society is really hungry for steel; and that is why, we see this trend also globally and its severe reflection in the country also, that the production of steel is going to increase continuously up-to 220 million tons. And now, here the share of India was roughly about 50 million tons; on the other hand, china was producing about 400 million tons, significantly larger.

Today, if you look at the Asian countries, more than 50 percent or around 50 percent of the world steel is produced in the Asia itself, by countries like China, Japan, Korea and India. These are the four major steel producers in the Asian countries and if you sum up all their rate at capacities, I mean how much they produced, you will find that it comes up-to the all most 45 to 50 percent of the global steel fraction.

We are going to examine this, you know, in order to achieve these targets, what we have to do, where we stand right now, what are our problems. If you have traveled up to this far, how difficult it is going to be for us to go to 180 million tons. Does it look to rosy or really we are capable of doing it? And that we are go to examine in this concluding lectures.

Now, one important aspect here is, if you take 55 million tons and India’s population if you set at 1.1 billion right, that is the population of India, so it turns out that 55 kg is the per capita steel consumption; 55 kg of steel per person and this is per year, which is called the per capita steel consumption of the nation.

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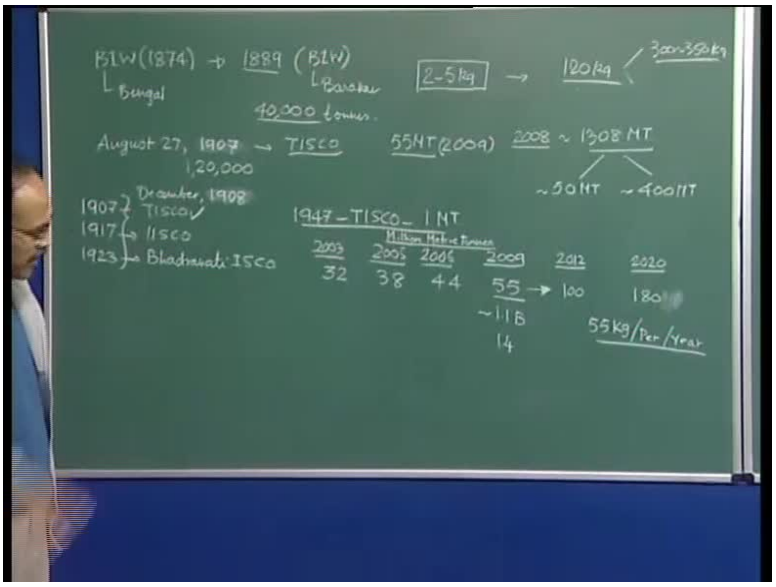

Although this figure is an average, one this is a quite a drastic range of the value. And someone estimated that in the villages of India, per capita steel consumption could be as low as 2 to 5 kg; for example, imagine in my house, I have lot of gadgets, I have a car, the fans are there, electrically peoples are there in my houses, which I made out of steel, so all consume lot of steel. So, I have learned more, that is made out of steel; I have a car, that is made out of steel; fans, air conditioners, freeze, everything is made out of steel.

Go to a villager, a village hutment, and if you say that steel, perhaps only the utensils are steel, and that is what you see, that the villagers or the villagers in India on a per capita basis do not consume much steel also. If you look around the huts, there is no steel in the building in the villagers, these are hutments. If you go to the roads, there are no steel used in making the roads, they are all kutcha roads. If you go to the village and look at the bridges over a little river or river land, you will see that the bridges are made out of bamboo or wood.

So, virtually this is not much steel, but there is a quite a bit of scope. If the standard of life is to go up, the roads has to be laid properly, the bridges have to be build; track bodies - we cannot afford to make the track bodies out of wood any more.

So, the track bodies have to be made out of steel. So, the we anticipate that as the prosperity; if you go by that slogan [FL], the villagers upliftment, the villagers will necessarily see is surge in the requirement of steel in the country, because you know at the villagers increases standard of living, they will demand for more steel. And where from steel is going to come? The steel is going to be rolled out from a factory and that is how the country has to be produced more and more steel. So, the demands are justified.

We have 1.1 million people, we are consuming too little amount of steel. And as I said that, well, this could be you know 2 to 5 kg in the villagers, and while in the cities, it could be about, some people may be, a few people may be consuming 200 300 kg of steel and so on.

So, the world average steel is, if you take the total, divide it 1308 million tons divided by the total population of the world, then you get the global average of per capita steel consumption, which comes out to be 120 kg per person per year. On the other hand, if you go to European nations, Americans, where every house may have one two or three cars, you know lot of steel structures and the houses made out of steel, the kitchens made out of steel, furniture's made out of steel, and there you can see, that this value you know in advance countries could go as much as 300 to 350 kg.

Even if you think like, if go up to the global average of 120 kg, you can imagine that 1.1 e million and may be by 2020 will be 1.3 million; so, you know, 180 from that point of view is even less. So, if you go up to 1.4 million per person, so in that case, we can see that, if you go to 180, possibly we can get about 100 kg or 110 kg - something like that, which will be pretty much close to the global average or so on.

So, this is a reasonable taking into account, the projection is not unrealistic; the projection is realistic. If the standard of living of the entire nation has to go up 180s, perhaps the value where we should stick to around to 2000-2020 with a net population of about 1.3-1.4 billion people.

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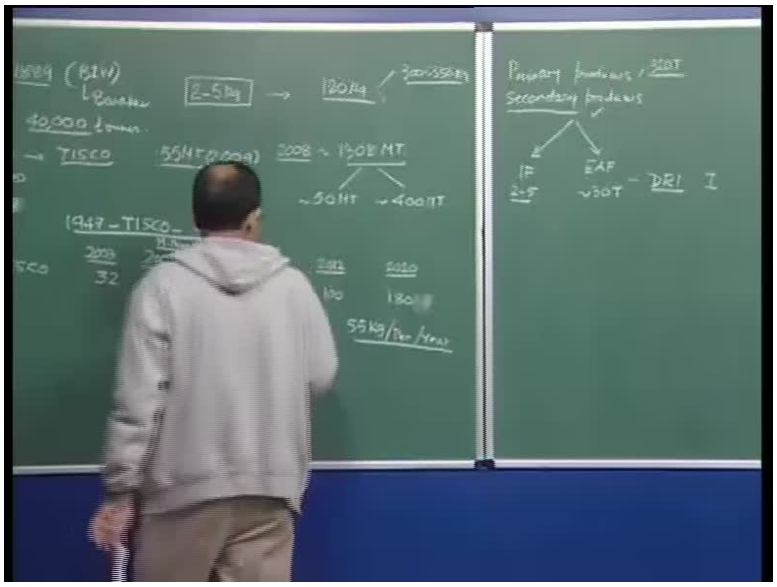

Now, how are steel made in this country? Before independence, these are the three sectors. Now, we will examine everything in the prospective of the current domestic steels scenario. So, we have basically in the country, primary producers we call, primary and secondary producers, that is where from our steel come - secondary producers. Or we can say that, well, we have integrated steel mills from which steel comes; we have mini steel mills also for which steel is produced.

So, mini mills are basically secondary producers; primary producers are basically primary integrated steel mills. And in secondary producers, we are talking about not only electric arc furnace, but we are talking about induction furnace steel making as well as electric furnace steel making.

This furnace is a very small capacity furnaces - 2 to 5 tons furnaces; on the other hand, electric furnaces in this country, we have about 30 ton size is the maximum, 30 ton 35 ton size. Primary producers' uses BOA vessel and we have converters in this country will goes up to 320 tons size. Ladles also I have mentioned here, ladles and converters, they are of the equivalent capacity. So, ladle and tundish, they both have about 300; that is Bokaro steel plant and is about 320 tons size and LD converter.

So, both primary and secondary steel producers, I have been producing steel. And interestingly, there is a unique feature of the Indian steel industry is that, till around 2006

or so, the share of the primary producers to secondary producers was roughly about you know 50 50; that is the kind of production, say 20 million ton through primary producers, 20 million ton through the secondary production.

We must understand that, this is also been reviewed, that the raw materials are basically different. When you talk of primary producers, we are talking of integrated steel mills, we are talking about blast furnaces which produces molten metal or molten pig iron.

On the other hand, when you are talking about secondary producers - secondary steelmaking - we are talking of induction furnace in the air, there is no blast furnaces. Therefore, the charge from which we are going to make steel a cannot be solely the scrap, because on the simple fact that our steel consumption is also not too large, then the society is going to generate too much of scrap; you go to US, you go to for example Europe, you see you know there are so much of scrap is generated, because people are using car - every third year, they buy a new car. So, the old car becomes scrap.

So, but in this country, because we consume less, we do not a produce much scrap; therefore, what are the basic materials from which the induction furnace and arc furnace produce steel? It is basically the DRI - direct reduced iron.

So, that is why, since 50 percent of the steel or 45 percentage of the steel produced in this country are by through secondary routes, through induction furnace through EAF, and that the induction and the EAF is based on the DRI. So, we must now understand that in the absence of scrap, when you use large tonnage of DRI, the country must be having adequate facilities for the production of DRI. And interestingly, for you to note, that we are the largest producer of DRI in the whole world.

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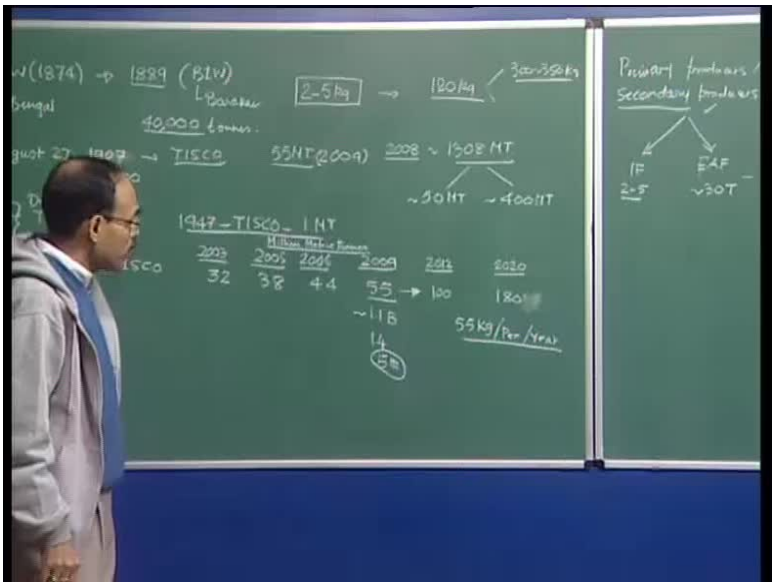

So, we are number 1 here. And what is our rank of steel producers 2009? We were the 5th steel producer, along with China at the top, Russia, then we have Japan, then we have Brazil, and then we have India; so, this is our 5th and we ranked 5th in 2009 which is steadily going to increase you know improve; as far as DRI is concerned, these are first rank order.

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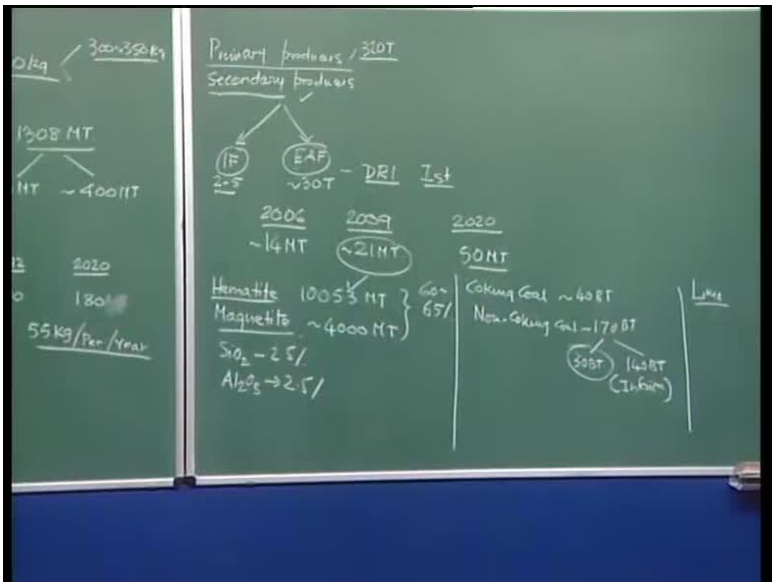

How much of DRI we produce around 2006? We produced about 14 million tons of DRI; so, we are not very good in keeping statistics, so this is values are, so every time I write.

I write (( )) approximate sign, which means it could be 15 million, it could be 13.5 million and so on. So, this is a reasonable value that I am, you know, authentic value that I am trying to put here. But 2009, the DRI production was somewhere around 21million ton - 20 or 21 million ton.

Now, we must and in the foreseeable feature also, we would do expect that in view of this growth - projected growth - the secondary steel producers are going to stay there and contribute immensely to the domestic production steel.

Why I am saying that, because when you are talking of primary producers, you cannot really produce all the steel from here to here through the primary production routes or the integrated steel mills, because setting of an integrated steel mill requires huge amount of land, and today as you all know, there is so much of dispute in the country about the acquisition of land.

You have to have infrastructure, you have to have you know huge cranes, huge vehicles, for excavators land excavators, in order to prepare the premises for the steel production; you require enormous amount of cash flow and you require large basis of vicinity in the, you know, location in the vicinity of the raw materials, there are so many constraints.

So, huge capital cost, you know infrastructural facilities, land acquisition problems, you know investors and all this perhaps will not allow the primary steel sector only we growing and contributing to 180 million ton. We will perhaps anticipate, that we can anticipate here that simultaneously also, the secondary sector is going to grow, because secondary sector as such does not consume that much resource; you can have electric arc furnace facility in the very small premises, capital expenditure is large, small and so on.

But two important issues come here, that when you are talking of secondary producers, the secondary producers all are lie on the source of electricity. And most of them, they are not doing that well, so that they can have their own capital plans. Most of this plans actually secondary producers, they depend on electricity from the local state governments, and that is where the cost of steel production, cost of steel produced through secondary routes are tend to be enormously high.

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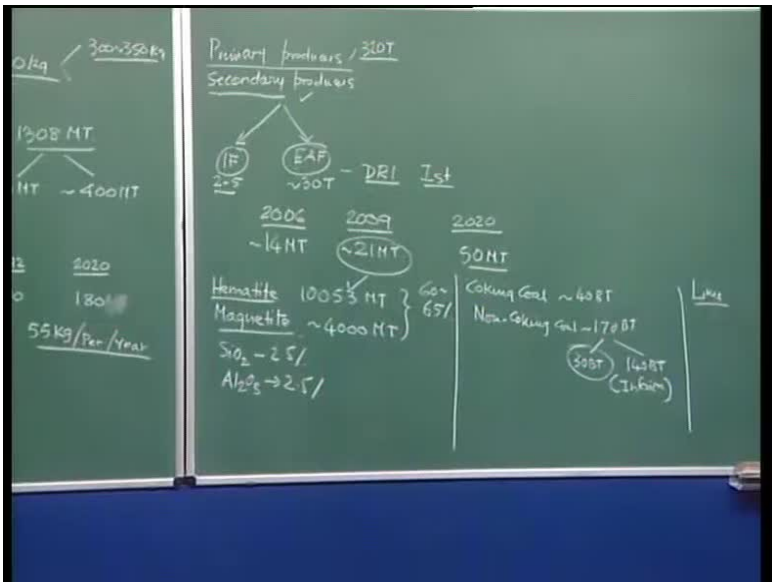

So, if the secondary steel sectors grow in this country, we must understand that the production of DRI has to further and increase, and it is projected; by the time we hit here for somewhere, we are talking about 2020, somewhere around 50 million tons, that is the kind of DRI we have to produce; and also the secondary sectors must tighten up there wealth, in order to sort out the issues - pending issues - with electricity generation and so on. I am going to talk about the problems more in a little bit later.

Now, if you look at this you know statistics and the primary versus the secondary producers, we note that we have basically, because we are talking about the raw material a little bit, you know, it is I cannot really go further and explain certain key issues.

We have an excellent resource of iron ore in this country, if you are aware of this particular fact. And I think we have both the kinds of reserves like a hematite and magnetite; and I think the hematite reserve goes somewhere like million tons, and approximately magnetite reserve goes like this; and these are extremely high good quality iron ore. And then, we are talking about 65 percentage - 60 to 65 percentage – iron, that is the level of iron we are talking about.

And today, you know, there are lot of interest on the part of the steel makers to have their captive steel mines, as far as there are certain localities in India; there is one called Chiria

mines, somewhere you know Chhattisgarh area, and very high very good quality iron ore and lot of interest is there in the part of the steel making companies to take that on lease.

But all through India, whether you talk of the Bellary district in southern India or you talk of Western India, which is Bastar district and close to a Jamshedpur area - that is, Singhbhum district - we have excellent, you know, throughout the Eastern India as well as Southern India and to some extent Western India also, we have excellent resources, resource material as well as the iron ore is concerned.

We have some problem though, because we have in this we have silica, our ore is high silica; silica is almost about 2.5 percentage, and we also have alumina, which is about 2.5 percentage. So, this is a problem with iron ore. What about coal or coke? The reserve of coke and coal runs in billions of tons. Now, roughly, we have say coking coal and non-coking coal; this is about 170 billion tons and this is about 40 billion tons.

And now, out of this 30 billion tons and 140 billion tons, this is inferior, and this 30 billion tons possibly is good, in terms of making direct reduced iron and so on. So, really, these are estimates of reserves does that mean, that we can take out each and every kg of coal from the mines. No, they depend on the bed depth, where they are looking it.

So, the problem with Indian coal, both coking and non-coking is the high ash; and that is why today, you see there are lot of coal washeries, you have plans which are based on the shore, which functions on the blending of the coal. So, we have our coke which is otherwise fine, but the contains lot of ash, and this coal, the coke is mixed with the imported coke, which has a relatively lower amount of coke ash. And when you blend the two cokes if it is result in picture, which has intermediate ash and which we charge into the blast furnace, in order to have good production rate and coke consumption rate in the blast furnace itself.

So, there is no dark of material as far as this is concerned. Actually, so much of iron ore we have taken out in the last few years, then the country does not have the means to produce steel. And as a result, what happened is, we landed up to be net exporter of iron ore and these are high value product; and you should have been manufacturing iron and steel in our own country, rather than exporting the raw material. Outside we were one of

the largest exporters of very high grade iron ore during 2007, 8, and 9, but I think the ministry is now - the central government is now - putting some kind of an embargo and discourage people.

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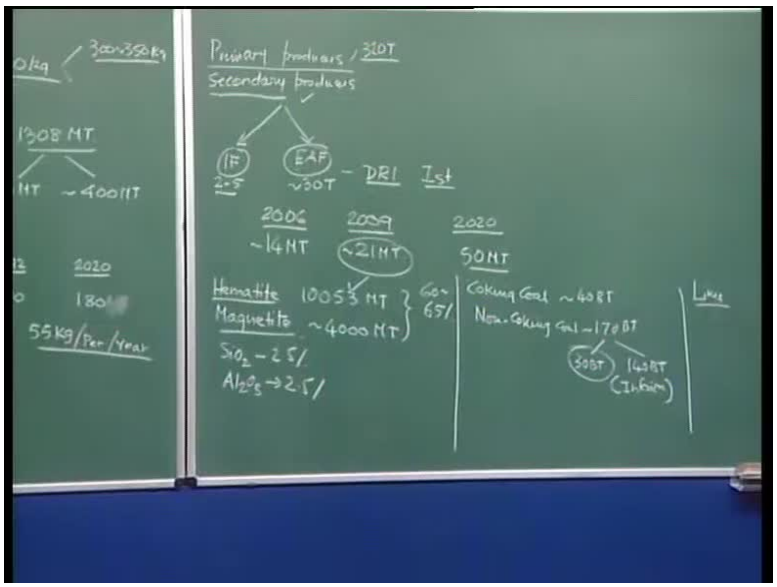

Now, that is why, I mean the abundance of raw material - high quality raw material… let me just talk about lime, we also have good quality lime or the plastic material available in the country, but so far as Indian limestone is concerned; they tend to be little bit hygroscopic. So, that is why that is the only demerit. But other than that, as far as the silica is concerned, this is relatively less; the lime has 50-60 percentage of Ca CO, it is a very good quality as far as the making of iron and steel is concerned.

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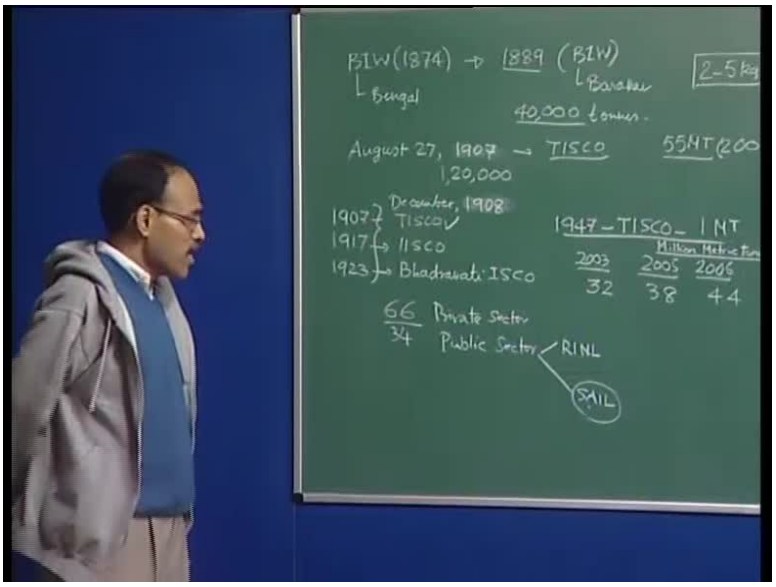

Now, we have many players, which have come to manufacture iron and steel in the country. And after independence, both private and the public sector steel industries have grown remarkably; and today, I think roughly, 66 percentage of Indian steel produced is through the private sector and 34 percentage of steel is through public sector.

In the public sector steel plants, we have, for example, SAIL plant - there are many such and RINI - these are Rashtriya Ispat Nigam Limited; that is the Vizag based steel plant; and that is what I said Vizag steel plants steel plant and it is shore based steel plants. So, why it is shore based, because it uses bending of coke-coal; so, you import coal, then you blend it.

So, if your plant is located close to the seashore, then importing and exporting the finished products becomes much more easier; transportation cost is minimum. SAIL as many plants starting with a Durgapur steel plant - Durgapur alloy steel plant - then you have Rourkela steel plant, Bhilai steel plant, and now Bhadravathi iron and steel company solid steel plant, so these are many Bokaro steel plants. So, there are many of these which are managed by the steel authority of India limited, which has head quarter in Delhi.

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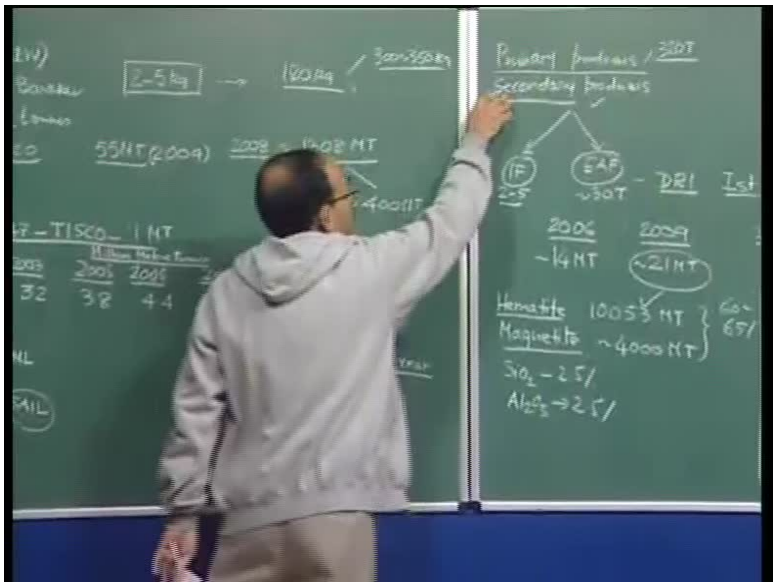

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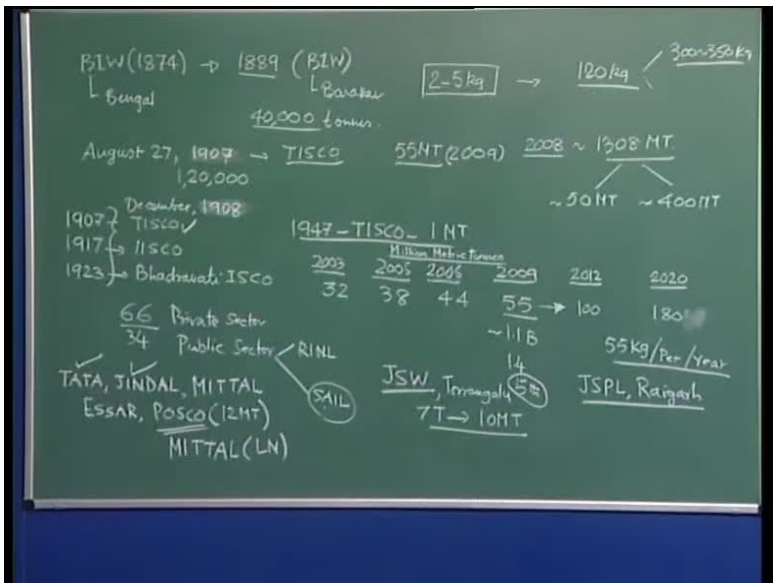

Private sector steel industry has grown remarkably over the years. And this private sector comprises the both the primary producer and the secondary producer. So, what are the key primary producers in the country? The key primary producers in the country are the Tata Jindals, then Mittal, this is not by the way Mittal steel, this is the ISPAT group Promod and Brodu Mittal, who works near Bombay - a place called Dolvi - so you have ESSAR.

And now, the projection is POSCO is going to come and POSCO is projecting 12 million tons plant, 12 million ton per annum plant in a year. You must reading many times in the newspaper, you know how difficult it is for POSCO to setup, you know sort out the land issues, the mines issues and so on and so forth.

Jindals have many steel plants; they have steel plants in Bellary district, which is Toranagallu. They have steel plants in Raigarh, that is in Chatthisgarh; we have steel plants in ESSAR, which is a stainless steel company in that various places. Tata's have their works principle works in Jamshedpur, they are also looking for some expansion in the MP district and all. But today in Jamshedpur, Tata makes more steel than they use to do 10 years back; so, this is huge expansion program going on in Tata itself.

So, the plant that Jindals have in Toranagallu, it is initially started with 2 million tons, then it went up to 4 million tons, and currently, it is going to produce in 7 million tons in one single place. And so, this is the JSW plant I am talking about Jindal South West in Toranagallu near Bellary so, this now produce a 7 million tons which is expected to go up to 10 million tons. So, in the one single campus itself, they are producing about 10 million tons - it will be producing 10 million tons of steel.

JSW is thinking about setting up new projects also; so, this is a future project, these are all existing projects, huge capacity plans; 3 million ton, 4 million ton, 7 million ton, these are the rated capacities, several million tons per annum. Mittals are also the future players; this is the LN Mittals group - Arcelormittal group – actually, they are also planning to setup plans somewhere in the Jharkhand district.

So, Jindals, for example, as I have mentioned Tata's are planning for expansion elsewhere also beyond Jamshedpur, similarly Jindals are also looking for expansion elsewhere. For example, I think 4 or 6 million tons of steel plant has been in usage by JSW at Salboni in West Bengal, similarly in Angul, JSPL - Jindal Steel and Power Limited, which is Raigarh based - Raigarh in Chatthisgarh - and this is the Naveen Jindal owns his plant.

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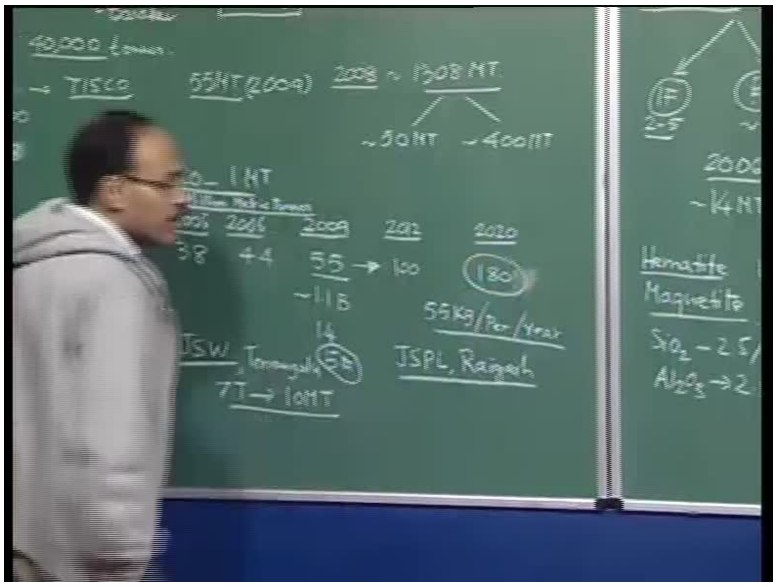

So, they are planning for some additional facility - new facility - in Orissa Angul district so new projects are also coming up. And this new projects, there all together; new players also this, they are quite old timers as far as steel is concerned. ESSAR is also has expanded their production capacity in Hazeera works and they have also started making steel as somewhere in Orissa also, they have started their production.

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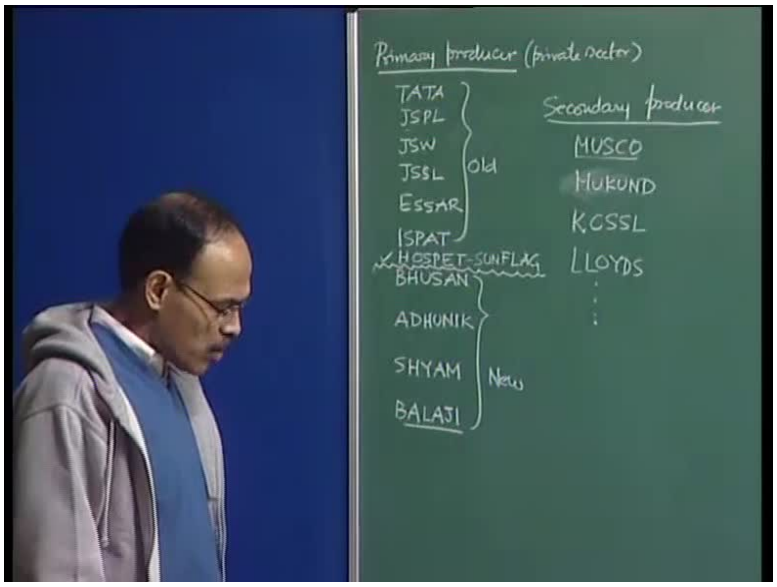

Apart from this, many steel plants, these are the old timers like as I have mentioned already; so, these are integrated steel producers, ISPAT industries, HOSPET steel,

Sunflag, ESSAR, Jindal stainless steel, JSW, JSPL, Tata, and this is I am talking about private sector. And because we need more investment, more steel, new players have come - Bhusan steel, Adhunik steel, Shyam Balaji and so on.

And these are basically, these either have small blast furnaces - mini blast furnaces - or they have huge blast furnaces. And we will you talk of mini blast furnaces; you must be knowing that mini blast furnaces about 50 to 300 meter cube, that is the volume of mini blast furnaces.

HOSPET steel, for example, they have a 350 meter cube blast furnace. And you have many secondary producers also enumerable secondary producers; it is not possible to list all of them, I have listed some key players. So, look at this one, MUSCO - Mahender Ugine Steel Company is one, Kalyani Carpenters Special Steel LLOYDS and there are many other steel plants, which are based on electric furnace as well as… These are the permanent players and they produce high quality alloy steels for automobile applications and for key engineering applications.

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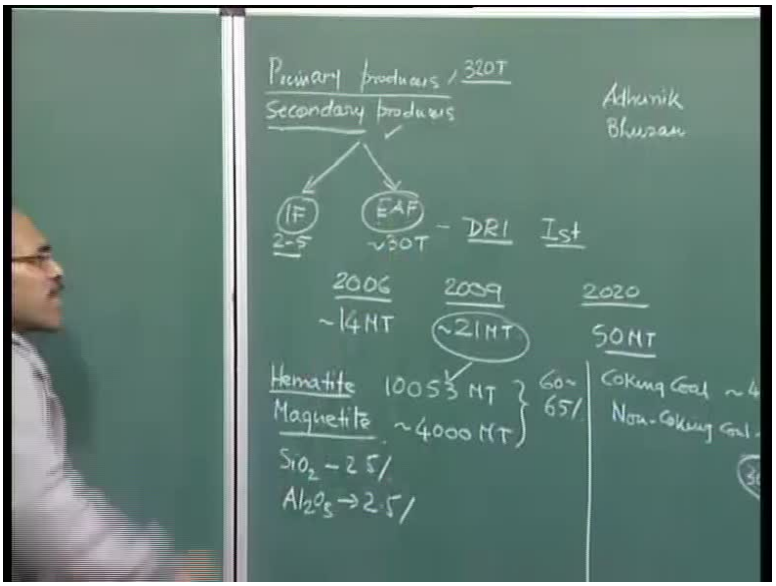

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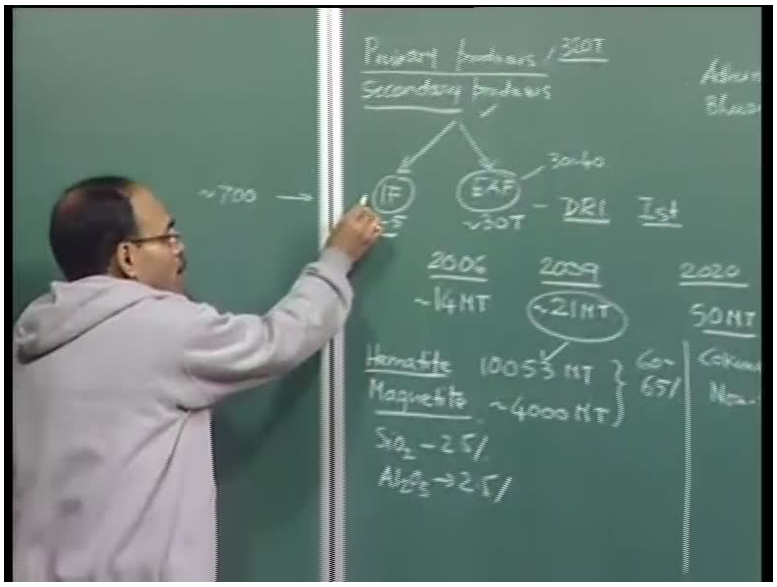

Now, one important aspect about the secondary steel production is, that why it is the arc furnace steel making has not really grown in India. I mean, if you look at the number of induction furnace facilities, they are roughly about 700; on the other hand, you have barely, you know, 30 to 40 electric arc furnaces in India.

So, the secondary prospector also that produces steel. And in this country, very interestingly, that most of it comes or a bulk, you know, a major chunk of it comes from the induction furnaces, where the number is really enormous term; and it is basically because setting up of an induction facility is extremely in expensive, in comparison to an EAF facility.

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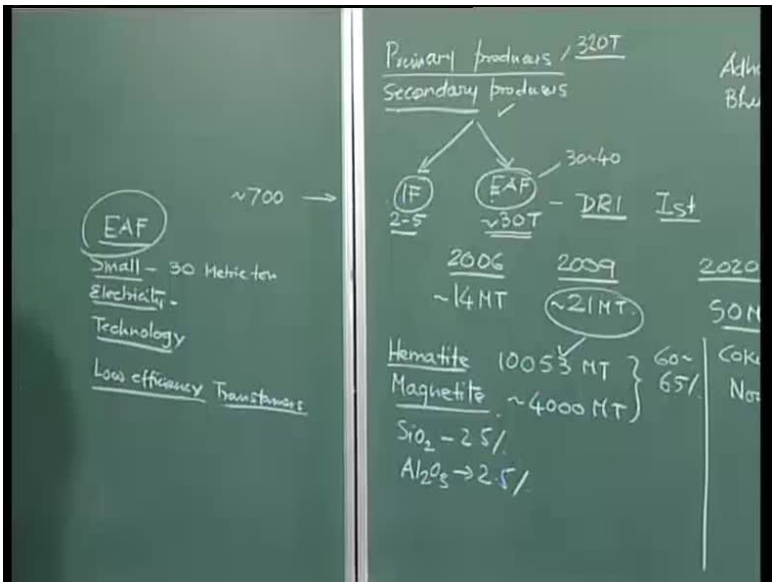

Now, the electric arc furnace in our countries are also age old; you know, their sizes are small; what are the characteristics of EAF is EAF's in India? For example, this is a small size - very small size. When outside you know in advance countries, you see about 400 tons size of electric arc furnaces; in our country, the electric arc furnace size is small merely about 30 metric tons metric tons.

Our electricity is a major problem; well, this is a problem with induction furnace also. We have problems with technology, this furnaces are age old furnaces; for example, if you go to MUSCO and if you see their electric arc furnace - a very old furnace - actually 30-40 years old furnace with not process controlled, with not many sensors. And finally, when we are talking of… now, we have low efficiency transformer as the transformer are also not good, which cannot feeding really a low efficiency transformers.

So, the tap to tap time is really high, because you require melting and refining to make steel. If you go electric arc furnace steel making, they are making life of integrated steel makers miserable, in terms of providing the right kind of competition, because so many developments have taken place in electric arc furnaces, which you may have done starting from kojet technologies, submerge gas injection, plume hood analysis, good process control, good in carbon determination, and on every different electric arc furnace has undergone revolution, as far as steel making is concerned. But when you look at the

steel making - EAF steel making - facilities in India, you become really sad to know the state of things.

And that is why, the steel produced by electric arc furnaces is not significant in this country; no new facilities have been deducted in recent years, because we do have problem nationally; we do have problem, as far as electricity is concerned.

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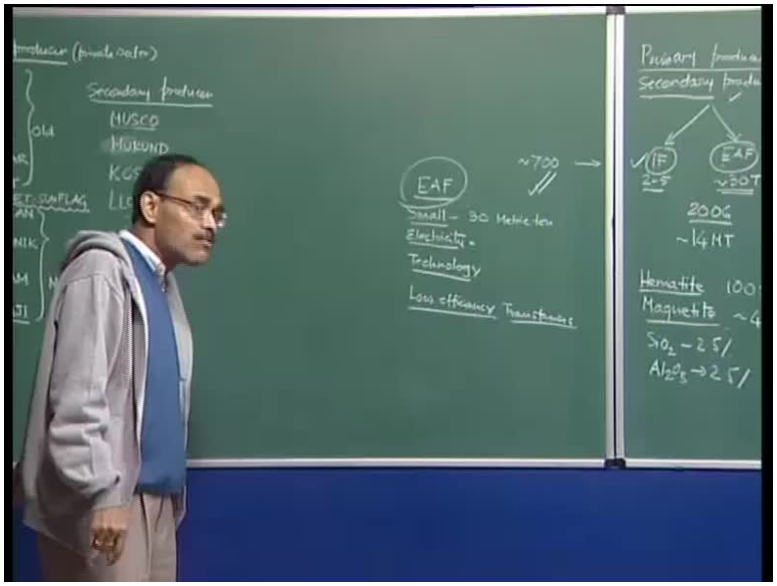

So, nobody wants to invest money in electric arc furnace. So, whatever you have been maintaining sort of a status, so the old EAF's are continuing… the old EAF's are again not that good and that is why the rate of production is very very low. And that is why, you know, people found out that why invest money here - invest money in induction furnace - which consumes small resources, and yet you can make lot of steel; and that is why, you see a proliferation in the induction furnace facilities.

So, also one important aspect is, that when you produce DRI's, you produce DRI fines; and people have found that, in induction furnace, these DRI fines we are talking about three millimeter size.

These DRI fines cannot be really charge into the EAF, because from the electrodes, you know, when you straight the arc, whatever is there is going to be tremendous amount of slashing and few gas evolutions and so on. So, if you tend to edge the DRI in a continuous moved into the EAF during as your arc, what is going to happen is, a lot of

the DRI is going to be driven out. So, the induction furnace on the other hand can accommodate this fines, find DRI's very effectively; and that is why, people have found that this fines are relatively cheap in the market.

So, we need a melting facility - small scale melting facility - not with much capital investment, which can accommodate the DRI's fines and it is induction furnace as such which can very elegantly do that. And that is why, people have found that well making of steel through induction furnace is going to be relatively cheaper, rather than setting up a EAF; I am trying to do the same thing.

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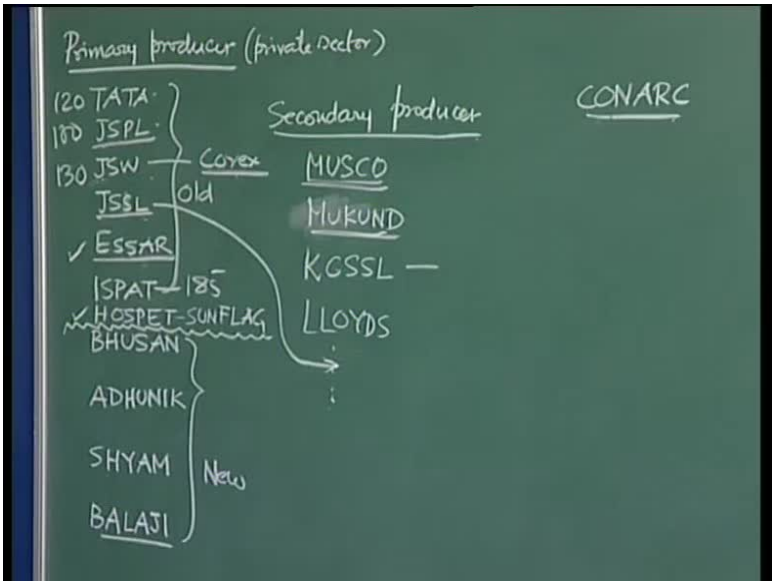

So, we have mini blast furnaces here as well as large scale blast furnaces, we have induction furnace melting facilities; these are of course, they all have electric arc furnace facilities; there are many such small small players who have you know induction furnace facilities.

Now, we will talk about little bit about the layout of the plant. Now, although these are integrated… let me first talk about the integrated steel making units; although they are basically, they make liquid metal pig iron and process pig iron throughout steel making, all of them uses oxygen steel making; today, nobody talks about Thomas processor Bessemer process.

So, but the process soon that four is followed by this integrated players are drastically a different; for example, if you go to HOSPET steel, you find many blast furnace; if you go to ISPAT industry, you will find out, they do not use traditional oxygen steel making process; we have in the ISPAT industries, what they have is a process called CONARC process; it is a twin shell converter plus arching.

So, there are two shells; so, it has a feature of electric arc furnace as well as converter. And, you know, why it is we have done steel making, so CONARC process gives you the flexibility to have desulphurization and dephosphorization under a different conditions, which can be, one is the converter would you blow in oxygen and other is the arching process where you can maintain reducing atmosphere; and then, you can possibly do the desulphurization as well. ESSAR steel has a huge electric arc furnace also; JSW for example, they have corex; you may have done in iron making, that corex process largest corex furnace is in the JSW, which is producing more than a million tons of steel per annum; this is a direct smelting deduction process if you know, there is only planting in India which has facilities.

So, ISPAT has a CONARC process; corex does not… JSW has both blast furnaces as well as corex. We also know that, corex process producers high calorific gas value, which can be converted into power also. So, if you go the ESSAR steel, you find they have huge electric furnace facility; by the by, ESSAR has the biggest DRI is 3.6 million tons per annum, that is the rated capacity of the DRI facility with the ESSAR group.

So, they make briquettes and they produce, they charge it into the electric arc furnace; they have relatively bigger size electric arc furnace; I think more than 100 ton size and they are the producers steel.

So, it is not the same, Tata steel conventional LD process, big blast furnaces 6 or 7 in number; and they have secondary steelmaking, they have both slab casting as well as billet casting facilities. So, that means, they produce long products as well as flat products.

If you go to JSPL, they have both electric arc furnace as well as liquid metal production units like blast furnaces. They have also bloom costing, near net shape costing as well as flat casting facilities; so, they produced both flat products as well as long products. JSW

at Toranagallu is a flat product plant, they do not bilateral bloom casting; they produces slabs. They are again, the hot metal is produced through corex as well as blast furnace and then we have steel making is which is in done through L D steel making.

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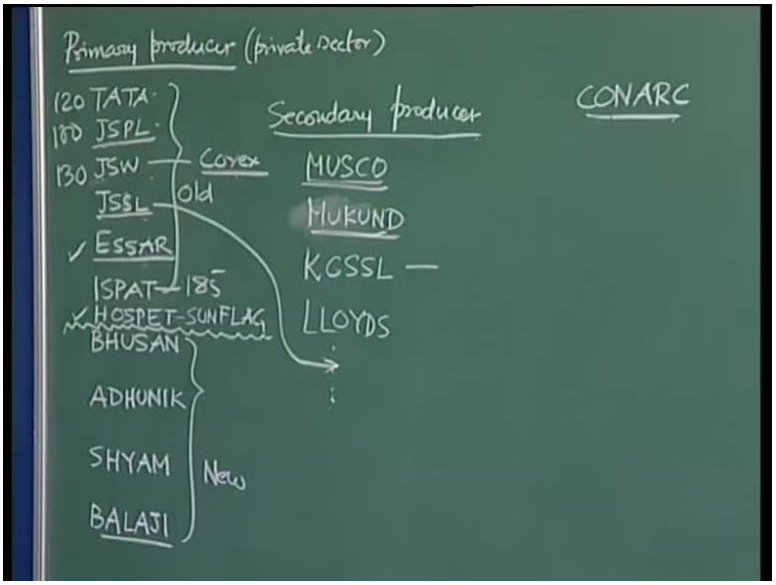

Jindal stainless is the old, it is not an actually integrated steel plant; so, I should have got it here. There is an another steel plant, they produce make stainless steel and they have an electric arc furnace, where stainless steel is going to be produced; they also have slag casting facilities - continuously slab casting facilities - all this slab have actually ESSAR steel, I have already known mentioned electric arc furnace base slab pastors, slab product melt.

ISPAT also ISPAT has, for example, is only plant which has thin slab casting; and I think Bhusan or Adhunik also, in their east coast, the Orissa plant also have the thin slab casting; I think Adhunik groups have thin slab casting facility in the Rourkela works.

So, CONARC process, ISPAT has CONARC process; so, they have a big DRI production facility also in Dolvi; and this DRI is used in the converter CONARC process a part of it. They have also blast furnaces there and they use lot of secondary steel making tank degassing; they have converter size, for example, we have we are talking about 185 tons, we are talking about 130 tons, we are talking about 100 tons, we are talking about I think 120 tons and so on.

If you go to Bokaro steel plant, for example 320 ton; if you go to Rourkela, the converter sizes are 100 ton. So, each plant actually is different; there is no comparison between one plant with the other, in terms of their capacity, in terms of their steel making circuitry, in terms of their product, in terms of their efficiency, in terms of their environmental friendliness, I think all these are different from one plant to another plant.

So, for us, the secondary producers are concerned, they are basically electric arc furnace based company companies, whatever I have listed there; I have not listed those which uses induction furnace. So, I would say, that most of them uses electric arc furnace coupled with lot of secondary steel making and continuous costing. And KCSSL for example, they are produced continuously cast slabs; on the other hand, if you go JSSL, this produces stainless steel slabs; and Mukund steel for example, they produces blooms and billets. So, again you see most of the small scale plants have actually long product plants, but one or two of them you know like KCSSL and JSSL - Jindal Stainless Steel, these are the flat products.

And most of them are based on electric arc furnace; that means, most of them by DRI from outside. For example, MUSCO gets their entire field of DRI from ISPAT; ISPAT is located in Dolvi, MUSCO is located in Kupili, they are close by in near vicinity of Raigarh district just in the outskirt of Bombay.

Similarly, if you go to for example HOSPET steel, HOSPET also has you know by some DRI from some sources; they also these plants also by scraps from the market and they have huge scrap storage facility, because you need the scrap mixed with the DRI’s, you know, that constitute the principle iron bearing field to the furnace.