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IIM Metallurgy Materials Engineering

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

In The Issue

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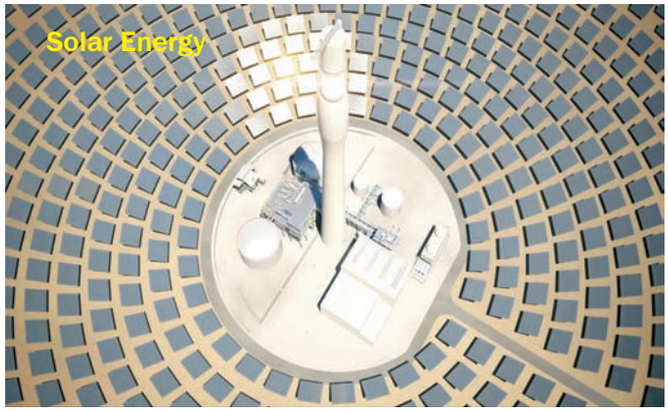

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Chairman's Message

On behalf of Delhi Chapter of The Indian Institute of Metals (IIM), I would like to convey a very happy and prosperous New Year 2016 to the fraternity of IIM Delhi Chapter and also to all the readers of Newsletter.

As you all know the basic purpose of this publication is to disseminate information and bring out articles of national and international interest in the area of ferrous and non-ferrous sectors. You may be aware that apart from our Chapter members, this publication is also sent to the members of the National Council of IIM and also to various other organisations in India. I am very happy to share with the esteemed members that we are getting appreciation from various quarters about the contents of the Newsletter. However there is always a room for improvement. I would invite the members' suggestion in this regard. I would also urge my fellow members to send in articles/ write-ups of their interest for coverage in our Newsletter.

The thrust of Delhi Chapter is on increasing the technical activities at our Chapter. Your Chapter is also giving attention to improve its ambience in terms of creation of facilities. We have created a photo gallery at our Chapter. We have done some upgradation of our existing facilities. The installation of a lift and roof-top Solar Plant is on the anvil at our Chapter.

You are all aware that since 1996 our Chapter has been organising an international event called Minerals, Metals, Metallurgy & Materials (MMMM) once every two years. This event consists of an international exhibition and concurrent conference. This is a flagship event of the Chapter. We have already held successfully ten such events so far. The next event, i.e., MMMM 2016 will be held at Pragati Maidan, New Delhi, from 10th to 12th August 2016. As you know this event calls for a lot of efforts to make it a success. Your Chapter looks forward to active participation and total commitment of its members to make this event a memorable and successful meet.

I once again wish all members of Delhi Chapter and their families and to all the readers of this Newsletter a Happy and Prosperous New Year 2016.

K L Mehrotra
Chairman

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High End Niche Steel Products - Recent Innovations in India

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

Abstract

In the recent past, there has been a spurt in the demand for value-added steels from the steel industry, owing to the growing requirements of steel consumers from various market segments including construction, power, heavy machinery, mining, defence, auto, railways, oil & gas etc. The development of new steel product requires strong focus on metallurgical and operational aspects in a steel plant. The practice adopted for new product development in most steel plants is a combination of laboratory studies, product and process modelling, as well as laboratory and in-plant trials. For producing a new product profitably, it is important to examine key operational aspects including capacity planning, debottlenecking and optimization of plant design and operation. This paper highlights some of the recent innovations, of both carbon and stainless steels, made by Indian steel industry towards development of high-end steel products in various market segments.

Introduction

Steel is one of the most attractive engineering materials because of its superior performance, wide application base, recyclability, eco-friendliness, high strength to weight ratio and relatively lower cost. In view of its indispensability, it is now said that 'Steel Can Best Be Replaced By Only Better Steel'. The steel industry in India is committed to the development of niche products at a competitive price through continuous technological inputs. It is worth mentioning here that the demand for alloy and special steels, which was estimated to be ~5.5 million tonnes in 2011-12, is expected to increase to ~7.6 million tonnes in 2015-16 and ~13 million tonnes in 2021-22. Also, the Government of India has planned to spend about one trillion dollars during 12th Plan (Aril'12-Mar'17) on infrastructure, which will result in huge demand of state-of-art steel products in near future.

Several new special steels having superior product quality attributes have recently been developed and commercialized by major Indian steel producers, such as, Steel Authority of India Limited (SAIL), Tata Steel, Rashtriya Ispat Nigam Limited (RINL), Jindal Steel Works Limited (JSWL), Essar Steel, Jindal and Power Limited (JSPL), Essar Steel, Jindal Stainless Limited (JSL) etc. for meeting stringent requirement and expanding demands of Indian market. In addition, there has also been a perceptible thrust on development of strategic and futuristic steel products indigenously. Some of the salient as well as those planned for future development, in different strategic market segments, are highlighted hereunder.

Defence and Space

India ranks seventh in the world for defence expenditure, which is nearly 2.5 percent of its Gross Domestic Product (GDP). The Indian Government is gradually opening the defence production to Private Sector, which promises exponential growth in product usage in coming years. One of the main requirements of the Indian Defence establishment relates to very high strength plates with good low temperature toughness property. Other security agencies like Border Security Force (BSF), Central Reserve Police Force (CRPF) and Police of various states also require high strength plates for making bullet proof vehicles, watch towers, security posts etc. Total demand for special steel for defence related application will be ~30,000 tonnes per year for next five years.

High Strength Quenched and Tempered Steel Plates for Indian Army

SAIL has developed SPADE quenched and tempered (Q&T) plates for meeting the requirements of Indian army for fabrication of Main Battle Tank (T-90, Arjun), Bullet/ Mine Proof Vehicles and Infantry Fighting Vehicle (BMP-II). This steel is characterized by high strength and superior impact toughness properties to achieve desired ballistic properties. Initially, SAIL had been producing SPADE plates mostly in 20-85 mm thickness through ingot route, which was adversely affecting the yield of steel. Subsequently, SAIL has developed technology to produce this grade through continuous casting route, which has significantly improved the yield of finished products. Recently, to meet the

(a) T-90 Main Battle Tank, Bhishma

(b) Bofors Gun with Carrier

Fig. 1: Some applications of defence grade steels

requirements of Indian armed forces, SAIL has also developed SPADE plates in 130 mm thickness through concast route. The successful ballistic test results of 130 mm plates encouraged Indian army to procure these plates for T-90 tanks. The plates had an yield strength (YS) of around 900 MPa, Ultimate Tensile Strength (UTS) > 1000 MPa, Elongation (E1) > 13% and Charpy Impact Energy (CIE): 35J at -40°C.

SAIL has also developed high strength plates (with YS: 690 MPa min. and UTS: 770-940 MPa) with good low temperature impact toughness properties (CIE: 27 J min. at -500C) for fabrication of carriage system of Bofors Guns. Presently, SAIL is producing this steel in the range of 4-54 mm thick (Q&T) plates and has christened the product as SAIL Rath. Fig.1 depicts some of the applications of defence grade steel plates.

High Strength Plates for Indian Navy

Indian Navy requires DMR 249 Gr.A plates for the fabrication of warships and aircraft carriers. This steel is characterized by high strength (YS: 390 MPa min.) and excellent low temperature toughness (CIE: 78 J at -600C) which is produced through specially designed alloy chemistry containing Nb, V, Ti, Ni and very low amounts of hydrogen content (2 ppm max.). SAIL's plants at Bhilai (BSP), Bokaro (BSL) and Rourkela (RSP) along with Essar Steel are the major producers of such steels.

DMR 249 Gr.B steel plates are also required by Indian Navy mainly for building landing and take-off platforms in aircraft carriers (Fig. 2.). It is Characterized by high strength (YS: 588-686 MPa)

Fig2: DMR 249 Grade B Steel Plates used in Air Craft Carriers

and superior low temperature impact toughness property (CIE: 78 J at -400C). SAIL has developed the process technology for production of this Q&T steel product and is producing it regularly as per the requirements of Indian Navy.

Maraging Steel

Maraging steels are carbon free iron-nickel alloys with additions of cobalt, molybdenum, titanium and aluminium. The term 'Maraging' is derived from the strengthening mechanism, which is

used to transform the alloy to Martensite with subsequent age hardening. The principal alloying element in this steel is 18 to 25 wt. % nickel. The steels produce massive Martensite on air cooling to room temperature. When the Martensite is aged at about 5000C, additional hardening of the Martensite is achieved by precipitation of various intermetallic compounds, principally Ni3Mo or Ni3 (Mo, Ti). In Maraging steel, high strength (YS: 1400 – 2400 MPa, depending upon tempering temperature) is combined with good impact toughness properties (CIE: 20 – 48 J at room temperature, depending upon grade) and weldability. This steel is mainly used in aerospace and tooling and machinery industries. SAIL and Mishra Dhatu Nigam Limited are jointly producing Maraging steel plates for various space related applications (Fig.3 a and b).

(a) Geo-synchronous Satellite Launch Vehicle (GSLV)

(b) Polar Satellite Launch Vehicle (PSLV)

Fig 3: Applications of Maraging Steel

Construction and Mining

Thermo Mechanically Treated Reinforcement Bars

Construction segment is one of fastest growing segments in India. Assuming a GDP growth rate of 8.5-9% in India, the growth rate of construction segment was estimated to be ~20% between 2010 to 2016. The estimated demand for structural steel in 2016-17 is 9.3 million tonnes. Consumption in India for structural steel was 7.5 million tonnes in 2014-15. The current domestic consumption of heavy structurals is about 1.6 million tonnes. The estimated consumption for 2016-17 is about 2.38 million tonnes. It is expected that total consumption of wire rods would reach 6.4 million tonnes by 2016-17 in case of mild and alloy steel grades from present consumption of about 5.0 million tonnes.

Reinforcement bars (rebars) constitute the largest product basket used in the construction segment. To meet the stringent quality requirements of this fast growing segment, several new grades like corrosion rebars, earthquake resistant (EQR) rebars and roof/rock bolt rebars have been developed through thermo-mechanical treatment (TMT) route. Corrosion resistant TMT rebars with addition of Cr, Cu, P etc. possess higher corrosion resistance (Corrosion resistance index: 1.5-2.0) as compared to conventional rebars. These rebars are produced as per IS: 1786-2008 in different diameters for use in reinforced cement concrete (RCC) construction in coastal and industrial environments. SAIL, Tata Steel, RINL and JSPL produce such rebars under different brand names.

Recently, earthquake resistant (EQR) TMT rebars have been developed in India for use in seismic resistant structures. These rebars are characterized by high UTS/YS ratio (1.18 min.), high uniform elongation (8% min.) and low variation in strength to avoid catastrophic failure of the constructed structure in the event of earthquake. This set of properties, which is achieved through microstructural engineering and strict control over chemistry and process parameters, improves the plastic energy absorption capacity of the rebars significantly. Performance of these rebars has been evaluated extensively under simulated seismic loading conditions with encouraging results.

Based on these efforts, two new grades of superior earthquake resistant TMT rebars namely Fe-415S and Fe-500S have been incorporated in IS: 1786-2008 standard through an amendment in 2012. These rebars are characterized by further enhancement in UTS/YS ratio of 1.25 min.

and upward revision in uniform elongation of 8 percent min. SAIL developed these grades, which were found to meet all the requirement as per International Standards. SAIL is the first steel producer in the country to pioneer the technology of producing such EQR rebars.

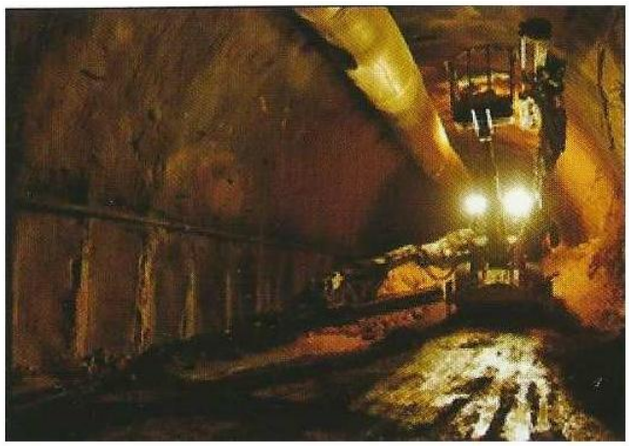


Fig. 4: Roof Bolts & their Applications in underground mines

Roof bolts are active support elements used in underground mines for enhancing inherent strength of the rock mass through keying/ beam-building effect (Fig. 4). Such roof support systems offer various advantages, such as unrestricted working space, easy and quick installation. Adoption of innovative alloy design and optimised process parameters (YS: 600 MPa min. and UTS: 720 MPa min.) for the first time by SAIL at its Durgapur (DSP) and Bhilai (BSP) plants for construction and mining segment. Recently, another superior Fe-640 grade (YS: 640 MPa min.) has also been developed by SAIL to meet further requirements. Tata Steel is also producing this steel upto Fe 600 grade. RINL produces Fe-415, Fe-500 and Fe550 grade TMT rebars and corrosion resistant TMT rebars in Fe-415 and Fe-500 grades. JSPL also produces and supplies TMT rebars in Fe-500D, Fe-500D CRS, Fe-550D and Fe-600.

Heavy Machineries

High Strength Abrasion Resistant Plates

As per the Working Group for 12th Plan, the consumption of plates is projected at a cumulative annual growth rate (CAGR) of 7.5 percent. The total production of plates in India was 4.7 million tonnes in 2014-15. Demand for high strength abrasion-resistant steels like HARDOX and WELDOX is ~50,000 tonnes per year in India. These steels are supplied in Q&T conditions.

(a)Excavator (b) ATM Chest

Fig. 5: Typical Applications of High Strength Plates

High strength steel plates find their applications in construction of dams, bridges, penstocks, Automated Teller Machine (ATM) chests, and earth movers (Fig.5). Presently, there exists a good demand for such high strength (YS: 550 MPa min.) steel plates in India and this is largely met through imports. SAIL is the first in the country to develop the process technology for production of such high strength plates in as-rolled condition and these are marketed under the brand name of SAILMA 550 HI/SAILMA 600. These plates are characterised by high strength, good toughness and weldability properties (Carbon equivalent: 0.45 max.) and are cost-effective substitute for Q&T plates of equivalent strength. A major break-through was achieved when high strength category plates with YS: 550 MPa min. and UTS: 690 MPa min. were developed in as-rolled condition under the brand name SAIL HITEN 690 AR for the fabrication of chest of automated teller machines (ATM).

Essar Steel, JSPL and SAIL have in the near past commissioned state-of-art Plate Mills which can produce wider plates – Essar: 5-150 mm thick and up to 5 m wide; JSPL: 5-150 mm thick up to 5 m wide; SAIL: 6-110 mm thick and up to 4.1 m wide (RSP). These mills are equipped with very high power reversible rolling mills and accelerated cooling facilities for producing high strength steel plates.

Oil and Natural Gas

APIX 70/X80 Grade Hot Rolled Coils/Plates

Steel pipelines are the most economical means for the transportation of water, oil and natural gas over long distances. The existing pipeline network for oil and gas transportation comprises almost 30-32% of all the modes of transportation. The oil and gas pipeline network in India extends to approximately 25000 km.

India is the one of the largest producer of steel pipes with total pipe production capacity of more than 1 million tonnes. The maximum demand is for API X70 grade steel. Demand for API steel grades for sour gas application in also steadily increasing in India. The estimated growth in oil and gas segment was 24% during 2010-15. There will be substantial addition of 20,000 km pipeline length shortly, which will require 2.0 million tonnes of API steel per year. Due to such unprecedented growth, there is a huge demand for API X70 grade steel for making pipes to transport oil and natural gas at high operating pressures. This has provided an opportunity for all steel manufacturers like SAIL, Essar Steel, Tata Steel and JSWL to develop this grade in form of hot strips / plates. Low carbon steel chemistry micro alloyed with Nb-V-Ti followed by thermo-mechanical controlled processing (TMCP) practice is generally used for development of API X70 grade steel.

Recently, demand for API X80 grade plates and HR coils has also increased in India. Therefore, many steel producers in India like SAIL, Essar Steel, JSWL and JSPL are developing this steel either through conventional TMCP technology or through High Temperature Processing (HTP) technology. Essar Steel has taken a lead role and is producing this grade of line pipes steel.

Auto and Pre-engineered Building

Interstitial Free Steels

The current demand of steel (HR, CR & long) for Auto segment is around 9.0 million tonnes in India which is expected to increase to 11.8 million tonnes in 2016-17. The steel industry from all over the world has been constantly pursuing development of new steels for achieving reduced weight and improved crash performance of vehicle (Fig. 6). In line with global trends, TATA Steel has developed two grades of interstitial free (IF) steels (Nb-stabilised and Ti-stabilised). Tata Steel is also first steel producer to make bake hardenable and high strength IF steels in India for auto applications. IF steels are characterized by high formability and have low carbon contents (~30 ppm). Addition of titanium and/or niobium is made for the elimination of solutes in the final steel after processing.

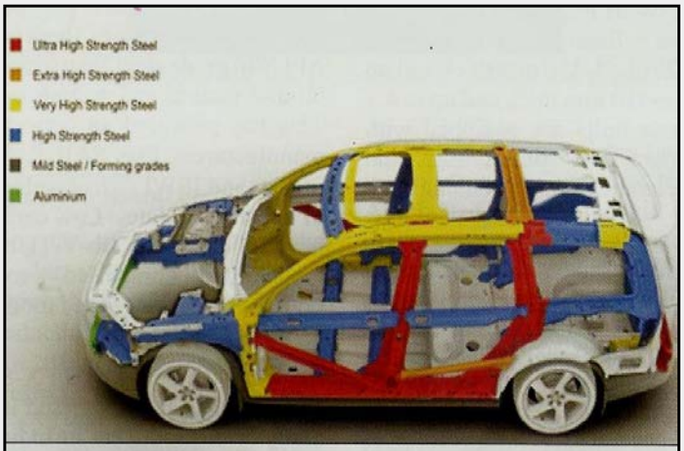


Fig.6: Application of steel in autobody parts

HSFQ Hot Rolled Coils for Cold Forming

An innovative concept using Silicon (Si) in presence of Niobium (Nb) was used for development of a series of high strength formable quality (HSFQ) (YS:

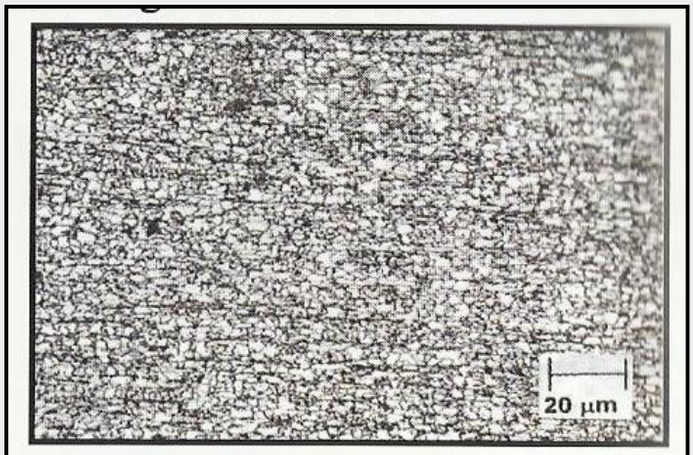


Fig.7: Fine grained steel of ~ 3 µm size

350/450/500/550 MPa min.) hot rolled grades for the first time in the country by SAIL at BSL. Industrial heats were made with varying Nb and Si contents in the range of 0.035-0.045 wt. % and 0.25-0.35 wt. % respectively. Development of high strength fine grained (<3µm across the thickness in 3.2 mm HR coil) hot rolled steel is a technical breakthrough (Fig. 7). Applications of these grades with higher strength (>500 MPa) and good formability (Elongation>25 %) includes chassis components of heavy commercial vehicle, earthmoving attachments etc.

Fig.8: Pre-fab structures

High Strength Formable Quality HSFQ 350 grade hot rolled coils from SAIL have been promoted for usage in Pre-engineered Building (PEB) segment (Fig. 8). Fully killed steel, using overall micro alloy content (MAE) of 0.03 percent max and restriction of N content to less than 70 ppm, helped to achieve high strength and good formability properties. Hot rolled coils in thickness range of 2 to 8 mm were developed. The nominal mechanical property requirements of YS: 350 MPa min, UTS: 400 MPa min and % E1: 28 min have been achieved. This product development initiative marks a step forward towards catering to burgeoning PEB market demand for this steel grade especially in the Southern Region of the country.

SAIL Forming Hot Rolled Coils for Hot Forming

High carbon and niobium are conventionally used for achieving high strength in steel used for fabrication of auto components like live rear axle. Increase in niobium leads to low hot ductility and high YS/UTS ratio whereas increase in carbon results in low ductility and thus induces overall deterioration in the formability of the product. These limitations were overcome by developing SAIL Forming 350 and 450 grades, with Nb, V and high Si, ensuring better castability and improved formability. These newly developed grades were successfully used for fabrication of live axles (Fig. 9) of commercial vehicles through hot forming. Thinner higher strength HR coils successfully replaced thicker material thereby reducing the weight of the component besides increasing fuel efficiency of vehicle.

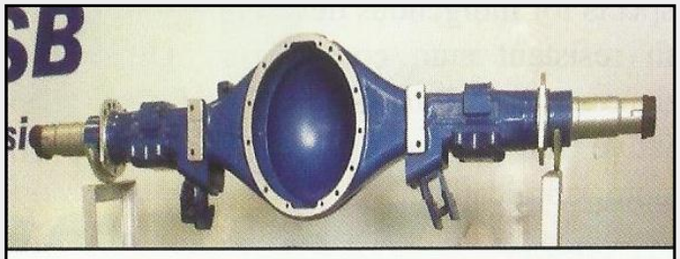


Fig.9: Live rear axle

Mn-B Steel for Hot Stamping

The challenge in the automobile industry is to build 'Low cost & safe vehicles'. A new process called "Hot stamping" has evolved which provides the flexibility and advantage of utilizing the much sought-after high strength materials without the

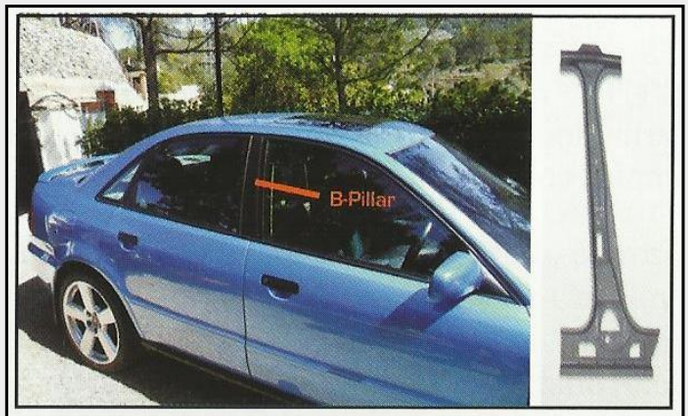


Fig. 10: B Pillar made with Mn -B steel

worry of spring back often found in these high-strength steels. This 'Mn-B futuristic product' was made with optimum Mn and B contents and processed into 2.5 mm (HR) and 0.8 – 2 mm (CR) in SAIL at BSL.

The materials were hot stamped in the austenitic range to form the B Pillar (Fig. 10), used in vehicles, and followed by quenching. The trials were conducted at Diede Die Development, Bilbao, Spain. Tensile strength obtained using flat die on SAIL sample (> 1500 MPa) was found comparable to that of POSCO material (>1400 MPa). The process offers flexibility in achieving higher accuracy of formed components, lowering load requirement in tools and eliminating spring back. This process development has opened prospects for indigenous development of critical crash resistant auto components. Other steel producers, like Tata Steel, have also taken initiative for producing Mn-B steels for hot stamping applications.

LPG Cylinder

LPG Steel (High Si / B)

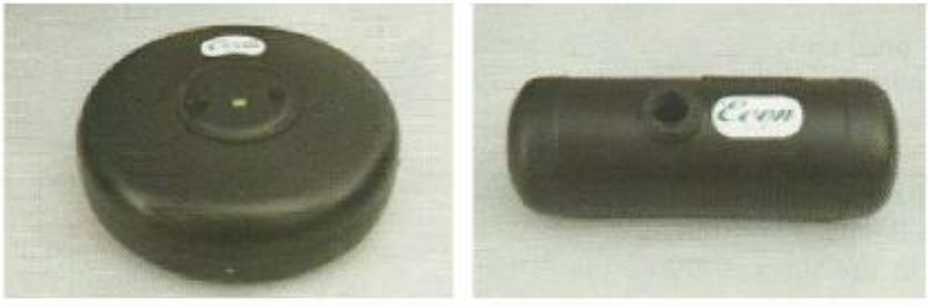
High formable hot rolled Liquefied Petroleum Gas (LPG) grade steel is regularly being produced by SAIL, Tata Steel and others for manufacturing domestic cylinders, where titanium/boron is used to improve cold formability. To reduce cost of production and improve properties, an innovative alloy design, with higher silicon (0.1-0.2%), lower manganese and boron addition, has been developed by SAIL at BSL.

Mechanical properties of LPG with modified chemistry were: 295-340 MPa YS, 375-430 MPa UTS and 41-45% elongation. In general, lower YS/UTS ratio favours an improved strain distribution during press forming, enabling more complex component to be formed without excess localized thinning. Hole expansion value of newly developed LPG was 163%. Higher percentage of total elongation coupled with lower YS/UTS ratio and good hole expansion value is a measure of formability characteristics of the steel. The material was also utilised for making auto-cylinders (Fig. 11 (a) and (b)). All major steel producers in India are making LPG steel as per IS: 6240 Gr B.

High Strength LPG Steel for Export Market

SAIL has embarked on a programme for developing high strength LPG grade steel for cylinder manufacture of various shaped exclusively

Fig. 12: Export Quality Cylinders of various shapes



(a) Torodial Auto Gas Cylinder (25-40 litres)

(b) Cylindrical Auto Gas Cylinder (5-100 litres)

Fig. 11: LPG grade HR Coils used for manufacture of Auto Cylinders

for export market (Fig. 12). The major quality requirement relates to achieving the desired mechanical properties of formed cylinders after normalizing at the customer's end. Cost effective alloy design, with and without niobium, was used to develop steels equivalent to EN10120 P245NB (YS: 245 MPa min.), EN10120 P265NB (YS: 265 MPa min.) and JISG 3116 SG295 (YS: 295 MPa

min.). The higher strength variant, conforming to JISG 3116 SG295, employed a slightly richer chemistry and 2.7 mm HR coils were used for fabricating higher capacity export cylinders (20 Kg.) for the first time in India. These cylinders were exported to Korea. A sizeable tonnage (> 6000 tonnes), as per EN10120 and JISG 3116 specifications, have been supplied for fabrication of export quality cylinders for Jordan, Korea etc.

High Strength LPG Steel for Lighter Domestic Cylinders

SAIL took the lead in preparing a new specification for hot rolled high strength LPG steel for domestic market and got it published under IS 15194 : 2011 standard and subsequently got it included in the design criteria as per IS 3196 Part I of Bureau of Indian Standards (BIS). Lighter domestic cylinders with 2.45 mm thick HR coils corresponding to HS 295 grade (instead of conventional 2.9 mm IS 6240 Gr. B material) were successfully developed meeting statutory requirements of various tests pertaining to modified IS 3196 standard (pneumatic, hydrostatic, burst test and drop test). Mechanical properties of the samples prepared from formed cylinders after normalizing conformed to the specification (YS>295 MPa, UTS>450 MPa and % E1>18) with more than 15% weight reduction of blank cylinder weight. Additional benefit with these lighter cylinders includes more number of cylinders per ton of steel and ease of handling and transportation.

Railways

High Strength, Wear Resistant and Corrosion Resistant Rails

SAIL is the largest producer of rail steel in the country since long. In the recent past JSPL has started rail steel production. The consumption of railway materials which was 1.1 million tonnes in 2010-11 is expected to reach a demand of 1.4 million tonnes by 2016-17.

SAIL has continuously been involved in up-gradation of rail manufacturing process technology and development of new grade of rails. As per demand of Indian Railways (IR), the first major development at SAIL was 90 UTS rail in 1983-84 with increased strength and wear resistance as compared to the 72 UTS grade. Keeping pace with the trend in IR, with higher traffic density requiring high strength, long performance and superior corrosion resistance, new grades of rails were developed recently by SAIL, namely, high tensile (UTS ≥ 1260 MPa) and high YS/UTS ratio (0.58) 880 Grade rails with Nb and V micro alloying, Cu-Mo corrosion resistant rails for coastal areas, Ni-Cr-Cu alloyed low cost corrosion resistant rails and high strength 110 UTS rails with YS/UTS ratio (0.60). The new Cu-Mo rails are expected to give double the service life of conventional 90 UTS rails.

Successful attempt was made to test the capacity of producing bainitic rail steel in SAIL at BSP. These rails were found to possess excellent fracture toughness (KIC = 55-60 MPa$\sqrt{}$ m at – 200C), elongation and UTS properties but wear rate was found to be slightly higher than 90 UTS rails.

JSPL is also making tract and crane rails, long rails and head hardened rails for superior wear resistance.

Power

Electrical steels are used extensively for fabrication of transformers, generators, motors etc. (Fig. 13). The likely demand for electrical steel is going to increasing to 0.8 million tonnes in 2016-17. The

Fig. 13: Transformer assembly

consumption of this grade of steel was 0.54 million tonnes in 2014-15. Production of electrical steels in the country was 0.14 million tonnes in

2014-15. Majority of the demand is met through imports (> 75%). With the setting up of facilities for CRNO production at RSP, SAIL developed the technology for production of M-47, M-45 and M-43 grades through concast route. SAIL has also developed cost-effective semi-processed electrical steel. Thyssen Krupp Electrical Steel Pvt. Ltd., India is another producer of CRNO and semi processed electrical steels.

Semi Processed Electrical Steels

Semi processed electrical steels are used for fabrication of cores for fractional and low horse power motors. Semi processed electrical steels have certain advantage over lower grades of fully processed CRNO steels, which include equivalent magnetic properties at lower silicon content and better punchability. This product was developed at SAIL which included careful design of a suitable steel chemistry with lower level of silicon content to achieve desired hardness in the temper rolled coils, optimal control of hot and cold rolling parameters to ensure desired recrystallization and grain growth in the coils after annealing and desired extent of cold reduction of annealed coils. Percent reduction during temper rolling is a critical parameter as it helps in generating sufficient numbers of dislocations in the steel which, in turn, facilitates abnormal grain growth during decarburization annealing. The average grain size of SAIL material was 120µm after decarburization annealing. Evolution of such coarse ferrite grains in the finished product was found to impact low core less value of less than 5.0 watt/kg (at 1.5 T and 50 Hz) even when silicon content was as low as 0.5-0.7%.

ASTM 387 Gr. 12 Cl.2 Plates

Production of ASTM A387 Gr.12 C1.2 plates with chromium ~ 1.0% and molybdenum ~0.5% has been established at SAIL for use in pressure vessels and boilers operating at high temperatures. Air cooled plates are normalized above 9000C and then tempered at 6500C as these plates are generally supplied in normalized and tempered condition as per the requirement of ASTM A 387 Gr.12 specification. SAIL plates satisfies the specified property requirements of ASTM A387 Gr.12 C1.2 specification (YS: 275 MPa, UTS: 450-585 MPa, %E1: 22 min.). Essar Steel also produces this grade of steel. Ageing or tempering after normalizing significantly increases the strength and toughness of the molybdenum steels. In Mo containing steels, there is formation of small amount of bainite phase after normalizing. Formation of small amount of bainite generates internal stresses which reduces the yield strength of the steel. Tempering treatment relieves the internal stresses and provides additional strength due to precipitation of molybdenum carbides.

Soft Iron Plates

Soft iron plates are required for making magnetic detector for nuclear research programmes. Soft iron plates have been developed by SAIL in collaboration with Bhabha Atomic Research Centre (BARC). Soft iron is characterized by high magnetic susceptibility but low retentivity which makes soft iron very useful in making temporary electromagnets. This steel grade is being used for fabrication of very large magnetic detectors for study of neutrino particles under the aegis of Indian Neutrino Observatory (INO) project. Essar Steel is also developing soft iron plates for INO applications.

Stainless Steels

The stainless steel sector in the country is in slight disarray presently with a production level of 2.75 million tonnes. The consumption level of 2.3 million tonnes is highly skewed towards flats, which accounts for nearly 80 percent of the total consumption. There is also a resultant pressure on price for this market segment. However, there is a reasonable demand for sophisticated products which are being imported.

Super Austenitic Stainless Steel

UNS S31727 is a super austenitic stainless steel with excellent resistance to sulphuric acid dew point corrosion. The steel is a crack sensitive grade with limited producers in the world. Process technology has been established for 1st time in India by SAIL for manufacture of hot rolled coils in 8 mm thickness through adoption to two-stage rough rolling and close control of chemistry, reheating temperatures and reduction regimes in terms of temperature, strain and strain rate. The steel has been specifically developed for niche applications such as heat exchangers,

flues, chimneys, etc. of dedicated heavy oil-fried boilers.

Meta-stable Austenitic Stainless Steel

Meta-stable austenitic stainless steel type 301LN is widely used for fabrication of structural components of Metro Coaches in the country. The current market requirement, as projected by ongoing Metro Rail Projects in India, calls for manufacture of this steel in high temper with UTS > 1000 MPa and YS/UTS ratio < 0.8, as this would facilitate substantial reductions in tare weight and crash-worthiness of metro coaches. A novel thermo-mechanical processing (TMP) methodology has been put to use in Salem Steel Plant (SSP) under SAIL, which entails imparting heavy cold reductions in Sendzimir Mill followed by short reversion annealing treatments at 750°C in Annealing Pickling Line. The improvement in properties (strength-ductility combination) has been attributed to grain refinement through formation of sub-micron grained austenitic () microstructure accomplished by controlled reversion of strain-induced Martensite () during the short annealing treatment. The process is distinct from conventional long annealing treatments performed at 1050°C, which are employed to soften the stainless steel after cold rolling by means of recovery and recrystallization processes.

Jindal Stainless Limited (JSL), a lead player in the field of stainless steel in the country, also produces the above mentioned grades.

Futuristic Products

Though the country has developed several value added steel products for various market segments, thereby reducing import, there are many sophisticated products that need to be developed for ensuring self-sufficiency and sustainability. Generating the required capability for developing these grades indigenously, at least for some of the high end products, calls for synergy, collaboration and pooling together of expertise and resource available – steel companies, national laboratories, academia and representative products (not exhaustive), where attention is needed, for developing them on a short to long term time frame (1 to 10 years) are mentioned below:

- For the auto segment, advanced high strength galvanized sheets, colour coated products etc. are under development in India. However, more thrust is required for development of products like Zn-Mg, Zn-Ni coated sheets and advanced high strength (TRIP & Dual phase) galvanized sheets for this segment.
- In the line pipe segment, it is imminent that efforts should be made by steel producers in India to develop line pipe steel of API X100 and higher grades, to keep pace with world development.
- There has always been a demand for corrosion resistant TMT rebars for construction in highly corrosive regions, like coastal and industrially polluted regions. In view of this, efforts need to be made to develop corrosion resistant TMT rebars in Fe-415S/ Fe-500S grade too which have excellent earthquake resistant capability.
- Use of Fire Resistant weldable quality steel need to be augmented for commercial purposes in the construction segment. This steel exhibits minimum two-thirds of its room temperature yield strength at 600°C as specified in IS 15103: 2002. Thus the structure will have adequate load bearing capacity even after exposure to higher temperature due to fire. In view of this, the risk against fire hazards is substantially reduced. Application of this steel reduces the overall cost of construction and maintenance of the structure by replacing the conventional cost intensive material/ coating.
- Indian steel producers will need to focus for the development of higher grades of cold rolled non-oriented (CRNO) steel, like M-27, M-22 etc., for fabrication of medium and high horse power (HP) motors and generators. For manufacture of large sized and sophisticated transformers, cold rolled grain oriented (CRGO) steel is used globally. The technology for producing this premium product is presently not there in the country. The technology is confined to a handful of steel makers in the world. This steel is characterized by presence of GOSS

texture [(110) <001>] along the rolling direction, which in turn, ensures low core loss values. Presently, demand for CRGO steel in India is ~0.25 million tonnes per year which is met entirely through import. This is one of the major futuristic products, which require attention of all the flat steel producers in India for its development.

- Development of amorphous steel can be an important area of focus in future. A simple alternative to the use of traditional silicon steel in the core is the use of amorphous steel. The amorphous steel is an alloy of iron with boron, silicon, and phosphorus in the form of thin (e.g. 25μm) foils. These materials have high magnetic susceptibility, very low coercivity and high electrical resistance. The high resistance and thin foils lead to low losses by eddy currents when subjected to alternating magnetic fields. On the downside amorphous alloys have lower saturation induction and often a higher magnetostriction compared to conventional crystalline iron-silicon electrical steel.
- High strength (1080 MPa UTS) wear resistant rails with improved toughness (KIC=45 MPa√ m at – 200C) and YS/UTS ratio: 0.6 min. is becoming popular world over. It will be prudent to develop such rails using Nb as a micro alloying element.
- Nuclear industry in India requires large quantity of boron added IS: 2062 grade steel for absorption of nuclear radiation during power production. Development of this steel in association with Department of Atomic Energy (NPCIL/BARC) can be beneficial to the country.
- Nano-structured steels are another class of steels having very good potential. In conventional steel, the grains and matrix that comprise the structure of the steel are measured in microns. On the other hand, nano structured steels have grain and matrix sizes smaller than 100 nanometers. These nano-scale microstructures produce unique mechanical and physical properties resulting in capabilities outside the known performance boundaries of existing steels. Extensive research followed by commercial level up gradation will be needed for developing these grades of steels.
- Austenitic stainless steels are costly mainly because of the cost of nickel. There is continued thrust in developing ferritic grade stainless steels with low nickel or nickel free varieties that match properties of austenitic steels in terms of corrosion resistance and formability. Production of Cr-Cu-Ti ferritic stainless steel and interstitial free ferritic stainless steel to match their austenitic counterparts would be needed for this cost sensitive segment. Low-Ni (<1.5 wt% Ni) and Ni-free varieties of duplex stainless steels (DSS), with optimum phase balance of austenite and ferrite, can impart superior yield strength impact strength and general & localized corrosion resistance than conventional austenitic grades. Development of high temper meta-stable austenitic stainless steel can ensure substantial market penetration in Metro coaches.

Conclusion

A large number of products have been developed in last two decades by various steel producers in the country. However, additional efforts are now required to develop more products with highly stringent quality attributes to meet future steel application requirements. Commercial development of process technology for manufacture of CRGO steel will be one of the prime thrust areas for future. Nevertheless, Indian steel industry, with its state-of-art facilities and highly skilled manpower is fully geared to meet the challenge for developing niche products that can save the country from drainage of valuable foreign exchange reserves.

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Metals and mining: Outlook's tough for the steel industry

Key takeaway:

Recent domestic steel demand data appears positive, but weak global steel fundamentals, falling global prices and imports will continue to weigh on domestic steel prices, in our view. More protectionist policies are possible, which may offer some relief, but we have doubts about the effectiveness of these measures. Balance Sheet stress could intensify. We stay selective: prefer JSW in the current environment; SAIL remains our least preferred steel stock.

Global steel fundamentals remain challenging:

Steel prices are down 7-18% across regions since end September. With Chinese apparent steel demand continuing to contract (-4% y-o-y Oct) and global steel utilisation falling to 68.3% in Oct (69.3% Sept), signs of inflection remain elusive. Iron ore prices have also dipped 21% since September. This lowers cost support further. While downside to steel prices may be limited, steel prices could stay at low levels given the oversupplied steel and iron ore market.

Domestic steel demand data in October encouraging:

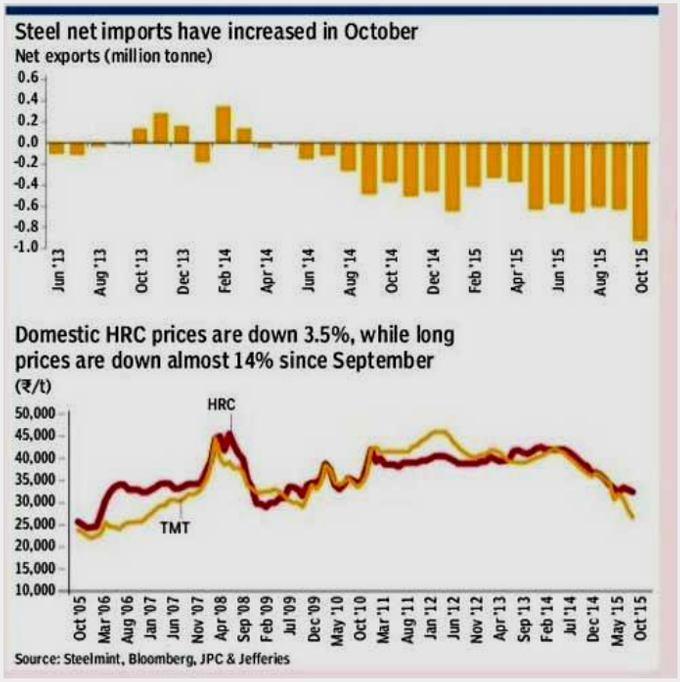
Domestic apparent steel demand grew 5.5%/6.6% y-o-y in Sept/Oct (YTD 4.5%) as per initial JPC data. This compares to a muted 1.4%y-o-y demand growth in September quarter. Monthly data is often volatile due to data bunching, restatement and inventory data issues, but positive steel demand data seems to corroborate other positive macro data recently. However, imports continue to gain share of domestic demand. Producer inventories have increased further in October.

Steel pricing pressure will persist:

Domestic steel prices remain under pressure, as domestic prices are largely driven by import parity and a sharp fall in Chinese steel prices has negated the 20% safeguard duty imposed on HRC (hot-rolled coils) in September. Price hikes announced post safeguard duty, Domestic HRC prices are down 3.5%, and long product prices are down 14% since September. We see scope for more correction in December as domestic HRC prices are still at a 4-5% premium to import parity.

Steel mills are seeking greater protection:

Imports grew 27% m-o-m (month-on-month) in October, though this mainly pertains to bookings made before the safeguard duty was imposed. A clearer picture will emerge in the coming months.



We understand HRC import bookings have moderated, but import orders of downstream products have increased after the safeguard duty was imposed. Steel producers are now seeking a higher safeguard duty, and safeguard duty in other product categories. Producers are also asking the government to set a floor price on steel imports. We think further protectionist measures are possible, but government will also weigh the impact on end-use sectors, especially given its 'Make in India' thrust. There was strong opposition from steel consuming industries (autos, re rollers, industry bodies) at the recently held public hearing with regard to safeguard duty on HRC. We are also sceptical of the effectiveness of potential floor prices on imports

as (i) implementation would be difficult given large variants of steel grades/products and (ii) exporters would find ways to circumvent floor price restrictions.

Stress testing FY17 Ebitda and balance sheet:

We believe balance sheet pressure could mount if prices do not recover materially. If prices sustain near spot (Rs 27,500/t) vs. our est. of Rs 30,500/ ton in FY17, FY17 Ebitda at our covered steel names would be lower by over 22% vs. our base case. Net gearing would rise to 0.8-2.5x and net debt/Ebitda would stay over 6.5x across our covered steel names. At SAIL, Ebitda would be inadequate to pay interest costs. We do not foresee major interest payment issues at Tata or JSW Steel but net gearing would exceed 2.5x (2.2x FY16) in FY17 at Tata. Covenant risks appear low and repayments are back-ended at Tata, but operating cash flows may be inadequate to meet capex and debt servicing requirements at Tata and JSW, if steel prices sustain near spot.

Source: The Financial Express

Global Steel Market

The past few years have been quite difficult and volatile for the global steel market. The conditions, however, have still not improved. The current financial year is also witnessing bleak market conditions and the overall picture of the global steel industry is now dull and gloomy.

For the last 3-4 years, the global steel industry has remained in the doldrums and this has now pushed the industry to a period of pause. Many steelmakers are reducing manpower to improve the bottom line, some are on a long maintenance break and a few have shut down businesses. With this, on the fear of pricing issues, we already saw steel prices have gone down to their lowest point in the second half of 2009 and have continued to remain volatile since then. This year also, steel prices have come down rapidly and those costs are now at levels that sustain a negative impact on revenues and profitability of steel manufacturers. Further, a rising tide of cheap steel exports from China continues to take its toll on the global steel industry. Competition from cheap steel exports has affected price realisations and reduced operating profit margins of many companies significantly. We are all aware that the global steel industry, for the last two decades, was dominated by events in China, which accounts for almost half of the world's steel output and has grown into the largest steel producing and consuming country. In the meantime, due to the economic slowdown in China, their demand for steel has decreased and this has converted to a huge flood of Chinese steel, which is no longer required domestically, prompting Chinese makers to increase steel exports. China is now exporting 100 million tonnes of steel per year at prices, which are below the production cost. This has started affecting the prices and the profitability of many steel companies. All in all, the global steel industry has become more complex than ever.

In terms of global steel production and consumption, besides China, other countries like India, Japan, South Korea, Taiwan, Iran, Mexico exhibits strong growth in both aspects. Global steel production for the first quarter of the current fiscal reached 400 million tonnes. World Steel Association forecasts that global steel consumption will increase by 0.5 percent and touch 1,544 million tonnes in 2015. In 2016, demand is expected to grow by 1.4 percent, reaching 1,565 million tonnes. Hence, the outlook for the steel industry is one of slow demand growth.

Further, positive news from developed economies is the sign of strong recovery in the Eurozone. In the developing and emerging economies, there is growing optimism about India and growth in steel use in some MENA and ASEAN countries. Although these developments will not be enough to fully counteract the deceleration in China, which has turned out to be more severe than expected, growth prospects are expected to gradually improve in 2016 and beyond. One thing is for certain, and that is, steelmakers will go through a continued period of volatility in the short-to-medium term. In reality, the future of global steel industry can hardly be predicted depending on the present situation. However, the industry may remain uncertain and challenging for some more time.

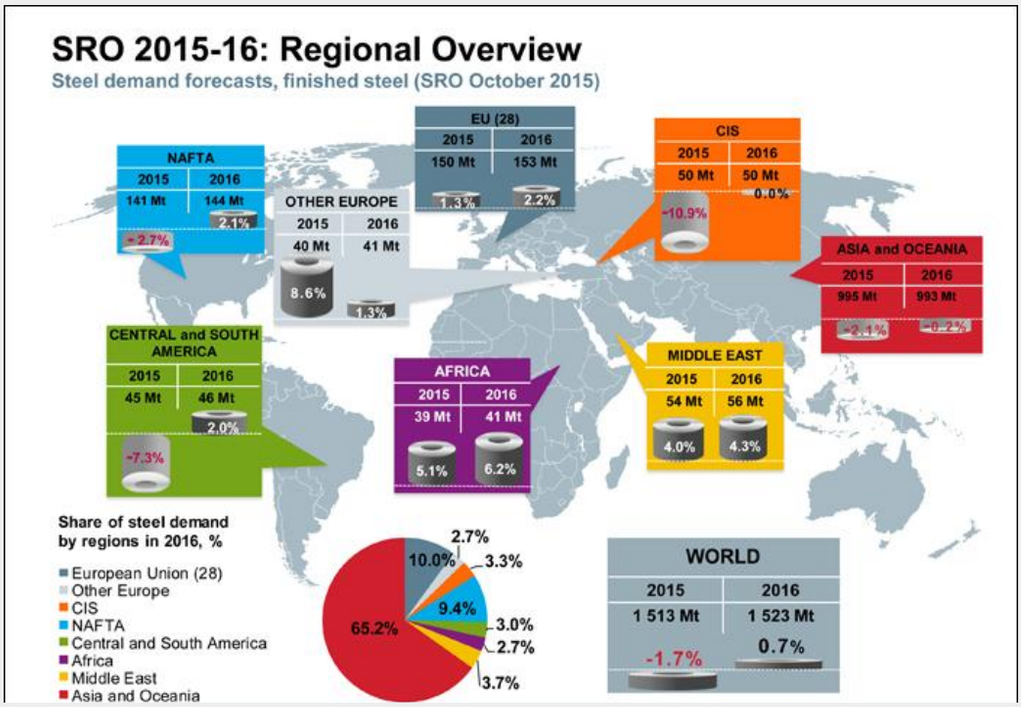
Source: Iron & Steel Review

Worldsteel Short Range Outlook 2015-2016

The World Steel Association (worldsteel) released its Short Range Outlook recently(SRO) for 2015 and 2016. Worldsteel forecasts that global steel demand will decrease by -1.7% to 1,513 Mt in 2015 following growth of 0.7% in 2014. In 2016, it is forecast that world steel demand will show growth of 0.7% and will reach 1,523 Mt.

The steel industry faces headwinds from various fronts

Commenting on the outlook, Hans Jürgen Kerkhoff, Chairman of theworldsteel Economics Committee said; "It is clear that the steel industry has, for the time being, reached the end of a major growth cycle which was based on the rapid economic development of China. Combined with China's slowdown we also face low investment, financial market turbulence and geopolitical conflicts in many developing regions. The steel industry is now experiencing low-growth which will last for the time it takes for other developing regions of sufficient size and strength to produce another major growth cycle.



We expect the current headwinds to moderate in 2016 but this is based on a belief that the Chinese economy will stabilise. Of particular concern is the vulnerability of the emerging economies to external shocks though we are also expecting some, like India, to show resilience to the global slowdown. On a positive note, the recovery of steel demand in the developed economies, even though the momentum has weakened a little, remains on track."

Source: www.worldsteel.org

A mixed performance for non-ferrous metals in 2015

China's uncertain economic situation is likely to hang heavy over the non-ferrous metals sector in 2015. The country is one of the largest consumers and producers of non-ferrous metals and its decision to re-balance economic growth from an investment-focused one to a consumption-oriented one has upset demand-supply balances.

It has not helped the other emerging markets, too, are seeing slower growth, while Europe's growth continues to disappoint. Moreover, capacities that were planned in the years when the prices were high are coming on line at a time when demand is flagging. Despite all these factors, non-ferrous metals such as zinc and aluminium were better off in 2014.

Let's take a look at how prices fared. Copper was in poor health for most of the year. China's crackdown on financing transactions using metal as collateral was also said to be a reason for

copper's fall from grace. The metal has fallen by around 14% since the start of the year. But Indian copper firms are smiling because excess copper concentrate in the market gives them an upper hand as the fees paid to them by mining firms have risen sharply. These fees are expected to remain firm in 2015, too. Indian copper smelters should be in good health in 2015.

In relation to copper, aluminium and zinc prices did better with their prices rising by around 5% and 4%, respectively, in the year. Aluminium metal premiums have been rising steadily during the year as buyers have been forced to pay extra for quicker deliveries. Higher prices have helped the margins of domestic firms.

Zinc was expected to see higher demand in 2014 due to demand for galvanizing operations in China. That did happen and zinc use rose 5.9% on the back of higher Chinese demand, while refined metal production rose by only 3.8%, causing a deficit situation. In aluminium, reacting to weakening demand conditions, companies have been shuttering unviable capacities. A tighter supply market has supported prices and metal premiums. In 2015, copper prices may see some volatility depending on whether supply declines in response to falling prices. While zinc and aluminium had a good year in 2015, there's no saying for sure that it will continue next year, too. If China's economic growth continues to slip and its appetite for non-ferrous metals declines, then some impact on prices should be expected.

Source: http://www.livemint.com

Presentation on Desalination of Sea Water

A presentation on "Desalination: The Quest to Quench India's Thirst for Drinking Water" was made at our Chapter by Sh. K. K. Mehrotra, Former Chairman-cum-Managing Director, MECON Limited, on 12th December 2015. Reproduced below are the salient points:

Water is life because plants and animals cannot live without water. Water is needed to ensure food security, feed livestock, maintain organic life, take up industrial production and to conserve the biodiversity and environment. Hence, there is no life without water. Earth is the only plant, so far known to have water and this makes it fit for human living.

Global Scenario of water availability

70% of the earth surface is covered with water, which amounts to 1400 million cubic kilometres (m km3). However, 97.5% of this water being sea water, it is salty & can't be used for drinking / industrial purposes.. Fresh water availability is only 35 million km3 and only 40% of this can be used by human beings. Out of the total fresh water, 69 % is frozen in ice caps, 30% is stored underground and only 1.0 % water is available on the surface of the earth. Out of the surface water, 87% is stored in lakes, 11% in swamp and 2% in rivers.

Long before, when the population was low and lifestyle was simple, water was available in plenty and was considered as a free resource. However, with growing demand for water and depletion of the available water, assured supply of good quality water is becoming a growing concern. As the water resources are not evenly distributed, across different continents, some countries have surplus water while many other countries are already facing scarcity of water. Skewed growth of population in different continents is further adding to this crisis. Table 1 shows region–wise availability of fresh water against share of world population.

Table : 1

Region	Available fresh water resources, %	% world population
Asia	42	72
Africa	12	13
Australia/ Oceana	5	1
North/ Centre America	15	8
South America	26	6

Since generations, the pattern of water use in different countries is mostly dependent on their culture, lifestyle and industrial development, as availability of water was not a serious concern. With growing population world over, need of fresh water has also increased substantially. Continent - wise per capita water consumption is presented in Table 2.

Table : 2

Continent	Per capita water use (m3/yr)
Africa	245
Asia	519
North/ Centre America	1861
South America	478
Europe	1280

Major consumption of water is for agriculture, industrial production and domestic purposes, apart from being used for fishery, hydro-power generation, transportation and maintaining biodiversity and ecological balance. The proportion of water used for agriculture and industries varies from country to country depending on the lifestyle, extent of industrial development and water use efficiency.

Developed countries are using comparatively less water for agriculture and more for industrial and domestic purposes, while the developing countries in Asia and Africa use 80-90% of the water for agriculture and only 5-12% of the water for industrial use. This is reflecting on inefficient use of water in agriculture and poor investments in industrial development.

Scenario of water availability in India

India is blessed with good rainfall well distributed over 5-6 months in the year. The average annual rainfall in the country is 1170 mm with a wide range between 100 mm in desert areas of Rajasthan to 10000 mm in Cherapunji. The total available sweet water in the country is 3000 billion m3 per annum. Out of this, over 1050 billion m3 water is lost due to evaporation, transpiration and runoff, reducing the available water to 1950 billion m3 and the usable water to 1123 billion m3.

Only 18% of the rainwater is used effectively while 48% enters the river and most of which reaches the ocean. Out of the total usable water, 728 billion m3 is contributed from surface water and 395 billion m3 is contributed by replenishable ground water. Per capita water availability over last 6 decades is given in Table :3

Table : 3

Year	Population (Million)	Per capita water availability (m3/yr)
1951	361	5177
1991	846	2209
2001	1027	1820
2011	1200	900 *
2025	1350	<800*

A country is considered water stressed if it has less than 1700 m3/person / yr water availability and water scarce if availability drop down to less than

900 m3/person /yr .

The projected water demand in the country by 2025 & 2050 will be about 1093 & 1447 billion cum respectively against the demand of 634 billion cum in 2000. Factor responsible for high demand of water in future is due to rapid industrialization to match projected GDP growth of the country, massive shift from rural to urban population.

Water requirement of various sector of Industries had almost doubled during last decade and are expected to increase more than threefold by 2050. Water consumption by major industrial units in % is shown below.

Thermal Power Plant	88
Engineering	5
Paper & Pulp	2.2
Textile	2.0
Steel	1.3
Sugar	0.5
Fertilizer	0.2
Others	0.8

Need for desalination plant

India is already in the bracket of water scarce country and is bound to face severe scarcity of water in future. Potential for increasing the volume of utilization of water is hardly 5-10 % and cannot meet growing demand for industrial & domestic requirement. On the other hand Country has vast coastline of 7500 km covering 9 states and 2 Union Territory. Many major industrialized cities / towns are located on these coastline. During last one decade , desalination technology has matured with high reliability of system./ equipment, lower capital cost, effective treatment of saline/ brackish/ mershy water.

Desalination Processes

The two most commonly used processes are Multi Stage Flashing : which involve s heating of sea water to produce steam & then condensing the same Reverse Osmosis (R.O) : involve forcing water through cartridges that contain thin film composite polyamide membrane which trap salt & other impurities but allow fresh water.

The overview of R.O process is depicted in Figure1.

Desalination plants in India:

Two desalination plant presently in operation are at Minjuar & Nemelli, Tamilnadu with 100 MLD capacity each. Salient features of Minjuar & Nemmali R.O Plants are given below:

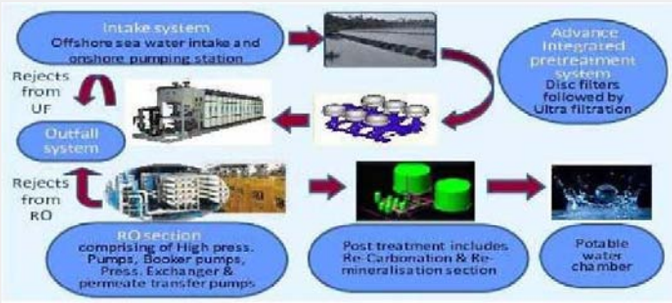
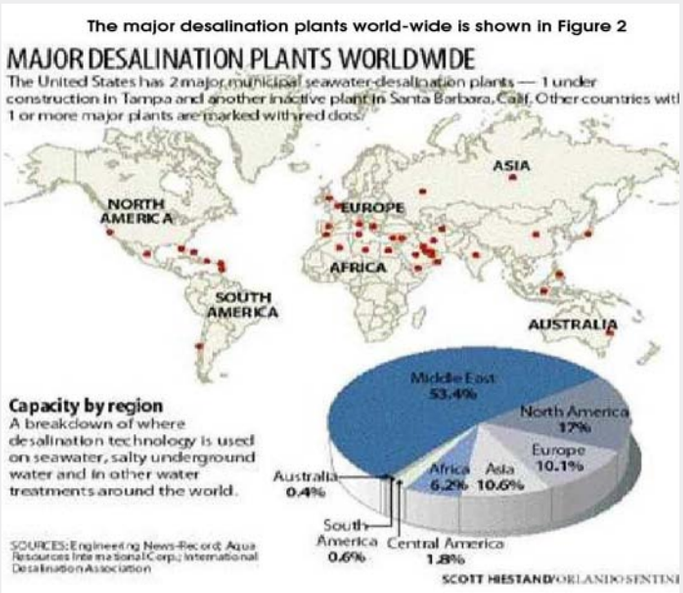


Figure: 1: Overview of R.O Process



Minjur Sea Water R.O at Kattupalli, Chennai

Technology Provider : Abengoa-Spain

Capacity : 100 MLD

Cost : Rs 5.15 billion (Euro 91 million)

Commissioned : 2010

Cost of water : Rs 49 / kl

Facilities : R.O membranes, pressure vessel, pressure exchanger, high pressure pumps & pressure filter vessels

Nemmeli Sea Water Plant – Nemmeli, Chennai

Technology provider : VA Tech Wabag, Autria & IDE Technologies, Israel

Engg. & PMC : MECON Limited

Capacity : 100 MLD

Cost : Rs 6.50 billion (US$ 100 million)

Commissioned : Feb, 2013

Cost of Potable water : Rs 40/ kl

- Plant design parameters : TDS - 41,900ppm, Temp. 24 -32 deg C, TSS- 50ppm (hourly avg.) & peak -200ppm, Turbidity - 50 NTU, product water TDS < 500ppm & IS 10500 Std quality.
- 1032m long ,1600 mm dia. HDPE Sea water intake pipeline , with state of art intake velocity head
- 734 m long ,1200 mm Dia. HDPE pipe reject outfall with diffuser
- Raw Seawater inflow to the plant :11060 m3/hr (265 MLD)
- Advance all integrated membrane system with automatic back washable disc filter for pre-treatment
- Modular skid design for Ultra filtration & Reverse osmosis, with VFD & ERI pressure exchangers for energy recovery
- 45.5% minimum permeate recovery in RO membrane & 37.7% over plant recovery
- Potable water production : 4200 m3/hr (100 MLD)
- Designed for continuous 24x7 uninterrupted operation
- Efficient re-carbonation & re-mineralisation systems including limestone storage and re-charging system.
- Guaranteed 3.85 KWh/m3 of product water and minimum use of chemicals

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Zinc-An Ideal Material for Die Casting

L. Pugazhenthy
Past President, The Indian Institute of Metals &
Executive Director
India Lead Zinc Development Assn
(Die Casting Society of India)

Introduction

Die Casting is rightly described as **"the shortest route from molten metal to the finished product".** This is a high volume production method, very fast too, and the per piece cost is always the lowest, among the various metal shaping techniques. Alloys of Zinc, Aluminium, Lead, Magnesium etc., are die cast worldwide with varying properties for a wide variety of applications.

The zinc die casting process

The zinc die casting process is one of the most versatile, efficient, effective and rapid production methods available for the manufacture of metal components. Accurate, well finished components are produced as a matter of routine; design complexity is achieved more easily than by other metal manufacturing processes.

Zinc die castings

Zinc die castings range in design and shape from the simplest of cabinet knobs to the most complex of precision automotive carburettor bodies. Zinc die casting alloys 3 and 5 possess a unique combination of properties which permit the rapid, economic casting of strong, durable, accurate components ideal for a wide range of applications.

Zinc die castings usually range in mass from a few grams up to about 11 kilograms. Even smaller castings are made on specialized machines. For example minute zip fastener components weighing only one tenth of a gram are cast at high speed on fully automatic precision die casting machines.

Characteristics and advantages of zinc die castings

The outstanding castability of zinc die casting alloys in combination with the capabilities of the pressure die casting process allows ready production of complex shapes with fine detailing and accurate dimensions. Lightweight thin wall zinc die cast components are produced economically, and closer tolerances can be held than are achieved readily using other casting processes.

The combination of several functions in one zinc die cast part is possible, where a number of separate components and manufacturing steps would be required by other production methods.

The as-cast finish of well-designed zinc die castings is excellent and castings require minimum finishing or further processing. The smooth corrosion resistant as-cast surface is adequate for many applications, or any of a wide range of protective and decorative finishes may be applied easily and economically.

Integral cast rivets, studs, bosses, inserts and other features including threads may be cast to eliminate subsequent machining, manufacturing and assembly operations, and zinc's outstanding ductility may be utilized to allow economic post forming and fastening operations.

Zinc die castings are stronger, tougher and more stable dimensionally than injection moulded plastics. Zinc die castings are produced at higher speeds than injection mouldings and their performance is superior over a wide temperature range. They are readily finished and can be electroplated more easily and economically than either plastic mouldings or aluminium die castings.

The mechanical properties of zinc die castings at normal temperatures are superi0r.to sand castings in grey iron, brass and aluminium, and to aluminium die castings, particularly in toughness and impact resistance.

These advantages allow production of zinc die cast articles with functional perfection and detailing unobtainable at economic cost using other processes. Many components now manufactured in iron, steel, brass, bronze, aluminium and plastics can be produced as zinc die castings, to achieve superior quality and function, usually at reduced cost.

Main characteristics of zinc die casting alloys

Good mechanical properties strength, hardness, rigidity. high impact strength, excellent ductility.
Wide freedom of shape capable of great intricacy and dimensional accuracy. minimum draft, formable after casting.
Durability, long-term stable properties, good corrosion resistance.
Economy, low production cost. low per-part die cost, little or no machining. special assembly advantages.
Product appeal smooth surfaces, cast-in texture, great variety in finishing, excellent feel'.

Zinc die casting alloys

Zinc die casting alloys are formulated specifically to give optimum performance, durability and dimensional stability to finished zinc die castings as well as desirable manufacturing properties, including stability of the alloy in the molten state, good castability and low casting temperature.

The two alloys most commonly used are alloys 3 and 5:

	Zamak 3	Zamak 5
Alloying Elements		
Aluminium	3.8-4.3	3.8-4.3
Magnesium	0.035-0.06	0.04-0.06
Copper	—	0.75 -1.25

Impurities		
Iron (max)	0.02	0.03
Lead (max)	0.003	0.003
Cadmium (max)	0.003	0.003
Copper (max)	0.001	–
Nickel (max)	0.001	–
Tin (max)	0.001	0.001
Silicon (max)	0.002	–

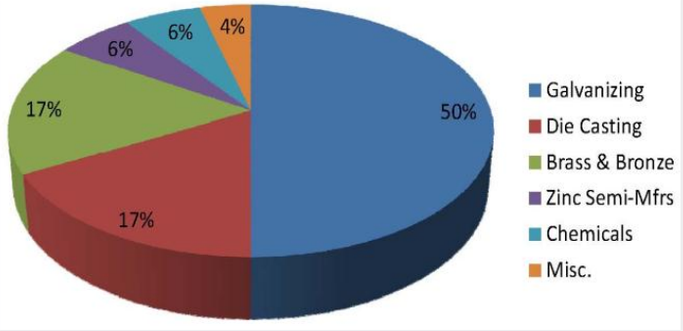
High fluidity Zinc Alloy

The latest to arrive on the scene is the new, high fluidity alloy, there is a tremendous opportunity for making zinc casting with thinnest walls of the order of 0.2 to 0.3 mm. The composition is as follows:

Aluminium	4.3 to 4.7%
Magnesium	0.005 to 0.012
Copper	0.035 max
Iron	0.03 max
Lead	0.003 max
Cadmium	0.002 max
Tin	0.001 max
Zinc	Balance

Uses of zinc die castings

Zinc die castings are used in a vast range of applications which together account for about two and half million tonnes of Zinc alloy per year (ie., 17% of the total zinc consumed globally). Zinc die castings are used in almost every industry. Applications include unstressed decorative parts, combined decorative/ functional parts, and functional/ structural parts which may be subjected to moderate continuous stresses, or high intermittent stresses and shock loads.



Automotive industry

In addition to familiar and visible parts such as carburettors, handles and grilles, zinc die castings are used for fuel injection pump bodies, brake parts, ignition/steering lock assemblies, steering damper bodies, energy-absorbing steering column parts, lever type shock absorber bodies, pistons for hydraulic systems, suspension levelling parts, wheel covers, body mouldings and seat belt mechanisms. Applications in the automotive service industry include high pressure grease guns, service station petrol pump mechanisms and petrol pump mechanical price computers.

Appliances

Uses include frames, housings, control panels, gears, gearboxes, pulleys, pumps, instrument parts, hinges, handles, electric motor housings and various mechanical parts in appliances ranging from food mixers to dishwashers.

Building industry

An enormous range of zinc die cast parts is used in door handles and fittings, door closers, locks, latches, catches, window pivots, handles and stays, switch housings, conduit fittings, light fittings, captive masonry nuts, brackets, and bathroom as well as plumbing fittings.

Leisure goods

Speaker frames, radio fascias and chassis parts, TV bezels, parts for cameras, projectors, fishing reels, sporting guns, gardening equipment, toys and a host of other sport and leisure products use large quantities of zinc die castings.

Business and data processing equipment

The duplicating machine by one well known manufacturer contained about 90 zinc die castings, ranging from large side frames to small levers and gears. In machines for office copying, postal franking, addressing, calculating and punched card systems, zinc die castings play essential roles both as complex high precision components and as simpler low-cost parts.

Defence

Zinc die castings are used in high-reliability items such as shell nose caps, complex fuse units, grenade bodies and fins, submarine detection devices, radio and radar equipment, and military vehicles.

Conclusion

A fast growing economy like India with likely huge investments in manufacturing, construction & infrastructure and increasing buying power by the customers presents a huge, unexploited potential for zinc die casting in non–automotive applications like builders hardware, bathroom fittings, electrical & electronic parts, heat sinks, toys, decorative items etc., in the coming years.

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Govt looking at policy response to contain steel imports

Government is looking at a comprehensive policy response as imposition of safeguard duty on steel imports has failed to contain the imports, a top official recently. Commerce Secretary Rita Teaotia said that recently the government imposed a 20 per cent safeguard duty on certain categories of steel but the the industry continues to feel "stressed" and the imports actually remains at the same level. "We have to look at it at a global context. What is the level of supply? What is the level at which people are actually willing to bring their prices down to have access to markets and what should be the instruments by which we will look to address this. So I think, we are going to looking at in a comprehensive policy response," she told reporters. She said things are being worked out to deal with the surge in imports. When asked what could be the options other than imposing duties, she said: "it is a work in progress". Safeguard duty is a WTO-compatible temporary measure that is brought in for a certain timeframe to avert any damage to a country's domestic industry from cheap imports. During the examination of applications of major steel producers like SAIL, Essar Steel and JSW Steel, the DG Safeguards had found "prima-facie increased imports (of certain kinds of steel) have caused or are threatening to cause serious injury to domestic producers..." Domestic steel producers had complained of a surge in imports of steel products like hot-rolled steel and other variants from China, Korea, Japan and Russia. In June, India had slapped anti-dumping duty of up to USD 316 per tonne on imports of certain steel products from three countries, including China, to protect domestic producers from below-cost inbound shipments. Industry is complaining that despite imposition of these duties, steel imports continue to rise from countries like China.

Source: www.indiatoday.com

Minimum import price on steel likely

The distressed domestic steel industry will get another layer of protection with the National Democratic Alliance government expected to notify a minimum import price (MIP) for steel products. Products under 14 categories would have different duties for base and special grades. The commerce department is likely to issue a notification for imposition of MIP, which would set the floor price, below which imports into the country would not be

PROPOSED MINIMUM IMPORT PRICE

Floor price ($ per tonne)

Category	Base grade	Special grade
Metallics	250	NA
Semi-finished product	400	460
Hot-rolled products	450	510
Hot-rolled universal/quarto plates	505	565
Cold-rolled	555	615
Coated flat steel	660	720
Colour-coated, pre-painted	760	NA
Cold-rolled non-grain oriented	915	NA
Steel pipes & tubes	515	580
Seamless tubes & pipes	775	925
Stainless steel tubes & pipes	2,417	3,404
Stainless steel ingots, other semi-finished products	2,117	3,104
Flat-rolled products	1,772-2,217	3,204-3,435
Bars, rods & sections of stainless steel	1,871	2,759

MIP will be before imposition of basic customs duty;
MIP not applicable when product used as input for exports

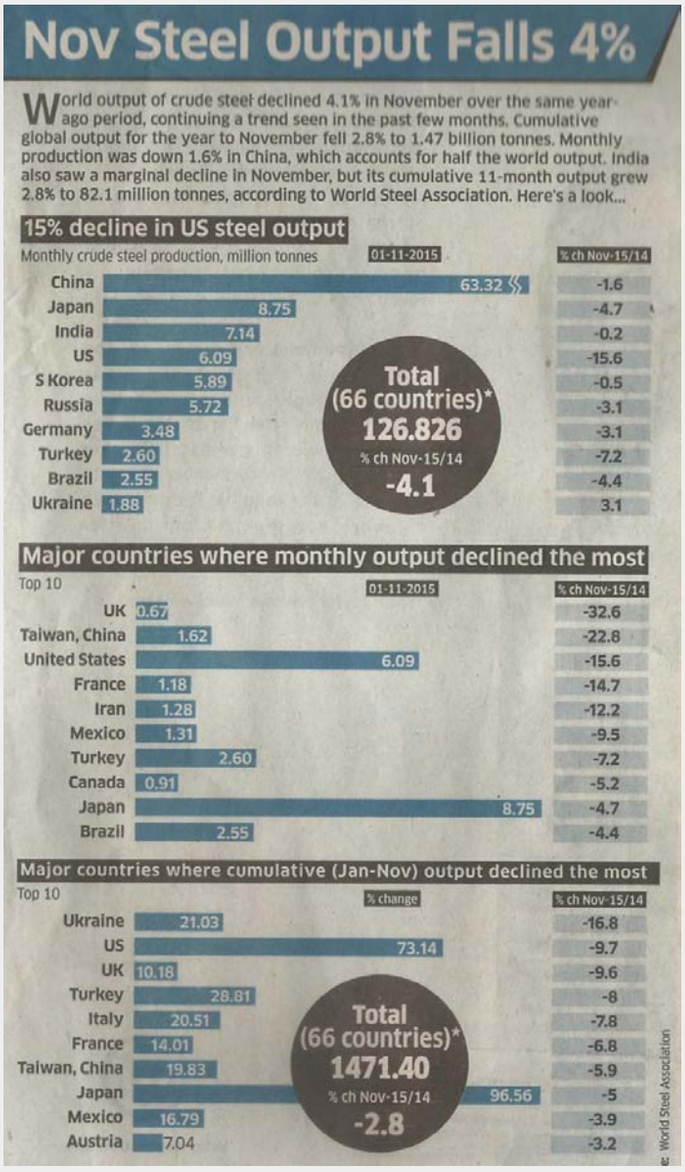
allowed. A person in the know said the commerce department had asked the steel ministry to reduce the number of items, so that the entire range is not covered. The government had earlier imposed a provisional safeguard duty of 20 per cent on hot-rolled coils. Recently, the steel ministry had sent a comprehensive list of 14 categories with around 40 products to the commerce and industry ministry. These included pig iron, heavy melting and shredded scrap, semi-finished products, quarto plates, cold-rolled coils, coated flat steel products, all kinds of steel pipes and tubes, flat-rolled products of stainless steel, bars and rods, among others. The government is likely to put in place a mechanism whereby if the free-on-board price at the point of origin according to major steel indices is lower than the invoiced one, the listed price would be considered for enforcing MIP.

The department of commerce would, however, exempt exporters of products from the MIP norm if imports were being used for manufacturing export products. To prevent misuse of this, the department is mulling a mandatory export obligation within six months, besides refund of actual value and MIP. Sections 3 and 5 of the Foreign Trade (Development & Regulation) Act and Section 11 of the Customs Act enable notification of such a threshold price. The MIP is defined as equivalent to the weighted average global price of a product and the non-injury price arrived at during the course of safeguard and anti-dumping proceedings, whichever is lower. Steel companies had accumulated losses of Rs 4,238 crore in the September quarter, against Rs 4,647 crore profit in the year-ago period. The Steel Authority of India made its highest-ever earnings before interest, taxes, depreciation and amortisation loss of Rs 3,900 crore for every tonne of steel produced in the second quarter this financial year. Besides, 145 steel and iron companies have accumulated debt of Rs 2.98 lakh crore and an unfavourable debt to equity ratio of 1.27, according to a report by CARE Ratings. A person close to the development said India was among the few countries where demand for steel products was rising but the companies were in losses. "Domestic demand is expected to rise by 7.3 per cent this year but industry is in downturn because of predatory pricing by Korean, Japanese and Chinese companies," he said. According to World Steel Association data, global steel demand this year is minus 1.7 per cent. In China, it is minus 3.5 per cent, South Korea is minus 1.3 per cent and Japan is minus 5.4 per cent. Till October this year, seven million tonnes (mt) of steel were imported against 5 mt in 2013-14. The imports are expected to reach 15 mt this year. "The rate and predatory pricing is worrying. The government wants to make the industry net importer of steel," said a senior official.

Source: Business Standard

China's steel industry battles for survival

As the iron ore price sinks into the $US30s, thousands of Chinese steel mills are engaging in a desperate battle just to stay alive. For the month of October, 101



members of the China Iron and Steel Association, the peak industry body representing large and medium-sized producers, made a staggering loss of 12.5 billion yuan, down 25 per cent from the year before. In their core steel business, these producers generated a loss of 14.8 billion yuan in the month, down 27.8 per cent from the previous year. Between January and October this year, they generated 38.6 billion yuan in losses. If you strip out their incomes from non-steel businesses, the loss would be 72 billion yuan. In order to get through the dark winter, Chinese steel mills are reportedly breeding pigs, opening kindergartens and providing plumbing services to improve their situation.

Out of 101 members of the association, 48 producers are in the red. The average profit level for the industry is -1.5 per cent. If this is not an industry in deep trouble, I don't know what is. The problem is the mounting gap between supply and demand. During the first 10 months of the year, the consumption of crude steel was 590 million tonnes, down 4.55 per cent from last year. During the same period, Chinese steel mills produced 675 million tonnes of steel. So the industry created 85 million tonne of excess supply. To put that into perspective, in 2014 the US produced 88.2 million of steel, Germany produced 42.9 million tonnes and Australia produced 4.6 million tonnes. The Chinese property sector, one of the most important consumers of steel, is still struggling despite a recovery in prices in large cities. The sector is dealing with excess inventory, and it will take years for developers to burn off the supply glut, especially in third and fourth-tier cities. As a result, the price for steel construction material has dropped 33.9 per cent this year.

Apart from the housing sector, many other consumers of steel -- such as the automobile, shipbuilding, machinery and whitegoods sectors -- are also facing strong headwinds. Orders at Chinese shipyards -- the country is now world's third largest shipbuilder -- have fallen 77 per cent in the first quarter from a year ago. Shen Wenrong, the chairman of Shagang Group, the country's largest private steel mill, said recently that he expects production in China to fall further amid subdued demand. "There is a good chance that the steel production in the country will drop by at least 10 per cent," he said. "Current production is about 830 million tonnes a year, and it will fall by 10 per cent within the next decade." He believes the country's steel production should be in a range of between 600 million and 700 million tonnes. "I think this level would be healthy. Even if it drops to 500 million tonnes, it is still healthy," he said. But even at a much-reduced level of production, Shen believes the price will remain depressed for a sustained period of time.

Source: www.businessspectator.com.au

Competitiveness, Cost and Productivity of Steel

Our and other related [McKinsey, Deloitte, WSA] industry analysis reveals that sustained profitability of an integrated steel complex requires a capital, product mix and operational infrastructure that should be able to yield a minimum operating margin/EBITDA of 17%. Similarly, for any brownfield expansion an EBITDA of 17% is required and for a green-field site the EBITDA requirement is higher at about 25%. This is the level at which capex cost, debt cost, equity cost and taxes can be recovered. Unfortunately, majority of the steel plants worldwide have net negative cash flows and have an EBITDA of an average of 10% or below. In India too, except for a few private sector integrated complexes, the operating margin currently hovers at around 10%. One of the reasons for this endemic nature of sub-par operating margin performance in the industry is due to the nature of the steel cost curve, which happens to be too flat. This means that the industry is characterized by intense price competition and unless an integrated plant sides down towards the lower end of the regional cost curve continuously, it will be hard for the firm to maintain its competitive position. Hence the product mix, capital, technology and the operational infrastructure should have the appropriate degree of design for flexibility built in, so that improvements, enhancements or rationalizations can be rapidly engendered in response to a changing business environment. Additionally, there is also a significant opportunity for improvement in operating margins in the existing plants through improved capacity utilizations, product rationalization, process optimization, operations improvement and debottlenecking. We think that the right design and operations improvement strategies can yield stellar results in the Indian steel industry and improve its competitiveness significantly.

Source: Metal News

Indian Steel Scenario

Although steel demand has been projected to improve fast in the NDA regime, there has not been any structural changes which will spur up demand. The winter months have begun and these are typically high production, high consumption months for the economy. There is hardly any new project that has been announced or has got financial closure. Both integrated steel plants as well as DRI-based industry have been under severe financial crisis due to sharp fall in steel prices.

The recent introduction of safe guard duty has partially helped steel plants producing H R coil. However Chinese steel suppliers have started offering CRFH material at prices which are lower than Indian cold roller's cost of production leading to their closure.

Major importers are now booking cold rolled (full hard) coils almost at the same price they were shipping in HR coils before the duty was levied. Before the duty was levied, hot rolled coils was the preferred import consignment. The current trend will not only hit large integrated steel producers, such as Tata Steel, Essar Steel, and Sail, that produce HR coils, but also the stand alone re-rollers who were producing CR coils. Cold rolled steel is the first value addition to hot rolled coils produced by steel companies.

Chinese colour coated steel makers are destroying Indian market. While the Indian domestic price line of various steel items has been impacted severely by flood of dirt cheap steel products, Indian colour coated steel market has been totally destroyed over past 2 years. The price gap between Indian and Chinese PPGI makers is so huge that Indian PPGI offers no competition.

India's INR 15,000 crore seamless pipe industry is staring at a spectre of large scale job cuts and plant shutdowns due to dumping by China at rock bottom prices in the Indian market as China is facing antidumping and safeguard duties from countries like the US, the European Union, Canada, Indonesia, Brazil and Mexico and is saddled with a large inventory due to subdued demand back home resulting in China's steel seamless pipe producers to export products to India at low prices Officials in the steel ministry said they were examining a proposal from the industry to extend safeguard duty on cold-rolled coils (CRC), galvanised products, wire rods and TOR steel. Taxes, Freight and the Cost of Capital Making Indian Steel Expensive World Steel Dynamics report has ranked India ahead of most countries, except those from the CIS in terms of the cost curve. According to WSD data for January2015, production cost for hot-rolled coils in India was USD 349 a tonne, compared with USD 428 in China, USD 429 in South Korea, USD 448 in Japan and the global average of USD 418. For CIS countries, the cost was USD 305 a tonne (all figures are ex-works). Add to it the taxes, freight and the cost of capital, and the picture is not really rosy for domestic steel makers, Indian companies claim. For hot rolled coils, the ex-plant price is about Rs 27,000 a tonne, while the cost to the consumer, which includes freight and taxes, is Rs 32,000 a tonne. Producers in countries such as China are taking advantage of this huge addition to dump their produce in the Indian market.

Mr. Sushim Banerjee, Director General of the INSDAG said "Our internal freight rate is two-three times higher compared to China. Capital costs, too, are high. Most Chinese mills are state owned and

Facts you NEVER wanted to know

- The strongest muscle in the body is the tongue
- The winter of 1932 was so cold that Niagra Falls froze completely solid
- Right-handed people live, on average, 9 years longer than left-handed people do
- A rhinoceros horn is made of compacted hair.
- Women blink nearly twice as much as men.
- China has more English speakers than the United States
- You share your birthday with at least 9 million other people in the world
- The pop you get when you crack your knuckles is actually a bubble of gas bursting
- Did you know that you are more likely to be killed by a champagne cork than by a poisonous spider?
- The venom in a Daddy Long-Legs spider is more poisonous than a Black Widow's or a Brown Recluse, but they cannot bite humans because their jaws won't open wide enough
- If the population of China walked past you in single file, the line would never end because of the rate of reproduction. (Assuming they could still do it standing up)

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avail of loans at one to two percent, compared to a market rate of 4.6 percent. Our market rate, on the other hand, is 10-12 percent," It is, therefore, unsurprising that China is selling at $80 a tonne below its marginal cost, as it can afford to take a hit. Japan and South Korea, on other hand, are selling at $150-160 below the domestic prices."

Steel imports have increased from China, Korea and Japan. After much lobbying, a safeguard duty has been imposed by the government on hot rolled coils. Also, through the past few months, there have been two rounds of import duty increase.

Source: Steel Tech

POSCO Named World's Most Competitive Steelmaker for 6th Year

Posco has been named the world's most competitive steelmaker in a global industry report for the sixth consecutive year. In an annual assessment of 36 steelmakers worldwide, global steel information service provider World Steel Dynamics gave POSCO the top mark of 7.91 points out of 10. The WSD report, which ranks the steelmakers based on 23 categories, gave top scores for POSCO in four segments, including technological innovation and human resources. POSCO said the company was highly recognized for its efforts to expand sales of high-end products and boost its competitiveness by carrying out technology-based solution marketing.

U.S.-based minimill Nucor Corp. came next, followed by Japan's Nippon Steel & Sumitomo Metal Corp. and Brazil's Gerdau. Hyundai Steel Co., an affiliate of the world's No. 5 auto conglomerate, Hyundai Motor Group, finished ninth in the rankings, the second time it has done so since last year.

Source: Steel Tech

Increase in Capacity Utilisation of Indian Steel Sector

As per the recent India Ratings and Research (Ind-Ra) report the capacity utilisation of Indian steel manufacturers is set to decline, as close to 12-14 million tonne of crude steel capacity will come on board by FYE16 with no significant hike in consumption demand. This would put further pressure on large steel producers in terms of end-product pricing and EBITDA/tonne.

The Indian steel industry is under stress with the credit metrics of steel producers deteriorating substantially from FY11 to FY15.

Ind-Ra opines that the credit metrics of its rated steel manufacturers would remain stressed in the near term, and the improvement in metrics to reach the levels of FY11, would require a significant increase in capacity utilisation and profitability. Ind-Ra estimates the EBITDA/tonne has to increase by 60%-70% by FY17 to allow the leverage profile of large steel producers to return to the FY11 levels.

Amid concerns of demand slowdown in China, steel mills have started curtailing their production too. On the other hand the supply of iron ore from Australia and Brazil have been robust. These two factors together have weighed heavily on iron ore prices and pulled down prices again below US$50/ tonne mark. In case of steel, it is sharper contraction in demand as against response by the suppliers. This is resulting into higher availability of steel in the market, which in turn is putting pressure on the prices. This is also resulting into higher exports from China and has been the biggest threat for global steel prices.

Low grade iron ore in demand

Indian iron ore miners resuming exports after a three-year hiatus face a radically altered market, but may find buyers for low-quality ore among loss-making Chinese steel mills bent on slashing costs. Vedanta Ltd, India's biggest private miner, shipped its first iron ore cargo of 88,000 tonne to China this month.

So overall, iron ore surging production from low-cost miners including BHP, Vale and Rio Tinto Group combined with weaker consumption in China to spur a glut. The top miners are betting that higher output will enable them to cut unit costs and raise market share while less efficient producers get squeezed.

Iron ore extended a slump below $50 a metric tonne, dropping to the lowest level since July, as BHP Billiton Ltd. forecast prices will probably extend their decline for years as output rises, while Vale SA reaffirmed plans to increase low-cost supply.

Source: MMR

Don't End Up Like Concrete All Mixed Up and Permanently Set

Change. Does this word scare or inspire you? "A living thing is distinguished from a dead thing by the multiplicity of the changes at any moment taking place in it." Change is evidence of life. It is impossible to grow without change. Those who cannot change their minds cannot change anything. The truth is, life is always at some turning point.

What people want is progress, if they can have it without change. Impossible! You must change and recognize that change is your greatest ally. The person who never changes his opinion, never corrects his mistakes. The fact is, the road to success is always under construction.

Yesterday's formula for success is often tomorrow's recipe for failure. The man who uses yesterday's methods in today's world probably won't be in business tomorrow. Consider what Thomas Watson, the founder of the IBM Corporation, said: "There is a world market for about 5 computers." Where would IBM be today if Mr. Watson had not been willing to change?

You cannot become what you are destined to be by remaining what you are. John Patterson said, "Only fools and dead men don't change their minds. Fools won't. Dead men can't." The same kind of thinking that has brought you to where you are today, will not necessarily take you where you want to go. Sante Boeve discovered this truth: "There are people whose watch stops at a certain hour and who remain permanently at that age."

Do not fear change; it is the unchangeable law of progress. Don't be a person whose mind is always open to new ideas, provided they are the same old ones. Defending your faults and errors only proves that you have no intention of quitting them. "There are people who not only strive to remain static themselves, but strive to keep everything else so… their position is almost laughably hopeless".

"It's the most unhappy people who most fear change." When patterns and tradition are broken, new opportunities come together. All progress is due to those who were not satisfied to let well enough alone. They weren't afraid to change. Change is not your enemy-it is your friend.

This is the nineteenth 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.

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Pricing Trends: Non-ferrous metals

Pricing trends of most of the base metals except Aluminium witnessed sharp connections in the last few months. Aluminium prices fell 7.3% during the month as its inventory level also decreased surprisingly by 4.4%. Other than aluminium prices of rest of the metals rose slightly during the month. A rise of 1.5%, was seen in lead, while marginal rise was noticed in zinc by 1% and copper by 0.8%. Marginal rise in USD index by 0.6% in October helped the prices to remain in range and stop the price fall for base metals. Inventory levels subsequently fell, sharp fall was seen in copper and lead by 17.3% and 9.7% respectively and slight fall of 2.9 in zinc.

Aluminium premiums increased after falling for last 2 months as US Midwest aluminium premium was up 5.4% at US$ 163/ tonne, while, on the other hand Japanese aluminium premiums fell by 5.2% to come in at 84/ tonne MoM.

Auction Bidding Process in Metal & Mineral Sector

After the success of coal block to start the bidding process for mines containing major minerals in an attempt to revive the sector affected by suspension of mining. The process will start soon with auction of around 70 mines. More blocks are to be put up for bidding depending on the success of the initial round…

The government is planning to auction up to 11 coal blocks in the fourth round of bidding which is likely to start shortly. Coal Secretary Anil Swarup said on the side-lines of a conference in Delhi…

Leading iron ore miners in Goa – Vedanta and Fomento Resources – will export around 2.20 lakh tonne (LT) of iron ore to steel plants in China and Japan soon. Vedanta was the first firm to resume iron ore mining in Goa and the company's iron ore division shipped its first consignment of 80,000 tonne recently to China…

Organisations like Niyamgiri Surakshya Samity (NSS), Lok Sangram Manch (LSM) and All India Kisan Mazdoor Sabha (AIKMS) have decided to restart organising people's movement against alleged attempt of Odisha government to revive proposal of bauxite mining in Niyamgiri hill range…

Aluminium major National Aluminium Company (Nalco) has moved closer in its bid to bag the Pottangi bauxite deposits with the Odisha government writing to the Union mines ministry to allocate the mines in favour of the central PSU…

Ground-breaking ceremony for the first manufacturing unit to be set up in Gopalpur Industrial Park Special Economic Zone (SEZ) project of Tata Steel in Ganjam district of Odisha was held in October…

The British steel industry is in full-scale crisis. Before they were pushed, the Government seemed unwilling to do anything practical about it. In the last few weeks, 2,220 employees in Redcar have lost their jobs, 3,000 on-site contractors have been laid off, and 6,000 further jobs will be lost in the local community…

A beaten-down stock coupled with perceived low appetite among foreign investors could force the government to trim the Coal India (CIL) offer for sale to 5% from 10% planned earlier and push the big-ticket disinvestment to the January-March quarter...

Valuation table for Emkay Metals & Mining universe

Company	M. Cap (Rs bn)	CMP (Rs) as on				P/E		P/B		EV/EBITDA	
		30-Sep-15	30-oct-15	Chg (%)	YoY Chg (%)	FY16E	FY17E	FY16E	FY17E	FY16E	FY17E
Coal India	2,020.6	328	320	(2.4)	(11.1)	11.8	10.5	4.4	3.8	7.7	6.2
GMDC	23.3	72	73	2.3	(51.6)	8.5	6.9	0.7	0.6	4.8	3.7
GPIL	2.4	73	74	1.4	(50.7)	26.0	2.6	0.3	0.2	5.9	3.9
Hindalco	173.6	71	84	18.7	(47.6)	11.1	11.2	0.4	0.4	7.2	7.0
HZL	664.0	140	157	12.4	(7.0)	8.1	7.7	1.4	1.2	4.0	3.3
JSW Steel	220.1	889	910	2.4	(27.0)	26.5	7.5	1.0	0.9	7.4	5.0
MOIL	35.8	197	213	8.0	(30.3)	9.0	7.6	1.0	0.9	1.3	0.4
NMDC	397.5	93	100	7.7	(40.4)	9.7	9.6	1.3	1.2	5.7	6.3

SAIL	220.3	51	53	3.9	(36.0)	-20.8	22.2	0.5	0.5	47.5	12.8
Vedanta Ltd.	296.3	85	100	18.0	(60.5)	11.9	6.5	0.5	0.5	5.7	5.0
Tata Steel	239.5	213	247	16.0	(48.0)	-117.8	15.3	0.7	0.7	8.1	6.6

Source: MMR

Challenges and opportunities for the aluminium industry

Indian aluminium industry has embarked upon implementing a number of greenfield projects to increase production of aluminium at a rapid pace besides creating enormous employment opportunities to fulfil the mission of our Prime Minister – "Make in India".

Apart from its potentially large growing market, India is endowed with large deposits of high quality bauxite ore, power (coal) and formidable pool of manpower. The industry is forging ahead with rapid expansion in both primary metal and downstream sectors. With the robust economic growth in the country and changing life styles, the stage is set for an exponential growth in aluminium consumption in India. All the end-use sectors, such as transportation, electrical, construction and packaging have witnessed aggressive growth, which makes aluminium's future even brighter.

Indian aluminium industry, with its investments of around Rs 1.2 – 1.5 lakh crore, and with this new expansions the employment (direct and indirect) is expected to increase substantially. The demand for the wonder metal – aluminium, in India is also growing at double digits and will reach 3.5 million tonne from current levels of 2.8 million tonne due to the emerging applications in transportation, aerospace, packaging, building & construction.

However, currently, the industry is facing numerous challenges. Similar to all other industries, the aluminium industry has also been hit by the global slowdown, due to continuous increase in input prices & interest rates, slowdown in demand, low & delayed realisation, shortage of inputs etc. These factors are causing threat to the sustainability and the very existence of the entire industry. Exports by Indian aluminium industry have been unviable due to high product cost as compared to other competitors in the global markets especially from China and Middle East smelters.

Challenges

- Falling LME prices
- Rising cost of production
- Raw material availability
- Increased imports

In the last 4 years ie since FY11 the imports have increased from 881kt in FY11 to 1563kt in FY15@ CAGR-15%. These imports in the upstream are from Middle East and downstream are from China.

Middle East and China have huge surpluses. China gets many incentives from government like power tariff discounts, export rebate (15% to foil and 13% to rolled producers), freight reduction while Middle has an advantage of low power cost. Both the countries have a focus on India due to close proximity and India is a natural market for them. Middle East has a capacity of 5.6 million tonne and surplus of 3.2 million tonne with another 0.85 million tonne being added in next 5 years. China also has a huge capacity in primary metal and a substantial surplus in downstream. The rolled product production surplus is 1 million tonne and is expected to increase to 2.1 million tonne by 2019. With the devaluation of RMB, the Chinese companies' competitiveness has improved further and India has to protect itself from the surge in imports from these 2 countries. China due to its export rebate policy is exporting foil and rolled products to India.

The government firmly believes that the growth of the aluminium value chain in India will not only benefit the incumbents, but also benefit the communities at large by generating additional jobs and the government by generating additional revenues through taxes, etc. Being an eco-friendly "green" and recyclable metal, aluminium will also help in conserving energy and our natural resources.

It is imperative on the part of Indian aluminium industry to ensure accelerated growth in production of primary metal and associated

downstream products so as to meet the principle challenges of aluminium industries. Aluminium usage and consumption in the country is very low as compared to global standard. Dependence on imported primary metal and scrap is not healthy for Indian aluminium industry to survive and grow, as global economic conditions as well as political reasons will affect such a situation as being dependent heavily on imports. Further, India having vast resources for production of primary metal should continue to produce more and more primary metal and be consumed within the country for critical application sectors such as defence, aerospace, automobiles etc., where primary metal is generally preferred to scrap.

Therefore, the desired accelerated growth of aluminium industry both in terms of production and consumption will be one of the key drivers of growth of the nation's economy. In order to accomplish this goal, it is critical that the industry and Government work together to draw up a strategy to ensure that the growth of aluminium industry is well guided.

Aluminium Association of India (AAI), the apex body representing entire spectrum of Indian aluminium industry in the country, having close rapport with various ministries, having always enjoyed the ministry's patronage, support and guidance in all activities, will help industry to approach appropriate ministry to remove obstacles coming in the way of growth of the aluminium industry especially in primary metal industry as well as downstream sector. Besides this, AAI is also closely collaborating with various overseas associations and it is imperative on the part of aluminium industries to take advantage of this close association for developing downstream industries on the state-of-the-art technologies. AAI will assist Indian aluminium industry in establishing close collaboration with aluminium industries through International Aluminium Associations. Services of AAI are available to the members for exchange of technical information and also transfer of technology through collaborative efforts, as AAI has already signed MoU with Aluminium Association of America.

Aluminium Association of India (AAI) help the growth of Indian Aluminium Industry

By disseminating vital information on technological developments and on various applications of aluminium, all of which are significant to India vide National & International Seminar / Workshop / Conference. By providing statistical / Techno-commercial information on aluminium to the members, Government etc. through print and electronic media. It also offers advice on technical problems, marketing issues. By forwarding large number of enquiries received from within country and abroad regarding various aluminium products.

Mission

To Promote utilization and growth of aluminium and its varied applications like building, packaging, transportation, power generation, aerospace, automobile, telecommunications, etc.

To Create a common forum for aluminium industry and its constituents to formulate common policies and strategies maintain close liaison with Government departments, project and further the interests of aluminium production and distribution, build awareness on health, environment, safety and energy.

To enhance the role of aluminium in the national economy as an eco-friendly metal of unique properties.

To disseminate knowledge on aluminium products, technologies, marketing, etc.

To interface between the aluminium industries, government and institutions of higher learning, to promote the cause of aluminium.

Source: MMR

India's silver import to set a new record this year

Silver imports are likely to set a new record this calendar year due to rapid change in consumer preferences from imitation jewellery and artifacts made of alternative materials to silver. Data compiled by the precious metals consultancy Smaulgld.com showed India's total silver import at

5,819 tonnes during the January-September period. On annualised basis, however, total silver import in 2015 is estimated at 7,759 tonnes - the highest ever India has imported in any calendar year so far, and a rise of 10 per cent from the previous year. During 2014 (calendar year), the total import of silver was recorded at 7,083 tonnes. Rising imports of silver indicate rapid change in consumer preferences over the past three years since its price started falling. Unlike in the past, consumers see a resale value in any form of silver purchase including jewellery, artifacts and investments products such as coins and bars. "As the trend shows from the volume of import between January and September, silver import in India will set a new record this year," said Mohit Kamboj, president of India Bullion and Jewellers Association (IBJA), on the sidelines of World Silver Council inauguration here. Under the aegis of IBJA, World Silver Council was launched to protect the interest of silver miners, importers, refiners, traders, jewellers and all other directly and indirectly linked with the white precious metal. Along with the World Silver Council, IBJA has also launched two other initiatives – First Step Foundation for fulfilling its corporate social responsibility and Skill Development Council to help enhance the skills of the workers. These initiatives were launched at the hands of Ram Nath Kovind, Governor of Bihar. Much of the silver demand in India is going for jewellery and artifact consumption as consumers see a resale value in silver. Falling prices have encouraged consumers to prefer silver ornaments to imitation jewellery and metal artifacts.

After a staggering 19.31 per cent decline in 2014, silver prices fell nearly eight per cent in 2015. This means, the downward cycle in commodities has made silver affordable for consumers with a price decline of over 26 per cent in the past two years to $14.32 an oz now from the level of $19.47 on January 1, 2014. Similar price decline was seen in local currency as well. Silver price in Zaveri Bazaar here is quoted at Rs 34,200 a kg now, a decline of 22 per cent from the level of Rs 43,800 a kg on January 1, 2014. "A large chunk of imported silver goes for retail consumption for jewellery and artifacts. The industry has witnessed a number of imitation jewellery consumers getting diverted towards silver ornaments due to falling prices. This does not mean the demand of imitation jewellery has completely evaporated. But, their average annual growth has declined in favour of silver jewellery," said Rahul Mehta, managing director, Silver Emporium, a silver jewellery and artifacts' manufacturer and retailer in Zaveri Bazaar.

As a consequence, there has been a rapid shift in silver consumption in the past 10 years. Global silver demand for industrial use has slumped to 54 per cent of global output in 2015 versus 69.4 per cent in 2005 and India is no exception. Similarly, demand from silverware / jewellery has risen to 25.4 per cent to 26.5 per cent and bars and coins from 5.2 per cent to 19.5 per cent. "The industry needs promotion of silver jewellery and artifacts; similar to the World Gold Council does for gold. Once World Silver Council starts promoting silver ornaments and other articles, India's silver demand and import would zoom further," said Mehta.

Source: Business Standard

New Metal Developed for Lighter, Fuel-Efficient Planes

Scientists including those of Indian-origin have developed a new super-strong structural metal which could be used to make lighter, fuel-efficient airplanes, cars and spacecraft. The new metal with extremely high specific strength and modulus, or stiffness-to-weight ratio, is composed of magnesium infused with a dense and even dispersal of ceramic silicon carbide nanoparticles. The researchers Suveen Mathaudhu and Sanjit Bhowmick found a new way to disperse and stabilise nanoparticles in molten metals and also developed a scalable manufacturing method. Nanoparticles could enhance the strength of metals without damaging their plasticity, especially light metals like magnesium, said the principal investigator Xiaochun. Structural metals are load-bearing metals, used in buildings and vehicles. Magnesium, at just two-thirds the density of aluminium, is the lightest structural metal. The technique of infusing a large number of silicon carbide particles smaller than 100 nanometres into magnesium added significant strength, plasticity and durability under high temperatures .

Source: The Times of India

Coal price slump to continue

Global oversupply and subdued demand in the wake of Chinese cutbacks & rupee slump, say observers.

India-bound imported coal prices fell 30 percent in 2015 and are expected to slide more.

Plats, the global observer of energy prices and trends, says their daily spot price assessment (CFR West Coast India 5,500 kcal/kg) for thermal coal, on January 1, 2015, was $67.35 tonne and $46.85 a tonne two days prior to 1st January 2015.

Gareth Carpenter, Platts' editorial director, coal says the fall has been "mainly due to surplus supply in the global seaborne market, slowing growth in emerging economies, a bleak macro-economic backdrop and local demand for dollar-denominated coal somewhat restricted by the weaker rupee".

The rupee continues to slide, being not far from an all-time low against the dollar. Historically, this has impacted short-term buying trends in the sector. Stocks at power plants are also at high levels and, hence, rising cost due to lower currency will impact the stocking demand. As of end-September, the stock at power houses was a combined 26 million tonnes or 22 days' stock. It was 8.6 mt or five days stock on end-September, 2014. The reasons are higher production from Coal India, diversion of e-auction coal to the power sector and tepid demand from utilities.

However, in the long term, there are reasons to expect at least a consolidation of Indian thermal coal prices," said Carpenter. The Indian market remains a harbinger of demand-side hope for imported coal from Indonesia, South Africa, amid the fallout from China's economic slow-down.

Platts Analytics forecasts a 48 percent increase in coal capacity buildout by the end of 2018 and due to an expected reversal of the decline in load factor in the medium term, average Indian consumption is likely to go up significantly. Coal India produces 81 percent of all Indian output and says they produced 494.2 mt in 2014-15. In 2015-16, it aims at 550 mt.

Platts believes, "Assuming Coal India meets its production targets, Indian private sector production growth still needs to average 32 percent a year if India is to cut its coal imports to 100 mt by FY18/19. This is unlikely, despite the reforms in the mining sector." The government estimates import in 2015-16 of 210 mt.

Says Andrew Leyland, director, metals & mining consulting, Wood Mackenzie, "While coal consumption will continue to grow, China's not going to need to take increasing tonnages from the seaborne market. India will be taking centre-stage when it comes to balancing supply and demand in thermal coal and the outlook will be driven by growth here."

It is similarly so with coking coal. The steel industry, the major consumer, is passing through a bad phase. Coking coal prices hit a 11-year low in 2015, $75/mt FOB Australia for the benchmark premium Low Vol FOB Australia. Spot prices have dropped 32 percent since the beginning of 2015, due to rapidly declining Chinese demand in an oversupplied market. China, which was the world's largest spot buyer for met coal, saw its imported met coal volumes shrink 24 percent year-on-year, after annualising for January-October's import volumes.

Edwin Yeo, Platts' managing editor, coking coal, says: "In terms of recovery, most sources indicated that it would be important to tide through the next few years as the commodities market appears to be experiencing a downturn. Participants were hoping India could grow fast enough to fill the vacuum left by a slowing China, though they were also sceptical as to whether it will manage to raise steel production amid an onslaught of competitively priced Chinese exports."

Source: Business Standard

Solar power's moment of reckoning arrives

Ever since Sun Edison of the United States bagged the 500 Mw Ghani Solar Park project in Andhra Pradesh by quoting a tariff of Rs 4.63 a unit in November 2015, it is widely believed that solar energy is ready to take off in India. To put it in perspective, the first auction under the National Solar Mission in December 2010 for 150 MW

witnessed bids of as high as Rs 12.76 a unit, though it was ultimately auctioned at Rs 12.16 a unit.

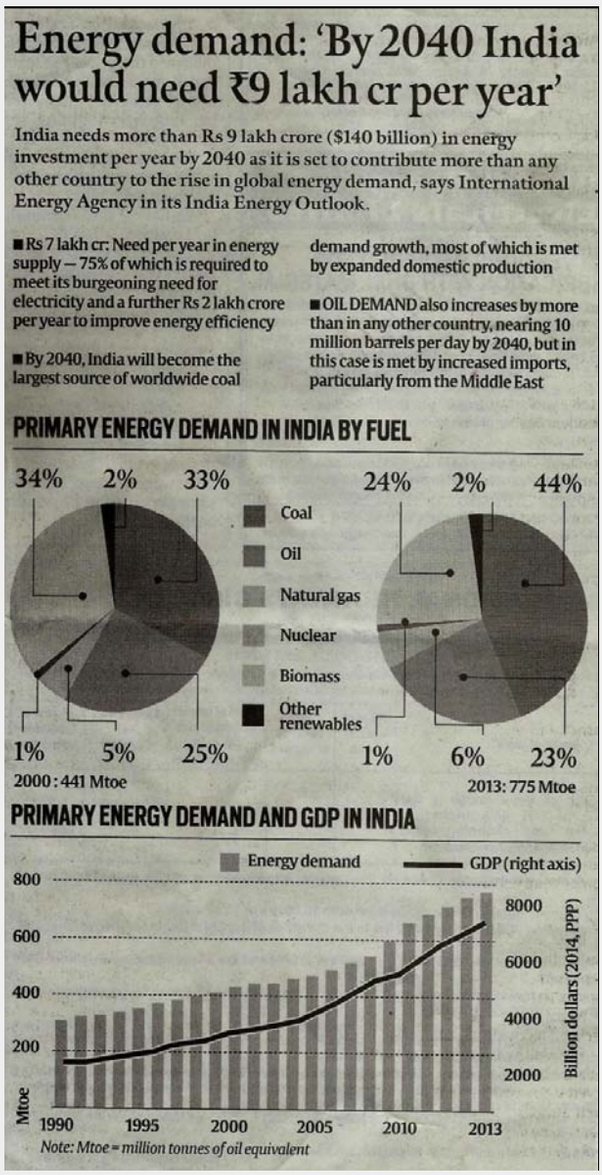
The union minister for new and renewable energy, Piyush Goyal, expressed his delight that "solar tariffs have broken the Rs 5 per unit level" in a tweet. At the conference on solar energy organised by Inersolar India in Mumbai a few days ago, this had fired the imagination of the participants.

PRICING SOLAR POWER

	Capacity (MW)	Tariff per unit (₹)
2010	150	12.16
2011	350	8.79
2012	235	7.00
2013	981	7.00
2014	1,600	7.00
2015	3,900	4.63

Speaker after speaker waxed eloquent on the reasons for the fall and the consequences. KPMG in a recent report says that solar power prices are now within 15 per cent of thermal power, and by 2020, the prices will be approximately 10 per cent lower. Rooftop solar power is already competitive compared to grid power for many consumers, and could be cheaper for a large section of the consumers by 2022. A "solar house" that is self-sufficient in energy could be a reality within the coming decade. "Solar energy is at an early stage both on the panel side and on balance of plant, and will see continued cost reduction for a while," says PwC Partner Kameswara Rao. KPMG Partner and Head (energy and natural resources) Manish Aggarwal estimates that solar tariff will settle at Rs 4.20 a unit by 2020, and thermal power generators may have to respond by reducing their costs.

According to Jayant Deo, a former member of the Maharashtra Electricity Regulatory Commission, the price of solar electricity has reduced to one-



fourth in the last five years because costs have tumbled worldwide. It is estimated that by the end of 2017, there will be grid parity in 80 per cent of the world. "The fall is due to the shift of solar cell production to Asia which has lower costs. It is also because of the improved efficiency of the cells and the reduced weight of the materials used," he says.With greater adoption, production of solar equipment has reached a virtuous cycle: falling prices lead to more purchase, which in turn generates further economies of scale.

Favourable regulation

The fall in solar tariff also needs to be seen in the context of the regulatory changes proposed by the government. It has initiated an exercise to

amend the National Tariff Policy of 2006 in order to give a boost to solar and other renewable power projects. According to the proposed amendment, while putting up a thermal plant, it will be mandatory to establish renewable energy capacity equivalent to 10 per cent of the thermal capacity. This has been proposed in order to balance the environmental impact of coal-based projects. The power generated from renewable energy projects will be bundled together with thermal power for tariff determination and onward sale. Moreover, the solar power purchased under the renewable power obligation is proposed to be increased to 8 per cent by 2019 from 3 per cent at present. Charges for inter-state transmission of renewable power will be waived.

Deloitte Touche Tohmatsu India Partner Debasish Mishra says: "Given the fact that the last auction had most of the leading players bidding less than Rs 5 per unit, it looks like a trend which is here to stay." According to him, the Narendra Modi-led government's target of 100 gigawatts of solar capacity by 2022 looks increasingly realistic with falling solar tariffs made possible by tremendous investor interest - both domestic and international. If the UDAY scheme (Ujjwal Discom Assurance Yojana) for distribution reform succeeds as planned by the government, one of the biggest impediments towards achieving these solar targets would be out of the way, Mishra adds. The success of this scheme is crucial for the power sector. All talk of more capacity is useless unless power can be evacuated efficiently.

Easier money

One of the issues that have plagued solar power for long is the lack of funding. That problem got resolved to an extent when the Reserve Bank of India recently included renewable energy within priority sector lending for a loan of up to Rs 15 crore per project. Tarun Kapoor, a joint secretary in the ministry of new and renewable energy, says: "The cost of money was quite high about five years ago when banks were reluctant to lend to the sector. That problem is not there today. Bankers have started understanding the sector. Money is available, but it is expensive; so getting money at the right price is the main challenge."

Following the Renewable Energy-Invest conference in February, the ministry had asked banks to give green commitments and it did get those from several banks. "We constantly talk to the banks to convince and motivate them. The good thing is that the message has come from the prime minister and finance minister, and there was some mention also in the Budget speech. Banks are becoming positive,'' says Kapoor. To help matters further, the government has allowed tax-free bonds specifically for renewable energy. Rural Electrification Corporation, Power Finance Corporation, Indian Renewable Energy Development Agency and NTPC have already raised money through green bonds. However, Tata International head (solar) Anjan Ghosh says finance is still an issue as banks are demanding the securitization of revenue streams.

German bank KfW has recently sanctioned €1billion for the solar capacity addition between 2015 and 2020. This is in addition to the €1.3 billion that KfW has already provided for the "green corridor" project. However, Claudia Arce, South Asia head of KfW, strongly emphasizes the need for India to address the issue of quality installations and take the distribution companies on board.

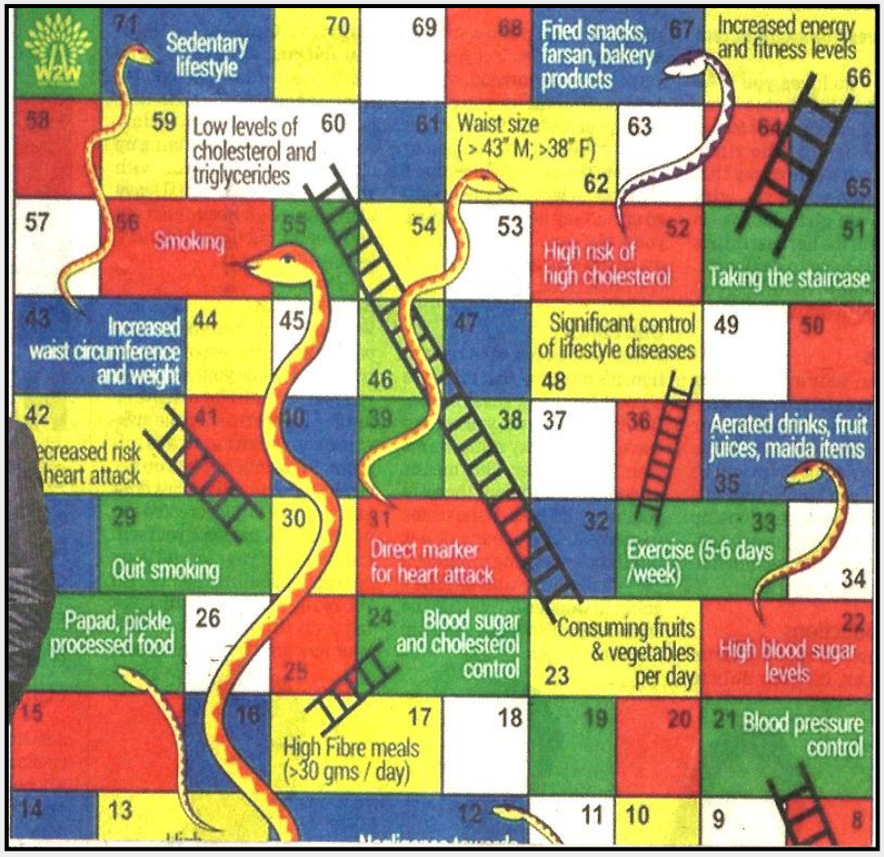
Source: Business Standard

Make in India Initiatives

The 'Make in India' initiative was launched on September 25, 2014. It is aimed at making India a global manufacturing hub and create millions of jobs. Under the programme, the Government has identified 25 key sectors in which India has the potential of becoming a world leader. Necessary steps have been announced to improve ease of doing business in the country and relax FDI norms in several sectors.

Thrust sectors include automobiles, chemicals, IT, pharma, textiles, ports, aviation, leather Tourism and hospitality, wellness, and railways are others. The documents will provide growth drivers, investment opportunities, sector-specific FDI, other policies & related agencies. While most sectors need central Government clearance for FDI, the crucial tourism sector has been happily clubbed in the 'automatic investment' category. India has vastly under-used tourism potential, even though the country offers one of the most geographically diverse holiday options – the world's highest and

longest mountain range of the Himalayas, a 7,517 km (4,671 mi) long coastline filled with seaside resorts and secluded beaches, the Ganges and coastal rivers, tropical and alpine forests, adventure sport hubs and ancient cities, including 30 World Heritage sites. Tourism in India, particularly domestic tourism, could see unprecedented growth thanks to a historic Indian governmental decision recently to open investment in railway infrastructure to 100% FDI under the 'Automatic' route.



A key 'Make in India' project is the Delhi-Mumbai Industrial Corridor (DMIC), with the 1,483 km long, high-capacity Dedicated Railway Freight Corridor (DFC) as is its backbone. The project aims to develop 24 new manufacturing cities along the Delhi-Mumbai Industrial Corridor, with each city given high quality infrastructure – improved power and water supplies, efficient public transport and waste management systems.

With a year 2019 deadline, the first phase has seven cities being developed two in Maharashtra and one each in the states of Rajasthan, Uttar Pradesh, Haryana, Madhya Pradesh and Gujarat. The DMIC project, with the government of Japan as its partner, feeds significant nourishment to a geographically crucial sector of India's economy. The DMIC states of Maharashtra, Rajasthan, Uttar Pradesh, Haryana, Madhya Pradesh and Gujarat contribute 43% of India's GDP, over 40% of industries and industrial workers, and over 50% of India's industrial output and exports. The new DMIC cities are expected to cope with increased pressures of urbanization, and lead India's economic growth across the next two decades.

Japan features prominently in India's new development and investment drive, such as the Investor Facilitation Cell of Invest India, a crucial liaison component in the 'Make in India' initiative. Invest India is also a part of the Japan Plus initiative created to deepen economic ties between India and Japan, and to fast-track investment proposals between two of Asia's largest economies. Recently, Japan has announced $15 billion low interest loan to India for a bullet train from Mumbai to Ahmadabad.

The Indian Railways, the world's eighth largest employer with 1.4 million people in its payroll, now estimates a record $120 billion investment in the next five years for upgrading and expanding its network. Four hundred railway stations across India are due for an elaborate upgrade, through a transparent e-bidding process.

Foreign direct investment (FDI) into the country has witnessed a 31 percent increase during April-June period of this fiscal. First seven months of the landmark 'Make in India' initiative saw Foreign Direct Investment (FDI) soaring by 48% as per the report from Ministry of Commerce and Industry. Foreign Institutional Investors (FIIs) channelled a record $40.92 billion into India from October 2014 to April 2015, an unprecedented 717% FDI upsurge in the year-on-year period.

India's Commerce Ministry said the record FDI upsurge indicated growing trust of global investors

in the country's economy, and in latest reforms to cut red tape. "A number of regulations and procedures were either done away with or eased," said a Government of India update. Foreign investors have now shown unprecedented interest for investment in the manufacturing sector.

Source: Steel Tech

How to Make 'Make in India'

Rising up the rungs of the World Bank's Ease of Doing Business Index is not the be-all and end-all of making India a manufacturing powerhouse, never mind the government's fixation on this ranking.

There are two other key pre-requisites. One, India has to support innovation and the creation of intellectual property at multiple levels: of policy, import duty, financial outlays and legal support. Two, Indian entrepreneurs must show ambition to operate on global scales of quality and quantity.

Create Intellectual Property

Indian companies routinely claim large tax concessions for alleged expenditure on R&D. But going by actual outcomes, in terms of creation of intellectual property that global companies want to license, all Indian R&D might well be called alchemy, the quaint quest to convert base metal into gold.

This must change. It is welcome the government proposes to reduce the tax break for R&D to 100%. This must be supplemented with subsidy to the extent of 100% for valid research, whether in-house, contracted out to specialized labs or university departments. Subsidies are scrutinized and audited far better than tax exemptions.

India's import duties are inefficient, often 'inverted', meaning, the duty on components is higher than that on the finished product – it is cheaper to import the final product than to assemble it locally using imported components. Inversion of this inversion, however, will not help. A higher tax on the finished good than on components will certainly encourage import of components and local assembly. But the resultant value addition would be make-believe, not made in India, the product of the duty differential.

Take phone components, with zero import duty and zero countervailing duty (CVD). The phone itself has a 12% CVD, alongside zero import duty. So Indian brands import semi-knocked down kits

from China at zero duty, add negligible value and sell at a mark-up while pocketing a fat excise duty concession.

Indian brands doing such sham value addition in India do not pay royalty on the patented technologies incorporated in the phones they sell, because these are actually manufactured in China, and come to India after having paid royalty and bearing the cost of royalty in their pricing. So the tax on the royalty payments for crucial technologies that go into the phones sold by Indian brands accrues to the government of China. If actual manufacture were to take place in India, royalty payments would be made from India and India would get the withholding tax.

To avoid both killing domestic production with inverted duties as well as spurious local value addition that reaps duty differentials, and to promote true manufacture in India, which takes advantage of proximity to India's huge market and low wage costs, import duty has to be the exact self-same rate on all imports, whether raw material, component or finished good, each of which will enjoy that rate of real effective protection. And this rate should be kept low.

The value addition that comes up on the basis of such a duty structure will be the real thing, not trading profits masquerading as make-in-India. And it would spare the Indian consumer the burden of high prices.

Build Judicial Capacity

To develop innovation, R&D is not enough. The legal system must support it, by protecting the transient monopoly for the creator granted via intellectual property. In the case of fast-changing technology, there is probably a case for sharply lowering the patent period from the 20 years of the pharma world, but this has to be done via global consultation. But for Indian companies to be in a position to license technologies and claim royalty, they will have to begin by licensing others' technologies, building them into their products, paying royalty for the privilege, and learn to improve on these on their own.

India's jurisprudence will have to evolve, to value patents. This can be tricky when the royalty is for one component of a multi-component gadget. Sometimes, it would be wrong to limit the base value of the component itself, as when that component alters the capability of the entire gadget itself. In other cases, using the entire product as the base value on which the royalty rate has to be applied would be grossly unfair.

US jurisprudence has arrived at a principle: the royalty should be applied on the smallest saleable patent-practising unit. But that patent-practising is crucial. To what extent a patent's deployment enhances the value of the product is a function of economics and technology, and has to be articulated by a judge. Creating the capacity in lawyers and judges to make this calculus is as vital to Make in India as having gung-ho entrepreneurs for whom slaying giants is adult business rather than childhood tales.

Source: The Economic Times

Future Dynamics of World Economy

Governments, businesses, and economists have all been caught off guard by the geopolitical shifts that happened with the crash of oil prices and the slowdown of China's economy. Most believe that the price of oil will recover and that China will continue its rise. They are mistaken. Instead of worrying about the rise of China, we need to fear its fall; and while oil prices may oscillate over the next four or five years, the fossil-fuel industry is headed the way of the dinosaur. The global balance of power will shift as a result.

LED light bulbs, improved heating and cooling systems, and software systems in automobiles have gradually been increasing fuel efficiency over the past decades. But the big shock to the energy industry came with fracking, a new set of techniques and technologies for extracting more hydrocarbons from the ground. Though there are concerns about environmental damage, these increased the outputs of oil and gas, caused the usurpation of old-line coal-fired power plants, and dramatically reduced America's dependence on foreign oil.

The next shock will come from clean energy. Solar and wind are now advancing on exponential curves. Every two years, for example, solar

installation rates are doubling, and photovoltaic-module costs are falling by about 20 percent. Even without the subsidies that governments are phasing out, present costs of solar installations will, by 2022, halve, reducing returns on investments in homes, nationwide, to less than four years. By 2030, solar power will be able to provide 100 percent of today's energy needs; by 2035, it will seem almost free — just as cell-phone calls are today.

This seems hard to believe, given that solar production provides less than one percent of the Earth's energy needs today. But this is how exponential technologies advance. They double in performance every year or two and their prices fall. Given that California already generates more than 5 percent of its electricity from utility-scale solar, it is not hard to fathom what the impact of another few doublings would be: the imminent extinction of the fossil-fuel industry. Exponential technologies are deceptive because they move very slowly at first, but one percent becomes two percent, which becomes four, eight, and sixteen; you get the idea. As futurist Ray Kurzweil says, when an exponential technology is at one percent, you are halfway to 100 percent, and that is where solar and wind energies are now.

Anyone tracking the exponential growth of fracking and the gradual advances that were being made in conservation and fuel efficiency should have been able to predict, years ago, that by 2015, the price of oil would drop dramatically. It wasn't surprising that relatively small changes in supply and demand caused massive disruptions to global oil prices; that is how markets work. They cause commodities futures and stock prices to fall dramatically when slowdowns occur. This is what is happening to China's markets also. The growth of China's largest industry, manufacturing, has stalled, causing ripple effects throughout China's economy.

For decades, manufacturing was flooding into China from the U.S. and Europe and fueling its growth. And then a combination of rising labor and shipping costs and automation began to change the economics of China manufacturing. Now, robots are about to tip the balance further.

Foxconn had announced in August 2011 that it would replace one million workers with robots. This didn't occur, because the robots then couldn't work alongside human workers to do sophisticated circuit board assembly. But a newer generation of robots such as ABB's Yumi and Rethink Robotics' Sawyer can do that. They are dextrous enough to thread a needle and cost as much as a car does.

China is aware of the advances in robotics and plans to take the lead in replacing humans with robots. Guangdong province is constructing the world's first "zero-labor factor," with 1,000 robots which do the jobs of 2,000 humans. It sees this as a solution to increasing labor costs.

The problem for China is that its robots are no more productive than their counterparts in the West are. They all work 24×7 without complaining or joining labor unions. They cost the same and consume the same amount of energy. Given the long shipping times and high transportation costs it no longer makes sense to send raw materials across the oceans to China to have them assembled into finished goods and shipped to the West. Manufacturing can once again become a local industry.

It will take many years for Western companies to learn the intricacies of robotic manufacturing, build automated factories, train workers, and deal with the logistical challenges of supply chains being in China. But these are surmountable problems. What is now a trickle of manufacturing returning to the West will, within five to seven years, become a flood.

After this, another technology revolution will begin: digital manufacturing.

In conventional manufacturing, parts are produced by humans using power-driven machine tools, such as saws, lathes, milling machines, and drill presses, to physically remove material to obtain the shape desired. In digital manufacturing, parts are produced by melting successive layers of materials based on 3D models — adding materials rather than subtracting them. The "3D printers" that produce these use powered metal, droplets of plastic, and other materials — much like the toner cartridges that go into laser printers. 3D printers can already create physical mechanical devices, medical implants, jewellery,

and even clothing. But these are slow, messy, and cumbersome — much like the first generations of inkjet printers were. This will change.

In the early 2020s we will have elegant low-priced printers for our homes that can print toys and household goods. Businesses will use 3D printers to do small-scale production of previously labour-intensive crafts and goods. Late in the next decade, we will be 3D-printing buildings and electronics. These will eventually be as fast as today's laser printers are. And don't be surprised if by 2030, the industrial robots go on strike, waving placards saying "stop the 3D printers: they are taking our jobs away."

The geopolitical implications of these changes are exciting and worrisome. America will reinvent itself just as does every 30-40 years; it is, after all, leading the technology boom. And as we are already witnessing, Russia and China will stir up regional unrest to distract their restive populations; oil producers such as Venezuela will go bankrupt; the Middle East will become a cauldron of instability. Countries that have invested in educating their populations, built strong consumer economies, and have democratic institutions that can deal with social change will benefit — because their people will have had their basic needs met and can figure out how to take advantage of the advances in technology.

Extracted by Mr. Raj Tiwari, Former Chairman, IIM DC
from the article on Future of World Economy
by Mr. Vivek Wadhwa of Stanford, USA

Why Dollar Rate Pinches?

Q. Our imports are from all over the world. So, why does the dollar exchange rate matter so much?

A. Although the share of goods from the US in India's import basket was less than 5% last year, the dollar is the dominant currency in international trade and most of India's trade with other parts of the globe is also denominated in dollars. Foreign investment flows, whether foreign direct investment (FDI) or foreign institutional investment (FII), are also largely in dollars. The exchange rate for most currencies in India is linked to the dollar-rupee rate.

Q. How is the exchange rate determined?

A. The exchange rate of any currency is really its price in another currency. Like the price of any product in the market, the exchange rate is determined by the demand for and supply of each currency. Say, if there is more supply of dollars in India than its demand, the rupee will become stronger vis-à-vis the US currency. In the current situation, the demand for dollars is out-stripping their supply for several reasons. These include the fact that our imports are much higher than exports and that FIIs have been pulling money out of Indian markets.

Q. How does the market for dollars work?

A. Over 90% of the trade in the forex market is between banks. Banks maintain their dollar stocks in a foreign bank or with their overseas branches. When anyone approaches a bank to either buy or sell dollars, the bank quotes a price. The price at which the bank buys

a currency will always be lower than the selling price, as is the case with a trader in any other commodity. It determines these prices based on its assessment of how much the market will bear. Of course, what the competitors are offering is also a factor. The bulk of transactions in the currency market involve the same set of traders buying and selling. For instance, in April, the daily inter-bank volumes in the spot forex market ranged between $8 billion and $10 billion. Of this, only around $2 billion was on account of merchant trade. Global currency trading (across countries) is estimated at $4-5 trillion (around Rs 340 lakh crore) a day.

Q. How does trading take place?

A. Like most modern financial markets, the dollar is traded electronically. Earlier, banks in India used a closed electronic dealing system where they offered two-way or buy-sell quotes on the currency. Just as stock brokers quote a price for a stock, dealers quote a price for a currency pair such ad dollar-rupee.

Q. So, how does a manufacturer plan given the fluctuating rates?

A. There are a variety of ways in which companies can 'fix' their exchange rate. They can enter into a forward contract with a bank which agrees to sell or buy dollars in future at a predetermined rate. (For instance, Company A may enter into a contract with Bank B that it will buy $1 million on December 1 at, say, Rs 65) They can buy currency options in the derivatives segment of the stock exchange. Forwards and futures are nothing but hedging tools, which help companies minimise their currency risks. Of course, it also means that any possible gains from rates moving in their favour in the spot market have to be foregone. In the above example, if the rupee appreciates to 60 to a dollar, the company would miss out on the favourable exchange rate.

Q. What are non-deliverable / forwards?

A. Investors in emerging markets such as India want to hedge against currency risks outside the country. This is out of fear that the government may place capital controls as happened in Mexico in 1982. In the NDF, investors who bet on rupee futures will get the equivalent amount in dollars on the due date, say, a month or three months later. The NDF market is seen to have greater depth than the futures contracts offered on Indian stock exchanges as large foreign banks trade abroad. Since these markets exist in places such as Singapore, Indian regulators have no control over them. With Indian companies venturing abroad, the scale of the NDF market has now grown.

Q. How does the RBI intervene?

A. In recent years, RBI intervention has largely been through public sector banks. The central bank offers dollars to state-owned banks at a price it fixes and these are then sold in the foreign exchange market to prevent a steep climb of the US currency. Alternatively, when the rupee is appreciating, public sector banks buy up dollars from the market.

Q. Why is the rupee falling so sharply?

A. Markets anticipate events and take positions accordingly. The fear of oil price spike due to a possible US-led attack on Syria, has made investors nervous about the impact on countries such as India. The rupee, which was already under pressure, due to a weakening economic situation and global factors, was amongst the worst hit on Wednesday.

Q. Is it not possible to curb speculation?

A. RBI has put restrictions on banks and on exporters and importers on trading in dollars. It has barred them from buying dollars in anticipation of future demand. But, exporters can still speculate by putting off bringing their earnings home, in anticipation of a further weakening of the rupee. Similarly, importers can pay early to avoid spending more rupees to buy the same amount of dollars later. Also, the size of the unregulated non-deliverable forward market has grown and is now around 70% of the size of the domestic market, compared to 20% a decade ago.

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