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IIM
Metallurgy
Materials Engineering

NEWS LETTER

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K L Mehrotra - Chairman, Delhi Chapter | **S C Suri** - Editor-in-Chief (IIM-DC Newsletter)

In The Issue

SHOW PREVIEW

11th International Exhibition & Conference

MINERALS METALS METALLURGY MATERIALS

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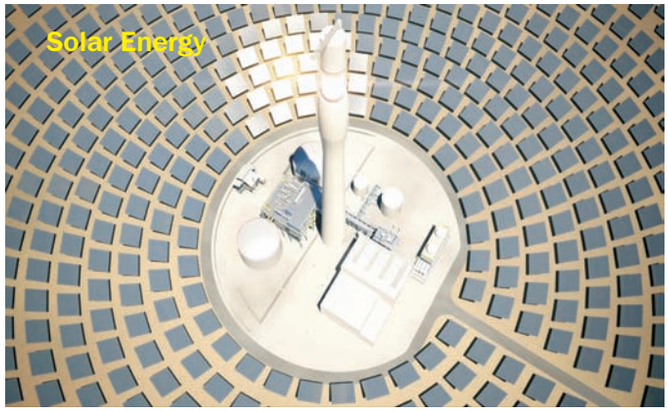

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President's Message

IIM NMD-ATM 2015: Convergence of Everything to do with Metals, Minerals, Materials and Mining

S.S. Mohanty
Director (Tech.) & Addl. Charge
Director (P&BP)
Steel Authority of India

सेल SAIL

IIM President
2015-2016

Metallurgy
Materials Engineering

Dear members,

The metals sector is at the core of economic progress of a developing nation like ours, and its resilience will determine our trajectory as we aim to emerge as the "next big thing" on the global economic map.

Closely woven into this sector are the minerals, mining and materials facets which demand an equal focus in order to ensure cohesive growth.

In this backdrop, it gives me great pleasure to inform you that the Indian Institute of Metals (IIM) will be organizing the 53rd National Metallurgists' Day (NMD) and 69th Annual Technical Meeting (ATM) during 13-16 November 2015 at Hotel Le Meridien, Coimbatore, Tamil Nadu, India.

NMD-ATM 2015 is the largest metallurgical conclave being organized in India during 2015 and will provide the stage for over 1000 delegates representing industry, academia & research organizations from India & abroad to actively network for a gainful experience.

This year's NMD-ATM 2015 will feature the following events:

1. International Symposium on "Vision 2015 – Global challenges & Opportunities in Steel Industry" on November 13, 2015.
2. National Metallurgists' Day celebrations on November 14, 2015.
3. Annual Technical Meeting (ATM) during November 15-16, 2015 on the theme "New Horizons in Material processing and Applications".
4. Technical Exhibition during November 14-15, 2015.

Every facet of business today is closely intertwined to economies, be it concerning logistics or operations, and is directed to ultimately push up the bottom-line. The mainstay of every activity has to be concern for delivering value to the consumer, be it in terms of products or services. NMD-ATM 2015 is an ideal setting to showcase the capabilities of any organization to august participants from the global metals and allied sectors.

Major leaders of the steel and non-ferrous industry, experts from leading research organizations & academia and technology providers will be participating in this four-day event. You need to mark your presence too and witness the unfolding of a whole new generation of technologies.

Let it not be all work for you at Coimbatore. Situated at the foot hills of the Nilgiri mountain range, it is well known for its salubrious climate, and you can even unwind with visits to nearby Ooty and Kodaikanal.

The NMD-ATM 2015 is the right place to be in, the very confluence of everything to do with Metals, Materials and Mining. You need to be there too, and may like to visit the IIM NMD-ATM 2015 website http://www.iimnmdatm2015.org for all the details to register.

I solicit your wholehearted support to make the NMD-ATM 2015 a grand success and look forward to seeing you at Coimbatore.

Mark the dates on your calander right now.

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Technology Profile of Indian Steel Industry

Shri S C SuriHon. Member IIM &
Editor-in-Chief, IIM DC Newsletter

A Note by the Author

The Indian Steel Industry occupies a pivotal role in the economic development of our country. India is now is the third largest producer of steel in the world. We have ambitious plans for the growth and development of steel industry in our country. The share of Mining and Metal Sector is around 5.0% of GDP.

The technology profile of the steel industry is covered under various technology areas namely the basic structure of the Indian Iron and Steel Industry and consequent Iron and Steel making operation viz. Coke Making, Iron Making, Steel Making, Continuous Casting, Rolling Mills and Processing Lines.

This particular issue covers the technology aspects of Coke and Iron making. The second write-up in the series would cover Steel Making and Continuous Casting. The third and final series would cover Rolling Mills and Processing Lines of the Iron and Steel Sector.

It is believed that the readers of our Newsletter would find this various facets of technology profile of our Iron and Steel Industry lucid. The basic objective of this write-up is to provide a deeper insight in the different technology / innovative aspects of Iron and Steel Making.

Introduction

Globally, there are two main process routes for steel making, i) the "primary or integrated route" based on Blast Furnace (BF) and basic oxygen furnace (BOF)/ LD Converter using iron as the basic raw material and ii) the Electric Arc Furnace (EAF) route using steel scrap as basic raw material with/without sponge iron. In India, steel is produced adopting three main process routes – Basic Oxygen Furnace (BOF), Electric Arc Furnace (EAF) and Electric Induction Furnace (EIF). The interesting features of the Indian steel industry is that about 32% of total crude steel production comes from the electric induction furnace (EIF) sector. This is the one of the outcomes of liberalization and is hardly found in any developed or developing countries. With 23% steel being produced through the EAF route, proportion of total electric steel making in India has crossed 55%. Only the balance 45% steel is being produced through the BF-BOF route.

Metallic iron inputs used for steel making through the three process routes vary widely from plant to plant. Hot metal produced in Blast Furnace and Corex Furnace is the predominant source followed by Direct Reduced Iron (DRI) produced in gas based or coal based plants and the last but not the least is the steel scrap (Figure-1). In these processes, scrap has a dual role to play-while in BOF it serves mainly as a coolant, in stand-alone Electric Furnaces; it is the chief source of metallic iron for direct melting.

Structure of the Indian Iron and Steel Industry

Structure of the Indian iron and steel industry thereof, is quite diverse. On the basis of inputs/ feed-mix used in iron and steel making /

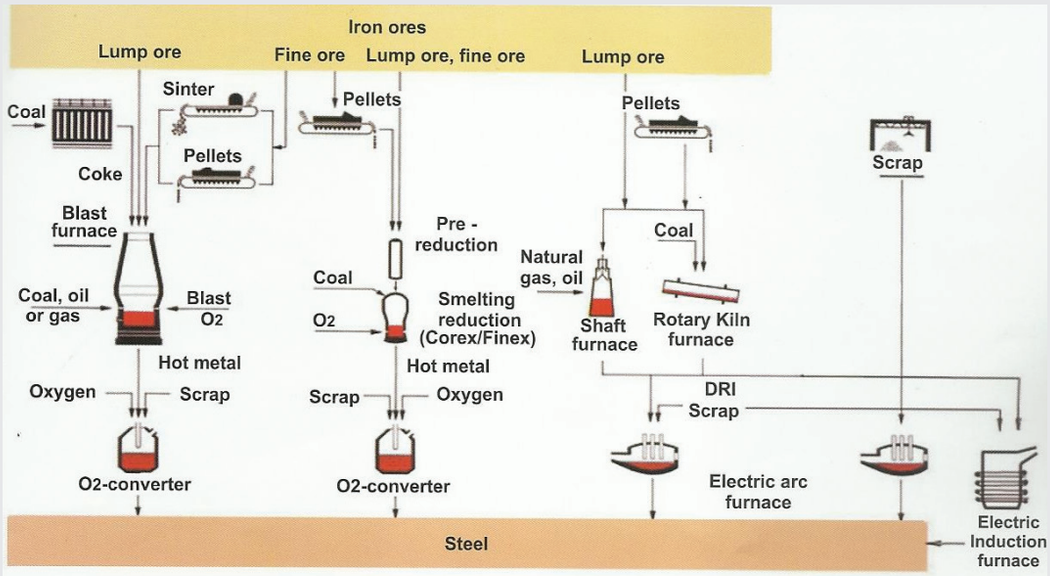


Figure- 1: Crude steel production methods adopting three main process routes
Source: [312, Dr. Michael Degner et al. 2008] &
(European Best Available Techniques (BAT) Reference Document)

processing, profile of Indian steel industry has been summarised under the following sub-groups:

a. Integrated steel plants comprising Coke Oven Sinter Plant – Blast Furnace (BF) – Basic Oxygen Furnace (BOF)/ Twin Hearth Furnace (THF): using coking coal and iron ore (lumps/ sinter) as basic inputs.

b. Integrated steel plants comprising Pellet Plant – Corex furnace – Basic Oxygen Furnace: using primarily non-coking coal/weak coking coal and iron ore (lumps/pellets) as basic inputs.

c. Integrated steel plants comprising gas based Direct Reduced Iron (DRI) plant /Blast Furnace – electric Arc Furnace (EAF): using natural gas, coke/coal and iron ore (lumps/ pellets) as basic inputs.

d. Integrated plants comprising coal based Direct Reduced Iron (DRI) plant – Electric Arc Furnace (EAF)/ Electric Induction Furnace (EIF): using non-coking coal and iron ore (lumps) as basic inputs.

e. Integrated plants comprising coal based Direct Reduced Iron (DRI)/ Blast Furnace (BF) – Electric Arc Furnace (EAF)/Electric Induction Furnace (EIF): using iron ore, non-coking coal and coke as basic inputs for steel production using hot metals from Blast Furnace to partially substitute DRI in EAF to optimize power/electrode consumption.

f. Mini Blast Furnace (MBF) – Energy Optimizing Furnace (EOF): using coke, iron ore lumps and scraps as basic inputs.

g. Stand-alone Electric Arc Furnace (EAF)/Electric Induction furnace (EIF) units: using steel scraps and purchased DRI.

h. Stand-alone Mini Blast Furnaces (MBFs): using mostly iron ore lumps and coke as basic inputs producing pig iron mostly for iron castings.

i. Stand-alone gas/pellets and natural gas & non-coking coal.

k. Stand-alone Hot Rolling/Rerolling Mills: using purchased/imported semis as basic inputs for production of mostly long products.

l. Stand-alone Cold Rolling Mills/ Processing Mills: using purchased/ imported HR/CR coils as basic inputs for production of CR/Coated flat products.

Design and Engineering Issues

Designing, engineering and manufacturing capability of iron and steel plant equipment in India is limited. Therefore, in most cases, technology is imported from abroad, and equipment/ machineries are designed and fabricated out of India. This is particularly, true for large plants viz, the integrated steel plants. Hence, the capital cost of any such ISPs is excessively high.

The high Capex is one of the major deterrent for growth and development of Indian Steel Industry. It is also one of the primary reasons for small/ medium/first generation steel entrepreneurs for selecting cheaper routes of steel making viz. the induction furnace route with/without captive sponge iron facilities.

With the setting up of new/green-field steel plants based on modern state-of-the-art technologies and also gradual phasing out of old/obsolete facilities in the course of modernization and expansion of existing plants, the technological profile of the Indian Steel Industry has been continuously changing for the better ensuring higher productivity, improved quality and competitive cost.

Since availability of high grade iron ore as well as lumpy ore is limited, processes such as beneficiation and agglomeration are receiving prominence. Energy conservation and environment friendly measures like recovery of waste heat from hot blast stoves, sinter cooler, coal based sponge iron, Pulverised Coal Injection (PCI), coke Dry Quenching (CDQ), Top Pressure

Recovery Turbine (TRT) etc and charging of hot DRI and hot metal in EAF are drawing attention of the industry. The industry has started thinking beyond conventional continuous casting towards Thin Slab Casting in pursuit of excellence.

Salient features of major iron and steel making technologies, particularly in the context of integrated steel plants are highlighted here under:

Coke Making

Coke Making is a high temperature dry distillation process that removes and captures the gaseous chemicals in coal leaving thereby a residue of solid and porous lumpy mass of carbon known as coke. Coke serves four basic functions in the blast furnace iron making. Besides being the sole reductant to reduce iron ore into iron, it is the chief source of heat required for the reduction process. Solid coke also provides the required permeability inside the blast furnace to enable gases to pass through the bed and supports the heavy column of material in the furnace.

The pre-requisite physical and chemical characteristics call for adoption of relevant technology for production of coke of required property. Generally, coke for metallurgical applications is produced in by-product coke ovens and in non-recovery/heat-recovery coke ovens. Most of the integrated plants in India have set up top charged by-product coke oven batteries and some like JSW Steel Ltd., Jindal Steel & Power Ltd. (JSPL) and Tata Steel Ltd. (TSL) have set up non recovery/heat recovery ovens. Further, a few plants have adopted CDQ in their quest for achieving the environment norms.

The scenario of coke making has been changing over the years on techno-economic and environmental considerations. From the conventional top charged, low/medium height coke oven batteries, the present trend is to go in for taller batteries and leak proof oven doors to economize on land use, increase productivity and reduce environmental pollution caused due to oven leakage. SAIL, RINL, Neelachal Ispat have installed 7m tall batteries. Bhushan Steel is in the process of setting up a 7.6m tall battery which may be tallest in the country. Several plants have adopted pre and post carbonization techniques to enable economic production of coke using inferior/weak/cheaper coking coal in an environment friendly manner. Towards these objectives, Stamp Charging and Partial Briquetting of Coal Charge (PBCC) have been adopted respectively by Tata Steel and SAIL plants, particularly with an aim to improve productivity and quality of coke even with relatively inferior coal. RDCIS, SAIL has developed a computerized coke oven heating system, which ensures consistent coke quality, reduced energy consumption, improved battery life and avoids wrong pushing. The system has been incorporated at COB#3 of BSP and COB#1 of DSP. An upgraded version is now being implemented at COB#4 of BSP and COB#3 of RSP.

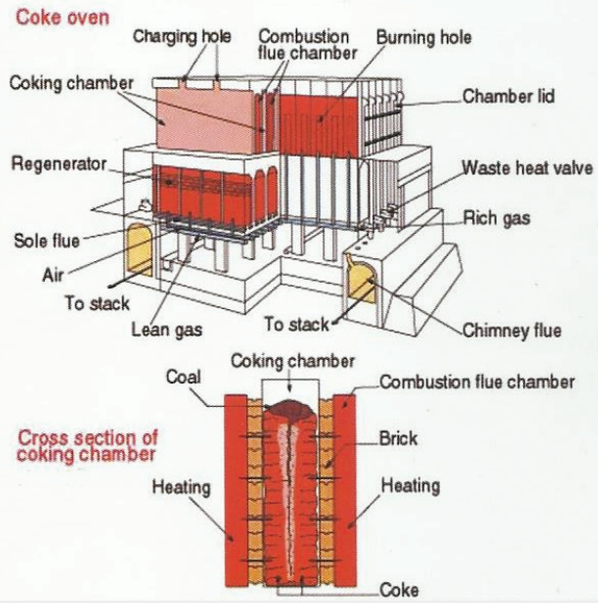
The above technological innovations like Stamp Charging & Partial Briquetting of Coal charge (PBCC),

Coal and Coke making

Coal	Anthracite (Non coking)
	Bituminous coal (Coking, For coke)
	Brown coal (Non coking)
	Peat (Non coking)

Coke quality	
Moisture	Dry quenching 0.1~0.2%
	Wet quenching 2~5%
Ash	11~12%
Volatile matter	0.5~0.6%
Mean dia.	50 mm

Composition of coke oven gas	
H_2	46 ~ 52%
CH_4	27 ~ 35%
CO	6 ~ 10%
C_mH_n	3 ~ 4%
CO_2	2 ~ 3%
N_2	3 ~ 5%



Tall ovens/batteries, Leak Proof Doors, Coke Dry Quenching (CDQ), on-line heating control technology etc. may be considered for extensive adoption for enhanced productivity, improved quality and reduced pollution. Other technological developments recommended for adoption are:

- Development of suitable models to optimize the coal blend in consideration of total cost, coke quality, oven health and easiness of pushing.
- Improvement in automation to facilitate improvement in productivity and quality i.e. level-1 or level-2 depending on the need.
- Refractory welding for quick repair.
- Energy conservation programme.

A revolutionary coke production process, which is being developed by Nippon Steel, Japan, is expected to reduce energy consumption and also boost production efficiency. Dry-cleaned and Agglomerated Pre-compaction System (DAPS) is a new coal pre-treatment process for coke making to enhance coke strength and supress dust occurrence to improve the environment friendliness of coke making by drying coal, separating fine coal from lump coal and forming the fine coal into agglomerate. The DAPS decreases the heat consumption of coke making due to lower moisture content of coal and productivity. The heat consumption decreases by approximately 15% compared to the conventional wet coal charging process at the same production rate. These are futuristic technologies and Indian plants need to keep an eye on these developments.

Life of by-product recovery coke oven in India remains much lower as compared to Japan or other western countries. Some of the by-products released during coke making are carcinogenic. This is an area of concern and hence control on emission and by-product recovery are considered very important. Some of the steel plants in India like Tata Steel have made special efforts to reduce the stack and other emission in top charged as well as Stamp Charged batteries.

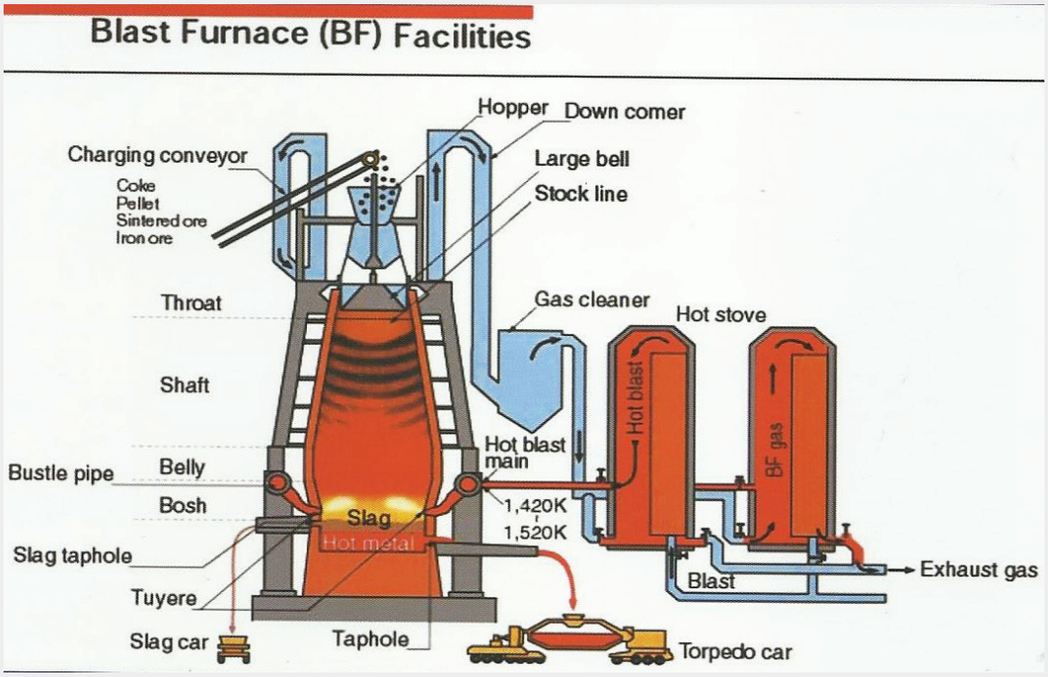
Due to environmental concerns, several companies have adopted non-recovery coke ovens equipped with modern innovations like vibro-stamp-charging and co-generation of power. No doubt, these have helped in reducing pollution normally associated with the by-product of coke ovens but these plants suffer from strong technological de-merits in the context of integrated plants, viz. non-availability of high calorific value coke oven gas for steel plant operation, lower productivity and large space/ land requirement etc. Similarly, CDQ technology has also its merits (in terms of energy efficiency) and demerits in terms of problems in discharging waste water from coke oven (which is presently being used in wet quenching of coke).

Iron Making

Iron making is the science of extracting iron from iron ore (oxides). This is primarily done in the blast furnace using coke made from coking coal, which is the most widely adopted technology for iron making in view of its scale of operation and thermal and chemical efficiency. BF iron is supplemented by Direct Reduced Iron (DRI) produced in gas based or coal based plants. Of late, Smelting Reduction processes like Corex and Finex have been developed to supplement the production of iron. The salient features of three routes in the Indian context is highlighted hereunder:

BF iron Making

Blast furnace is the main unit where primary reduction of iron ore takes place leading to production of liquid iron, also called hot metal. There are around 50 large and medium sized blast furnaces in India; and their sizes till recently varied in the range of 530 M3 – 3200 M3. Over the years, quite a few older furnaces have been phased out or renovated/upgraded to be equipped with some of the latest technological innovations such as Bell-Less Top Charging, Coal Dust Injection, Oxygen Enrichment, High Top Pressure, higher hot blast temperature, etc. Recently, several larger blast furnaces (3800 M^3 and above) with state-of-the-art technologies have been installed. Such furnaces have achieved much higher hot metal productivity (upto 2.8t/M^3/day) with lower coke rate, higher coal dust injection, lower slag rate and higher oxygen enrichment. SAIL has set up

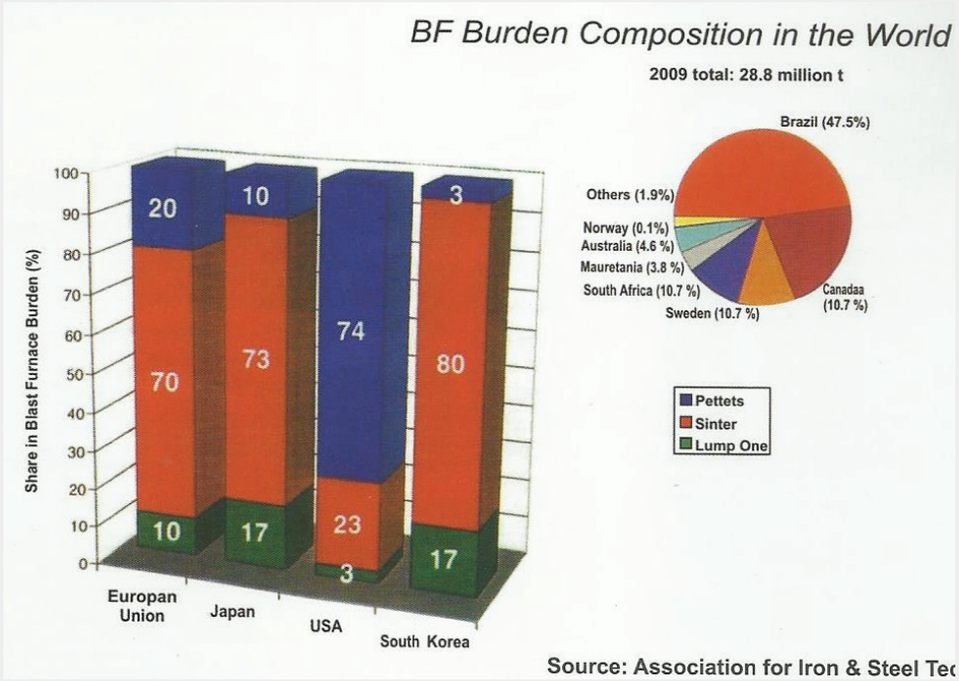


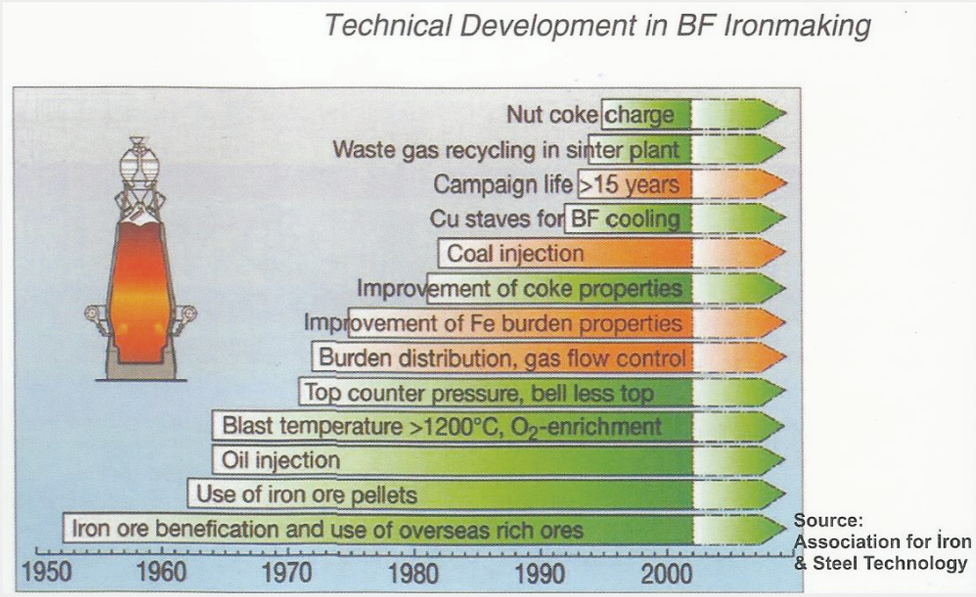
a 4060 M3 Blast Furnace at IISCO Steel Plant (ISP), Burnpur and one Blast Furnace each of similar capacity shall be setup at RSP, Rourkela and BSP, Bhilai. It is also satisfying to note that reduction of coke rate by injection of coal or other substitutes is gradually becoming the main agenda of India blast furnaces to substitute the use of scarce and costlier coking coal.

However, overall scenario in the BF sector in India, particularly the older installations, is pretty bleak and a lot needs to be done to improve the level of technology and techno-economic parameters through well-defined technology intervention programmes. Since the availability of lumpy ore is very limited, there is a need for charging prepared burden (sinter & pellets) in place of lumps. Successful use of pellet in BF is also expected to increase bed permeability inside BF which not only improves furnace operation, but also enables higher coal injection thereby reducing coke rate. Besides increased use of prepared burden, some of the technological innovations that need to be considered under Indian conditions to improve the productivity and quality of hot metal and to reduce the consumption of fuel are:

(i) Process improvements viz. revamping/ conveyorization of stock house and increasing screening efficiency of ore, sinter and coke, strengthening stoves capacity, increasing blast volume and flow rate, increasing oxygen enrichment of blast, higher hot blast temperatures of at-least 1100°C, application of close circuit water for better cooling efficiency, increasing the inner useful volumes by the use superior quality refractories (by 150-200 M^3).

(ii) High level of alternate fuels injection to drastically reduce coke rate, incorporation of technologies for





injecting pulverized/granulated coal (+200 kg/thm), oil (100 kg/thm), Natural gas (100 kg/thm) and waste plastics granules have to be seriously considered.

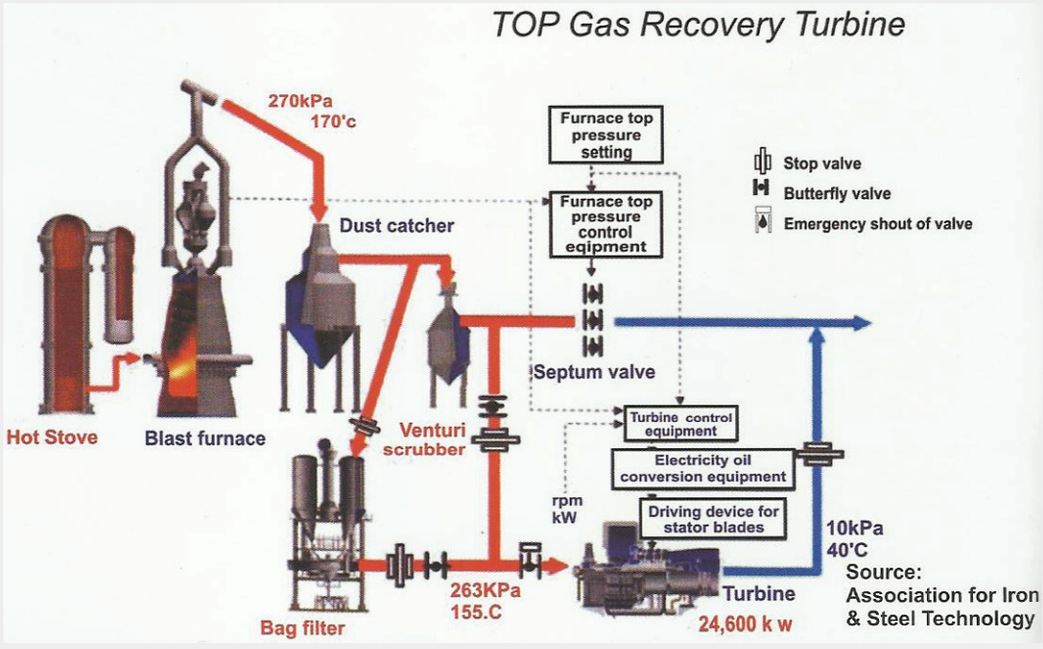
(iii) Adoption of energy efficiency measures in existing and new blast furnaces e.g. Top pressure Recovery Turbine, use of waste heat stove gas for preheating of gas, high efficiency stoves etc.

(iv) Increase in campaign life by introduction of various measures like copper staves, silicon carbide and monolithic linings in stack and bosh, closed circuit demineralized water and provisions for regular monitoring of heat flux all along the furnace height and cross-section, use of titanium bearing material as a regular hearth protection measure etc.

(v) Application of sophisticated probes (under and overburden probes, vertical probes etc), models and computerized expert system for process analysis, control and optimization are very important tools for bringing about quantum jump in productivity levels of India blast furnaces.

(vi) Efficient casting practice through upgradation of casthouse equipment, clay mass and liquid disposal system, incorporation of powerful mud gun and drilling machines etc.

In post liberalization era, a large number of Mini BFs (175 M^3 – 350/400 M^3), mostly stand-alone units, based on Chinese Technology have been set up in the country. There are also a few tiny Blast Furnaces (50 M^3). Similar BFs normally suffer



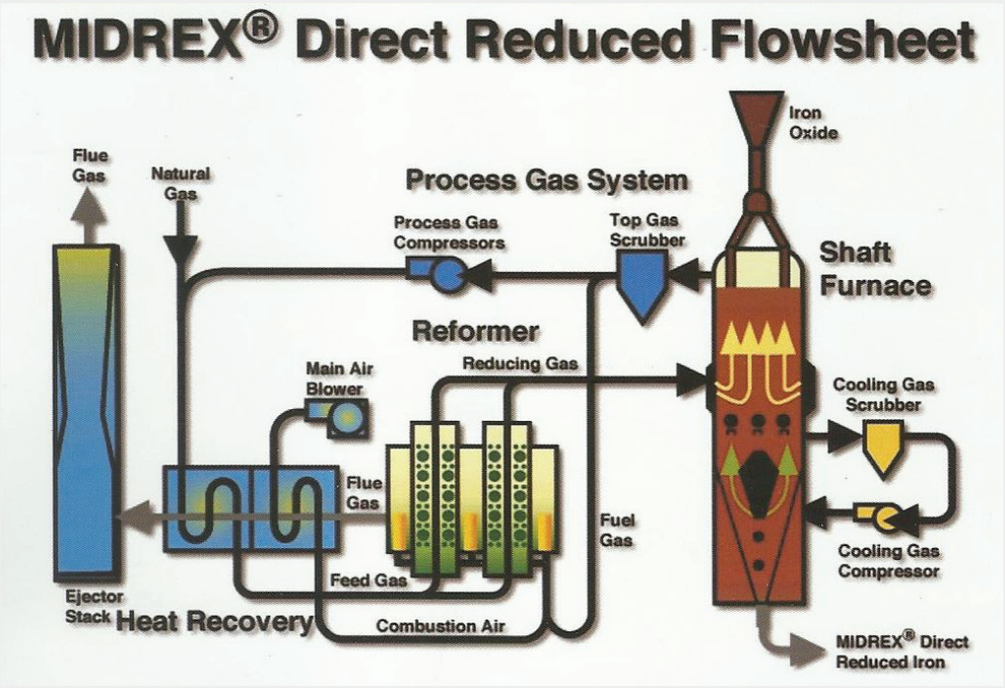
from poor thermal and chemical efficiency and hence inferior consumption norms and higher environmental pollution. China, who were the pioneer in adopting/supplying MBFs has been gradually pulling down the shutters of all such Mini BF based iron/steel plants under their Climate Change programme, in spite of the fact that most of such furnaces are highly productive (productivity: more than 3 T/M^3/D). In India, these MBFs are contributing significantly in terms of optimum grade of pig for iron casting foundries and are also feeding hot metal to EAFs resulting in saving in electric power consumption. However, there is need to modernise/renovate these installations, failing which the inefficient units may be considered for closure.

On account of the spiralling prices of raw materials (especially coking coal/ coke), there is increasing need to carry out research on the following to make the BF iron making cost competitive:

- Achieve Benchmark norms in consumption of vital raw material input.
- Harness the thermal and kinetic energy of the entire system
- Increase the BF campaign life
- Produce good quality coke from cheaper coal blend
- Produce sinter/pellets from cheaper iron bearing materials
- Beneficiation inputs and reduce slag generation

Direct Reduced Iron (Sponge Iron) Making

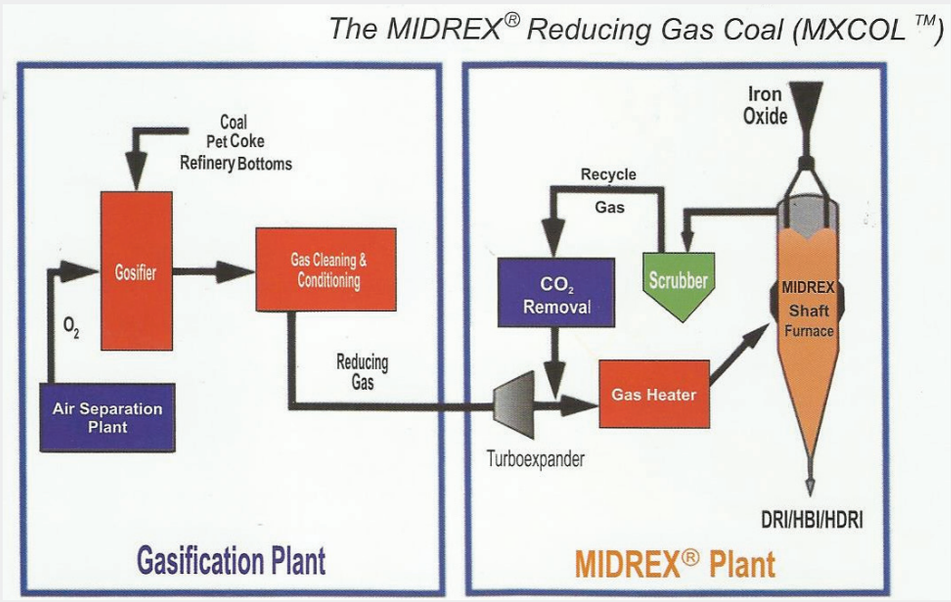
DRI is the solid metallic iron obtained upon Direct Reduction of high grade iron ore. There are two established process routes: gas based process using natural gas and coal based process using non coking coal. There are further two gas based DRI processes in the world i.e. MIDEX and HYL-III (now called Energiron) and both have been successfully adopted in India. Essar has also developed and mastered the hot charging of gas-based DRI technology that remarkably reduces power consumption in EAF steel making. Since natural gas availability in India is limited besides being very costly, these processes have not found wide acceptability. To reduce the dependence on natural gas, Essar Steel is setting up a new gas based plant using Corex gas for reformer heating. JSW Steel, on the other hand, is setting up one DRI plant using Corex gas process gas in place of natural gas utilizing the concept adopted in Saldhana, south Africa.



A revolutionary and challenging new alternative likely to be suitable in India conditions is non coking coal gasification by the well-established coal gasification process of Lurgi and use of the synthesis gas (syn-gas) thus generated as reductant in shaft furnace to produce gas based DRI. JSPL is putting up two gas based modules at Angul, Orissa using sys-gas produced from coal gasification. Besides all other advantages already stated above, the process is quite environment friendly.

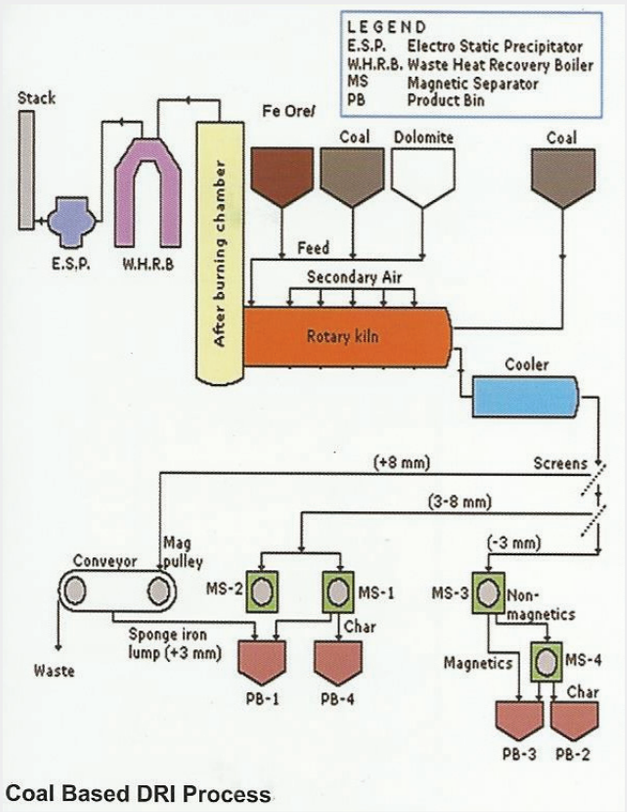
Coal based DRI process has established itself as a viable technology in India in terms of locational

The MIDREX® Reducing Gas Coal (MXCOL ™)



flexibility, productivity and kiln campaign life. There are over 350 units in India of varying module size. Today, India is the world's largest producer of sponge iron as also of coal based sponge iron. During 2010-11, total production of sponge iron is reported at around 27 million tonnes, of which contribution of coal based plants is approximately 75%.

A large number of coal based plants of smaller modular size 50/100 tpd or below have mushroomed recently adopting thereby indigenous / retrofitted technologies. These plants are trailing behind in terms of productivity, quality, energy and/or environment friendliness. To address the problem of quality, the BIS specification for coal based sponge iron needs to be revisited there by specifying a cap on the minimum level of metallization, Fe metallic and Fe total to qualify as DRI. The sector also requires stricter enforcement of pollution control measures. Complete utilization of char (Dolochar) generated from coal based plants remain a chronic problem and R&D solutions may be needed to address the same.

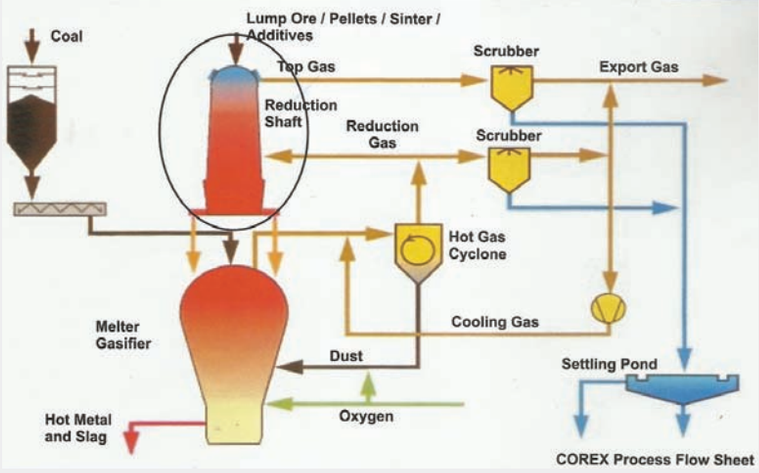


Coal Based DRI Process

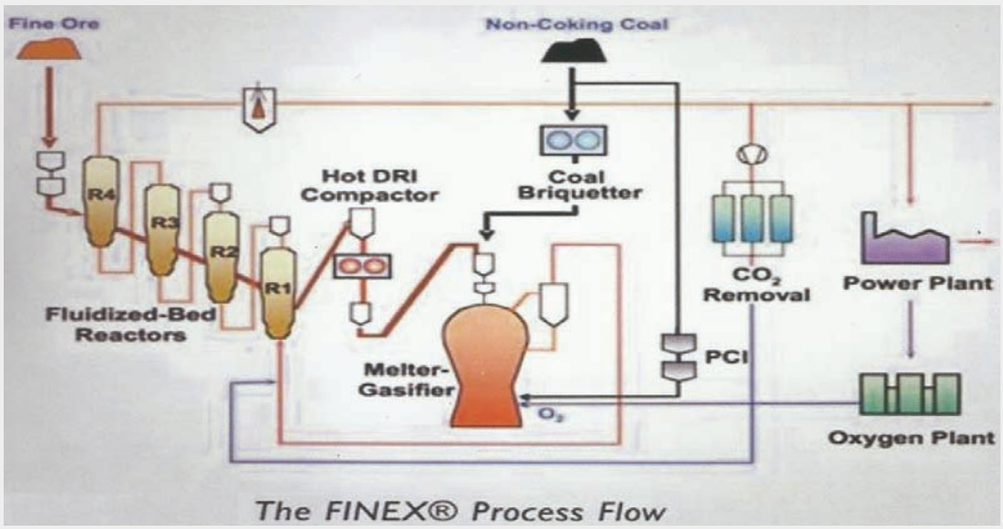
Alternative Iron making Process

COREX Iron Making

COREX is a proven smelting-reduction (SR) process developed by Siemens VAI for the cost-effective and environment friendly production of hot metal from iron ore (lumps & pellets) and coal without resorting to coke making. In India, JSW Steel has successfully adopted the Corex process (C-2000 Module) in Karnataka. Initially, the plant resorted to utilization of gas in power generation but today, they are gainfully utilizing the gas mixed with BOF gas for process heating in



COREX Process Flow Sheet



The FINEX® Process Flow

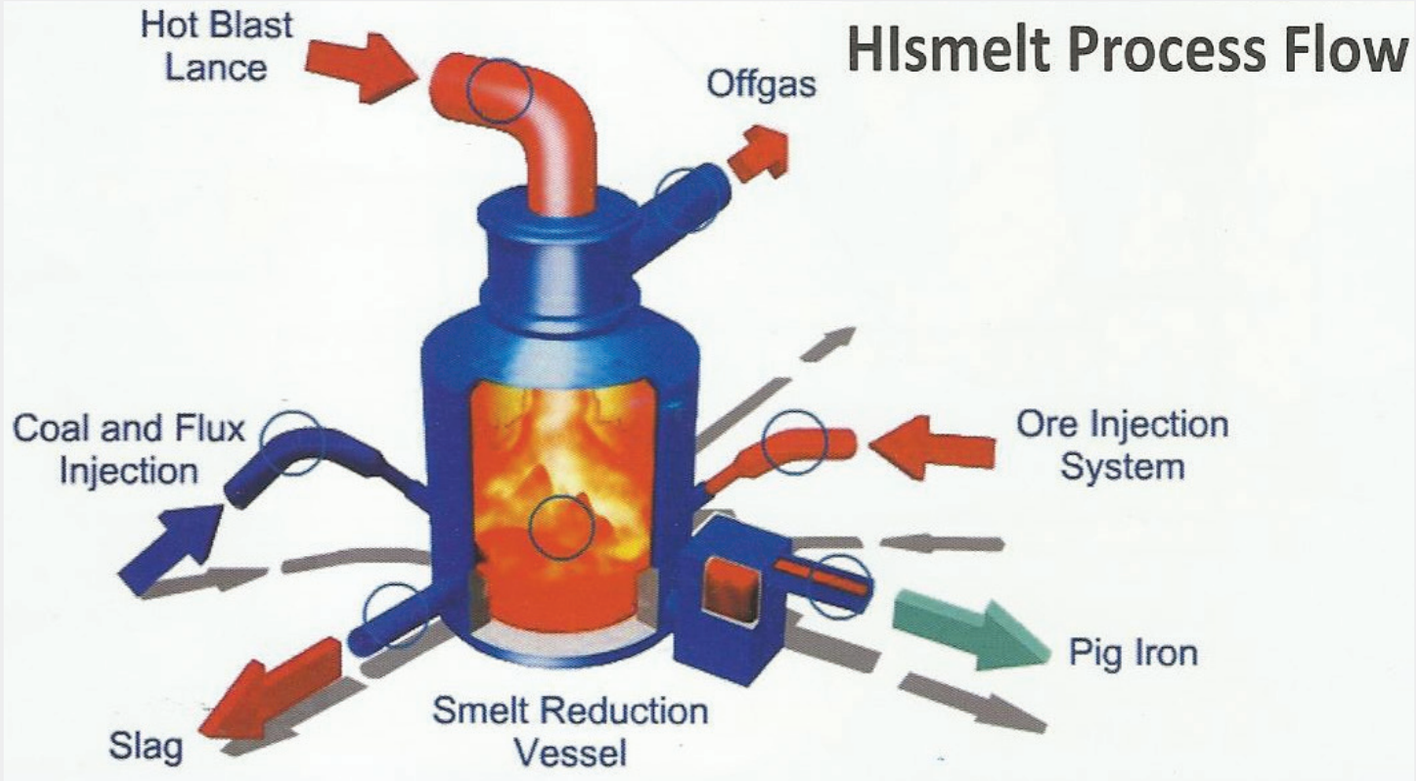
mill side. However, now JSW has decided to utilize the Corex gas for production of DRI and they are already in process of setting up the DRI plant using the Corex Gas. Essar Steel, Hazira is also installing two similar (Cores C-2000) modules shortly.

FINEX Iron Making

The limitations of the COREX process with respect to use of iron ore fines directly led to the development of FINEX process at Pohang, POSCO, South Korea. In this plant, the process has been successfully demonstrated at 1.5 million tonne modular capacity.

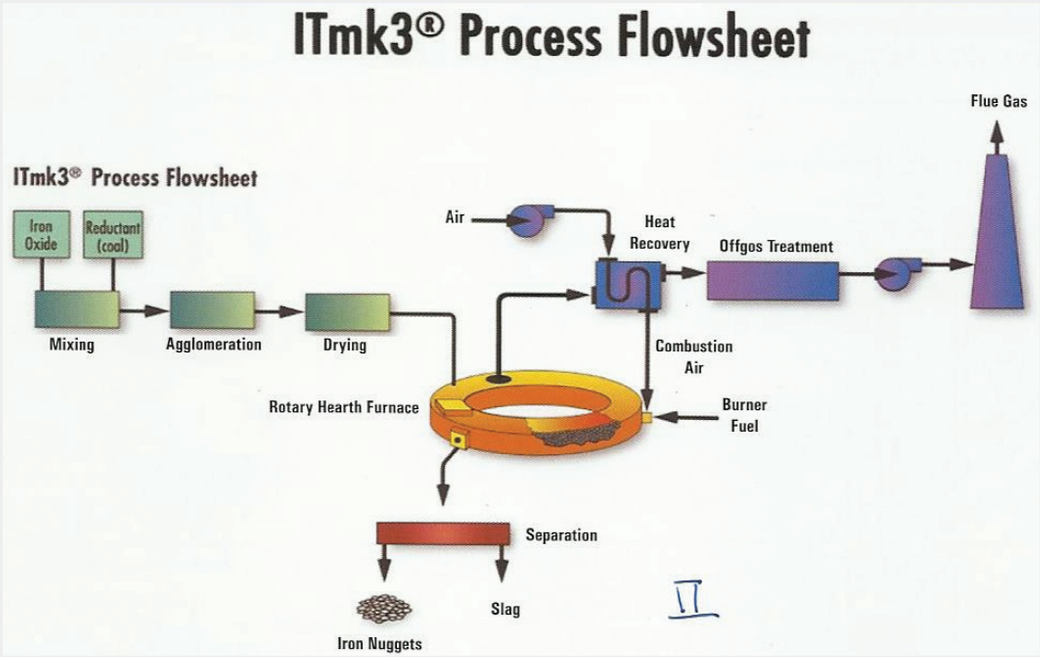
HIsmelt Iron Making

HIsmelt i.e. High Intensity smelting reduction is yet another promising technology for production of hot metal. Unlike Blast Furnace using hot blast of air and COREX/FINEX processes using oxygen, HIsmelt process uses oxygen enriched hot air blast. The process seems particularly relevant for high alumina and high phosphorous Indian iron ore and therefore positioned to become a technology of choice for future iron making. The first large scale demonstration plant (0.8 MTPA) was setup at Kwinana, Australia. However, before the process could be successfully demonstrated with 100% capacity utilization, the plant was put under shutdown and is yet to be restarted.



ITmk3 Iron Making

ITmk3 process uses low grade iron ore and non-coking coal to produce high purity iron nuggets in a rotary hearth furnace. The process is already less energy intensive, less capital intensive and more environment friendly. The first commercial plant (0.5 MTPA) is in operation since 2005.



Beside the aforesaid process, there are several other promising smelting reduction/direct reduction technologies which are in the various stages of development.

To be continued…..

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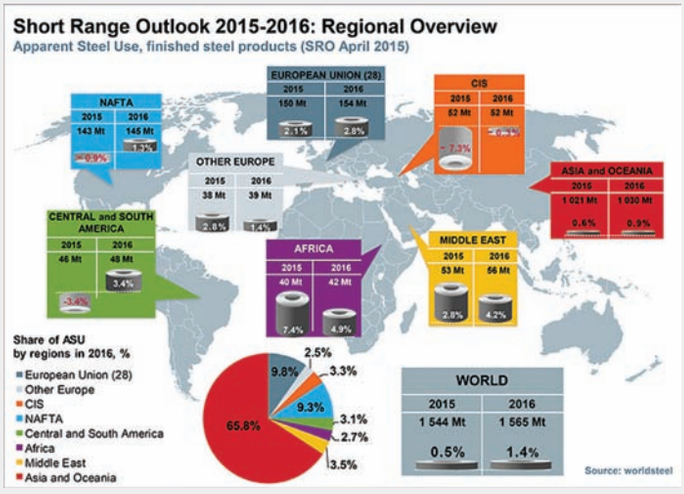
WORLDSTEEL SHORT RANGE OUTLOOK 2015 – 2016

The World Steel Association (worldsteel) released recently its Short Range Outlook (SRO) for 2015 and 2016. Worldsteel forecasts that global apparent steel use will increase by 0.5% to 1,544 Mt in 2015 following growth of 0.6% in 2014. In 2016, it is forecast that world steel demand will grow by 1.4% and will reach 1,565 Mt.

The outlook for the steel industry suggests slow growth for global steel demand.

Commenting on the outlook, Hans Jürgen Kerkhoff, Chairman of the worldsteel Economics Committee said, "We are releasing a restrained growth outlook for the global steel industry mainly due to the deceleration in China. The outlook also reflects the influence of major structural adjustments in most economies, particularly owing to limited investment growth post 2008. As these changes take effect, the steel industry will experience a slower pace of growth, it will focus on operational efficiencies and on the value that steel products generate for customers and society."

"While we continue to face some downside risks coming from some parts of Europe – geopolitical instability, international capital flow volatility and the economic slowdown in China – the impact of these risks has come down. We have also started to see some encouraging developments. We hear increasingly positive news from developed economies, especially signs of firming recovery momentum in the Eurozone. In the developing and emerging world, we see increased optimism about India and growth in steel use in some MENA and ASEAN countries. While these developments will not be enough to counterbalance the deceleration of China,



we expect to see gradually improving growth prospects beyond 2016," Kerkoff concluded.

An interesting factor which has become increasingly apparent is that in some developing economies the steel markets are beginning to exhibit the characteristics of mature markets.

China

Chinese steel demand in 2014 saw negative growth for the first time since 1995 due to the government's rebalancing efforts that had a major impact on the real estate market. This situation is likely to remain unchanged in the short term and Chinese steel use will continue to record negative growth of -0.5% in both 2015 and 2016. In the medium term no strong rebound is expected. Some uncertainty remains regarding the impact of government measures aimed at stabilising the decelerating economy.

The rebalancing of the Chinese economy is inevitable as China enters its next stage of development, but it will take time. In the short term, it has global consequences for the steel industry in terms of trade flows and possible intensification of trade frictions, resulting from significant increases in steel imports in many economies during 2014.

Oil prices

The sharp decline in oil prices influenced the forecast, though its impact varies between countries. On the one hand, it has a negative impact on steel demand for infrastructure investments financed from oil revenues; on the other hand it helps business sectors and consumers in oil importing countries, thus creating better growth prospects. As inflationary pressure is alleviated, further relaxation of monetary policy by the Central Banks is possible in countries with high inflation, which will eventually strengthen the recovery of underlying real steel use. As economies adjust to lower oil prices, it may lead to reduced demand for steel in some economies in the short term, but should support economic growth and demand for steel in the medium term.

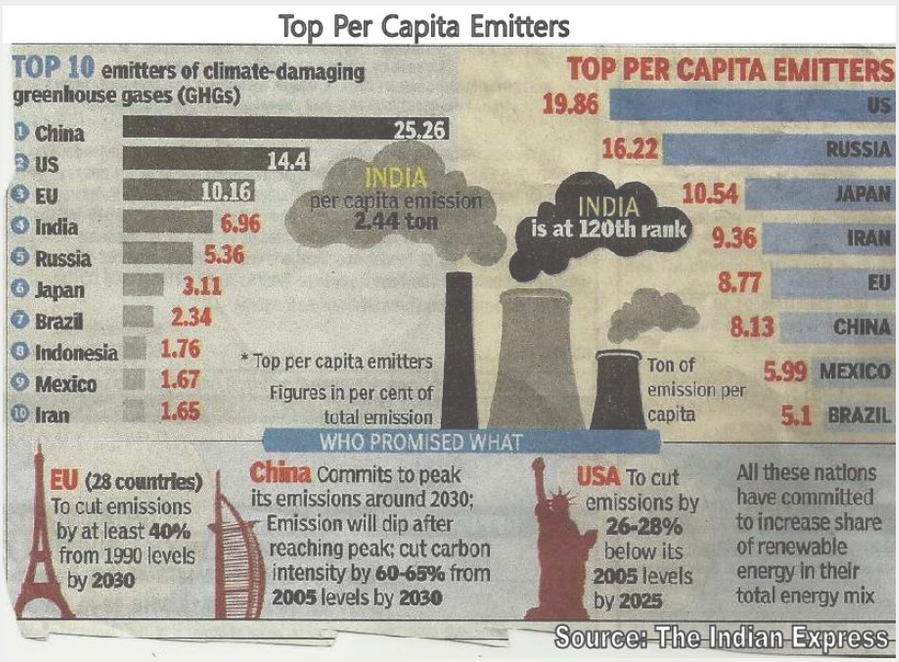
The developed world

The developed world showed growth in steel demand of 6.2% in 2014 on the back of strong US fundamentals and a firming EU recovery. However, growth in the developed world is set to moderate in 2015 due partly to the high base effect, but also less favourable steel market environments in the US, Japan and South Korea. The recovery in the EU, although becoming regionally broader based, is still constrained by weak investment activity and high unemployment. Steel demand in the developed economies will grow by 0.2% in 2015 and by 1.8% in 2016.

The developing world (excluding China)

The developing economies (excluding China) posted low growth of 2.3% in 2014, in particular because of the continued deterioration in the Brazilian and Russian steel markets. Growth momentum in the developing economies is expected to remain generally weak in 2015, however, we expect positive growth in some economies such as India, Indonesia, Vietnam and Egypt, where steel markets are still developing. Steel demand is expected to grow by 4.0% in 2016 after growing by 2.4% in 2015.

Source: World steel Association



CRGO Steel: A potential growth area for India

'FDI in greenfield projects: India surpasses US, China'

ENS ECONOMIC BUREAU
NEW DELHI, SEPTEMBER 29

INDIA HAS surpassed both the US and China in attracting foreign direct investment in greenfield projects, according to fDi Markets, a data service of *Financial Times*.

The FT data shows that India attracted FDI for greenfield investment, measured by estimated capital expenditure, worth $31 billion in the first half of 2015, ahead of $28 billion to China and $27 billion to the US. According to *FT*, India has more than doubled its investment in the first half last year, attracting $30 bn by the end of June 2015 compared with $12 bn in the first half of the last year.

India was ranked fifth last year for capital investment, while increasing its number of projects by 47 per cent. In 2014, China received $75 billion FDI while the US and the UK received $51 billion and $35 billion respectively.

As per the department of industrial policy and promotion (DIPP), India attracted FDI equity inflows worth $19.39 billion during the January-June period, up 30 per cent year-on-year.

TOP 10 DESTINATIONS - H1 2015

COUNTRY	CAPEX ($BN)*
India	31
China	28
US	27
UK	16
Mexico	14
Indonesia	14
Vietnam	8
Spain	7
Malaysia	7
Australia	7

*Source: fDi Markets. *includes estimates; all figures rounded up from decimals*

Source: The Indian Express

Electrical steel, also called lamination steel, silicon electrical steel, silicon steel, relay steel or transformer steel, is a specialty product tailored to produce certain magnetic properties, such as a small hysteresis area (small energy dissipation per cycle, or low core loss) and high permeability.

The material is usually manufactured in the form of cold-rolled strips less than 2 mm thick. These strips are called laminations when stacked together to form a core. Once assembled, they form the laminated cores of transformers or the stator and rotor parts of electric motors. Lamination may be cut to their finished shape by a punch and die, or in smaller quantities may be cut by a laser, or by wire EDM.

Electrical steel is an iron alloy which may have zero to 6.5 percent silicon (Si: 5Fe). Commercial alloys usually have silicon content up to 3.2 percent (higher concentrations usually provoke brittleness during cold rolling). Manganese and aluminium can be added up to 0.5 percent.

Silicon significantly increases the electrical resistivity of the steel, which decreases the induced eddy currents and narrows the hysteresis loop of the material, thus lowering the core loss. However, the grain structure hardens and embrittles the metals, which adversely affects the workability of the material, especially when rolling it. When alloying, the concentration levels of carbon, sulphur, oxygen and nitrogen must be kept low, as these elements indicate the presence of carbides, sulphides, oxides and nitrides.

These compounds, even in particles as small as one micrometre in diameter, increase hysteresis losses while also decreasing magnetic permeability. The presence of carbon has a more detrimental effect than sulphur or oxygen. Carbon also causes magnetic aging when it slowly leaves the solid solution and precipitates as carbides, thus resulting in an increase in power loss over time. For these reasons, the carbon level is kept to 0.005 percent or lower. The carbon level can be reduced by annealing the steel in a decarburising atmosphere, such as hydrogen.

Electrical steel made without special processing to control crystal orientation, non-oriented steel, usually has a silicon level of 2-3.5 percent and has

similar magnetic properties in all directions, ie, it is isotropic. Cold-rolled non-grain-oriented steel is often abbreviated to CRNGO.

Grain-oriented electrical steel usually has a silicon level of 3 percent (Si: 11Fe). It is processed in such a way that the optimum properties are developed in the rolling direction, due to a tight control (proposed by Norman P. Goss) of the crystal orientation relative to the sheet. The magnetic flux density is increased by 30 percent in the coil rolling direction, although its magnetic saturation is decreased by 5 percent. It is used for the cores of power and distribution transformer. Cold rolled grain-oriented steel is often abbreviated to CRGO.

CRGO is usually supplied by the producing mills in coil form and it has to be cut into "laminations" which are then used to form a transformer core, which is an integral part of any transformer. Grain-oriented steel is used in large power and distribution transformers, and certain audio output transformers.

CRNGO is less expensive than CRGO, and is used when cost is more important than efficiency and for applications where the direction of magnetic flux is not constant, as in electric motors and generators with moving parts. It can be used when there is insufficient space to orient components to take advantage of the directional properties of grain-oriented electrical steel.

CRGO: World Scenario

The CRGO market capacity in the world is estimated to be around 3 million tons per annum (mtpa), according to official estimates by the India's steel ministry. The capacity is mainly located in CIS, Japan, South Korea and Europe. Over half of the global demand is from developing markets in China, India, Latin America, Middle East and others.

Official estimates state that demand is expected to grow at 3.7 percent CAGR up to 2020.

Currently, only 11 players have the technology to manufacture CRGO, which is produced in 13 plants worldwide. Nippon Steel and Sumitomo Metal Corporation, Japan are the world leaders.

CRGO: Indian demand

According to official estimates, Indian demand for CRGO is around 2.5 lakh tons per annum. However, demand is expected to grow at about 12 percent per annum to reach 7-8 lakh tons per annum by 2022.

Dependence on imports is leading to supply and price constraints. Currently, imports are mostly from the US, Poland, UK and Japan.

For example, ThyssenKrupp Electrical Steel (India) Limited, Nasik,, is the only processing plant in India based on imported semi-finished cold rolled coils.

The Indian steel industry has made several attempts to adopt CRGO manufacturing technology through collaborations but without much success as of now.

As majority of imports are in the seconds grade, it leads to a very high failure rate of (25-30 percent).

High import dependence

An analysis of data shows that India has very high import dependence in terms of cost component of CRGO.

To ensure availability of CRGO steel to the power equipment manufacturing industry, the government has exempted CRGO steel from customs duty with effect from May 2012.

To ensure restriction on imports of inferior grades, BIS certification is mandatory.

Indigenous production of CRGO is required to reduce the dependence on imports that in turn will help in saving foreign exchange. Local production would also remove the use of substandard electrical sheets by the Indian electrical industry and lower the T&D losses and transformer failures.

The plan for expanding installed power generation capacity in the country augurs well for CRGO due to the demand-supply gap. There is also scope for exports to various countries leading to earnings of valuable foreign exchange. This will also help in employment generation.

Efforts taken by companies

In the 1980s SAIL/RSP attempted to produce

CRGO/CRNO, through technological transfer agreement with A K Steel, US, but could indigenise production of only CRNO.

During 2007-10, the Ministry of Steel made efforts through the Japan government to pursue Nippon Steel Limited to share its technology, with active participation of SAIL, RINL and Tata Steel but could not yield any result.

Later, SAIL, RINL and BHEL entered into a memorandum of understanding (MoU) for development/ of CRGO steel, through technology transfer from abroad. This also did not make any progress.

RINL made efforts to ink an MoU with NMLK of Russia in December 2014.

SAIL has continued with its endeavour for technology transfer from AK Steel, US, which is yet to meet with success.

RINL and PGCIL entered an MoU in 2012, with an intention to form a joint venture company to produce CRGO/CRNO at Visakhapatnam.

Later, RINL also signed an MoU with MECON for the same, but has not met with success in 2012.

JSW Steel tied up with JFE, Japan to produce special steel grades at Vijayanagar. The unit, when started, is expected to produce CRNO, to be followed by the more specialised CRGO steel. Tata Steel does have vicarious access to the CRGO technology.

CRGO (IN TONS)	FY10	FY11	FY12	FY13	FY14
IMPORT	127620	161824	175261	183090	194383
PRODUCTION	NA	NA	NA	4700	3300

Efforts taken by govt.

Recently, a joint decision was taken by various ministries to indigenously develop technology to produce CRGO. This is notwithstanding the efforts of the domestic steel companies for technology transfer from abroad. The Ministry of Steel now proposes to set up a 3-5 ton R&D pilot plant, which has been accorded in-principle approval by the erstwhile Planning Commission. The project will be a joint collaborative initiative of the Ministry of Steel, DSIR (CSIR-NML), Tata Steel and RINL with a financial outlay of Rs 500 crore.

The detailed project report is being prepared by MECON and it is expected before the end of 2015. It is estimated that product development to commercialisation of CRGO steel would require 60 months.

The Ministry of Steel is also facilitating setting up of a Steel Research & Technology Mission of India (SRTMI) to spearhead R&D activities of national importance.

SAIL, MIDHANI sign MoU for R&D in steel

Mishra Dhatu Nigam Limited (MIDHANI), a PSU under the Ministry of Defence, has signed a memorandum of understanding (MoU) with Research and Development Centre for Iron & Steel (RDCIS), the R&D arm of Steel Authority of India Limited (SAIL), to jointly undertake R&D work in iron and steel industry.

To begin with, the two state-owned companies have decided to take collaborative research in cold-rolled grain-oriented (CRGO) steel products. CRGO, referred to in industry circles as "electrical steel", is a high-value product with virtually no production base in India.

Only around 11 global steel producers have the capacity to produce CRGO. India's annual requirement amounting to around $2 billion is almost entirely imported. Apart from SAIL, private players like Tata Steel and JSW Steel have also evinced interest in manufacturing CRGO in India.

Electrical steel, also called transformer steel, is specialty steel usually manufactured in the form of cold rolled strips less than 2 mm thick. When assembled, they form the laminated core of transformers or the parts of electric motors which are the key to generation, transmission and distribution of electricity to end-users.

Source: Steel Insights

A New Generation of Annealing in Hydrogen Atmosphere -Indigenously developed Process by M/s. Technotherma (India) Pvt. Ltd, New Delhi, India

The cold rolling of steel is done at temperatures below the recrystallization temperature. During cold rolling process the reduction in thickness is due to plastic deformation which occurs by means of dislocation movement. Steel gets hardened because of the buildup of these dislocations. These dislocations reduce the ductility of cold rolled steel making it useless for forming operation. To recover the ductility, cold rolled steels need to undergo an annealing process for the relieving of the stresses that have buildup within the microstructure during the process of cold rolling.

Annealing consists of heating of the steel to above the recrystallization temperature, soaking at that temperature and then cooling it. Heating of the steel during annealing facilitates the movement of iron items, resulting in the disappearance of dislocations and formation and growth of new grains of various sizes. It has three different stages namely (i) stress relief, (ii) recrystallization, and (iii) grain growth.

The final mechanical properties and the microstructure of the steel are largely dependent upon the annealing process since it significantly influences the crystallographic texture of the steel.

The annealing is usually carried out under protective gas atmosphere for preventing surface oxidation in order to meet the high demand on the surface of the cold rolled steel. The protective gas atmosphere consists of nitrogen gas, hydrogen gas, or a mixture of these two gases in various proportions. Mixture of the two gases is obtained through cracking of ammonia (75 % H2 and 25 % N2).

Annealing can be carried out either in batches or by continuous process by utilizing protective atmosphere. The most popular batch annealing system is by utilizing BELL TYPE of furnaces. The producers as a rule prefer the batch annealing furnace due to its versatility and adoptability for various thicknesses and alloy compositions. It's advantage of mixing charges of different strip composition, thickness and weights in Bell annealing furnace and flexibility has made this batch type of annealing installation most popular.

In the beginning, heat treaters were using Nitrogen or HNX. However, since the early 1983's manufactures of wide strip steel and furnace engineering companies in the world have been considering alternative technologies to use existing batch annealing equipment to reduce costs. The result is the new generation of high performance hydrogen hood type annealing furnaces and bases. In the beginning, using Hydrogen atmosphere was considered explosive and unsafe. But with the stringent demand of surface quality in present requirements of cold rolled strips forced technologist to make Hydrogen atmosphere safe and user friendly.

However, this process technology was available with overseas furnace producers and was used

as a special tool from them to market their product in India. In India only the collaborators of overseas suppliers had license to supply Hydrogen atmospheric furnaces. This had created unfair competition. TECHNOTHERMA worked on this problem to give solution to its customer and was successful in developing fully automatic Hydrogen feeding and atmosphere control process. It is hundred percent in house developed process and system by TECHNOTHERMA.

The TECHNOTHERMA developed process assures was first time used by a company from Egypt. The process has resulted into

1. Shorter annealing cycle
2. Reduced energy consumptions
3. Temperature uniformity of coils
4. Significant increase of productivity
5. Coil surface much cleaner
6. Easy and safe operation due to high level of automation

The Hydrogen atmosphere has many advantages over Nitrogen atmosphere. Such as

The throughput has increased by 100% using the Hydrogen flow system and hydrogen as the controlled atmosphere gas. This is due to three factors:

A. The conductivity of hydrogen is approximately 6,5 times greater than that of nitrogen(at a temperature of 740.Deg.C)

B. The dynamic viscosity of hydrogen is 50% of that of Nitrogen

C. The resulting transfer coefficient for hydrogen is considerable higher than for Nitrogen, ie, Hydrogen transfers the heat quicker from the inner cover to the center of the coil, than Nitrogen

D. The replacement of Nitrogen by Hydrogen also improves radial heat conduction across the coils. With Nitrogen gas in conventional furnaces, the ratio of parallel flow heating to radial heating of the charge is approximately 5:1 whereas with Hydrogen gas, the ratio changes to approximately 1:2

Hydrogen annealing technology not only increase output but also improves mechanical properties. Using Hydrogen, the mean yield strength and tensile strength tent to be lower than mean values obtained for Nitrogen annealed coils.

CONCLUSION

In the area of Batch annealing furnace TECHNOTHERMA has long and wide experience with more than 312 bases operating under HNX atmosphere over the last 27 years.

The latest Hydrogen controlled Bell annealing furnace is also supplied to overseas user in Egypt. The certificate of performance as well as repeat order from same user for bigger Bell Annealing furnace supports Technotherma's claim as proof. Technotherma is available at a service of Indian cold strip producers and will be glad to fully cooperate with them for cutting not only capital cost but also process cost. On top that a competent service team will always available at a phone call for Indian producers.

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TECHNICAL TALK ON RENEWABLE ENERGY – THE ENERGY OF THE CENTURY ON 26.9.2015

Shri Jai Uppal, Senior Consultant, Renewable & Alternate Energy, delivered a talk on "Mainstream of Renewable Energy – the Energy of this Century" at our Chapter's premises on 26th September 2015.

He highlighted the Indian and global scenario in the area of Renewable Energy.

Per Capita Electricity Consumption

Country	Power Consumption (kWh/PC)
China	3,298
Germany	7,081
India	1050
Japan	7,847
Sweden	14,030
United States	13,246
World Average	3064

He stated that per capita electricity consumption in India is very low as can be seen from the table below:

Global Primary Energy Sources (MTOe)

	2013	2030	CAGR (%)
Coal	3973	3448	-0.8
Oil	4235	4313	0.1
Gas	2880	3547	1.2
Nuclear	646	1044	2.9
Hydro	320	482	2.4
Bioenergy	1366	1827	1.7
Other RE	159	708	9.2
Total	13579	15370	0.7

In his presentation he covered the details of Global Energy Sources like coal, oil and gas. The following table will give these details:

Regarding the pattern of Energy Sectoral consumption, it was indicated that industry, transport and building/construction occupy the major consumption sources.

In his presentation, Shri Jai Uppal discussed about the impact of GHG global warming and Indian CO2 emissions.

Indian Energy Consumption

Type of Energy Consumption	Units	(1950)	(2014) (Domestic +Imports)	R/P
Coal & Lignite	Mill T	32.3	620 +150	100
Crude Oil	Mill T	0.27/3.4	38+190	20
IC Power (Hydro+N+RE)	GW	2.3 (0.6)	285 (40+4.8+37)	NA
Power Generation	BU	6.6	1049	NA

The Indian Energy consumption pattern was covered in the Talk. The table below gives the details of the same:

The Indian Energy Consumption pattern was covered. The price trend of Solar Power also reviewed. The pattern of wind and hydro power were also touched upon.

Apart from above issues the presentation also touched upon the basics of the following issues:

a) Role of Renewable Energy
b) RE Sectoral Growth Rates
c) Total installed RE capacity
d) Solar power in India
e) Bio Energy & Bio Power

After conclusion of the Talk, there was a lively interaction between the audience and the speaker on the various issues relating to renewable energy.

The Talk was attended by about 30 persons.

The presentation ended with lunch.

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The Indian Economy

According to the World Bank, Indian economy is expected to grow at 7.5 percent in 2015-16, followed by further acceleration to 7.9 percent in 2016-17 and 8 percent in 2017. The service sector contributes 17%. Overall growth in the Index of Industrial Production (IIP) was 4.1 percent during April 2015. In the year 2014-15, IIP growth was 2.8 percent as compared to (-) 0.1 percent in the previous year. Eight core infrastructure industries registered a growth of 4.4 percent in May 2015. In the year 2014-15, these sectors grew by 3.5 percent as compared to 4.2 percent growth in the previous year. Urbanization in India has increased from 20% to 35% in the last 10 years. The per capita GDP consumption was 2000 USD which has grown at a CAGR of 14% in last 5 years.

The Forex Reserves was USD 350 billion during the start of this FY. India's exports stood at US$ 22.34 billion in May 2015 and cumulative FDI equity inflows was US$ 373.16 billion (April 2000 to April 2015). The Share of top investing countries in FDI are Mauritius (35 percent), Singapore (13 percent), UK (9 percent), Japan (7 percent), Netherlands (6 percent) and USA (6 percent). Major Sectors attracting highest FDI equity inflows are Services Sector (17 percent), Construction Development (10 percent), Telecommunications (7 percent), Computer Software and Hardware (6 percent), Drugs and Pharmaceuticals (5 percent), Automobile (5 percent), Chemical (4 percent) and Power (4 percent).

Transportation in India

Airports: Airports Authority of India (AAI) manages 115 airports in the country, which includes 23 civil enclaves.

Railways: The Indian Railways network is spread over 65,800 km, with 12,617 passenger and 7,421 stations plying 23 million travellers and 2.65 million tonnes (Mt) of goods daily.

Roadways: India's road network of 4.1 million km is the second largest in the world. With the number of vehicles growing at an average annual pace of 10.16 percent, Indian roads

carry about 65 percent of freight and 85 percent of passenger traffic.

Ports: India has 13 major ports and 200 minor ports. The cargo traffic is expected to rise to 1800 MMT at a CAGR growth of 17%. India has a coastline which is more than 7,517 km long.

Indian Auto Industry

The Indian auto industry is the Third-largest in the world. By 2020, India's share in the global passenger vehicle market is expected to double to 8 percent from 4 percent over 2010-11. Currently India is the second-largest two wheeler, third largest passenger car and fourth largest commercial vehicle manufacturer. Two wheelers dominate production volumes in FY15, the segment accounted for about 80 percent of the total automotive production in the country.

In India, the automobile industry is witnessing CAGR growth of 5 percent in last 5 years. In India, the compounded annual growth rate (CAGR) was 11%, 10%, 9% and 9% for the production of passenger vehicle, commercial vehicles and two & three wheelers respectively in the last 10 years. Two wheeler productions in India will increase from 18.5 million in FY15 to 30 million by FY2025E. The passenger car sales will triple by 2025E, on the strong demand from the rise in the income level.

Two wheelers accounted for the largest share in exports (by volume) at 67 percent in FY14. Passenger vehicles comprised a sizeable 19 percent of overall exports. Exports of three wheeler vehicles registered the highest growth at 16.6 percent in FY14. Passenger vehicles are to increase at a CAGR of 18 percent during FY2014-21. Commercial vehicles are expected to register a CAGR of 19 percent during FY2014-21. Two and three wheelers are projected to expand at a CAGR of 8 percent during FY2014-21.

The Indian luxury car market expanded at a CAGR of 30 percent, with 25,000 units in 2013 (about 1 percent of the passenger vehicle market in India). The Indian luxury car market is estimated to expand at a CAGR of 25 percent during 2014-20 and reach 150,000 units by 2020. The luxury SUV segment is growing at about 50 percent, while luxury sedans are increasing 25-30 percent. India has the world's 12th-largest HNI population, with a growth of 20.8 percent (highest among the top 12 countries). With expansion in the education and realty sectors, and increasing wealth of IT professionals, more consumers aspire to own luxury cars. To compare with China, Indian Passenger vehicles were at 3.22 Millions with 2% growth last financial year while China has made 19.9 Millions PVs with 10.5% Growth.

Growth Drivers of Steel

Along with the production, India has maintained its level of installed capacity utilization, which was around 88 percent in 2014. India still lags behind in terms of steel consumption and this adds a huge growth potential for the industry going forward. Demand for steel is expected to grow to 105 Mt by 2017 due to increased drive from Make in India, Strong domestic outlook of automobiles has been supported with passenger car buyer average age reduced to 30's in FY15 from 40's in 2000 and an increase in housing construction. Infrastructure is India's largest steel consumer, accounting for 63 percent of total consumption in 2014 due to the heavy usage of steel in this sector and soaring construction and infrastructure activity in the country. Engineering and fabrication is the next largest consumer, with 22 percent followed by automotive industry with 10 percent of total consumption. Major car makers, both domestic and foreign, have lined up investments of almost Rs. 60,000 crores over the next few years.

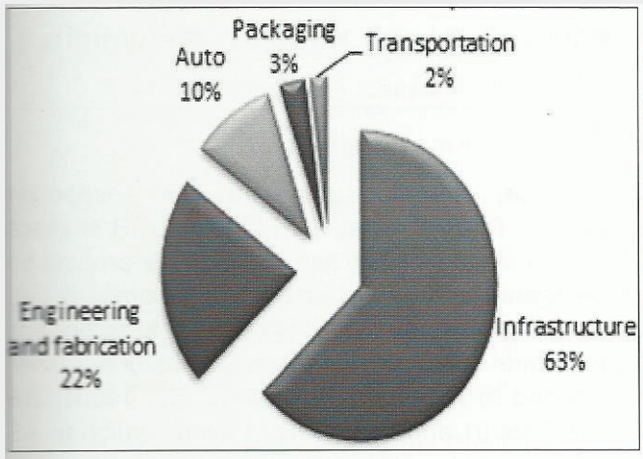


Fig. 1: Sectorwise steel consumption

Make in India to Drive Indian Steel Industry

The 'MAKE IN INDIA' initiative was launched on September 25, 2014 with an aim of providing global recognition to the Indian economy. The program includes major new initiatives designed to facilitate investment, foster innovation, protect intellectual property, and build best-in-class manufacturing and infrastructure. The 25 key sectors identified under the programme include automobiles, auto components, bio-technology, chemicals, defense, manufacturing, electronic systems, food processing, leather, mining, oil & gas, ports, railways, ports and textile.

The objective of the mega programme l s to ensure that manufacturing sector which contributes around 15% of the country's Gross Domestic Products is increased to 25% in next few years.

According to reports by 2020, India is set to become the world's youngest country with 64% of its population in the working age group. With the Western countries, Japan and even China aging, this demographic potential offers India and its growing economy an edge that economies believe could add a significant 2% to the GDP growth rate annually. Value of top priority projects ready for procurement in FY 2015-16 is about ~USD 24000 millions, half of which are on PPP basis and projects to be implemented over the next five years are worth of ~USD 34000 million.

Indian Steel Industry

India is currently the 3rd largest producer of crude steel in the world and is expected to become the 2nd largest producer of crude steel in the world by 2017-18. The steel industry in India is estimated to be 85 Billion USD and contributes around 2 percent of the Gross Domestic Production (IIP) is 6.2 percent. Per capita consumption of steel in India is at 68kgs as against an average of 216kgs of the world. India's share in world production of crude steel increased from around 3.5 percent in 2004 to 5.5 percent in 2015. Total crude steel production rose at a CAGR of 6.8 percent over the last five years to reach 87.5 Mtpa in FY14. Private sector is considered to be the growth engine in the steel industry with growing emphasis towards technological advancement and modernization of the steel plants in India. Private sector contribution is 65% of the total steel production in India.

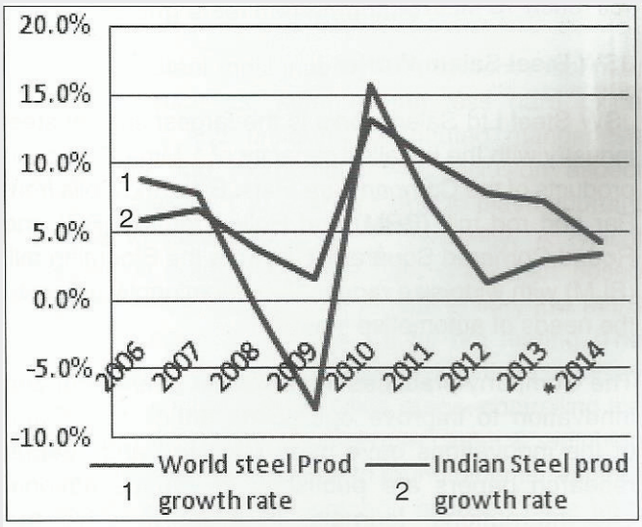


Fig. 2: Steel growth rate

Indian Steel Production has shown a strong growth over the last decade due to overall economic development and favorable industrial development and increasing investment trend. There has been a bulk of capacity addition which has contributed towards increased production. The steel industry has grown at a CAGR of 7% compared to the rest of world growing at a CAGR of 4% in last 10 years. The current installed capacity is at 110 Mtpa and it is expected to go to 300 Mtpa by 2025. To achieve steel capacity build-up of 300 Mtpa by 2025, India would need to invest USD210 billion over the next decade. Over 300 MoUs have been signed with various States for capacity additions by both public and private players. With growth in demand for steel outpacing growth in domestic production over the last few years, import dependency has increased. India was a net importer of steel till FY13, but turned a net exporter of the same in FY14. Import of steel reduced at a compounded annual rate of 4.4 percent, whereas exports increased at a CAGR of 1.5 percent. Infrastructure is India's largest steel consumer, accounting for 63 percent of total consumption in FY14.

Source: Steel Tech

STEEL'S STEAL

Steel companies have been lobbying for many months, asking the government to impose higher tariffs and thereby reduce steel imports. The government has obliged, and seems ready to do more. An anti-dumping duty was imposed on some stainless steel from China in June, and the basic customs tariff for mild steel raised (from five percent to 7.5 percent for some steel products, and on others from 7.5 percent to 10 percent). Now a safeguards duty of 20 percent has been imposed. This is after the rupee has dipped by about six percent against the dollar in the last six months, which has the same effect as a six percent import duty. Take it all together and the increase in total protection since March will add up to 30 percent. How much protection does the steel industry need?

The official concern for the steel industry is based on two reported facts: that some steel companies have slipped into the red because of falling prices, and that steel imports have grown, with much of it coming from China. But the World Steel Association's monthly production statistics show that India's steel production grew in 2013 by some four million tonnes, in 2014 at an annual rate of about 4 million tonnes. Meanwhile, imports from China are reported to have grown "232 percent" in 2014-15; that's a big number, but is to be imposed when there is injury to domestic producers. Where's the injury?

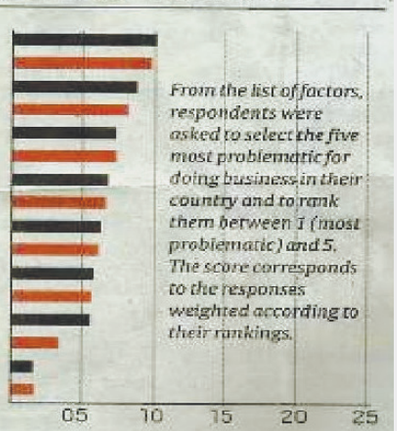
Competitiveness Index: India moves up the ladder

India has moved up by 16 places to 55th spot out of 140 countries in the World Economic Forum's Global Competitiveness Index 2015-16, based on reforms and the anti-corruption stance of the government. But challenges of corruption and infrastructure still weigh heavily on investors who want to do business in the country, said the report.

- Infrastructure in India has improved (81st spot, up by six places) but remains a major growth bottleneck—electricity in particular, according to the report, which compiles the rankings based on 12 indicators.
- India scores poorly in both mobile and fixed lines as well as road, port and air connectivity.
- Overall, India is seven spots lower from 2007. Switzerland topped, followed by Singapore and the US.

THE MOST PROBLEMATIC FACTORS FOR DOING BUSINESS

	Score
Corruption	10.1
Policy instability	9.6
Inflation	8.9
Access to financing	8.1
Government instability/coups	7.3
Inadequate supply of infrastructure	7.3
Tax rates	6.8
Inefficient government bureaucracy	6.6
Complexity of tax regulations	6.3
Insufficient capacity to innovate	6.1
Foreign currency regulations	5.7
Inadequately educated workforce	5.5
Restrictive labor regulations	5.5
Poor public health	3.3
Poor work ethic in labor force	1.5
Crime and theft	1.5



From the list of factors, respondents were asked to select the five most problematic for doing business in their country and to rank them between 1 (most problematic) and 5. The score corresponds to the responses weighted according to their rankings.

GLOBAL COMPETITIVENESS OF INFRASTRUCTURE IN INDIA

Indicator	Value	Rank
Quality of overall infrastructure	4.0	74
Quality of roads	4.1	61
Quality of railroad infrastructure	4.1	29
Quality of port infrastructure	4.2	60
Quality of air transport infrastructure	4.3	71
Available airline seat km/week, millions*	3,726.6	11
Quality of electricity supply	3.7	98
Mobile telephone subscriptions/100 pop.*	74.5	121
Fixed-telephone lines/100 pop.*	2.1	116

Source: The Indian Express

That brings up the second argument, about price pressure. Steel prices have fallen sharply, but so have costs. Since January, NMDC has cut its price for iron ore lumps by a third, and for iron ore fines by nearly half. Most of the major steel producer reported a profit for 2014-15, including Steel Authority of India. One private producer reported its highest profits in five years. Some reported losses, of course – more so in the June quarter. But let's not forget that many steel companies are over-leveraged and they should not get a government bail-out on that account. In one loss-making firm, the materials bill has shown an increase when iron ore and other inputs have got much cheaper. Steel is a basic input for the entire engineering industry (cars, household goods, machinery of all kinds), and for the infrastructure sector (roads, railways, power, real estate, etc). Raise the cost of steel and you raise

the cost of producers may not be able to pass on cost increases. Higher import duties on stream users of steel. Should the government be playing favourites among different sets of producers?

This kind of protective intervention used to be standard policy in the 1980s and earlier, and it didn't work. Instead, India became a high-cost economy. The whole point of the reform introduced in the 1990s was that the economy wold be made more open, and exposed to international competition so that domestic producers would be under pressure to cut costs and improve efficiency. Many did; for example, Tata Steel managed a dramatic cut in the size of its bloated workforce. The oft-stated intention, including by finance ministers in the Vajpayee government, was that tariff levels should be brought down to the levels of East Asia. What is now proposed to be done flies in the face of this goal, is a step back in time, and a step away from openness. On the evidence so far, the idea of a safeguards duty should be dumped.

Source: Business Standard

Domestic aluminium business to go through testing times

Hindalco Industries would see its domestic aluminium business go through testing times in the short term as recent ramp-up of projects would impact its performance in the coming months, Chairman Kumar Mangalam Birla told shareholders at the company's 56th annual general meet. "High interest outgo and depreciation is expected to keep the company's performance under pressure," Birla said.

The country's largest aluminium producer has fully ramped up its Mahan aluminium smelter facility, in Madhya Pradesh, and about 55 percent of ramp up has taken place at Aditya smelter, in Odisha.

The chairman also informed the shareholders that the company has refinanced its loan to get a longer tenure of 10 years, thus giving it additional repayment time.

"In the coming years, focus will continue to be an operational excellence and increase productivity of new assets," said Birla.

He, however, remained optimistic about the copper business, which has been saving the day for the aluminium major for quite a few quarters now.

The copper business saw its Ebitda (earnings before interest, tax, depreciation and amortisation) grow 45 percent on a year-on-year basis in the year ended March.

"Operational efficiencies, lower cost of production, coupled with a favourable trend in treatment charges and refining charges, have been the success drivers," he said.

Birla said though coal costs have moved up post re-allocation of the blocks, the company managed to lock 25-30 percent coal as captive. Coal and bauxite are the key raw materials used for making light-weight base metal and, hence, captive supply of the same helps companies bring down input costs.

Source: Business Standard

Gold imports may rise to $37 billion this year

Gold imports in the first eight months of this calendar year were almost $24 billion. Analysts expect another 300 tonnes or $13-13.5 billion worth of import in the remaining months of calendar 2015. The figure for all of 2014 was $31.2 billion. There was an import surge to nearly $5 billion in August. These might be subdued in September, as the market has again slipped to a marginal discount of $1-2 an ounce and demand is low due to the 16-day pitrupaksha period.

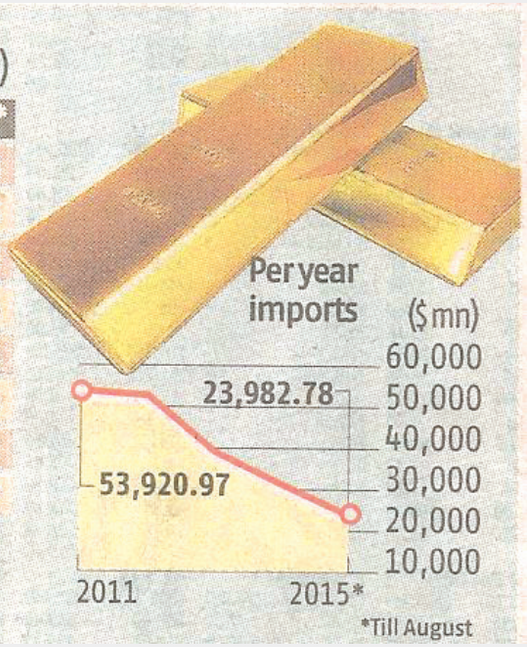
Prices have remained lower this year. From $1,250-1,300 an ounce last year, they are now around $1,100. However, after withdrawal of the 80:20 import restrictions last year-end, imports have increased. They slowed in May-June on fear of low rural demand due to a weak monsoon but a fall in prices from end-July led to a sudden rise in import, ahead of the festive season.

Increasing capacities of gold refineries in India has led to a spurt in import of dore, the semi-pure alloys. It was 120 tonnes for all of 2014,

INDIA GOLD IMPORTS ($ mn)

	2014	2015	% chg*
Jan	1,441.17	1,572.40	9.11
Feb	1,331.31	1,981.61	48.85
Mar	2,570.71	4,984.86	93.91
Apr	1,755.90	3,131.41	78.34
May	2,172.60	2,421.25	11.44
Jun	3,121.00	1,968.26	-36.93
Jul	1,827.80	2,965.25	62.23
Aug	2,065.12	4,957.74	140.07
Total	16,285.61	23,982.78	47.26

*y-o-y; Compiled by BS Research Bureau
Data source: DGCIS



compared to 150 tonnes in January-August 2015. Refineries import because there is a two percent lower import duty and they also get refining margins on the dore they convert to gold bars. From roughly 15 percent of total import, this year dore's share might end at 25 percent. In August, dore import is estimated at 32 tonnes, the highest-ever monthly import.

In India MMTC PAMPS is the only bullion refinery certified by the London Bullion Market Association (LBMA). Edelweiss Commodities hopes to get similar status in two years and Rajesh Exports is looking to integrate its refinery with Valcambi, its latest acquisition. "In two years, there will be at least three LBMA-certified refineries. With their capacities and other small refineries taken together, dore imports will be half or even more of India's total gold import," said D P Jhawar, head of Edelweiss' commodities' business.

Dore import requires less outgo of foreign exchange, as it is cheaper and value addition by refining is done in India. Which is why it attracts eight percent import duty, compared to 10 percent for gold.

Source: Business Standard

Pearl of Wisdom

Economy is the mother of Wealth	Poverty grows on Laziness
Effort is the mother of Success	Power grows on Fear
Endurance is the mother of Patience	Patience grows on Understanding
Ecstasy is the mother of Love	Position grows on Responsibility

Efforts is based on Enthusiasm
Efficiency is based on Good Advice
Energy is based on Health
Entanglement is based on Desire

Knowledge drives away Fear	Wealth accrues by Efforts
Anger drives away Friends	Efforts expands by Enthusiasm
Jealousy drives away Love	Enthusiasm deepens by Conviction
Doubt drives away Faith	Conviction is enriched by Wisdom
Stupidity drives away Everything	
Gold shines in Furnace	Saving lead you to affluences
Love shines in separations	Spending lead you to poverty
Life shines in distress	Lending lead you to tangles
Truth shines by oppositions	Selfishness leads you to sorrow

In the anatomy of any organization, there are four kinds of people

Wish Bones:
Who wish someone else could do the job/work

Jaw Bones:
Who talk a lot but do little

Knock Bones:
Who know what everyone else does and knock them down

Back Bones:
Who get down and actually do the work

Contributed by
Shri K L Mehrotra, Chairman IIM DC & Former CMD - MOIL

Management Thoughts

Leadership & Vision

A leader is one who sees more than others see, who sees farther than others see and who sees before other do

- The very essence of leadership is that must have a vision and translate into reality
- Leadership is a combination of strategy and integrity / character. It is must be without one, but be without strategy
- One of the test of leadership is the ability to recognize a problem before it becomes an emergency
- Leadership is learning and learning faster. Leadership is influencing the minds of others
- Champions are not made in gyms. Champions are made from something they have deep inside them. A burning desire, a dream, a Vision, Will, Hope and Courage. They have to have a last minute stamina. They have to be little faster. They have to have skill and will. But the WILL must be stronger than skill
- 5 E's of Leadership:
  Envision
  Empower
  Enable
  Energize
  Encourage
- The most pathetic persons are those who have sight but no vision
- Leadership is a dealer of hope
- The mind of leader starts with H and ends with T, listening with EAR in between H.**E.A.R**.T.
- Vision takes you from the past and commits you to the future
- A vision is not a plan, vision need to come first, plans afterwards
- A vision is where to go / are going a plan is how you get that
- The best vision is within the sight but just out of reach

The scientist is not a person who gives the right answer but he is the person who asks the right question.

- If you want right answer, ask right question
- When you do good, you feel good. When you feel good, you do good
- Be positive and proactive

Contributed by
Shri K L Mehrotra, Chairman IIM DC& Former, CMD – MOIL

NEWSICLE

INDIA LEAST AFFORDABLE TO BUY PETROL

Indians pay most in terms of average day's wages to buy petrol and the country is high on fuel unaffordability along with other emerging markets. Here's a snapshot of global petrol affordability index...

INDIA REPLACES PAK

➢ India has replaced Pakistan to become the **least affordable** nation to buy fuel. An Indian needs to spend over **21%** of average daily wages to buy a litre of petrol with the Modi govt phasing out subsidies. Poor wages and limited infra result in widespread energy poverty in both the countries

➢ **China**, the world's second biggest oil consumer, and **Brazil** too **rank high** on **unaffordability**. **Russia**, the fourth nation in the BRIC quartet, however is more **affordable**, given its high oil production

FUEL ALMOST FREE IN VENEZUELA

Oil-rich Venezuela is the most affordable nation to purchase petrol with prices near zero. One needs to shell out 13 cents a gallon, or nearly 3 cents or Rs 2 a litre, for petrol in the South American nation

US, OPEC MOST AFFORDABLE

➢ Besides Venezuela, the US joins UAE, Kuwait and Saudi Arabia in being most affordable to buy petrol, with other developed countries like Canada, Switzerland and Australia

Rank	Country	Petrol Price ($)	Unaffordability*	Income Spent**
1	**INDIA**	1.04	**21.1**	1
2	Pakistan	0.76	**20.8**	1.4
3	Philippines	0.99	**11.9**	1.3
4	Indonesia	0.73	**7.6**	2.6
5	South Africa	1.1	**6.8**	4.1
6	Turkey	1.76	**6.6**	0.6
11	China	1.14	**5.1**	1.1
13	Brazil	1.18	**4.6**	1.9
27	Russia	0.62	**2.8**	2.5
28	Slovenia	1.48	**2.6**	2.4
40	UK	1.83	**1.5**	1.2
41	France	1.57	**1.5**	0.7
44	Germany	1.64	**1.4**	1.2
46	Japan	1.16	**1.3**	1.6
52	Norway	2.04	**0.9**	0.7
53	Australia	1.16	**0.8**	1.9
54	Canada	0.97	**0.8**	2.8
55	Switzerland	1.75	**0.8**	1.0
57	US	0.72	**0.5**	2.1
58	UAE	0.44	**0.4**	0.8
59	Kuwait	0.2	**0.2**	0.7
60	Saudi Arabia	0.12	**0.2**	0.6
61	Venezuela	0	**0**	0

*% Of Average Daily Wages Spent To Buy a Litre Of Petrol

**Portion Of Annual Income Spent On Purchasing Petrol (%)

Only 32% of proposed reforms implemented

The new World Bank report measuring implementation of reforms across states on a 98-point action plan revealed that on average just 32% of the proposed reforms have been implemented across the country. The report stated that less than 20% of reforms that require medium term actions have been undertaken.

10 REFORMS STILL TO BE IMPLEMENTED

Comprehensive checklist of all registrations: 32 *	
Customisable checklist of registrations based on business: 32	
Sub-registrar, land records and municipality data integrated: 32	
Surprise inspections only: 32	
E-filing of commercial disputes: 32	
GIS system includes infrastructure details: 31	
Mutation integrated with registration: 31	
Downloadable and verifiable BOCW certificates: 31	
E-summons for commercial disputes: 31	
Online payments at courts: 31	

** Number of states in which implementation is needed*

THE WAY FORWARD

- India ranks 142 out of 189 economies in the World Bank's Doing Business 2015 report, the second worst performing economy in South Asia and the government wants to move to amongst the top 50.
- On an average, states have made progress in tax reforms and construction permits while steps such as electronic courts and an online land bank are lagging the most.
- But no state has provided a full list of licenses, NOCs and registrations required by a business to set up and operate.
- The next set of reforms will be by generating usage through proactive communication, getting feedback from end users and having structured discussions.

RANKING:

TOP 5 STATES

	SCORE (IN %)*
1. Gujarat	71.14
2. Andhra Pradesh	70.12
3. Jharkhand	63.09
4. Chhattisgarh	62.45
5. Madhya Pradesh	62.00

AT THE BOTTOM

	SCORE (IN %)
32. Arunachal Pradesh	1.23
31. Nagaland	3.41
30. Meghalaya	4.38
29. J&K	5.93
28. Mizoram	6.37

*BASED ON IMPLEMENTATION STATUS OF REFORM MEASURES ACROSS THE FOLLOWING AREAS:

1. Setting up a business
2. Allotment of land and obtaining construction permit
3. Complying with environment procedures
4. Complying with labour regulations
5. Obtaining infra related utilities
6. Registering and complying with tax procedures
7. Carrying out inspections
8. Enforcing contracts

The implementation status of each state has been converted to a percentage, and, on the basis of this total percentage, state rankings have been calculated in the report.

Pessimism Never Wins

Every person has the potential to be passionate. Everyone loves something. We are shaped and motivated by what we love. It reveals our passion. "Keep your face to the sunshine and you cannot see the shadow." She showed that enthusiasm is a choice, not a result.

Ignore what you are passionate about, and you ignore one of the greatest potentials inside you. Nothing significant was ever achieved without passion. "Whatever your hand finds to do, do it with all your might."

Most winners are just ex-losers who got passionate. The worst bankruptcy in the world is the person who has lost his enthusiasm, his passion. When you add passion to a belief, it becomes a conviction. Conviction gets more done than belief ever dreamed of.

Driven by passionate conviction, you can do anything you want with your life-except give up on the thing you care about. "What generates passion and zeal in you is a clue to revealing your destiny. What you love is a clue to something you contain.

Life is a passion, or it is nothing. "Without passion man is a mere latent force and a possibility, like the flint which awaits the shock of the iron before it can give forth its spark" (Henri Frederic Ameil).

Passion is the spark for your fuse. In fact, the bigger the challenge or opportunity, the more enthusiasm is required. Follow this advice for a successful life: "There are many things that will catch my eye, but there are only a very few that catch my heart… it is those I consider to pursue"

This is the sixteenth of series of "Nuggets of truth" which are our sound food for soul. Get ready to blow the lid off our limited Thinking & create your recipe for happiness & success.

Compiled by Shri K L Mehrotra

Chairman – IIM-DC & Former, CMD – MOIL

Four new isotopes discovered

The burgeoning periodic table will see four more isotopes being added to its fag end.

H. M. Devaraja from the Manipal Centre of Natural Sciences at Manipal University, Karnataka – who was a part of an international collaboration – has, in a paper published in the journal Physics Letters B, claimed to have discovered four new atomic nuclei. These are one isotope each of the heavy elements berkelium (BK, atomic number 97) and neptunium (Np, 93) and two isotopes of the element americium (Am, 95). The researchers observed the deep inelastic multinucleon transfer reactions of Calcium 48, and Curium 248. The multinucleon reactions occur in collision of two complex nuclei. The resulting reaction sees intense dissipation of energy as well as mass distributions of the products of which neutron rich and neutron deficient products are of interest to physicists. Current techniques make it difficult to produce isotopes greater than atomic number 92.

A beam of Ca48 was projected on to a 300-nanometer-thick foil of Cu248 at GSI Helmholtzzentrum fur Schwerionenforschung, Germany's linear accelerator UNILAC (Universal Linear Accelerator – which can accelerate ions up to 60,000 kmps – or 20 percent the speed of light). The collision threw up over 100 residual nulcei with proton numbers between 82 and 100. Of these particles, four new neutron-deficient isotopes were found, and were confirmed by studying their decay chains: 216U (the previous lowest neutron deficient isotope of Uranium discovered was 217U) that decayed within 5.5 milli seconds (ms) to Thorium; 223Am which decayed within 7.5 ms to Protactinium; 233BK which decayed in 30s to the new-isotope 229Am, which further decayed into Neptunium.

The decay chain of the fifth isotope 219Np could not be observed as researchers believe it decayed faster than their system, whose smallest measure is 5 micro-seconds (0.000005 seconds). The known Periodic Table currently comprises over 3,000 isotopes of 114 chemical elements; while another 4,000 undiscovered isotopes are theoretically believed to exist. These isotopes, however, have far eluded experimental physicists. "By using this method (deep inelastic multinucleon transfer), we have succeeded in generating many different atomic nuclei at once. This becomes important for the study of super-heavy elements. New isotopes, in particular those of super-heavy elements, which contain an especially large number of neutrons, cannot be made by any other method," says author Sophia Heinz.

These experiments will form the base for further observations. The collaboration is seeing the development of the next generation separator "SuperSHIP" (which can record decay reactions of up to 100 nano seconds – that is, 0.01 micro seconds), which will enable detection of far more isotopes.

Source: The Hindu

CONGRATULATIONS

A quiz contest Metallica 2015 was organised by our Chapter among school students of Delhi and NCR on 8th August 2015. Seventeen Schools participated in the contest. A team of two students (Shashank Vishwanath and Kheelit Pruthi) from Cambridge Foundation School, Rajouri Garden, New Delhi, was declared the winner of the contest.

This team was sponsored by us in the national quiz called Prof Brahma Prakash Memorial Materials Quiz (BPMMQ) held at Kalpakkam (Tamil Nadu) on 19th September 2015. About forty teams from different schools in India participated in this contest. The team sponsored by our Chapter was ranked third in the contest. The difference between the second and third team was very thin. The Cambridge Foundation School team was given a cash prize of Rs 5,000/- by organisers of the BPMMQ.

The Delhi Chapter has been sponsoring a team of two students every year in the BPMMQ. This is the first time in the history of Delhi Chapter that a team sponsored by our Chapter has won this laurel at the national level. This is a matter of pride for our Chapter, the two students (Shashank Vishwanath and Kheelit Pruthi) and the Cambridge Foundation School, Rajouri Garden.

The Chapter conveys its heartiest congratulations to the two students and Cambridge Foundation School, Rajouri Garden, New Delhi, on this achievement.

Important Days International			
World Customs Day	January 26	World Population Day	July 11
World Mother Language Day	February 21	Hiroshima Day	August 6
World Women's Day	March 8	Nagasaki Day	August 9
World Meteorological Day	March 14	World Youth Day	August 12 (UN)
World Consumer Day	March 15	World Youth Day	August 14 (Church)
World Disabled Day	March 20	World Enforced Disappearance Day	August 31
World Forest Day	March 21	World Literacy Day	September 8
World TB Day	March 24	World Ozone Day	September 16
World Ship Day	April 5	UN Peace Day	September 20
World Health Day	April 7	World Alzheimer's Day	September 21
World Heritage Day	April 18	World Heart Day	September 24
World Earth Day	April 22	World Tourism Day	September 27
May Day	May 1	World Day of Elderly	October 1
World Solar Energy Day	May 3	World Habitat Day	October 3
World Red Cross Day	May 8	World Postal Day	October 9
World Day of Family	May 15	World Standards Day	October 14
World Telecommunication Day	May 17	World Blind Day	October 15
World Anti-Tobacco Day	May 21	World Food Day	October 16
Commonwealth Day	May 24	UN Day	October 24
World Environment Day	June 5	World Thrift Day	October 30
World Yoga Day	June 21	World AIDS Day	December 1
World Architectural Day	July 1	World Human Rights Day	December 10

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