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Ace Graphics

Administrative Office

1, Alpha, M. G. Road, Vile Parle (E), Mumbai - 400 057. India **Tel. :** 91-22-2619 2376, 2617 1575 / 2617 1866

Email :

info@metalworld.co.in Editorial : editorial@metalworld.co.in Marketing : marketing@metalworld.co.in Website : www.metalworld.co.in

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D. A. Chandekar Editor

Dear Readers,

he metal demand in the country seems to be increasing steadily thanks to the user sectors like infra, construction and auto. The first sign of recovery was visible in September when auto sales showed sizable improvement. Many thought it was accumulated demand as there was almost nil sale during the first few months of lockdown. When the positive trend continued in subsequent months, still it was stamped as festive spike. Now that this upward trend is still continuing, experts are believing it to be a sustainable growth. Let us hope this continues and 2021 be a better year for iron & steel sector in the country.

As mentioned in my last month's column, after the pandemic, there is a greater need for the industry to be competitive in the global marketplace and for that it must adopt smart manufacturing processes and techniques. Many

Editorial Desk



companies in the manufacturing sector have started looking at Industry 4.0 solutions for increasing the productivity, efficiency and competitiveness of the enterprise. The deadly pandemic has also taught us to care more for the mother earth and thus the metals sector needs to develop environment friendly production and processing technologies creating minimum waste and controlling emission of harmful gases. The problem in developing such green processes is that they are costlier than the prevailing process. It is a big challenge to make them commercially viable so that the industry adopts them for regular use.

The good news is that IMF has recently released its projection estimation of GDP growth rates of various nations and large economies. It says India's GDP growth rate will be around 11.5 % in the fiscal 2021-22 which is definitely very much heartening. One thing we have to understand that this 11.5 % growth is against the depressed performance of Indian economy in 2020-21. In any case, we are witnessing the signs of economy's revival all around and look forward to some exciting period in the coming fiscal.

The covid period has not only changed the working and thinking of corporations but it has also changed the mindset and the priorities of the society. My gut feeling is that this will have a gradual but definite effect on metals demand profile. Let us remain alert and keep watching how the situation unfolds in coming months !

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Indian foundries urge govt to minimize import duty on pig iron and scrap

"The higher input cost has an adverse impact on the USD 3-billion Indian foundry exports which makes units uncompetitive in the international markets. Hence, we are demanding the reduction of import duty for pig iron and other raw materials", Vijay S Beriwal, Hon. President, The Institute of Indian Foundrymen

My Best wishes to Metalworld Team for progressive year 2021.'Metalworld' magazine has contributed greatly to enhance the knowledge of Foundryworld since the last two decades by disseminating technical and commercial updates, market trends, details of upcoming events and many more.It's a privilege for me to share my views in connection with the foundry industry in your annual issue.

n the occasion of Metalworld Annual issue, D. A. Chandekar, Editor& CEO had an exclusive interaction with Vijay Beriwal, Hon. President, The Institute of Indian Foundrymen (IIF) to get more insights on Indian Foundry Industry, IIF initiatives for the growth of Indian Foundry Industry etc. Vijay Beriwal also spoked about the foundry industry seeking measure from upcoming Union Budget 2021-22 to minimise the impact of rising input cost.

How is the present situation inthe Indian foundry especially after covid-19 ?

The present situation in the foundry sector is quite robust (barring the unprecedented hike in the input cost during 3 / 4 months). Orders for casting components from tractor industry is huge, from automotive industry is fast improving, from heavy machinery manufacturers is satisfactory, from overseas market is steadily growing. The industry went through a very rough patch due to the migration of manpower to their hometown and nonproductive CAPEX expenditure due to COVID-19 as per MHA guidelines but now the manpower challenge is substantially settled and Govt. of India's ECLGS Scheme helped the Industry particularly MSMEs to take care of CAPEX and COVID-19 setbacks.



How do you see the future of Indian foundry sector, short term as well as long term ?

We estimate the future of the Foundry sector as quite tough in the next 2/3months due to this unprecedented hike in the input cost but in the long term I am not optimistic but sure that the Foundry sector will grow very firmly.

What will be the impact of reducing trade with China on foundry sector ?

It is a global fact that China's ghost manufacturing capabilities are tough to challenge and China plays a major role in exporting

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upgraded foundry equipment at a very competitive price which is apart from our imports of various foundry chemicals from China. The impact of reducing trade with them will result in (i) developing and manufacturing of Quality Foundry Equipment's at competitive cost indigenously and (ii) to explore other countries to meet our requirements of those Foundry chemicals at reasonable prices.

How do you estimate the export opportunities for Indian castings ?

There is a shift in focus of global procurement preference for castings from China to India has opened huge export opportunities to India Foundries particularly from the European & North American buyers. Foundries in India have received and are continuously receiving very good RFQ/orders for supply of Sanitary Castings, Automation Castings and Engineering Castings from the existing as well as new overseas buyers. The Foundry Industry has to gear up and to upgrade their infrastructure, manufacturing facilities and specially their attitude to encash this global opportunity.

How is IIF facilitating the growth of Indian foundry sector ? What are the new initiatives you are taking in this regard ?

The Institute of Indian Foundrymen (IIF) is committed to serve the Foundry Industry by providing information & knowledge on latest technological developments promotion of efficient management of resources including efficient energy management, skill development, publication of technical matters on topics of interests to foundrymen, business development & promotion by organizing annual conference & exhibitions which are largest of its kinds. My focus is on -(i) Bringing the best of the indigenously developed technology to the shop floor of Indian Foundry sector, (ii) Maximizing the use of Green/Renewable Energy in the foundries along with introduction of efficient energy management system and iii) Organizing B2B meetings with the prospective domestic / international buyers and virtual exhibitions to gap the bridge of this travel restrictions amidst pandemic.

What are the expectations of foundries from the policy makers ? Are there any specific demands for the forthcoming union budget ?

As we are aware of that the Foundry Industry is the mother of all engineering industries. The high input cost has an adverse impact on the USD 3-billion foundry exports from India and makes units uncompetitive in the international markets. Our policy makers has to pay a serious attention to the survival & growth of the foundry Industry which will truly fuel the engine of national industrial growth. Keeping this in mind, we urge the following measures to be considered in the upcoming Union Budget 2021-22 are as

- (i) Indian Foundry casting exports contributes in the range of 25% - 28% of the overall India's exports and hence upcoming new scheme (Rod DTEP) should be launched with existing MEIS benefits.
- (ii) Hit by surging input costs, we are demanding the reduction of import duty for pig iron and other raw materials.
- (iii) We are seeking subsidies on power from the government to stay competitive in the global markets.
- (iv) Immediate suspension of export of iron ore and also reduce the export duty on Pig Iron (iii) Central Govt. should introduce a monthly monitoring system to check production of Iron Ore & Pig iron linked with export of iron ore & pig iron so that the prices of iron ore & pig iron can be kept it under close surveillance to provide foundry industry the global competitiveness.

Industry 4.0 will change the face of India's Aluminium Industry

"Indian aluminium industry has to adopt 4.0 Technology (artificial intelligence, robotics, augmented reality and virtual reality etc) to become globally competitive and generate wealth which can be utilized for value addition and setting up MSME's in the country and generate substantial employment" *Dr. Anupam Agnihotri, Director, JNARDDC*

Dr. Anupam Agnihotri is working as Director at Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC), Nagpur.

JNARDDC is a centre of excellence set up in 1989 to create a research and development support system for the emerging aluminium industry in India by undertaking basic and applied research in the areas of bauxite, alumina and aluminium. JNARDDC is an autonomous body of Ministry of Mines.

Dr. Agnihotri is also holding additional charge of Managing Director Bharat Gold Filed Limited.

Dr. Agnihotri is an IIT-Kanpur alumnus, Dr. Anupam Agnihotri has a Doctor of Philosophy Degree in Materials and Metallurgical Engineering from VNIT, Nagpur.

Under UNDP, he has served as a visiting faculty to the University of Quebec in Canada as well as the Hungarian Research Institute under United Nations Development Program (UNDP).

Dr Agnihotri is deeply involved in research activities on aluminium technology related to energy audit, environmental monitoring, modernization programs, low cost material alternatives etc.

On the occasion of Metalworld Annual Issue, D A Chandekar, Editor & CEO Metalworld had an exclusive interaction with Dr. Anupam Agnihotri, Director, JNARDDC to understand more about JNARDDC contribution in India's aluminium industry research and how going to support the industry in the global competitiveness.

How do you see the important role of research and technology in the growth of aluminium industry in India?

For any industry to



leapfrog ahead of competitors, innovation led by continuous research is the key. Research and development area recurring process which requires continuous study. Continuous research leads to enhancing capability and economic growth of industries through development of new technologies, innovative methods of production, improved product quality etc. Economic performance of emerging countries like India can be directly related to



research and development carried out in industries. With advancements in technology, productivity will improve, leaner ores can be economically processed, environmental impact can be reduced through effective utilization of all the products. Now a days with increasing focus on developing circular economy, advancements in technology through research will help achieve complete utilization and zero waste for aluminium industry which is one of the major contributors to GHG emissions from metal sector.

Modern chemistry, innovations in military, transportation, industrial revolution helped the West to pull ahead economically. New industry 4.0 technologies like big data, smart factories, digital twins, etc., propel the aluminium industry into new heights of achievements. Hall's discovery made changed status of the aluminium from semiprecious metal to commercially producible metal. There are several innovations and research developments in aluminium industry which led to growth of the industry viz. direct chill casting, discovery of heat treatable nature of certain aluminium alloys, alloy development, extrusion etc. Technologies like additive manufacturing and inert anodes, zero waste concept, sustainable production and implementation of industry

4.0 will change the face of the Indian aluminium industry. Indian aluminium industries are already working on zero waste concepts and implementation of industry 4.0.

What are the key objectives and activities of JNARDDC ?

JNARDDC was solemnly established to provide technical support to the Indian aluminium industry, both the primary and secondary. JNARDDC has made key contributions in the areas of beneficiation, technological evaluation of bauxites, reduction of energy consumption & environmental pollution (through effective utilization of aluminium industry residue materials viz. bauxite residue, dross, scrap, spent pot lining etc.), aluminium process modelling, alloy development and indigenization. In-line with industry 4.0, JNARDDC, on its own, has developed Wi-Fi enabled anode butt monitoring system, anode current distribution measurement system and bath parameters measurement system for aluminium smelters. Significant contributions aimed to promote circular economy, zero waste concept, recycling and value addition of industrial rejects include development of products like glass ceramic tiles using red mud, proppants using partially lateritised khondalite (PLK),

refractory aggregates from saprolite, aluminium sulphate from dross, filler materials for paint industry using lithomargic clay etc. JNARDDC has served as Aluminium Sector Expert for Bureau of Energy Efficiency, Ministry of Power for their "National Mission for Enhanced Energy Efficiency" Program.

JNARDDC also works closely with Ministry of Mines, Government of India when it comes to on formulating policies pertaining to aluminium. JNARDDC has provided vital inputs while framing various rules, regulations and policies like National Non-Ferrous Metal Scrap Recycling Policy, Quality Control Orders and Aluminium Import Monitoring System (AIMS) etc. JNARDDC is a part of an Inter ministreal committee formed to identify ways of aluminium import substitution and reduce import dependency by meeting sector specific requirements domestically. JNARDDC is also working with BIS on standards formulation & revision and process standardization.

There has always been a very low synergy level between the research institutes and the industry in our country. How, in your opinion, can we change this situation? What are the initiatives JNARDDC is taking in this direction?

The main reason for low synergy is the apprehension about the likely loss of

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confidentiality and long time for research outputs. Industry prefers ready made solutions rather than investing in research in view of their limited patience and investments mainly driven by return on investment considerations. Also, industry including the large to medium or small enterprises are initially afraid of revealing their activities and know-how fearing that they may lose their niche or any proprietary knowledge they have built over period of time.

JNARDDC which made the modest beginning has been successfully catering to the R & D needs of Indian aluminium industry for more than 29 eventful years. The constant interaction with Industry, providing timely solutions while maintaining the confidentiality, innovative thinking, projecting achievements at every available forum and international collaborations are some of the measures which we have taken and will be continue to take with more vigour to further strengthen the confidence of Industry in JNARDDC

How can JNARDDC help the industry in increasing its competitive edge in the global marketplace?

There is no doubt that aluminium production in India being in fourth cost quartile (thermal power) has drastically affected our competitiveness and it is high time we concentrate our focus on fourth quartile in value addition chain ofhigh-end product development which will lead to improved margins and cost competitiveness. India is on threshold of 4th industrial revolution and Indian aluminium industry has no choice than to adopt 4.0 Technology (artificial intelligence, robotics, augmented reality and virtual reality etc) to become globally competitive and generate wealth which can be utilized for value addition and setting up MSME's in the country and generate substantial employment. The Centre intends to focus on

- reducing the country's import of Al alloys for strategic & defence applications
- Increase in number of Al applications for increased per capita consumption
- Achieve zero waste by suitable treatment & effective use of waste generated
- Improved energy efficiency / conservation techniques
- Effective ways & means to utilize low / inferior grade bauxite ore









VISION

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Instrumentation

Smelter Process

Cell Monitoring

MISSION

To undertake innovative research projects for providing complete technological solutions to meet the challenges for sustainability of aluminium industry

EXPERTISE

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- Beneficiation
- Petrography
- Alumina Technology
- Special Alumina

- Metal Forming Casting
 - Alloy / Product development
 - Characterisation

· Physico chemical analysis of ores & minerals Metal and Material characterization

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A new economy after the Covid-19 pandemic



Dr. Bruno G. Rüttimann is a Swiss engineer and economist who has been in the aluminium industry for 20 years as an expert in the fields of globalisation, strategy and lean production. Presently, he is a lecturer at ETH Zurich (Swiss Federal Institute of Technology) based in Zurich, and a business consultant at Inspire AG, a technology transfer institute of the ETHZ. "The economic policy even more has to favour exports and facilitate investments to finance internal growth observing international standards. Non-subsidized Chinese exports will lose costcompetitiveness with China becoming very soon a serious technology exporter" **Dr. Bruno G. Rüttimann**, *Globalization Expert*.

The Global Economy is facing a tougher start to 2021 than expected as coronavirus infections surge and it takes time to roll out vaccinations. While global growth is still on course to rebound from the recession of 2020 and it may take longer time and would not be as healthy as previously forecasted. As we are all aware of that the World Bank has already trimmed its prediction to 4 per cent in 2021 and the InternationalMonetary Fund will shortly update its own outlook as well.

D A Chandekar, Editor & CEO of Metalworld Magazine had an exclusive interview with the globalization expert, Dr Bruno G. Rüttimann to understand more about the Covid pandemic disastrous impact on the world economy. He also highlighted that it is the biggest economic throwback after the 1929 crisis, even more than the 2007 subprime-originated crisis.

Post-covid consequences to the European economy?

Indeed, the effects of the Covid pandemic have been disastrous, however the origin of 2019 crisis was completely different from the 1929 one, crisis sparked-off by collapsing stock-market. Furthermore, the spreading of the 2019 pandemic has also been completely different, mainly a consequence of globalized business and tourism opportunities.

We have not to forget that during the last decades



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the world in terms of technology, economics and society has undergone a deep evolution and transformation. This fact is very important because it changes the way how we automotive market experienced a near V-shaped recovery, aerospace will remain for the next time in an L-shaped pattern due to reduced business travels with consequent increased pandemic, being a mature economy, Europe faces also a structural problem, suffering in addition increased pressure by lowpriced Chinese exports.



will act in future.

Europe has been particularly hit hard by the pandemic, especially Q2 due to the near Europe-wide lock-down. Automotive sales in Germany dropped in Q2 by 40%. However, in Q3 the business sectors have been recovering differently: the prices of economy-tickets. Construction and packaging had not suffered much, while medical equipment manufacturers benefitted from the crisis. The pandemic has left an eclectic economic situation with winners and losers. Furthermore, aside of the

What are the structural changes occurring in Europe?

The whole aluminium industry is experiencing a further evolutionary transformation. Evolutionary because this transformation has already begun in the 1990's with the deverticalization of the grand old Western state-owned aluminium companies splitting, with exceptions, upstream and downstream horizontally. This was a direct consequence of fast spreading globalization of trade and foreign direct investment. Now, two major but interconnected trends are observable:

First: new international mainly Asian players have emerged and are taking increasingly a big stake of importance, and that not only in the primary sector, namely e.g. Zhongwang in extrusions to name only one. The still ongoing forced exports, mainly driven by China, is increasingly accompanied by financialcapital globalization of foreign direct investments.

This not only by Western companies in emerging markets but now also big investors oriented to participate globally at the new economic possibilities. This allows also to buy Western knowhow. Not only Chinese but also well-known Indian players are present among them, namely Birla/Hindalco or SA-based Gupta/Alvance. Exports are for emerging economies important benefitting from existing cost-differential, however exports should be "at arm's length" and not based on governmental subsidies.

Second: Europe is a mature economy with a generally already modern infrastructure in place; the big infrastructure projects boosting investment mainly in emerging economies sustaining fast growth is not present such as in America or Asia. The centre of gravity of European aluminium industry is in the transportation sector, with increased individual mobility which is end-demand triggered.

The new markets such as automotive are progressing fast but need also advanced technology, these markets, different from governmental infrastructure investment, are subject to economic cycles and pandemic effects, more volatile than the construction sector, which showed resistance. Now a pronounced forward escape trend of European semifinished products manufacturer is observable. investing further in demanding downstream technology for value-add components manufacturing. This has even been accelerating through the increasing incidence of electric vehicle market.

The competitive logic in the new markets is different needing additional skills; the necessary company portfolio has to be adapted. Not products but solutions have to be offered. However, this meanwhile worn-out concept has never been such important as now; it is even a mandatory choice forced also by sustained low-cost imports.

What impact will have the American and European duties

Face to Face

on selected Asian countries for aluminium sheet and extrusions?

Fair competition is a question of ethics; from this point of view China is socially not acceptable on the international political parquet. One can argue a "China first" politics above all is in the interest of China, yes, however not to the detriment of other economies and for sure not based on unfair acting. A concerted reaction was overdue and should have occurred already a long time ago to show where "the buck stops". Low-price politics "per se" cannot be blamed, it is just exploiting naturally competitive advantages.

Low-price politics is reprehensible, if it is made by governmental aid to gain global market shares to the obvious detriment of other economies - this is called fraudulent dumping. In addition, exploitation of child labour or not observance of environmental codex is an additional part of unfair competition with ethic connotation. Indeed. more and more customers are becoming sensitive towards these topics and suppliers will forcedly have to adapt to comply to demand if they will do business. Trade based on fair competition should increase progress of entire society in terms of general living standards as well as generating wealth for every individual and not only increase financial return of shareholders.



However, increasing nationalism and protectionism might have a negative impact to a sound evolution of global trade, remember "America first". Generally, since several years, world trade has been stuck below the 19.000 billion US\$ threshold. Although I personally advocate free trade without duties, in certain cases where subsidised dumping is evident, l encourage strongly the application of import duties. The imposed duties will force China to search for new export markets; hence, the problem is not solved but only relocated. The world problems are the Chinese overcapacities, and that not only in the aluminium industry, overcapacities which the Chinese domestic market alone cannot absorb.

Will this pandemic have profound consequences on globalization and established supply chains?

Contrary to common opinion, I don't think so. Supply chains will not experience profound changes, however, they will be fine-tuned, and that also in view to observe common ethic standards, e.g. also towards green aluminium. The reason is simple: it doesn't help to have perfect supply chains when the final demand is missing. A problem concerning all should be resolved by all.

Regionalization in terms of continents or even country localization of supply chains suffer the same effects in case of a pandemic. However, local supply chains such as aluminium semi-fabrication industries are important in certain industries. The degree of globalization depends from the business type.

Nevertheless, an intelligently managed supply chain has to balance availability risk versus cost savings. The fine-tuning of supply chains will regard exactly this aspect. It might sound like a joke but it is sad sarcasm: the only country drawing finally advantage from the pandemic has been China the origin cause of this pandemic. Indeed, the only large economy not showing a contraction of GNP in 2020 has been China, gaining additional market shares. I leave all further interpretations to you.

What is your assessment about the Indian aluminium industry?

Although of the same magnitude like China regarding population size, India has not yet been developing the same economic dynamics so far to exploit this huge potential. I want not to enter into the possible causes to this obvious inadequacy, however India has to pay attention not to lose a big opportunity to take over the Chinese heritage. The economic policy even more has to favour exports and facilitate investments to finance internal growth observing

international standards. Non-subsidized Chinese exports will lose costcompetitiveness with China becoming very soon a serious technology exporter. Nevertheless, the rather traditional products need still to be produced. Investment in equipment to assure Western quality standards is for that essential. In any case, without sustained and further adequate governmental economic policy to promote the Indian aluminium industry, the opportunity will vanish soon, other emerging economies seizing this opportunity.

Proposals for some highlighted inter-texts might be:

> "What changes is the way how we will act in future" "The pandemic has left an eclectic economic situation with winners and losers" "Exports should be at arm's length and not based on governmental subsidies" "Not products but solutions have to be offered" "Fair competition is a question of ethics" "The world problems are the Chinese overcapacities" "A problem concerning all should be resolved by all" "An intelligently managed supply chain has to balance availability risk versus cost savings"



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Stimulus support to regain aluminium demand of pre-covid level by Q4 of FY21

"The Government's stimulus measures and progressive unlocking of economic activity is expected to bring back aluminium demand to pre-COVID levels in Q4FY21. In FY22, demand of aluminium is expected to grow by 21% to reach FY20 levels across all the major segments" says Satish Pai, MD, Hindalco Industries Ltd.

A fter taking charge as the CEO of Hindalco's Aluminium Business in August 2013, SatishPai was the driving force behind three mega green-field projects that established Hindalco as among the biggest producers of primary aluminium in Asia. He is also on the Board of Hindalco subsidiary Novelis - the world's largest aluminium rolling and recycling company.

In February 2014, he was appointed as the Deputy Managing Director of the company and was also entrusted with Hindalco's copper business. Satish became the Managing Director of Hindalco in August 2016, where he oversees the Indian metals business and guides Novelis' operations globally.

Prior to joining Aditya Birla Group, Satish worked with Schlumberger based out of Paris. Over the course of his 28-year-career with the MNC, he held important positions and was responsible for Schlumberger operations globally.

Satish holds a patent in directional drilling. He received the Distinguished Alumni Award by IIT Madras in 2017. He was conferred the Doctor of Letters HonorisCausa (D. Litt) by Ajeenkya DY Patil University in 2020.

Satish serves as Director on the boards of Aditya Birla Management Corporation Pvt. Ltd. and ABB, Zurich. He is the Vice Chairman of the International Aluminium Institute, the Vice President and Chairman - Non Ferrous, Indian Institute of Metals, and Vice President & Chairman of the Government Affairs Committee of the AluminiumAssociation of India. He is the Chairman of FICCI's Non-Ferrous Metals Committee.



n the occasion of Metalworld Magazine Annual Issue which is a reference guide for the decision makers. D A Chandekar, Editor & CEO had an exclusive interaction with Satish Pai, Managing Director, Hindalco Industries Ltd. to understand the current scenario in the aluminium industry. Pai also highlighted the government policy support is needed for the revival of industry especially after the covid-19.

How is the present situation in aluminium industry, especially post covid-19?

The stringent lockdown measures due to the Covid-



19 pandemic have impacted aluminium demand globally. Dismal performance across all sectors, especially automotive and industrial, were the key reasons behind the global demand contraction in CY20. The global growth is seen accelerating back in H2 CY20 as lockdown measures eased gradually and economic activity started to revive it again as demand picks up. The demand of aluminium has seen a two speed recovery in CY20. On the price front, aluminium prices recovered to \$1810/t in H2CY20 (Low: 1529/t, High: 2052/t) compared to an average of \$1593/t in H1CY20 (Low: 1421/t, High: 1810/t).

On the domestic front, all sectors except medical equipment and pharma packaging have been impacted in 1HFY21. Automotive sales are picking up in the backdrop of resilient rural economy and with the changes in mobility in the Covid period. In building and construction, we expect workers to return now that the festival period is over and demand should recover to pre-covid levels in this sector as well. Demand for packaging has continued to remain robust with growth in pharma and flexible packaging. We are observing signs that the demand for electrical/power is gradually reviving. Overall, we estimate that domestic aluminium demand is expected to reach pre-COVID levels by Q4 of FY21.

What time frame you have in mind for the complete recovery

of aluminium sector in the country?

The Government's stimulus measures and progressive unlocking of economic activity is expected to bring back aluminium demand to pre-COVID levels in Q4FY21. In FY22, demand of aluminium is expected to grow by 21% to reach FY20 levels across all the major segments.

What support does the aluminium sector require from the policy makers, especially in the light of forthcoming union budget?

In the forthcoming budget Hindalco is looking forward to receiving support from the Government in the following areas:

- Reduction in basic custom duty on critical raw materials for aluminium especially Calcined Petroleum Coke and Raw Coke, which is the input for CPC.
- Increasing tariff rate of basic custom duty for aluminium downstream products from 10% to 15% to curb the imports from non-FTA countries.
- Reduction of cess on coal to support high power intensive industries like aluminium.
- Parity in aluminium ingot and scrap duty.
- Implementation of RODTEP for aluminium to replace MEIS.
- Implementation of Aluminium Import Monitoring System.

In addition to the budget initiatives, aluminium is one

of the chosen industries under Atmanirbhar Bharat and we are working with the government on how to reduce import and focus on domestic production.

The recent pandemic has raised big question on sustainability of many enterprises. What is the philosophy and actions of Hindalco to impart sustainability in the enterprise?

Hindalco's focus towards moving more downstream is a part of our sustainable business model which has helped us to delink the business from LME volatility. Hindalco today, on a consolidated level is more than 80% LME delinked in terms of EBITDA. With the recent acquisition of Aleris by Novelis and announcement of 34 Kt Extrusion Plant in Silvassa, India is a big step forward in Hindalco's downstream strategy with its long-term downstream investment plan. This shows the Company's intent of strengthening further its sustainable business model while building a larger valueadded product portfolio over the next few years.

The aluminium industry has an important and significant role to play in the circular economy. It can contribute to lower waste and energy savings in the products it produces. Aluminium products can contribute to energy savings in the production process and use phase, as aluminium is lightweight and its recycling consumes significantly less energy than most other materials.



Hindalco's efforts in product stewardship revolve around sustainable transportation and logistics. India's first lightweight aluminium trailer and bulker, which help transporters save up to 15,000 litres of fuel per trailer, was developed and commercialized by Hindalco. Another initiative is on sustainable packaging, a combination of aluminium and jute bags, for food items.

Hindalco has taken a number of innovative steps on the waste circularity front. In a global-first initiative to create value out of aluminium processing, Hindalco has tied-up with cement manufacturers to use red mud as a replacement for mined resources. This is a pioneering effort in reducing environmental impact on both aluminium and cement sectors. Hindalco is the first aluminium company in the world to achieve this breakthrough on red mud utilization. Similarly, 100% of the Fly Ash is being utilized for making Cement, Bricks, and Roads. Hindalco has been ranked as the Aluminium Industry Leader for its sustainability performance in the 2020 edition of the S&P Dow Jones Sustainability Indices (DJSI) Corporate Sustainability Assessment (CSA) rankings. It is also the only company from India to be recognized as an Industry Leader this year.

Hindalco is also working closely with Xynteo on sustainable mining, which is focused on good environmental practices in water and biodiversity, community livelihood and health, among others. The work on biodiversity is being undertaken across Hindalco's multiple locations in partnership with International Union for Conservation of Nature for biodiversity management with a goal of No Net Loss. Hindalco is working on water positivity in its mining locations by supporting construction of rain water harvesting ponds, reservoirs, agri-water management through CSR activities for local communities.

What efforts Hindalco is making to increase the aluminium consumption in the country?

Hindalco, with its new innovative products like the Aluminium Bulker, Aluminium Trailer, is set to usher a revolution in the transportation industry. These lightweight and costefficient innovations in the transport segment has not only made travelling efficient and sustainable but also environment friendly. Hindalco continues to expand the consumption of aluminium with its existing range of products and newer innovative products, in-line with the rising consumption of aluminium in the country. The increase in adoption of aluminium in diverse industry sectors grows in-line with the global awareness of aluminium's lightweight strength and infinite recyclability as a sustainable raw material.

Presently, what other new initiatives and expansion plans are being implemented at Hindalco?

Hindalco's new initiative includes development of aluminium Bulker and Trailer in the transport segment catering towards rising consumption of aluminium in the country. Other initiatives include one of its kind aluminium foillaminated jute bag - an ideal substitute for plastic bags with aluminium foil lamination. These are 100% recyclable bags and expected to replace singleuse plastic bags in the country. Hindalco is also working towards products like Aluminium Bus and LPG Cylinders to replace steel which shows how Hindalco is guided by its purpose -Making Metals that are Greener, Stronger, Smarter.

The expansion plans in Hindalco includes expansion of Utkal Alumina refinery by 500 Kt, coming up in Q4 of FY21. Hindalco's recently announced ₹730-crore Extrusion project in Silvassa, is a part of its downstream strategy where it intends to enhance its VAP capacity from over 300,000 tonnes currently, to more than 600,000 tonnes with investments of around ₹7,000 crore over the next few years. Hindalco's focus on the downstream assets is a part of its Sustainable Business Model with an emphasis on further derisking its business from the LME volatility.



Zinc and lead demand to rise on Construction and auto sector consumption



What are the recent observations about the Indian Lead Zinc Industry ?

Since 2000 investment in the Indian lead and zinc industry has been significant and it has expanded very rapidly. Hindustan Zinc are currently the second largest zinc mining company in the world and fourth largest producer of refined zinc metal. The company's Rampura Agucha mine, located in Rajasthan, was the world's second most important by production in 2020 after Teck's US based Red Dog operation.

Regarding lead, Hindustan Zinc ranks number two globally in terms of mine output and number 5 regarding production of refined metal. Further expansions in both lead and zinc production are planned by the company over the next few years. These include a new 300kt per year zinc refinery in Gujarat. We anticipate that the company will continue to be one of the leading participants in both markets for many years to come.

Prospects for the Lead and Zinc Industry Globally "We expect demand for zinc metal continue to rise, driven by positive trends in the construction and automotive sectors. Similarly, demand for lead metal in lead-acid batteries continue to remain the dominant power source for the world's automotive sector" says

Paul White, Secretary General, International Copper, Nickel and Lead and Zinc Study Group

Paul White is Secretary General of the International Copper, Nickel and Lead and Zinc Study Groups all of which are based in Lisbon, Portugal. These Groups are intergovernmental organisations with a combined membership of 37 countries whose main purpose is to improve transparency in the base metal markets and promote co-operation between governments and the mining and metals industry. Prior to his election as Secretary-General at the beginning of 2018, Paul was Director of Market Research for the International Lead and Zinc Study Group. He conducted research and presented papers on all aspects of the global lead and zincmarkets. Before joining the Study Groups Paul worked as a physical metals trader in London for the Sumitomo Corporation and Brandeis Limited, a subsidiary of Pechiney World Trade. He has degree in Chemical Engineering and an MBA from the Universities of Surrey and Warwick in England.

> It is clear that the COVID19 Pandemic has impacted both the supply and demand of lead and zinc.

Activity in most end use industries dropped significantly in 2020 perhaps most notably in the automotive sector. In the medium to long-term we expect demand for zinc to



continue to rise, driven primarily by positive trends in the construction and automotive sectors. We also expect increased use of zinc in other applications such as thermal spraying of offshore windmills and in fertilisers. In the case of lead, lead-acid batteries remain by far the dominant power source for the world's automotive sector. This is expected to continue for the foreseeable future despite the increased use of lithium batteries in the electric vehicle and e-bike sectors.

What are the objectives and activities of the Metal Study Groups; INSG, ILZSG and ICSG?

The Groups are focused on the enhancement of transparency in the global lead, zinc, nickel and copper markets. This is achieved via the publication of regular, detailed and highly accurate information. We also promote international cooperation amongst our member countries and between governments and the private sector. This is accomplished via regular meetings of the Groups comprising both government and industry representatives. In addition to our regular market analysis, recent topics that have been discussed and reported on include the growing importance of responsible minerals and metal supply chains, meeting the challenge of mining and smelting waste, innovative technology

in mining and metals, social acceptance of the mining and metals industry and the importance of base metals to the circular economy.







Digitalization in Mining, Minerals and Metals

"Digitalization is a technology boon with the potential to address the much needed challenges of cost-effectiveness in mining, mineral and metal industry.Building on the capabilities offered by a prudent combination of IT-enabled model, computing, cloud storage and communication technology to unlock the value over coming two to three years"

Sadguru Kulkarni is a Chemical Engineering graduate from UDCT (now called as ICT-Mumbai). He worked with top management positions in the Aditya Birla Corporate Group, Aditya Birla Science & Technology Centre and in Hindalco for eighteen years. Prior to Aditya Birla Group, he was working with Hndustan Unilever Research Centre as a Principal Scientist-Chemical in Mumbai. His areas of expertise include process science & engineering, technology transfer, for a large range of products and processes. He holds over ten patents/ patent applications in these areas.

Mining, minerals and metals industry has been generally considered as a classical, old-economy industry, with its resource intensity. It is heavily relying on the natural occurrence, often considered as gifts of Mother Nature, large scale of operations, often long gestation periods, burden on environment. It is more capital and labour intensive industry,



Sadguru Kulkarni Business Head -TecTrans Associates Former President -Technology & Tech Services, Hindalco Industries Ltd. Former Principal Scientist - Hindustan Unilever Research Centre

and associated with high risk to the business. All these often resulting into a general lethargy towards change. Unlike many other manufacturing sectors, the metal sector is generally observed to be cautious, and rather sluggish in responding to the opportunities offered by the advents in technology. However, several factors are now challenging this :

- Uncertain availability of trained manpower and expertise :This has become a reality especially for the metal sector facilities, which are continuous in nature, use extreme conditions (e.g. high

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temperature, operation in enclosed space, hazardous environment, molten material handling etc), have a high cost of even short shutdowns, making quick restarts technically and economically unviable.

 Renewed focus on personal safety, based on the realities of the Covid-19 pandemic:

Need to operate without direct exposure, advance warning of unsafe conditions, have become essential. Importance of life irrespective of work conditions has become a stark reality; coaxing people to stay away from inherently unsafe jobs.

- Competition : Need to be on the top of all relevant information 'here & now' has been the utmost priority of management. The speed of response based on uncertain information is a need. The cost of noncompliance is amounting due to the enhanced awareness of the statutory bodies and society at large, alike.
- Advents in information technology and rapid extensions of classical IT into ITEMS (ITenabled enhanced manufacturing & services) has led to unique capabilities such as lower cost of computing at higher

speed, supported by availability of hard and soft sensors, for direct as well as derived parameters, remote sensing & remote motor capabilities, advanced predictions based on big data analysis of trends, intelligent identification and filtering off data outliers, and machinelearning to match or even surpass trained human expert with lifetime experience, etc.

- Some of these factors have taken leads from service industry as well as high tech manufacturing industry (such as electronic component manufacturing, automobile assembly lines, Packaged food and pharmaceutical industry), and are now finding wider applications in commodity manufacture as well.

The combination of needs and opportunities, with perceived economic advantages has led to the mining, mineral & metal sector initiating activities in digitalization. Most global vendors working in automation, instrumentation and controls have extended their capabilities to address this opportunity, to seamlessly integrate with the present hardware and software in metallurgical and supporting plants (like for example power plants, lime kilns). Digitalization of

metallurgical plants including steel, other metal industry and manufacturing industry in general, is reported by most core technology suppliers as well as automation vendors: SMS offers end to end solution for steel industry, starting with maintenance management, embedded systems for tracking of individual machines and plants, etc. (Ref: https://www.smsgroup.com/sms-groupmagazine/overview/digitaliz ation-in-the-steel-industry/), ABB offers intelligent electrical machinery & components, process control, operations optimization, asset management through data base and tracking, real time tracking and optimization of melting furnaces, rolling, long products, casting etc in steel plants as well as in other metal plants. (Ref: https://new.abb.com/metals /digital),

Honeywell approaches the problem from classical process control point of view and targets to build digitized factories. Honeywell has partnered with Tec Mahindra to build on the joint ITES capabilities. (Ref: https://www.mahindra.com/ news-room/pressrelease/honeywell-and-techmahindra-announceexpanded-collaboration-tobuild-digitized-factories-ofthe-future),

Emerson like other automation majors offers total solutions and have

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examples in the areas of power plant digitization (Ref: https://www.emerson.com/e n-us/perspectives/digitaltransformation) an in digitization of alumina refinery -Ref:

https://www.emerson.com/d ocuments/automation/alumi na-refining-4-0-what-digitaltransformation-looks-like-en-5363224.pdf).

Outoteca total solution provider for metals technology has started complementingtheir core metallurgical technologies, through partnering with ITES companies for whole range of metallurgical

manufacturing from copper, zinc, titanium etc (Ref: https://www.outotec.com/pr

oducts-and-

services/commodities/digital ization/insights/).

Some German MSMEs have developed niche solutions for melts shops, furnaces and foundries (Ref: https://rguasia.com/wp-

content/uploads/2020/11/2 020-10-16_FRPmelt.pdf).

Examples and achievements of digitization in the industry are highlighted below.

Digitalization Applications in Steel Industry:

- Operations & Production Management
- Control Production process, electricals
- Model based control & optimisation of production processes for steel and associated materials like lime kiln, power plant,
- Smart Melt shop

operation

- Digital Twin of steel mills (as well as other processes)
- Asset management,
- Maintenance management from breakdown to proactive
- Realtime optimization of casting- batch & continuous
- Rolling Mill optimization-HRM & CRM
- Central Control room, and extensions (plant on your mobile)

Mine of the Future:

Mining is the first step of all integrated metallurgical industry; and has been running in a well-established, conventional manner, with document-based processes. tight control of statutory regulations; intense high density vehicular movement, labour intensity, extreme environmental risks, and involving long term planning and execution; and now a serious societal outlook. The offers of new IETS technology has offered a new paradigm to the mining industry and some of the features include the following:

- Digitization of documents, and real time integration of documents with implementation to ensure execution as planned; thus, providing low tolerance vis-à-vis plan.
- Real time monitoring & control of environment to avoid emergencies &

hazards

- Potential for automated guided vehicles (AGVs) to commute from mine site to godown, with automated weighing, mass balance reconciliation shift-wise in real time.
- Use of automated or assisted excavators with intelligent vision to facilitate remotely controlled mining thus improving safety
- Use of field sensors and elemental analysers, to track mined ore quality inn real-time, thus enabling minimization of WIP material, reducing cost- a step closer to JIT operation.
- Safety systems (as described earlier)
- Use of VR- Virtual Reality based simulators to get job-ready operators.
- Use of assisted robotics for hazardous operations like underground mining, wall-concretization, pumping of water sump inside the mines, operation of remote solar plants etc
- Potential for steep reduction

Ref:

https://www.riotinto.com/en /about/innovation/smartmining

Supply chain digitalization:

Supply chain has generally been a back-office process, extensively using data base and ERP technologies. ITES has enabled supply chain to unlock value from all steps of supply chain such as:

- Stores and materials management
- Logistics incl. transportation sourcing, optimization and tracking
- Packing line management
- Sourcing optimization in real time
- Customer Service-Tracking & Resolution

EHS management:

Environment, Health and Safety involve extensive systems, as well as supervision all on the ground. Availability of sensors, vision, etc has helped EHS to ensure strict adherence irrespective of supervision. Virtual reality is a boon to safety as it helps the novice learn processes and operations as if s/he is performing the job, without any real risk. The availability of many packages and videos for almost every job on the internet show the potential of VR in training in safety & beyond.

- Document digitization, authorization and interlocks
- Smart sensors- optical, proximity, surface temperature, image analysis, alarms
- Movement capture in safe, unsafe & prohibited areas + alarms
- Robotization of inherently unsafe operations- such as sludge removal, confined

area maintenance, hazardous sample drawing, working at heights, online maintenance

- Remote supervision
- Auto-enunciation of noncompliance
- Safety Training with virtual reality packages, 360-degree Cameras and virtual dynamic simulators

Concept of Embedded System for improved plant performance:

- With the cost of sensing & computing hardware and storage coming down in accordance with Moore's Law, it has become viable to build in a predesigned CPU as a chip in almost every piece of equipment. This CPU, of the size of a business card or smaller, is designed to engage with the primary equipment (such as a pump), to record key performance parameters (such as speed, power consumption, vibration - frequency, amplitude as well as pump specifications, no of operating hours etc). The chip can send the data wirelessly to a central cloud storage, where it is analysed using predefined statistical tools, to identify abnormalities if any, identify root cause based on predefined logic and send it to the

Technology



central control room for corrective action if required (e.g. lubrication, alignment, bearing change, air-lock, deposits etc). The control action, once taken by the preventive maintenance team, is fed back to the central data base for records. The analytics has now self-learning capability such that any hitherto unforeseen diagnosis gets appended to the database as a new learning and the diagnostic capability improves with such learning. These

'embedded systems' have enabled more effective preventive and proactive maintenance, thus helping improve the uptime and resultant plant productivity.

Digitization of aluminium smelter to solve a longstanding operations problem:

Use of novel magnetic sensors, wireless transmission, modelling and cloud computing has been used to attack and solve the long-standing problem of anode effect in aluminium smelter, through for improved prediction of anode effects in Aluminium Smelters:

'Anode Effect' in aluminium smelter pots is a dreaded fear of most operators. Anode effect takes place, when the carbon block anode/s and the cathode block with the molten metal



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layer tend to come in close contact, causing 'shorting' that leads to imbalance of the flow of high amperage current through the shorted zone; and causes disturbance and perturbation in the cell, along with generation of toxic perfluorocarbon gases and consumption of significantly higher power, causing the average specific energy consumption for the entire potline to go up by percentage levels. The entire disturbance takes place in seconds to minutes! It takes physical control action by the field operator to raise the anode beam. and control the 'anode effect'. Aluminium smelter plant operators have wondered about whether they could have an advance warning system of potential anode effect, so that they can plan the corrective action ahead of its possible occurrence!

Dr J W Evans of Dept of Materials Science and Engineering University of CA, Berkeley, CA developed a system, consisting of a novel device based on magnetic field measurement, mounted on the anode beam to measure current flowing into each anode rod, transmit the current wirelessly to a central computer, from where the data is transmitted in real time to a cloud computing system located in Evans Lab in CA. The big data analytics of the current in individual anodes has an algorithm, that precisely predicts which anodes are likely to 'short'

and cause anode effect, three times faster than any of the existing anode effect predictor; and send the information back to the plant, so that the field operator can take a corrective action before its occurrence! The system has been tested in Alcoa's Aluminium smelter in US & Canada. The availability of such data in Evans lab for multiple smelters across the globe makes the system learn across the smelters, thus improving the predictability and reliability. Ref: Evans J W etc al, Light Metals 2012 Edited by: Carlos E. Suarez TMS (The Minerals, Metals & Materials Society), 2012

Lime kiln plant Optimizer:

Qualical : Lime is an essential secondary raw material for metallurgy industry, especially steel plants; and a lime kiln plant is present in most steelmakers. Optimal and reliable operation of lime kilns is important for lime quality; but is seldom focussed on, being a secondary requirement for steel plants. Qualical- an Indian digital service venture with domain expertise in lime kilns and a flare for digitalization has come out with module that tracks the parameters of lime kiln in real time, and makes them available as real-time data as well as short & long term trends on mobile platform for limekiln operators and managers alike. The statistical & physico-



chemical model of lime kiln inbuilt in 'Qualical Lime Kiln System' guides the operator in consolidating, reconciling and analysing the real time data to suggest any corrective action. Ref:

https://medium.com/qualica l/digital-lime-plant-8aaaec3a075

Conclusion:

Digitalization is a technology boon with potential to address manylong-standing ills of mining, mineral and metal industry. Building on the capabilities offered by a prudent combination of classical domain knowledge of mining/mineral/ metallurgical processes, ITenabled practices, and the cost effective availability of modelling, computing, cloud storage and communication technology, this industry is slated to adapt digitalization to bring about prudent innovations in manufacturing technology and unlock value, over coming two to three years.

About the Author:

Presently Sadguru Kulkarni works as a free-lancer advising manufacturing companies in the areas of processes, as well as ITES for manufacturing. He is on the editorial board of MetalWorld. Contact Details: Cell: +91 9702010471, email: Sadguru.Kulkarni@ gmail.com



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Aluminium Scrap Recycling seeking policy support to boost the investment

With nearly four million tonnes of installed capacity almost equivalent to that of primary producers, the Indian aluminium scrap recycling industry is currently passing through challenging times due to the massive impact of novel coronavirus (Covid-19) pandemic which disrupted production and consumption alike.

The pandemic which was reported first in India in February 2020 yielded nationwide lockdown the next month bringing thereby both manufacturing and service sectors to a grinding halt. Factories remained closed. Being the pandemic worldwide phenomena, import of aluminium scrap, the sole raw material for recycling, also halted.

Not only ship ferrying aluminium scrap from the origin countries like the European Union, United States and African nations, stopped due to lockdown, transportation of imported goods from Indian ports to the recycling plants for processing also got hampered. Therefore, almost all leading aluminium recycling companies were forced to pay demurrage worth lakhs of rupees unnecessarily resulting into a sharp increase in the cost of secondary aluminium production.

Vaccination and unlocking to rescue recycling sector

"Scrap recycling Industry needs special treatment from the government with proper encouragement through tax incentive, favourable policy for scrap import for level playing field and a preferential treatment for its application in user industries which will preserve natural resources and also conserve energy for future generations", Dilip Kumar Jha Industry Analyst

With the gradual unlocking, markets have started opening steadily. Also, launch of Covid-19 vaccines and their immunization drive has come as a major relief for all sectors including aluminium scrap dealers, its importers and users. Import of aluminium scrap from overseas and its transportation from the port to recycling factories have also started which has come as a major relief for entire processor and user industries. Apart from that, job losses and salary cuts continue to sting user industries which experts feel would restore soon.

Since the market has opened gradually and the



initiative "Atmanirbhar Bharat"

sectors like aluminium scrap

recycling. The scheme is set

especially for downstream



government has pumped in Rs 20,00,000 crore to boost consumption which reflected in the equity markets with the benchmark environment. Recycling of aluminium scrap saves energy of nearly 95 per cent, preserves natural resources like bauxite which is used for



in both manufacturing and services sector which will eventually help India reduce import and boost supply of specific products from domestic sources. The scheme, therefore, would support domestic economy, create more jobs and restore trust in local products. It will also enhance India's manufacturing

capabilities and increase exports for these specialized sectors, which include automobiles and autocomponents. The scheme will also make India's manufacturing competitive internationally, build economies of scale, and help India position itself firmly on the global supply chain map.

India's aluminium recycling sector comprises around 2500 processing units, employing around 500,000 people directly and indirectly and contributing nearly 50% aluminium demand. Secondary aluminium produced through recycling of scrap is used primarily in housing, construction, automobile, white goods and all other sectors as a substitute to the primary metal. The aluminium

Sensex hitting the psychological barrier of 50,000, the aluminium recycling industry is set to come back on track soon. But, it will take a couple of years for the aluminium recycling industry to reach the pre-Covid level due to lag effect of the economic revival on to the downstream sector.

Policy need for aluminium recycling sector

The aluminium scrap recycling industry is surviving on its own despite uncertainties from both raw material supply and finished product consumption sides. India is the only country which has levied 2.5-5 per cent of customs duty on import of various types of metallic scrap despite its processing being considered beneficial for economy and

primary aluminium production and thus, helps produce finished products at cost-effective rate. Thus, secondary metal produced through recycling aluminium scrap is cheaper than the primary metal produced through alumina (obtained through processing of bauxite as a natural resource). "We do not want any incentive from the government. But the government should consider recycling as a green sector and provide us a level playing field," said Sanjay Mehta, President, Material Recycling Association of India (MRAI).

Meanwhile, the Centre in November 2020 had introduced a Production-Linked Incentive scheme to boost India's manufacturing sector and encourage investors to pump in fresh



Feature

recycling industry is dominated by nearly two dozen large players that contribute nearly 70% of the demand while the need for the remaining quantity is met through a large number of players mainly in unorganised sector. While organized sector players use most modern technology, plant and machinery, unorganized sector players run their units only through age old systems. The industry representative bodies have called for upgradation in plant and machinery in addition to adoption of new technology to improve accuracy, efficiency and productivity. Aluminium scrap can be recycled several times to obtain the base metal without losing its physical and chemical properties.

Primary resistance

The aluminium recycling industry in India is facing stiff competition from the primary metal producers. With their deep pocket size, primary aluminium producers raise their voice loudly with the government which sometimes affects the recycling industry hard. Now, the primary metal producer has fired a fresh salvo on secondary producers by urging the government to raise import duty on metallic scrap, the sole raw material for recycling industry. Its majority imported grades are not available in the domestic market. Experts believe that the increase in

import duty would push scrap recycling into deep trouble and processing of used metal would be challenging for Foundry, Automobile and Engineering etc. If duty increased, aluminium scrap recycling in India would be uncompetitive and thus, the entire industry would be finished, they said.

Dhawal Shah, Vice President, MRAI and Managing Director of Mumbai-based Metco Marketing, said imported aluminum scrap creates employment, leads to aluminum production with fewer greenhouse gas emissions and allows manufacturers to produce "valuable material", some of them is exported.

Call for BIS quality scrap import

A large quantity of imported aluminium scrap has raised several quality concerns among players in the recycling industry and environmentalists. Therefore, these players have called for an urgent need for a quality parameter set to import scrap only set by the Bureau of Indian Standard (BIS). The BIS quality benchmark is set to restrict import of substandard quality scrap. Sometimes scrap importers do complain about substandard quality of imported scrap which is causing a huge financial losses with mounting compensation claims and thus disputes arise.

A benchmark BIS quality norm should be in line with

ISRI specifications would help to facilitate fair trade of scrap and will enable the availability of the right quality of scrap at the right price and ensure quality end products with zero harmful effects on the environment. Experts, however, believe that the quality standard should be levied for both primary metal and scrap; and must be bake by strong and dependable testing infrastructure, along with end-use / quality certificates with proper details with regard to metal content and contamination, to maintain the quality of end products.

Conclusion

Aluminium is an essential commodity for various other industries/SMEs due to its critical role in diversified applications crucial for economy like energy security, national defence, infrastructure, electrification, aerospace, automobile, consumer durables, packaging etc. Recycling of scrap provides cost-effective aluminium without compromising its physical and chemical properties. Hence, scrap recycling needs special treatment from the government with proper encouragement through tax incentive, favourable policy for scrap import for level playing field and a preferential treatment for its application in user industries which will preserve natural resources and also conserve energy for future generations.





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Analysis



Foundry Clusters to adopt Energy Efficiency Project : BEE

Sheela Bhide

Foundrymen

Senior Advisor,

Institute of Indian

Energy efficiency is the key to minimize climate change risk. With the utmost importance of energy efficiency in the manufacturing sector, the Bureau of Energy Efficiency, Ministry of Power, Government of India, has taken up an important program for mapping the levels of energy efficiency amongst clusters of Micro, Small and Medium Enterprises (MSMEs).

MSMEs account for a large part of the country's consumption of resources. It also occupies a position of prominence in the Indian economy, contributing to more than 45% of the industrial output and 40% of the country's exports in value addition terms.

MSMEs, the critical growth driver of the Indian economy, play an important role in the context of energyintensive industries. Although their individual energy consumption is rather low, their collective use is considerable. The poor energy and environmental performance are directly related to the lack of technical capacity in these enterprises to identify access, adapt and adopt better technologies and operating practices.

National Programme on Energy Efficiency and Technology Upgradation of

MSMEs

In 2007, to recognize the importance of MSMEs in promoting energy efficiency, 'National Programme on Energy Efficiency and Technology Upgradation of MSMEs' was flagged off by Bureau of Energy Efficiency. Lackof access tolatest technologies make this sector vulnerable to energy security and competitiveness in global market. Moreover, lack of access to finance for MSMEs is one of the major stumbling blocks for implementing energy conservation measures and energy efficient technologies.

With this cognizance,

Bureau of Energy Efficiency (BEE) has implemented 21 pilot energy efficient technologies with financial assistance programme in 4 SME sectorsunder XII plan. To aid the replication of these technologies across the sectors, cluster level entities (i.e., local service providers, industrial associations etc.) were also strengthened. It has managed to promote such programme very effectively by spreading the awareness across nationwide cluster; knowledge management products like case studies, audio visuals were also developed.

Due to continuous efforts of the Bureau and all the stakeholders, MSMEs in India have started to shift from a traditional strictly cost and quality approach to energy efficiency, zero waste and reduced carbon emissions.

Current Activities

Further, for bringing more competitiveness and making this sector more energy efficient, it is important to understand the consumption of energy and its flow within the facility along with the classification of energy usage and its relationship to processes and production outputs in present scenario. Thus, Bureau of Energy Efficiency is conducting energy mapping of 10 sectors which will cover energy usage pattern, detailed analysis and technology gap analysis. Bureau has also

developed more than fifty (50) multimedia tutorials on energy efficient technologies for more than twenty (20) sectors for knowledge transfer and thereby easy adoption of these technologies.

Bureau has also signed a MoU for joint implementation of the programme titled "Promoting Energy Security of MSME sector" with Office of DC, MSME during recently held National Conclave on Enhancing Energy Efficiency in MSME Sector. Implementation of this programme will start soon.

Although the energy saving potential is immense in this sector which BEE intends to unlock, there are quite a few challenges faced by Indian SME entrepreneurs which are risk averseness, cumbersome documentation and lack of awareness/motivation. With the collective efforts of Bureau towards improving the energy performance, the current state of awareness, perception and responsiveness towards energy efficiency programmes for this segment has become the mainstream across the country.

Mapping Energy Efficiency in Foundry Clusters

Secretary, Bureau of Energy Efficiency (BEE), Ministry of Power, has undertaken an Energy Mapping project for foundry sector across India for MSMEs with ultimate

Analysis

objective to recommend policy initiatives to the

Government of India for the foundry sector. IIF is taking a lead in implementing the project in select foundry clusters

BEE has appointed Price water house Coopers (PwC) India for the project, who are a leading service provider to industries on various aspects of energy conservation, such as energy audits, technology selection and implementation support. .

The study aims to identify the present scenario of the foundry sector in terms of production, energy consumption covering major foundry clusters. PWC will organize detailed energy audits in 10 MSME foundries in 5 clusters (a total of 50 units) i.e., in Howrah, Rajkot, Batala, Shimoga and Agra. The cost of detailed audit and report for the selected unit will be borne by Bureau of Energy Efficiency (BEE)

Such programme activity includes collection of basic data on production and process and offer the opportunity to get a free energy audit conducted in the selected units. The data provided will only be used in aggregate, to understand sector level patterns and to suggest efficient technologies and interventions for the benefit of the foundry sector in India.

Analysis

METLDEX MCX METLDEX - An Innovation in India's Commodity Market

Ulti Commodity Exchange of India (MCX), the country's leading commodity bourse, launched Base Metals Index 'METLDEX' on October 19 2020. It is country's first tradable real-time Base Metals index, i.e. MCX iCOMDEX Base Metal, or METLDEX, as part of the MCX iCOMDEX series of indices.

Commodity indices like the METLDEX are generally constituted of futures contracts, unlike the equity indices that are based on cash prices. This makes these indices unique as they are based on some unique principles. The METLDEX, for instance, takes into account the physical market size of its constituent commodities across the country, apart from their liquidity in the futures market, while determining the weights of the index constituents. Secondly, every constituent contract of the METLDEX has a definite life and 'expires' at the end of this life. For continuity of the index, therefore, the constituent contracts are 'rolled over' from one expiry to another. The roll over happens on pre-decided dates called 'roll over days'.

The rollover days of METLDEX are two business days just before the first day of staggered delivery tender period of the constituent MCX base metal contracts. Thirdly, as the constituent contracts roll over between two expiries, the index captures the difference between the returns of the two expiries. In doing so, it gives rise to a 'roll return'. That is why commodity indices like METLDEX are referred to as 'excess returns' indices, which means that the index investor gets a 'roll return' over and apart from the return from the price movement of the constituent commodities.

The METLDEX tracks the movement in the prices of five key base metal futures contracts traded on MCX, thus providingan indicative benchmark for performance of the metal-using manufacturing or infrastructure sectors. The constituents of METLDEX are the futures of Aluminium, Copper, Lead, Nickel and Zinc traded on MCX. As these deliverable base metal contracts reflect the Indian supply and demand fundamentals, apart from global price trends, the resultant index created from these also is an effective

barometer for the metal market in India.

As noted above, the constituents of METLDEX are determined by two parameters -liquidity and physical market size in India. Each commodity within the index is weighted threefourths by its liquidity and one fourth by its physical market size in India, determined by local production and imports. Accordingly, the weights for the year 2021 (applicable from the January 2021 rollover period) are: Copper34.55%, Nickel 31.77%, Zinc 16.19%, Aluminium 12.11% and Lead 5.35%.MCX announces the weights in October every year to ensure that the weights are known at least three months in advance to the actual rebalancing of the



The inception date of the MCX Base Metal Index is 31 December 2015, with an inception value of 10,000. The Index complies with



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Analysis

global standards, adhering to the financial benchmarks set by the International Organization of Securities Commissions (IOSCO) in construction, administration and governance.

An alternative investment and hedging tool The futures contract on MCX METLDEX is characterized by some unique attributes which makes it an innovative product not just in the Indian commodity market, but the financial marketplace, as well. METLDEX futures is a cash settled instrument. which makes it suitable for both retail investors and institutional participants. As it tracks five metal markets, it enables an investor to take advantage of a general movement of the metals market, rather than that of any specific metal. Thus, the index participants can look at generating returns with less risk than holding the futures contract for a particular metal, as one needs to have a broader view on the segment as a whole to get a sense of the price direction. Investors can take their investment decisions only on the expected movement of the index, without having to handle delivery on expiry of the futures contracts traded on the exchange. At the same time, it can also be an additional instrument for manufacturing companies to manage commodity price risks in their operations. Like its constituents, METLDEX

futures is quoted in rupees, absorbing currency volatility in the metal price movement while being driven by international and domestic factors.

As METLDEX tracks the price movement in five underlying base metals, a single commodity constituent can move the index only to the extent of its weight in the index. As a result, the index is much less volatile than its constituents as abnormal price fluctuations in the index is less likely than such movement in its constituents.

Commodity indexes such as the METLDEX futures generally have low correlation with mainstream investment tools such as stocks and bonds; hence financial investors can include it in their asset allocation and diversify their portfolio while hedging against inflation. The above attributes give the index an impressive riskweighted returns over most time periods.



tı

Commencement of trading in MCX METLDEX is a part of SEBI's plan to broaden and deepen the commodity derivatives market by introducing new products and participants in the market. The new product addresses the investment demand of all classes of investors - retail and institutional. The latter can track and benchmark their sectoral investment in base metals, as also create passive index-based strategies and ETF products on the index and offer them to their clients. Besides, the futures contract on METLDEX can enable participants to create a variety of trading and arbitrage strategies, using constituent commodity contracts and the index futures product. In doing so, they inject liquidity in the underlying Base Metal futures, thus making them more attractive for hedgers and investors.

Conclusion

Thus, MCX METLDEX and the futures contract on it can accelerate growth of the metal derivatives market. enhance its market efficiency and further strengthen the metal ecosystem in the country. With advantages such as low cost of participation, less risk, good liquidity and easy understanding in terms of exposure to entire base metal segment, the MCX METLDEX futures has enabled many participants to find a new avenue to invest and participate in the financial market segment linked to metals.

18.8%

Default for risk free rate is 0 for Sharpe Ratio Calculation. | Data as of 31st December 2020

16.8%

-18.4%

-1.9%

20.2%

Absolute Index Returns

Industry Update



Industry 4.0 to improve the scrap recycling industry process

Global manufacturing industry is leaning towards the costeffectiveness and it can be achieved by implementation of Industry 4.0 technologies and it's best practices. Ithelpstoenhanced the productivity, revenues, profits and competitive advantages.

Industry 4.0 is a revolutionizing decisionmaking processes within the manufacturing industry. Among the technology portfolio that has enabled this revolution, the latest research has highlighted the potential of data analysis to improve the different stages of the production cycle, from resource provisioning to scheduling, delivery and warehousing.

Recycling and reuse of scrap in the foundry sector, and particularly in large steelworks, is a critical aspect in the sustainable and efficient production of metals with the quality demanded by the industry.

The state of the art in foundry raw materials optimization systems, is based on the characterization and classification of the different material families (scrap, internal returns, etc.), relying on the information provided by the suppliers. In the best



Alberto Montenegro Correa CEO, AMV Soluciones

of cases, this information is verified by taking a random sample of the material received, which is melted in lab furnaces and analyzed. The reliability of the results given by the optimization system depends directly on the representativeness of such information, and this is where the problem arises: if the scrap quality is good, the final results will match the expected ones.

On the contrary, if the scrap is heterogeneous or its logistic control is more complex, there is a big risk of getting chemical deviations in the final metal, which would imply the rejection of an important

Industry Update



part of the molten castings, with the subsequent negative impact on costs and productivity.

As a consequence, low quality scrap, which is very abundant available at low prices and it is underutilized while virgin raw materials (primary aluminum, pig iron...) used instead, despite it is much more expensive and difficult to produce in a sustainable way.

Substantial improvements have been made, using modern systems that offer 3.0 solutions with Operational Research algorithms, that collect almost all the variables that influence the melting process: full traceability of materials, environmental variables, preparation of furnace charges, additives, melting parameters (times, temperatures, electrical variables...), by-products, final metal, chemical composition or yields.

The next natural step has been to apply all this knowledge, and add Big Data techniques, predictive Machine Learning algorithms, and anomaly detection algorithms, in order to know, with the highest possible accuracy, the behavior of the different types of scrap, according to the operating conditions, and to provide real time accurate information to the decisionmaking systems. This is a turning point in efficiency and quality parameters for metal manufacturing.

Strategic products, such as steel, can benefit from a reduction in manufacturing costs in the range of 2% - 3%, improving their sustainability by increasing the use of lower quality scrap by more than 10%. In a steel plant with a production of 1 million tons / per year, this would mean cost savings of over 10 million euros per year.

This technology is also applicable to iron foundries (grey / ductile) in key sectors like the automotive and the wind power industries. We are at AMV (www.amvsoluciones.com) already working on that. We develop the best tools to optimize the industrial

optimize the industrial production system by: reducing costs and time, rationalizing resources, improving processes and quality control. It creates customized software solutions.



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Rare Earth Metals and Alloys: The Indian Perspective and Prospects

Introduction

The product that captured alobal attention of scientists. technologists, entrepreneurs and even world leaders in the late twentieth century is the neodymium - iron boron permanent magnet (Nd-Fe-B). Among all classes of permanent magnets such as hard ferrite, alnicos, and various rare earth permanent magnets (REPMs) such asNd-Fe-B, SmCo₅, & Sm₂Co₁₇, the class of Nd-Fe-B magnets gives the greatest device performance at the smallest size.

Their ever expanding application areas include computer and office automation, automotive, consumer electronics, appliances, factory automation equipment, medical diagnostics instruments, alternate energy devices and military hardware. Fig. 1 illustrates the size miniaturisation aspect of Nd-Fe-B magnets over ferrite magnets.

Global rare earth resources

The value chain for magnets commences from sourcing the minerals, separation ofrare earth oxides or salts (phosphate, halides etc), extracting the pure rare earth elements and using them to produce magnets.

The most important metals required to make Nd-Fe-B magnets are the rare earth elements such as Nd, Pr, Dy and/or Tb. Although most of the rare earth elements are relatively abundant in mineral form, separating their oxides/ salts and converting them into pure metal form or usable compounds is expensive and damaging to the environment. An estimate made in the year 2019 gives a projection of global reserve of rare earth elements (La to Lu in lanthanide series plus Sc and Y) to be 120 MT. The country-wise distribution of these reserves and mining production in the year 2019



S Pandian, Formerly, Defence Metallurgical Research Laboratory, Hyderabad

R N Patra

Formerly Indian Rare Earth Limited and former President, Indian Institute of Metals

Amol A Gokhale

Professor, Indian Institute of Technology Bombay, and President, Indian Institute of Metals (IIM) Table 1. Global reserves of rare earth elements and mining production in 2019

are given in Table 1.

The rare earth elements exist in a variety of minerals but are most abundant only in bastnasite and monazite. Bastnasite contains light rare earths (La - Eu) and a small amount of heavy rare earths (Gd - Lu). Monazite also contains mostly the light rare earths but only a fraction of heavy rare earths. Bastnasite deposits in China and the U.S. make up the largest percentage of economically exploitable rare earth resources. Monazite deposits in Australia, India, Brazil, China etc. make up the second largest resource. China is also having resource for xenotime, a mineral rich in heavy rare earths, particularly the much needed Dyand Tb to make high quality magnets for electric vehicles.

Indian scenario on rare earth resources

IREL (India) Ltd. (earlier known as the Indian Rare Earths Limited) is the main player in India for extraction of rare earths from the placer deposits of monazite



Fig.1: Up to six times size reduction is possible with rare earth permanent magnets over hard ferrites for the same flux output.

mineral on the east and west coasts of India. It produces oxides/halides of rare earths in purities of 95%, 99% and 99.9%.Since contaminants such as halides, oxides and other rare earths dilute magnet properties, they are preferred to be as low as possible. At present, the RE compounds market is dominated by China with its non-radioactive rare earth resource measuring upto 80% of its total resource.

Global scenario on production of pure rare earth elements and rare earth alloys

Preparation of RE metals is largely carried out by adoption of (i) molten salt electrolysis in fluoride media using Ce, La, Nd, Pr oxide as feed, (ii) reduction of Sm, Yb, Eu, Tm oxide by calcium/lanthanumand (iii) reduction of Y, Sc, Gd, Dy, Tb fluoride by calcium.

All the reduction processes are followed by refining processes to achieve the required purity levels. These processes include a combination of vacuum melting, vacuum arc refining and electron beam melting, and finally zone refining for ultra-purification. Neodymium and praseodymium metals of higher than 99% purity are needed for manufacturing high quality REPMs. Interestingly, didymium, a mixture of Pr and Ndcan also be used without separation for manufacturing REPM.The structure and the permanent magnet characteristics of Pr₂Fe₁₄B are guite comparable to those of Nd₂Fe₁₄B, and the use of

didymium does not diminish the magnet characteristics and, on the contrary, it leads to a significant cost reduction over the use of Nd alone.

In the beginning of the twentieth century, when RE separation technologies were not developed for large scale production of pure rare earth elements, electrolysis of anhydrous mixed RE chloride in fused salt medium was industrially practiced for production of mischmetal (MM), which comprises light rare earths(La to Eu), was used for making ferro-alloys that found applications in gas lighters, foundry and metallurgy in general. The process was having very low current efficiency around 35% and was energy intensive, thus consuming about 30 kWh/kg of mischmetal. In the 1970s, two Indian manufacturers were having domestic production facilities for the same and both of them had to abandon their operations by 1980's owing to the lack of economic competitiveness of these products, as mischmetal from Chinese sources became available in India.

The US Bureau of Mines under the Department of Interiors developed molten salt electrolysis of rare earth oxide in fluoride media for producing rare earth metals. A Japanese company adopted the process in 1980's for production of Ce/La-MM by operating two parallel streams of 20 kA electrolytic cells. The current efficiency in these cells was about 65% and the specific

Industry Update



electrical power consumption is reported to be about 12 kWh per kg of RE metal produced. Since the 1990's, Nd, Pr, Ce, La and MM are produced by this method using 3 kA cells in China. As far as the mining capacity is concerned, China leads the world (Table 2) by an estimate of about 63% in the year 2018 and 2019, with 10% increase year over year. However, in terms of production of pure rare earth elements. China is way above other countries with 85% of world production in Nd, Pr, Dy and Tb.

Indian scenario on production of pure rare earth elements / rare earth alloys

In India, Bhabha Atomic Research Centre (BARC), Mumbai developed RE metal manufacturing process by calcium reduction of RE oxides and fluorides in the 1970s for catering to its strategic requirements. R&D on rare earth oxides/salts into metal was actively pursued in CSIR laboratories also in early 1990s but it did not result in large scale production. Till date, any viable process or suitable manufacturing method has not been adopted for commercial production of various rare earth metals on an economically competitive scale in India. The electrolytic production of RE metal in molten salt fluoride media is similar to the Hall-Heroult electrolytic process of producing aluminium metal from alumina feedstock. Though India has 5.5 lakh tonne per annum aluminium production capacity in the country, RE



Industry Update

metal production by the above method is yet to be established. Issues such as (i) environmental degradation and (ii) requirement of huge electrical power at affordable cost are to be addressed, even if the gap in the value chain addition is managed by acquiring technology from foreign companies. Possibilities of acquiring such technology were sounded by Indian companies presently trading in imported rare earth magnets.

At present, India lacks the technology and production base for converting rare earth oxides to rare earth metals and/or alloys suitable for magnet making. Currently, BARC is continuing its R&D efforts to produce Nd/Nd-Fe and Sm/Sm-Co to be used for making magnets by collaborating with DMRL. Feasibility of extraction of rare earth metals and recovering them from magnet scrap is being pursued by IMMT, Bhubaneswar and NML, Jamshedpur.

The economic and its associated political overtones made the users of rare earths to plan and adopt strategies to counter if the current supply of rare earths in global market dwindles or the cost skyrockets, as it had happened in the years 2010-2011. In this context, rare earth mineral rich countries have opened up their own resources to be harnessed with value addition. Meanwhile, China has plans to remain the global leader for rare earths by extending

its reach to mineral sources existing in other countries. It has its stakes in countries such as Australia and Zambia.

Current Indian source of rare earth bearing minerals are adequate to meet the country's strategic need for production of both Sm-Co and Nd-Fe-B permanent magnets for use by Defence, Space and Atomic Energy departments. These strategic requirements of rare earth permanent magnets are only a small fraction of those used in various high technology applications of the civilian sectors of the country, for which the indigenous production need to be established, as the entire domestic demand is currently being met from overseas sources.IREL regularly mines rare earth ores and has established mineral beneficiation facilities and processes. It has proven technologies for making rare earth oxides/salts to various purities.

Summary and the Way Forward

The indigenous development of Nd-Fe-B magnet in large quantity rests with the availability of the raw materials, especially Nd, Prand Dy or Tb. IREL (India)Ltd is seemingly capable of producing rare earth oxides up to 99.9% in capacities that may meet the requirements for a production plant of Nd-Fe-B. The magnet making technology that was established at Defence Metallurgical Research Laboratory utilizes the raw

material either as pure Nd or as Nd-Fe alloy, which can be harnessed, incorporating the recent process improvements for commercial production. The gap in the value chain palpably exists in extracting the rare earth metals/alloys from its respective oxides/salts. A future course of action plan for India is to focus on this aspect of securing the indigenous rare earth raw materials, so that a complete value chain can be established for producing rare earth magnets from its own mineral resource. This can be made feasible by assuring alternate energy at affordable price, suitable land and business friendly regulations and environment.

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Aditya Paranjpe Chief Operating Officer

There are good factories and then there is the best. The fine line demarcating these two is a universally accepted metric and renowned jargon in the corporate grapevine, known as Overall Equipment

Efficiency (OEE). Often interchanged with the term Productivity, OEE, unlike the former has a narrower scope. OEE is closely hinged to a sub-process, equipment performance and the related factors whereas Productivity finds a rightful place among coalesce of several such sub-processes, like workshops or manufacturing establishments. Exceptional OEE of all equipment results in exceptional Productivity of the factory.

As one nears perfection, it becomes even more of a galling feat to achieve. Upgradation of equipment and profound industrial processes may make an uncanny difference in output but not at a penny-ante cost. There is always a last drop of efficiency that can be squeezed out before jumping onto the hard decisions. Identifying the right place to find this last drop is demystified with Industrial IoT (IIoT).

In numbers, OEE is the ratio of Fully Productive Time (FPT) to the Planned Production Time (PPT). Fully Productive Time is the total time required to manufacture faultless products. Several losses occur at different steps as we move from PPT towards FPT. These losses are broadly categorized into Availability Losses, Performance Losses and Quality Losses. As we discuss these losses, we will find out how TOR IoT can help minimize them.

Industrial IOT as a Lucrative Solution for OEE Revamp

Promise to tap the hidden potential makes IOT worth the candle

Availability Losses- Losses occurring due to unplanned downtimes are classified under this. These downtimes are a result of equipment breakdown or unplanned maintenance. Duration of the downtime is long enough for the operator to record the incident.

With IoT, availability losses can be easily avoided through Preventive Maintenance and Predictive Analysis. Web application compares the recent data of the machine with 'control values' using specialized algorithms and predicts possible failure modes. Deviations are highlighted and alerts are raised on frequent violation of the rules.

Subtle signs of misbehavior are missed due to inconsistent service schedule or plain negligence, leading to equipment failure. These failures can be avoided one step before Predictive Analysis through Preventive Maintenance. Maintenance scheduling ensures timely after-sale service of the machines and addresses the underlying problems in their infancy. Failures are prevented by generating alerts well before the conditions reach red.



Performance Losses- Frequent halts and sub- optimal utilization of the machine lead to Performance Losses. Halts are too short to record but frequent enough to affect the performance. Stops for refueling, lubrication, die setting and the like are indispensable to maintain quality but can be eliminated through right procedures.

Frequent interruptions in operation is compared with the predefined limits, beyond which the notifications are pushed based on the priorities set.

Prime movers like electric motors and engines give best efficiency at a fixed percentage of load and deviation towards either end of the spectrum disturbs the equilibrium but actual load during operation of the machine cannot be dictated with on-paper values.

Although efficiency in real time cannot be measured with pin-point accuracy, acceptable operating range for a machine can be specified. Performance of every machine when compared with the machines of similar type provides relative effectiveness of each equipment. Performance comparison averages out any momentary slump in performance caused due to uncontrolled factors, which might affect one or several machines working in tandem.

Quality Losses- Quality losses include manufacturing defects and start-up failures. Every output failed reduces Fully Productive Time, thus affecting OEE. Manufacturing defects are usually process driven and can be a result of incorrect settings, untrained operators and other such factors.

These losses can be tracked at different checkpoints and diagnostics will help to identify the points with most failures. Once recognized, past records of the equipment at those points can be used to single out the exact cause. In a nutshell...

Most industries adopt methods which involve human intervention. Maintaining manual records, periodic maintenance which miss out on minor glitches, overwriting or illegible handwriting in logs are just few activities which are surprisingly prominent in well-established organizations to this day.

These actions may seem harmless at first glance with an argument that industries have sustained on these processes for decades.

Industrial IoT eliminates the human factor in monitoring. It gives crisp and clear information which is devoid of any ambiguity. By adopting IoT, the subtle differences get highlighted which were not possible to capture with conventional measures.

Furthermore, this data unlike previous processes, does not stay buried in the archives. Analytics, resource management, production schedule can be derived from the recorded data which helps in corporate decisions being well-informed and backed with concrete numbers.

OEE has always been a sensitive subject and organizations have come a long way to earn their proverbial wisdom. What is good can always be made better and with IIOT, one can discover the 'Hidden Factory' within their plant with untapped potential waiting to be unleashed.

TALK TO YOUR MACHINES



Analysis

Base metals - the preferred investment in 2020

The year 2020 has been anything but predictable, with a host of events starting from the global economic fallout triggered by the pandemic, to the eye catching revival in China's economy and global Central banks trying to uplift their economies being the major factor behind the volatility in the Base Metals complex. Lets prognose each factor in detail.

The Pandemic

While the metal market had just begun to recover from the demand crunch caused by the prolonged Sino-American trade war which dominated the headlines for whole of 2019, the world was up against a lethal pandemic, the Covid19 virus.

The implacable virus that originated from Wuhan, China branched out to about 218 Countries and Territories and roiled the global growth prospects. The number of reported covid19 cases has surpassed 83

million with a death toll of over 1,812,000 deaths (increasing at an alarming rate).

Governments around the globe imposed nationwide lockodown to prevent the wildspread of the virus. China, The United States of America, Japan and Euro-zone are the primary consumer hubs for industrial metal, hence, the economic performance of these countries play a significant role in defining the consumption map of metal vis-à-vis the price volatility.

The Pandemic precipitated curbs led to halt in all the economic activities around the globe which was a major setback for the industrial metals spectrum in 2020.

China at it's A game

While the world stuggled to tame the implacable virus, a host of positive data sets from China, the biggest consumer of base metals, helped the prices pave there way through. After witnessing the worst fall in the first qaurter of 2020, China's economy saw a bold recovery which made industrial metals the perfect investment option for global investors.



China's GDP (Y-o-Y) cooled down to -6.8% in Q12020 (the first quarterly decline in GDP since 1992) from 6% reported in the last quarter of 2019. A wildspread of the coronavirus which origined in Wuhan, the capital of Hubei Province, in China passed out to most parts of the nations which led to the fall in GDP numbers. However, China succesfully contained the virus outbreak and commenced its road to recovery from the second quarter of 2020.



China's impressive journey was primarily driven by the enornous stimulus package announced by their government officials.

While most nations driected the stimulus support towards helping the workforce, but China's deal (a 3.6 trillion yuan {\$500 billion} fiscal stimulus package in May 2020) aimed at boosting investment expenditure.

The annual special bond issue by China which is focused on funding of infrastructural project was set at 3.75 trillion yuan (\$535.33 billion) for 2020.





Surge in construction and infrastructual development was China's plan to overcome the economic turmoil. With a flurry of infrastructural projects, domestic demand increased which layered a base for the comeback of the world's biggest metal consuming economy, China.

The robust revival was evident in China's industrial profits (yoy), Manufacturing & Non Manigacturing PMI, monthly auto sales and GDP figures. Strong demand from China outpaced all the global worries and helped most base metals post double figures gains in 2020.

Easy money by Central Banks

The central banks around the globe remianed on toes for most part of 2020, removing all the big guns to counter the worst economic downfall since the Great Depression in the 1930's.

Falling GDP figures, a weak labor market, dead end for business activites and a bleak economic outlook forced central banks around the globe to mount extraordinary rescue packages.

After slashing the interest rates thrice in 2019, down to a range between 1.5 and 1.75 percent, the U.S. Federal Reserve further trimmed the rates to 0.25 percent in 2020 in order to get their economy back on track. Along with lower interest rates, the U.S. FED also infused an enormous liquidity in the system through quantitative easing (QE).





Most of the central banks around the globe slashed the interest and infused a sizeable stimulus packages through different me thods which boosted the demand for industrial metals.

Copper – leads from the front

The prices of Copper, majorly used in power and construction, was dragged to as low as \$5100 per tonne in 2019 due to the prolonhged Sino- American tarde dispute. China accounts for almost 50 percent of the global copper consumption whereas U.S. accounts for 10 percent.

However, the year 2020 had different plans for the leading metal. With the striking recovery in China, construction and infrastructural development shot up which surged the demand for Copper and other industrial metals.



Despite of the shackled global economy, Copper, often used to gauge $\frac{1}{\sqrt{2}}$ $\frac{1}{\sqrt{2}}$

China's official Manufacturing Purchase Managers Index, which provides information about current and future scenarios of the manufacturing segment, also indicated that the industrial activities witnessed speedy recovery in comparison to the rest of the world.

Also China's Non Manufacturing PMI, which gauges the service sector also portrayed a steady expansion, signalling towards an overall revival in the worlds largest metal consuming nation.

The bullish trend in the red metal prices was further supported by China's scrap import quotas. Copper scrap a ccounts for a huge chunk of the global copper market (Copper market size: 24.5 million tonne).

Due to strict norms on scrap imports by the largest scrap buyer (first introduced in 2018), global scrap trade flows witnessed a significant plunge. The fragile global scrap supply chain was further disrupted by the pandemic which shifted the demand towards other forms of Copper.

$\left(\begin{array}{c} \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \right)$

Analysis

Moreover, constant depletion in LME Copper inventories also levied some support to the prices. Since May 2020, Copper inventories in the warehouse tracked by the LME dipped over 60 percent (LME Copper inventory stood at 113,975 tonnes as on 29th December 2020).

Another supporting pillar was the disrupted mining activities. Most nations imposed severe restrictions which forced many mines to suspend operations. Situations further worsened when the number of infected mine works increased. Many labor union went on strikes due to lack of safety measures taken during the ongoing crisis further threatening the mine supply and pushing the prices higher.

Moreover, China aiming to be the global hub for Electric Vehicles in the next few years has also kept the industrial metals prices elevated. With the world moving towards green society, demand outlook for the industrial metals looks promising. Major economies like China and Europe switching to renewable energy systems for the environmental benefits is expected to drive the demand for Copper and other industrial metals going forward.

Another factor underlining the speedy recovery in China's economy was the surge in China's metal imports. China's copper purchases in the first eleven months of 2020 stood at 6.17 million tonnes, surpassing the previous annual record of 5.297 million tonnes reported in 2018 with a month to spare.



Imports soared as rapid revival from the coronavirus led economic slump driven by heavy infrastructural investment proposed by the China's government uplifted the domestic demand and helped the Shanghai Futures Exchange (ShFE) outrun the London Metal Exchange (LME).

A spread between Shanghai and London prices opened an arbitrage window in May'20, leading to a significant rise in Chinese imports. Rising imports from China also helped ease the global market supply glut, as the rest of the world struggled to pave its way through the pandemic which further supported the prices. However, the prices discrepancy narrowed since September 2020 as economies outside China revived which made imports costlier for Chinese traders

Outlook

With surging demand from China, additional stimulus on the way and growing usage of Copper in electric vehicles the demand outlook for the leader metal looks to be very promising. However, with the on going crisis thing might turn south any moment. While a few vaccine against the pandemic are out in the market, concerns over its economic impact remains uncertain.

Another setback for Copper and the rest of the pack is the tarde tiff between U.S. & China.The protracted trade and tariff dispute between U.S. & China has shown some signs of easing as they agreed on the phase one trade deal. But the tiff between the largest Copper consumer is still not over. In totality, it would be another better year for copper.

MCX Copper (CMP: Rs.614/kg)prices could move higher towards Rs.700/kg mark in 2021. However, Rs.580 and 560 are possible zones which needs a closer look, if the price falls.

Yash Sawant, Analyst, Angel Broking

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Statistics

ICSG PRESS RELEASE

Date Issued: 20th January 2021



The International Copper Study Group (ICSG) released preliminary data for October 2020 world copper supply and demand in its January 2021 Copper Bulletin. The Bulletin and ICSG online statistical database provide data, on a country basis, for copper mine, smelter, refined and semis production, copper refined usage, trade, stocks and prices. The bulletin is available for sale (annual subscription €550/€850 for orders originating from/outside institutions based in ICSG member countries).

Preliminary data indicates that world copper mine production fell by around 0.5% in the first ten months of 2020, with concentrate production remaining essentially unchanged and solvent extraction-electrowinning (SX-EW) declining by about 2%:

Copper: Preliminary Data for October 2020

- World mine production declined by 3.5% in April-May as these two months were the most affected by the COVID-19 related global lockdown that resulted in temporary mine shutdowns/reduced production levels. However, world mine production started to recover in May as lockdown measures eased and the copper industry adapted to the strict health protocols.
- In Peru, stoppages resulting from the COVID-19 pandemic combined with operational issues/adverse weather that affected a few major mines, resulted in a 14.5% decline in mine output over the first ten months of 2020 including a significant decline of 38% in April-May compared to the same period of 2019. However, as the Peruvian mining industry started to recover the extent of the reduction narrowed and October output was 1.5% above that in October 2019.



- COVID-19 related constraints and other operational issues resulted in declines in production in other major copper mine producing countries, most notably Australia, Mexico and the United States.
- In Chile, the world's biggest copper mine producing country, output was up by 2.5% in 1st half of 2020, recovering from production constraints in early 2019 (output had declined by 2.5% in 1st half 2019). However, with a 3% decline over July-October 2020 compared to the same period of 2019, accumulated output in the first 10 months of 2020 remained essentially unchanged.
- Production in the Democratic Republic of Congo (DRC) and Panama increased significantly mainly due to the ramp-up of new
 mines or expansions. In Indonesia, production grew by 25% as output levels improved following the transition of the country's
 major two copper mines to different ore zones in 2019.

Preliminary data indicates that world refined copper production increased by 1.5% during the first ten months of 2020 with primary production (electrolytic and electrowinning) up by 2.5% and secondary production (from scrap) down by 3.5%.

- Chilean electrolytic refined output increased by 32% as in the comparative period of 2019 production was negatively affected by temporary smelter shutdowns as a result of upgrades to comply with new environmental regulations. After including a 6.5% decline in electrowinning production, total Chilean refined copper production (electrolytic and electrowinning) increased by 5%.
- Chinese refined production growth was negatively impacted by temporary shutdowns
 related to COVID-19 restrictions, tight scrap supply and constraints associated with
 concentrate imports and oversupply in the sulphuric acid market.
- Indian refined output decreased by 20% primarily as a consequence of the temporary suspension of Birla Copper's operations in March-May following a nationwide lockdown due to COVID-19. In the United States, temporary shutdowns and a long strike at Asarco's operations led to a 14% decline in refined output. Japanese refined production rose by 5% mainly as a consequence of a recovery from a number of maintenance shutdowns over the same period of 2019.
- Globally, constrained scrap supply due to the COVID-19 lockdown and lower copper prices during the first half of the year have
 negatively impacted world secondary refined production.

Preliminary data indicates that world apparent refined copper usage increased by 2% over the first ten months of 2020.

- The COVID-19 related global lockdown has had a notable negative impact on the world economy and subsequently on key copper end-use sectors in all regions.
- World ex-China refined copper usage was significantly impacted and is estimated to have declined by about 10%. Among the biggest copper using regions, refined usage fell by 17% in Japan, 12% in the EU, 5% in the United States and by about 12% in Asia (Ex-China).
- However, due to a 50% (1.25 million tonnes) increase in net refined copper imports, Chinese <u>apparent</u> usage increased by 14% offsetting usage declines in other regions of the world. <u>Real</u> Chinese industrial usage was negatively impacted by the COVID-19 related production suspensions at semis fabricators early in the year and weaker external demand and should present lower growth than <u>apparent</u> usage.



1,800

Preliminary world refined copper balance in the first ten months of 2020 indicates an <u>apparent</u> deficit of about 480,000 t due to a strong Chinese apparent usage:

- In developing its global market balance, ICSG uses an apparent demand calculation for China that does not take into account changes in unreported stocks [State Reserve Bureau (SRB), producer, consumer, merchant/trader, bonded]. To facilitate global market analysis, however, an additional line item - Refined World Balance Adjusted for Chinese Bonded Stock Changes - is included in the attached table that adjusts the world refined copper balance based on an average estimate of changes in bonded inventories provided by two consultants with expertise in China's copper market.
- Over the first ten months of 2020, the world refined copper balance, based on Chinese apparent usage (excluding changes in bonded stocks), indicated a deficit of about 480,000 t. The world refined copper balance adjusted for changes in Chinese bonded stocks indicated a market deficit of about 380,000 t.

(Copper Prices and Stocks and World Refined Copper Usage and Supply Trends table on next page)



World Refined Copper Usage (Kt Cu)

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Copper Prices and Stocks:

- Based on the average of estimates provided by two independent consultants, China's bonded stocks are thought to have
 increased by about 105,000 t over the first ten months of 2020 compared to the year-end 2019 level.
- As of the end of December 2020, copper stocks held at the major metal exchanges (LME, COMEX, SHFE) totalled 251,175 t, a
 decline of 51,212 t (-17%) from stocks held at the end of December 2019. Stocks were up COMEX (+106%) and down at the LME
 (-27%) and at SHFE (-39%).
- The average LME cash price for December 2020 was US\$ 7,755.24 /t, up 9.8% from the November average of US\$ 7,063.43 /t. The 2020 high and low copper prices were US\$ 7,964 /t (on 18th Dec) and US\$ 4,617.50 /t (on 23rd Mar), respectively, and the year average was US\$ 6,180.63 /t (3% above the 2019 annual average).

Please visit the ICSG website www.icsg.org for further copper market related information.

World Refined Copper Usage and Supply Trends

Thousand metric tonnes, copper

	2017	2018	2019	2019 2020		2020				
				Jan	Oct	Jul	Aug	Sep	Oct	
World Mine Production	20,058	20,565	20,528	16,948	16,885	1,737	1,763	1,698	1,806	
World Mine Capacity	23,993	24,062	24,154	20,573	20,829	2,112	2,120	2,059	2,135	
Mine Capacity Utilization (%)	83.6	85.5	85.0	82.4	81.1	82.2	83.2	82.5	84.6	
Primary Refined Production	19,485	20,023	20,018	16,622	17,050	1,699	1,773	1,750	1,814	
Secondary Refined Production	4,063	4,035	4,028	3,364	3,241	321	332	322	331	
World Refined Production (Secondary+Primary)	23,548	24,058	24,047	19,986	20,291	2,021	2,105	2,072	2,145	
World Refinery Capacity	27,545	27,979	28,794	23,959	24,666	2,524	2,529	2,453	2,540	
Refineries Capacity Utilization (%)	85.5	86.0	83.5	83.4	82.3	80.1	83.2	84.5	84.5	
World Refined Usage 1/	23,705	24,484	24,427	20,340	20,773	2,164	2,174	2,219	2,259	
World Refined Stocks End of Period	1,375	1,227	1,220	1,304	1,341	1,259	1,251	1,341	1,341	
Period Stock Change	10	-148	-7	77	121	-55	-8	90	-0	
Refined Balance 2/	-157	-426	-381	-354	-482	-143	-69	-147	-113	
Seasonally Adjusted Refined Balance 3/				-352	-477	-117	-125	-115	-130	
Refined Balance Adjusted for Chinese bonded stock change 4/	-154	-486	-559	-530	-379	-130	- 49	-109	-46	

Due to the nature of statistical reporting, the published data should be considered as preliminary as some figures are currently based on estimates and could change.

1/ Based on Chinese and EU apparent usage.

2/ Surplus/deficit is calculated using refined production minus refined usage.

3/ Surplus/deficit is calculated using seasonally adjusted refined production minus seasonally adjusted refined usage.

4/ For details of this adjustment see the paragraph of the press release on "World refined copper balance".

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Statistics

Metals Despatch

Newsletter of the International Metals Study Groups

LEAD AND ZINC MARKET FORECASTS

January 2021, Issue No. 28

COPPER MARKET FORECASTS

The outlook for world supply and demand for lead and zinc was presented during the ILZSG webmeetings held on 16 and 19 October 2020.

Lead Usage

Global demand for refined lead metal was forecast to fall by 6.5% to 11.39 million tonnes this year and to rise by 4.4% to 11.89 million tonnes in 2021.

Lead Supply

The Group expected world refined lead supply to fall by 4.3% to 11.66 million tonnes in 2020. In 2021, a 3.6% rise to 12.08 million tonnes was forecast.

World Refined Lead Metal Balance

The Group anticipated that the global supply of refined lead metal would exceed demand by 276,000 tonnes in 2020. In 2021, a further surplus of 192,000 tonnes was expected.

Zinc Usage

World demand for refined zinc metal was forecast to fall by 5.3% to 12.98 million tonnes in 2020 and to rise by 4.2% to 13.52 million tonnes in 2021.

Zinc Supply

Global refined zinc metal production was forecast to increase by 0.9% to 13.60 million tonnes in 2020. In 2021, an increase in world output of 2.9% to 13.99 million tonnes was predicted.

World Refined Zinc Metal Balance

The Group anticipated that global supply for refined zinc metal would exceed demand significantly in 2020 with the extent of the surplus forecast at 620,000 tonnes. In 2021, supply was expected to continue to exceed demand resulting in a surplus of 463,000 tonnes.

For further details, please contact **Joao Jorge** at <u>joao jorge@ilzsg.org</u>

STUDY GROUPS' NEXT MEETINGS INSG: 23 & 26 April 2021 ILZSG: 27-28 April 2021 ICSG: 29-30 April 2021

Due to the ongoing pandemic these meetings will be held virtually The world balance of refined copper production and usage was developed at the ICSG web-meetings held on 14-15 October 2020.

Copper Supply

After a small decline of 0.2% in 2019, world copper mine production, adjusted for historical disruption factors, was expected to decline by about 1.5% to 20.45 million tonnes in 2020 and then to recover by around 4.5% to 21.79 million tonnes in 2021. World refined production was expected to increase by about 1.6% in 2020 and 2021 to reach 24.52 million tonnes and 25.66 million tonnes respectively.

Copper Usage

World apparent refined copper usage was expected to remain essentially unchanged at 24.49 million tonnes in 2020 and to grow by about 1.1% to 24.75 million tonnes in 2021.

World Refined Copper Metal Balance

World refined copper balance projections indicated a deficit of about 50,000t in 2020 and a surplus of about 70,000t for 2021.

For further details, please contact Ana Rebelo at rebelo@icsg.org

NICKEL MARKET FORECASTS

The INSG held its web-meetings on 12 and 13 October and developed its production and usage forecasts for world primary nickel.

Nickel Supply

World primary nickel production was 2.382Mt in 2019, and was forecast to reach 2.436Mt in 2020 and 2.586Mt in 2021.

Nickel Usage

World primary nickel usage was 2.403Mt in 2019. The INSG forecasted increases to 2.318Mt in 2020 and 2.518Mt in 2021.

World Primary Nickel Balance

The Group anticipated surpluses of 117kt in 2020 and 68kt in 2021.

For further details, please contact Ricardo Ferreira at ricardo ferreira@insg.org

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- O TALON.
- O UBC.
- ALLOY WHEELS.
- Aluminium Radiator / Aluminium Copper Radiator.
- O Different grades of TELIC.
- Aluminum Ingots.

BRASS SCRAP-

- Brass Heavy Scrap.
- Brass Honey Scrap.
- Brass Ingot.

COPPER SCRAP-

- O DRUID Copper Scrap.
- O Barley.
- O Copper Ingots.
- Copper Tubes.
- Milly Berry.

LEAD SCRAP-

- Battery Scrap.
- Lead Remelted Ingots.
- Lead Wheel Weights.
- Lead Refined Ingots.

ZINC SCRAP-

- ZINC ASH.
- ZINC Die cast scrap.
- ZINC Ingot.

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SIAM

SIAM										
Summary Report: Cumulative Production, Domestic Sales & Exports data for the period of April-December 2020 with % Change										
Report I										
(Number of Vehicles)										
Category		Production		D	omestic Sale	5		Exports		
Segment/Subsegment	A	oril-Decemb	er	A	pril-Decembe	r	A	oril-Decembe	er	
	2019-2020	2020-2021	% Change	2019-2020	2020-2021	% Change	2019-2020	2020-2021	% Change	
Passenger Vehicles (PVs)*										
Passenger Cars	1,643,739	1,178,942	-28.28	1,291,234	1,028,101	-20.38	404,675	190,612	-52.90	
Utility Vehicles(UVs)	852,686	756,835	-11.24	725,650	677,107	-6.69	133,322	99,684	-25.23	
Vans	97,580	70,139	-28.12	101,036	72,666	-28.08	2,274	877	-61.43	
Total Passenger Vehicles (PVs)	2,594,005	2,005,916	-22.67	2,117,920	1,777,874	-16.06	540,271	291,173	-46.11	
Commercial Vehicles (CVs)** M&HCVs										
Passenger Carrier	33,554	5,067	-84.90	29,206	2,578	-91.17	5,885	2,829	-51.93	
Goods Carrier	154,159	88,610	-42.52	146,682	77,576	-47.11	11,128	6,915	-37.86	
Total M&HCVs	187,713	93.677	-50.10	175.888	80,154	-54.43	17.013	9,744	-42.73	
LCVs										
Passenger Carrier	33,862	9,787	-71.10	35,644	7,426	-79.17	3,132	908	-71.01	
Goods Carrier	379,612	286,283	-24.59	359,162	270,623	-24.65	26,232	19,642	-25.12	
Total LCVs	413,474	296,070	-28.39	394,806	278,049	-29.57	29,364	20,550	-30.02	
Total Commercial Vehicles (CVs)	601,187	389,747	-35.17	570,694	358,203	-37.23	46,377	30,294	-34.68	
Three Wheelers										
Passenger Carrier	794,692	346,407	-56.41	420,269	76,835	-81.72	384,905	268,065	-30.36	
Goods Carrier	91,704	58,067	-36.68	86,985	53,766	-38.19	5,324	3,269	-38.60	
Total Three Wheelers	886,396	404,474	-54.37	507,254	130,601	-74.25	390,229	271,334	-30.47	
Two Wheelers					,					
Scooter/ Scooterettee	4,767,058	3,056,748	-35.88	4,463,879	3,103,112	-30.48	286,278	149,607	-47.74	
Motorcycle/Step-Throughs	11,388,624	9,182,647	-19.37	8,954,239	7,199,152	-19.60	2,387,116	2,015,869	-15.55	
Mopeds	497,827	459,867	-7.63	495,677	462,107	-6.77	11,437	6,539	-42.83	
Electric Two Wheelers	0	1,475	-	0	1,417	-	0	0	-	
Total Two Wheelers	16,653,509	12,700,737	-23.74	13,913,795	10,765,788	-22.63	2,684,831	2,172,015	-19.10	
Quadricycle					, ,			, ,		
Quadricycle	4,996	2,300	-53.96	954	-27	-102.83	4,434	2,257	-49.10	
Total	4,996	2,300	-53.96	954	-27.00	-102.83	4,434	2,257	-49.10	
Grand Total of All Categories	20,740,093	15,503,174	-25.25	17,110,617	13,032,439	-23.83	3,666,142	2,767,073	-24.52	

Society of Indian Automobile Manufacturers (14/01/2021) * BMW, Mercedes and Volvo Auto data is not available ** Daimler & Scania data is not available

SIAM										
Summary Report: Cumulative Production, Domestic Sales & Exports data for the period of January -December 2020 with % Change										
									of Vehicles)	
Category		Production		D	omestic Sale	s	Exports			
Segment/Subsegment	Jan	uary -Decem	ber	Jan	inuary -December		January -December			
	2019	2020	% Change	2019	2020	% Change	2019	2020	% Change	
I Passenger Vehicles (PVs)*										
Passenger Cars	2,313,062	1,706,797	-26.21	1,819,884	1,432,304	-21.30	531,226	276,808	-47.89	
Utility Vehicles(UVs)	1,156,634	1,039,764	-10.10	984,928	897,406	-8.89	171,440	149,842	-12.60	
Vans	159,312	104,707	-34.28	157,303	103,754	-34.04	3,493	1,448	-58.55	
Total Passenger Vehicles (PVs)	3,629,008	2,851,268	-21.43	2,962,115	2,433,464	-17.85	706,159	428,098	-39.38	
II Commercial Vehicles (CVs)**										
M&HCVs										
Passenger Carrier	48,859	15,793	-67.68	41,620	13,413	-67.77	8,174	5,392	-34.03	
Goods Carrier	254,165	123,621	-51.36	246,681	115,345	-53.24	20,150	10,338	-48.69	
Total M&HCVs	303,024	139,414	-53.99	288,301	128,758	-55.34	28,324	15,730	-44.46	
LCVs										
Passenger Carrier	49,474	19,747	-60.09	51,820	17,525	-66.18	4,399	1,518	-65.49	
Goods Carrier	542,860	384,017	-29.26	514,622	358,906	-30.26	37,979	27,439	-27.75	
Total LCVs	592,334	403,764	-31.84	566,442	376,431	-33.54	42,378	28,957	-31.67	
Total Commercial Vehicles (CVs)	895,358	543,178	-39.33	854,743	505,189	-40.90	70,702	44,687	-36.80	
III Three Wheelers										
Passenger Carrier	1,081,579	567,972	-47.49	564,251	182,096	-67.73	522,329	378,438	-27.55	
Goods Carrier	130,232	83,079	-36.21	123,195	78,316	-36.43	7,125	4,318	-39.40	
Total Three Wheelers	1,211,811	651,051	-46.27	687,446	260,412	-62.12	529,454	382,756	-27.71	
IV Two Wheelers		1 0 1 0 0 0 0		5 6 4 4 6 4	1 005 101		070.005		07.00	
Scooter/ Scooterettee	6,248,114	4,316,888	-30.91	5,841,184	4,205,194	-28.01	372,025	233,327	-37.28	
Motorcycle/Step-Throughs	15,087,432	12,150,069	-19.47	12,011,692	9,458,577	-21.26	3,067,153	2,764,301	-9.87	
Mopeds	722,845	611,718	-15.37	/13,981	603,242	-15.51	13,305	8,961	-32.65	
Electric I wo Wheelers	0	1,475	-	0	1,417	-	0	0	-	
I otal I wo Wheelers	22,058,391	17,080,150	-22.57	18,566,857	14,268,430	-23.15	3,452,483	3,006,589	-12.92	
Quadricycle	0.000	0.000	10.70	1 100		400.70	5 400	0.000	11.70	
Quadricycle	6,629	3,399	-48.73	1,403	-39	-102.78	5,162	3,008	-41.73	
	6,629	3,399	-48.73	1,403	-39	-102.78	5,162	3,008	-41.73	
Grand Total of All Categories	27,801,197	21,129,046	-24.00	23,072,564	17,467,456	-24.29	4,763,960	3,865,138	-18.87	
Society of Indian Automobile Manufacture	ers (14/01/202	1)								
* BMW, Mercedes and Volvo Auto data is	not available									
** Daimler & Scania data is not available										

SANKET PRAKASHAN - 1, Alpha, M.G. Road, Vile Parle (East), Mumbai - 400 057.