METALWORLD

Devoted to Foundry & Non-Ferrous Metals Industry

Vol. 20 No. 06 | June 2021

Registered-RNI No. MAHENG/2002/7908

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P D Pant

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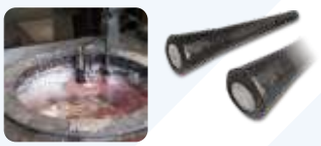

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Editorial Desk

D. A. Chandekar
Editor

Dear Readers,

In mid eighties, when I joined a metal producer as GET (Graduate Engineer -Trainee), metal production and processing was altogether a different ball game. Apart from an EAF and concast, we had a small manually operated rolling mill where the labours used to feed the hot billet in between the rolls using long tongs. This process was repeated from both sides of the rolls every time changing the billet face. Quite a risky operation considering very few safety gadgets these labours were wearing. With no concept of 'housekeeping', the shopfloor environment was very dusty and dirty. Labour unions were very strong at that time and undoubtedly the bosses of the shopfloor were not the managers or the supervisors but the rowdy union leaders. Naturally the fresh GETs like us felt out of the place and also somewhat unsafe. Spending professional life in such a shady place after studying engineering can not be anybody's dream. I think this was the main reason why 'Metallurgy' was the last preference of all the engineering streams prevailing at that time. Many colleges would not even have this branch. Even the salaries in metallurgical plants were no way comparable with other industry verticals like auto, electrical, engineering etc. Further, many big plants are situated far away from the big cities, offering limited opportunities for socialising and entertainment. Those were the times with no mobiles and only one or two channels on the TV. Why would a young engineering graduate join this industry unless all the other options are exhausted ?

Since then in last about three and half decades, the metallurgical industry has surely changed its style of functioning , both in the office as well as in the plant. In eighties and ninties, the new management philosophies and techniques like Kaizen, JIT, TQM, Quality Circles were the buzz words in the industry and in almost all the big corporates. The management executives and 'would be' senior management personals would waste lot of professional time in attending these useless training sessions and playing childish games in the name of team building activities, as a part of these sessions. I know some would surely argue from the other side and would definitely have few valid and logical points.

The real transition took place by the start of 21st century when modern technologies like automation, ERP started creeping in the industry. Metallurgists started sitting in AC offices instead of an iron cabin situated at one corner of the shopfloor. Even the meltshops, rolling mills and the other processing lines in the plant were now controlled, monitored and operated through a central control stations studded with monitors displaying real time figures, graphs and charts. The salaries too improved over the years and with the explosion in telecommunication sector, now it does not really matter wheather you are in Mumbai or at a remote location in Odisha.

Today the new concepts like Industry 4.0 are storming the industry but I feel that the shopfloor is a place which can be made still better, with some innovative housekeeping, cleanliness, targeting zero accident weeks and months and consolidating professional work environment with human face.

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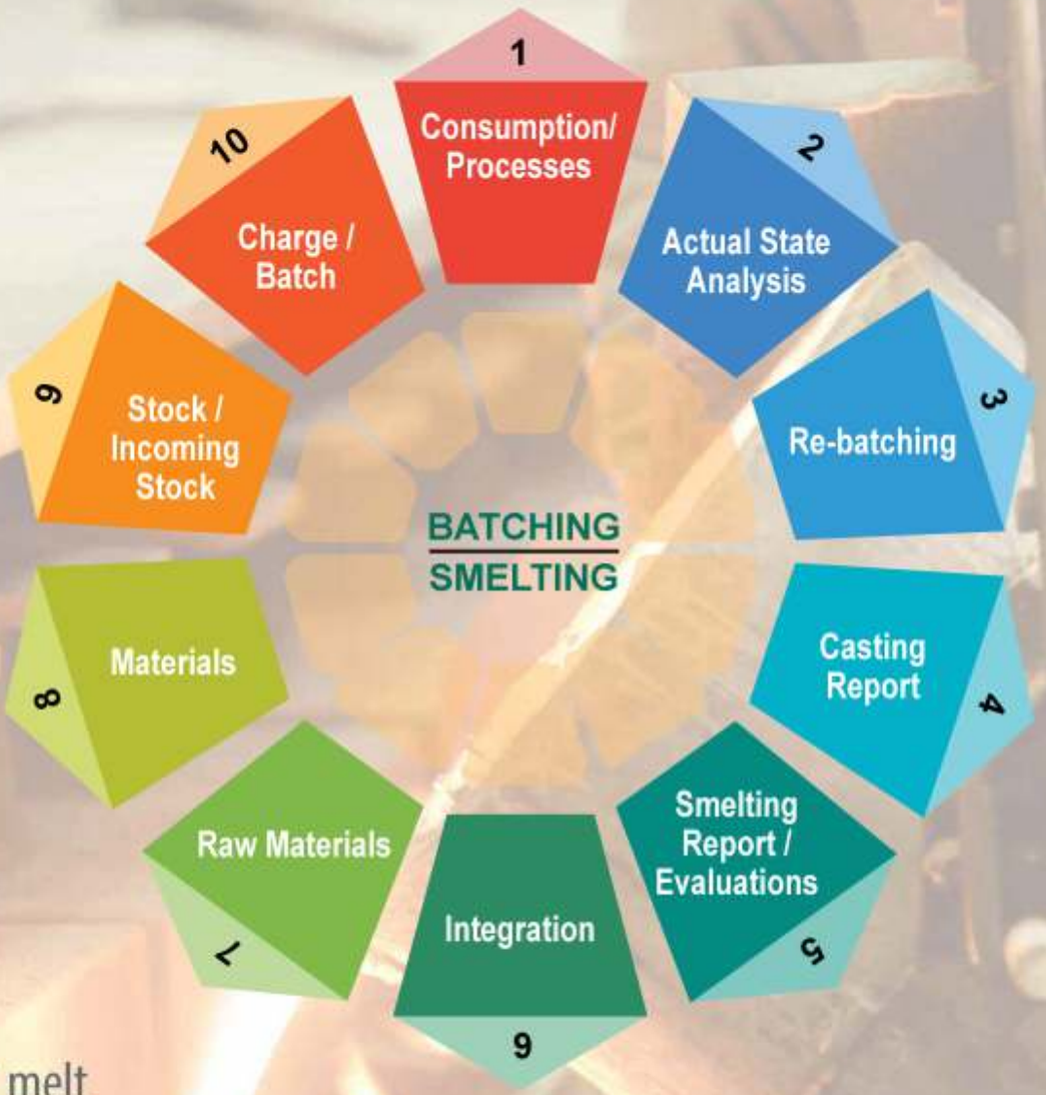

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Metal Power to provide one-stop solution of spectrometers to become Atmanirbhar

P D Pant is a B.Tech. (Elect. Engg.) merit scholar from IIT Kanpur and a Management post-graduate from IIM Calcutta, with over four decades of experience in metals industries. Having founded Metal Power in 1987, he was also responsible for setting it up as a Company specialized in manufacturing Analytical Instruments. A true pioneer in the analytical instruments field, he is the driving force behind Metal Power's R&D focus. Through the years, Pant's focus has been on import substitution and building products that support quality and profitability improvements in metals industries. Today, Pant is recognized as one of the foremost personalities in the field of spectrometry. He has been felicitated by a host of industry bodies with multiple awards and accolades and is a frequent speaker at various fora besides having authored articles and papers for multiple national and international publications.

Over the past 30 years, under his leadership, Metal Power has emerged as a pioneer in the world of spectrometry, not just in Bharat but across the world. Through the years, Pant's focus has been on import substitution and building products that support quality and profitability improvements in metals industries. Today, Pant is recognized as one of the foremost personalities in the field of spectrometry. He has been felicitated by a host of industry bodies with multiple awards and accolades and is a frequent speaker at various fora besides having authored articles and papers for multiple national and international publications. Recently, under his leadership, the Company) metal Power Analytical P. Ltd., has been given recognition by the Technology Development Board of the GOI. The Company has been chosen on the basis of innovation in the field of spectrometry.

He has been responsible for several firsts in the metal industry – from the first indigenously-made Bharateeya spectrometer to the first range of Certified Reference Materials made in Asia and several other products. He is driven by his passion for Nation-building.

D A Chandekar, Editor & CEO had an interaction with P D Pant, MD, Metal Power to understand more about key insights on second wave of Covid-19 and how Metal Power one-stop solution of design, mfg and supply of Spectrometer would be helpful for the metal industry.

Excerpts :

1. How is the metal industry coping up with the second wave of Covid-19?

I am happy to state that we

are all witness to a great display of resilience by the Bharateeya Industry, including the Metals Industry. To the best of my knowledge, especially where there are associations or groups/clusters of industries, the constituent members do get together regularly to discuss and see how they can cope up with the situation imposed by the Chinese virus and its waves. Such groups of companies provide the much-needed help to each other, including mental and psychological support, information of how the leaders in the group and in industryare coping and how to make the best out of an adverse situation.

2. How do you see the future of metals industry in India? Especially for the coming year?

I am quite optimistic of the future of our industries. Very sensibly, the Government of Bharat has kept up the scorching pace of infrastructure development including – Educational Institutes of various kinds – Universities, Colleges, Institutes of Eminence, Vidyalayas; Railways; Roads & Expressways; Waterways incl. rivers, canals & reservoirs; Airways, including development of several airports and runways; Power; Defense; Electricity Generation; Tourism;Hospitals& Health Centres;Public toilets etc. The development of infrastructure automatically means a tremendous boost to Industry, which will soon come into its own as soon as the Chinese virus evaporates. To top it all, all these developments are still on-going.

It has also been our observation that during these Covid times, whenever there was relaxation of lockdown given by state governments, there has been an almost immediate increase in order levels and industrial activity.

3. How is the Metal Power products solution to help the industry to become cost competitive in global markets?

Metal Power started developing import substitutes in 2000. Our main objective in designing and manufacturing a fairly long line of instruments has had far reaching effects in Bharat.

- It has brought down the price of spectrometers not only in Bharat but also in various other countries.
- Metal Power has helped its vendors develop products of high quality and thus raised their expertise in their respective fields. This would have helped them in improving the general quality of all that they produce.
- Metal Power manufactures spectrometers for all levels of customers including small start-ups to the highest level of manufacturers and even R&D establishments. All models of our spectrometers give the highest levels of performance. Our smallest Model – the MOSS costs less than Rs.10 lakhs and yet enables analysis of C, S, P etc. down to 0.005%. MOSS also analyze Nitrogen down to 0.005% and Boron to 0.0005% (5 ppm). On the other hand, our highest Model Metavision-10008X can analyze almost all elements down to 1 ppm and some even to sub-ppm levels. Using this model, Oxygen & Nitrogen too can be analyzed down to 1 ppm. Similar features for Hydrogen analyses are in the final stages of development. With these features, the spectrometer is almost like a Complete Lab on its own. It can also analyze ultra-fine foils and wires down to 0.1 mm dia. The price is substantially lower than that of similar imported spectrometers besides affording wider range of uses and better

performance. There are also some additional super features that are being developed.

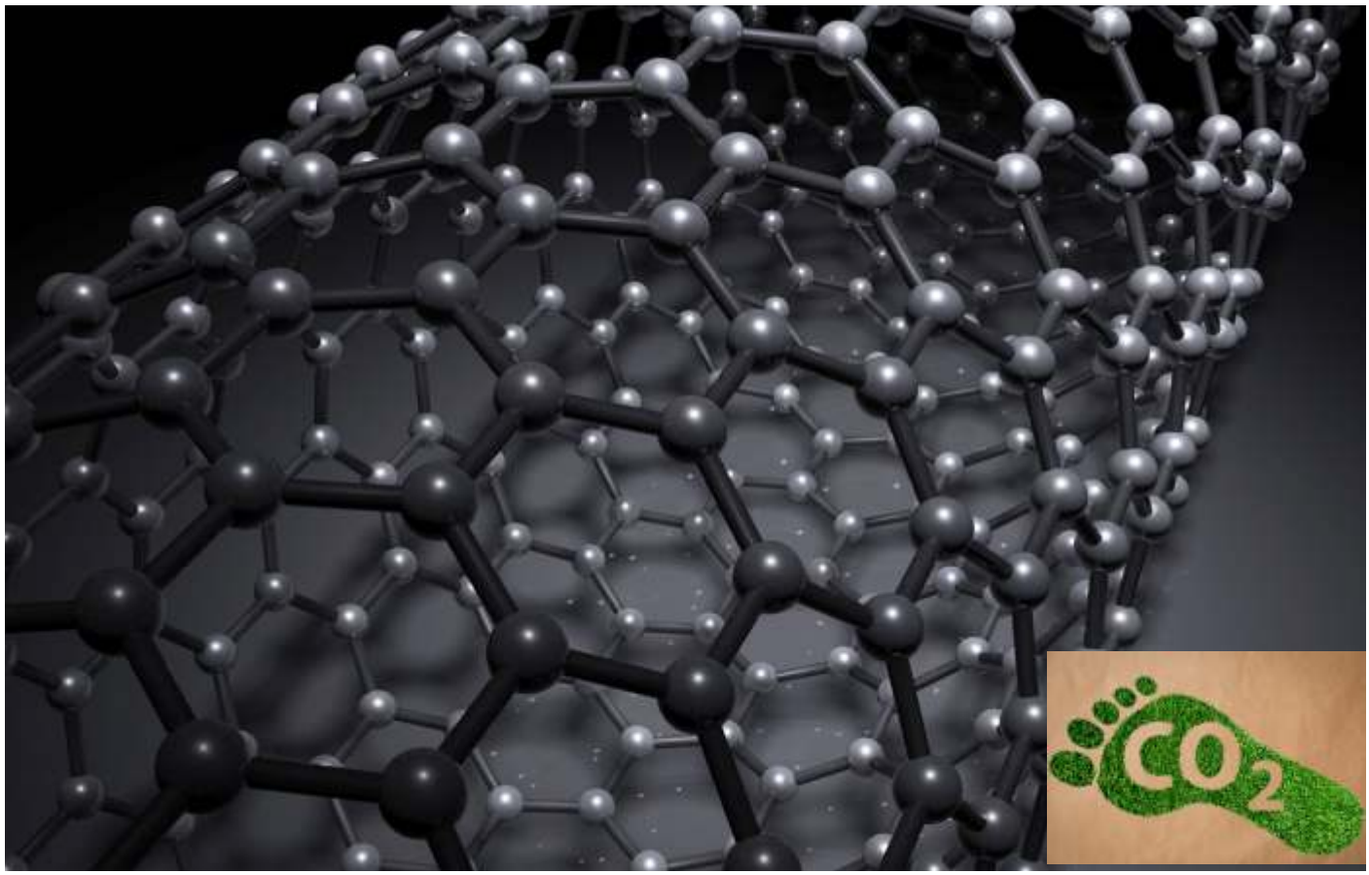
- Metal Power wanted to give users a truly One Stop Shop. Thus, Metal Power design, manufacture and supply a huge range of over 30 different accessories for spectrometers. These include various kinds of Adaptors for fine wires, foils, very small components etc., various kinds of sample preparation machines, Sampling Moulds, Safety Devices and now even a Smart Tool for Cleaning & Pointing Electrodes instead of using age-old wire brushes.
- Metal Power's exports have gone up in the recent past and we are now contributing significantly to forex earnings and Bharat's growing stature.

4. How is Metal Power contributing to the concept of 'Atmanirbhar Bharat'?

Metal Power has no foreign collaboration. Only about 5% by value of the products we make are imported. The rest are all mainly designed & manufactured by us in Bharat. The efforts of the men behind Metal Power have proven that our engineers and scientists who have studied in our own country can do great things and build a truly Mahaan Bharat. Perhaps this is exactly what our right Hon'ble Prime Minister means by Atmanirbharata! In this context it might be appropriate to mention that it is a matter of pride to us that Metal Power's efforts have been recognized by the Government of Bharat which has recently given us the National Award for Innovations and Import substitution.

5. What are the future plans of Metal Power?

Metal Power is now engaged in manufacturing totally new types of spectrometers and certain other new products, which are expected to be introduced by us into the Bharateeya market by the end of the year.



BALCO reducing Carbon footprint through next-generation technology

"We are committed to sustainable development and across all our areas of operations using leading-edge technology, and judicious utilization of resources"

Abhijit Pati, CEO and Director, BALCO Bharat Aluminium Company (BALCO), India's iconic aluminium producer is a strong proponent of leveraging next-generation technology to make its manufacturing process sustainable and reducing carbon footprint. BALCO has reduced its power consumption in its 'potline 1'

at its smelter in Chhattisgarh to 12,862 KWH/MT which is at par with global standards. This potline has hence, the best performance amongst potlines in India and the Gulf countries in terms of specific power consumption and has thus reduced its carbon footprint significantly.

A smelter is a plant where aluminium is produced through the process of smelting, which involves extracting it from its oxide, alumina. A potline is a long building, or collection of buildings, which contain a series of "pots", or large electrolytic cells, in which aluminium is made.

The company has achieved this benchmark by deploying a smart combination of high-end technology and indigenous innovations.

Speaking on BALCO's carbon footprint reduction in its manufacturing process, Abhijit Pati, CEO and Director, BALCO, said, “We are committed to sustainable development and across all our areas of operations using leading-edge technology, and judicious utilization of resources”. BALCO has been one of the early adopters in India to explore the field of smart technologies for heightened operational efficiencies. These investments and skills further bolster the culture of safety and productivity that we have meticulously fostered across the organization.

We are conscious of our responsibility towards building a stronger and sustainable tomorrow and, therefore, are actively exploring innovations that help reduces carbon footprint as early as possible in the creation process. We are ensuring a future-ready organization for a self-reliant India.”

The company has integrated smart technologies and design modifications in its potlines progressively to reduce its specific power consumption by using a graphitized pot with thermal modelling and other digital interventions. The company relentlessly drives innovation and continuous improvement in its smelting technology. BALCO's specific energy consumption has been one of the lowest in the aluminium industries across the country. BALCO has also brought down its specific water consumption today by 170% from its previous specific water consumption levels, which is also one of the lowest amongst its peers. These figures are a testimony to BALCO's spirited endeavours towards environment and energy conservation which contribute to a greener and better planet.

BALCO has been the recipient of various awards and accolades for its environmental conservation efforts. For the year 2020, BALCO has won the 'CII Energy Efficiency Award', Sensitivity: Public (C4) Golden Peacock Sustainability Award' and 'CII HSE Excellence Award, Chhattisgarh'. BALCO has also achieved the 'International Green Apple Award' 'CII Energy Excellence Award', 'Sustainable Business of the year Award', 'National Award for Excellence in Energy Management' and 'Energy & Environment Global Environment Award' in recent years.

Bharat Aluminium Company Limited (BALCO) is India's iconic aluminium producer. It is owned 49% by the Government of India and 51% by Vedanta Limited. Vedanta Limited is one of the world's largest diversified natural resources companies and the largest producer of aluminium in India. BALCO operates a 0.57 million tonne per annum (mtpa) aluminium smelter in Korba, Chhattisgarh.

It is also a leader in value-added aluminium products that find critical applications in core industries. With its world-class smelter and power plants, the company fulfils its mission of spurring emerging applications of aluminium as the 'Metal of the Future' for a greener tomorrow.

About Vedanta Cares

Vedanta is committed to reinvesting in the social good of its neighbouring communities and the nation. Under the aegis of Anil Agarwal Foundation, Vedanta is setting up 10 'field hospitals' with 1,000 beds for COVID -19 patients across India. The company has pledged Rs. 150 Cr to help the country in its fight against the rapidly spreading second wave of Covid 19.

The company had contributed Rs 201 crore last year in the wake of the Covid crisis catering to the livelihood of daily wage workers, preventive health care and support to all its employees and contract partners across its plant locations.

About Vedanta Limited

Vedanta Limited, a subsidiary of Vedanta Resources Limited, is one of the world's leading Oil & Gas and Metals company with significant operations in Oil & Gas, Zinc, Lead, Silver, Copper, Iron Ore, Steel, and Aluminium; Power across India, South Africa, Namibia, and Australia.

Vedanta has been contributing significantly to nation-building. Governance and sustainable development are at the core of Vedanta's strategy, with a strong focus on health, safety, and environment.

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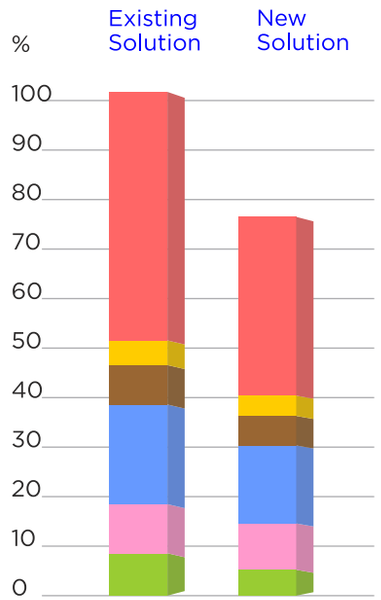

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Decarbonisation: is aluminium a solution or a problem?

Aluminium is both a major contributor to global greenhouse gas (GHG) emissions and one of the key energy transition metals needed to build a low-carbon future. Julian Kettle, Wood Mackenzie Senior Vice President, Vice Chair Metals and Mining, asks: can initiatives to cut aluminium's carbon intensity offset the impact of increasing production?

It's often said that a pessimist sees the difficulty in every opportunity, while an optimist sees the opportunity in every difficulty. As a natural optimist, I can see the huge opportunity the energy transition presents for aluminium: the buildout of low-carbon energy supply and transmission will consume vast quantities of primary aluminium and associated alumina and bauxite.

However, I'm also a realist, so I'm fully aware that increased aluminium production will generate a large – and growing – carbon footprint. Ironically, the rate at which aluminium industry emissions can be reduced at scale will be determined by the buildout and availability of low-carbon power, which itself requires the use of low-carbon aluminium, amongst other metals. This is what I call the 'energy transition circularity'.

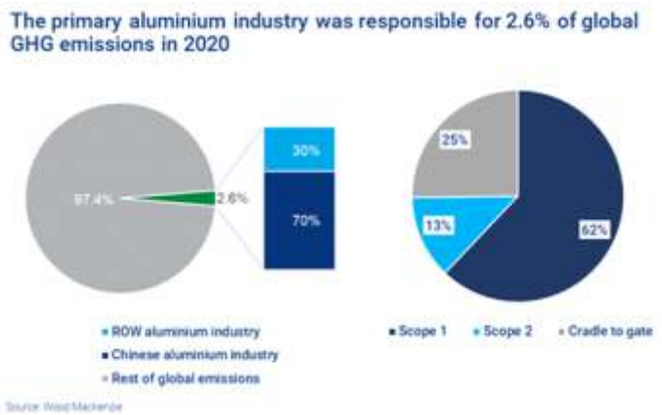
So, can aluminium cut its emissions intensity fast enough to be truly part of the solution?

Primary aluminium: hooked on coal-based power

The primary aluminium industry accounted for around 2.6% of global GHG emissions in 2020. Around 70% of the emissions arising from aluminium production came from China, despite it only producing 57% of the global total output. This reflects the dominance of coal in China as a power source for both smelting and refining aluminium, with coal accounting for 85% of the energy used for smelting and 87% of the energy used in refining.

On a global basis, power accounted for close to 60% of GHG emissions relating to aluminium production in 2020. Decarbonising power sources therefore offers the greatest opportunity for emissions reduction in the aluminium industry – or as a pessimist might have it, decarbonising power sources creates the greatest obstacle to emissions reduction.

Cradle-to-gate (i.e. the raw material supply chain from extraction to factory gate) accounted for 22% of total primary aluminium GHG emissions, with coal accounting for 68% of the energy supply for refining. If the alumina refining industry were to switch to gas this would lead to a 26% reduction in emissions. There is also the potential to reduce emissions by making greater use of electrical heating for process steam generation, but that requires the availability of commercially viable green electricity.



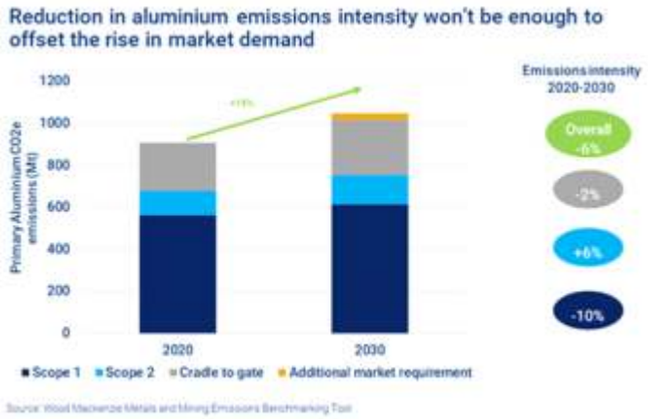
How will aluminium emissions intensity be reduced?

Our base case projects that primary aluminium supply will rise by 24% or 16 Mt by 2030, to allow for stocks to return to normal levels. Based on known changes to power sources and specific energy and emissions reduction plans, the intensity of carbon dioxide equivalent (CO_2e) emissions will decline by just 6%.

By far the largest contributor to the decline will be Scope 1 emissions – direct emissions from owned or controlled sources. These are set to fall by 10% as producers introduce more efficient smelters into the global fleet, undertake limited switching of power sources, and drive carbon efficiencies. There will also be some limited application of inert anode technology (in which the traditional carbon anodes are replaced in favour of inert materials), but we believe commercial adoption will be slow this decade.

By contrast, aluminium's Scope 2 emissions – direct emissions from purchased electricity – are set to rise over the coming decade. This reflects the concentration of expansion in Asia, where coal-based power sources will continue to dominate.

As noted above, there is scope for significant reductions in supply chain emissions using gas or electrical heating in alumina refineries. A 100% switch from coal to gas for alumina refining could offer a potential 26% reduction in cradle-to-gate emissions intensity. But, with low-cost coal the preferred energy source, particularly in Asia, progress will be slow this decade.



Primary aluminium emissions are set to rise

Despite limited reductions in CO_2e intensity, a significant expansion of primary production (driven in large part by energy transition needs) means CO_2e emissions from aluminium production are set to rise in absolute terms over the next decade. Our modelling indicates that, even with a willingness to build or procure low-carbon power and reduce process carbon emissions through inert anode technology, total industry emissions will rise by 15% over the next decade. The grid will not be able to decarbonise fast enough to allow the aluminium industry to meet the needs of the energy transition while also cutting its emissions.

A rapid expansion of secondary (recycled) supply and use could offer a fast-track solution, given that secondary aluminium has 5% of the GHG emissions intensity of primary. However, in most of the electrical applications that are critical to the energy transition, secondary material cannot be used. Also, a massive expansion of recycling will require policy and societal change, neither of which will be quick.

Part of the problem… for now

Going back to my opening comments, do I feel optimistic or pessimistic about aluminium's role in the decarbonisation journey? In my view, the aluminium sector will be part of the problem of carbon emissions for the next decade. However, the optimist in me believes that ultimately it will be part of the solution by helping to deliver low carbon energy. But it's going to take time, and when it comes to tackling the decarbonisation challenge, time is in short supply.

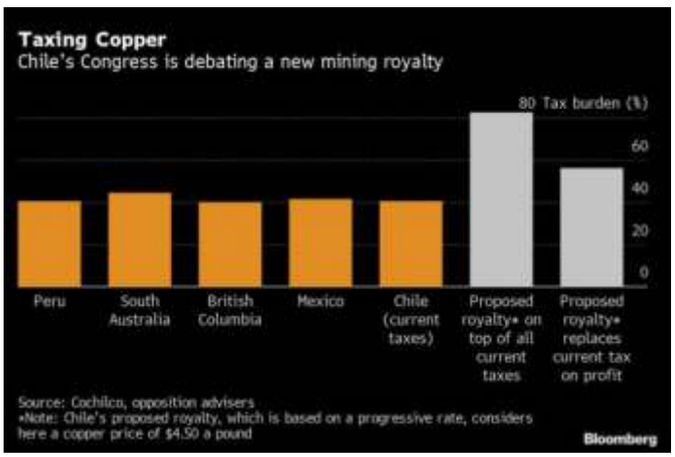
A Giant Copper Union Joins Push for Bigger State Role in Chile

As the top copper-producing nation drafts a new constitution and heads toward presidential elections, an influential mining union is pushing for a bigger state role in mining and a much larger government take.

The FTC, which brings together unions at Chile's state-owned copper producer Codelco, wants privately-run mines to pay 75% of earnings in tax and ensure that Codelco takes the lead on all new major projects, President Patricio Elgueta said in an interview.

FTC directors are pitching the proposal to lawmakers, other politicians and members of the Constitutional Assembly. Normally, the manifesto of a labor federation -- even one that represents 15,000-plus workers -- wouldn't hold much legislative or regulatory sway, especially with a market-friendly government in power.

"We have hope and faith that we will be heard," Elgueta said from Codelco's Salvador mine in northern Chile. "The government needs to have an essential role."



The federation's tax proposal would focus on "economic returns," unlike a royalty bill in the senate that would place progressive duties on sales. It would also differentiate between bigger and smaller mining operations, as well as place higher levies on companies that export semi-processed copper than on those that ship out refined metal products. While Elgueta said the royalty bill is a "step forward," the FTC's plan is "more ambitious." Both the government and the mining industry oppose the bill, saying the much heavier implied tax burden would make investing in Chile less attractive even with high copper prices.

How the battery revolution will power our future

U.S. President Joe Biden has made batteries a critical component of his carbon-neutral strategy. He insists on American production of modern batteries rather than relying on imports from China. Chinese companies, including Contemporary Amperex Technology Co. Limited (CATL), BYD Auto, and Hefei Guoxuan High-Tech produce 79 percent of the world's batteries. American manufacturers make only seven percent.

According to innovator Elon Musk, batteries are the key to our future. Their development led to the technical revolution that brought smartphones, tablets, and electric vehicles to the world. Therefore, it is surprising that the science behind the lithium-ion batteries driving the modern world has remained essentially unchanged for more than three decades.

The prototypes of lithium-ion batteries appeared in the 1980s. Then the physicist John Goodenough suggested using lithium cobaltite in batteries. In 2019, he received the Nobel Prize for his idea.

A BloombergNEF study found that the average price of lithium-ion batteries fell from $688 to $137 per kilowatt-hour between 2013 and 2020. They predict that by 2023 prices will be close to $100 per kWh. The average price of batteries for electric vehicles (EV) was $126 per kWh. Thus, the cost of the battery pack in the total vehicle price dropped to 21 percent. By 2030, due to new technological advances, the cost of batteries can drop to $58 per kWh.

However, lithium-ion batteries have serious disadvantages. Among them are a high fire hazard,

sensitivity to temperature differences, self-discharge, and aging. Many still remember the story of the Samsung Galaxy Note 7 series smartphones that suddenly caught fire. It is this property that prompted airlines to require the carriage of lithium-ion batteries exclusively in carry-on baggage. Another liability is that lithium-ion batteries used in electric vehicles contain hundreds of kilograms of metals and materials such as graphite, cobalt, and high-purity nickel. When mined and processed, it can cause significant pollution and increase carbon dioxide emissions.

Aluminium — The EV manufacturers' dream metal

Policy incentives and technological advancements are going to guide the manufacturing and adoption of EVs or Electric Vehicles in a big way.

Electric vehicles are set to push the demand for aluminium exponentially, with innovation in products being the focus of the downstream aluminium sector.

According to government data, from 69,012 units in 2017-18, EV sales zoomed to 1,67,041 units in 2019-20.

Two-wheelers have led this growth.

Making it drive

Making the EV story successful is aluminium, both used in the manufacturing of electric vehicles and also in creating the necessary charging infrastructure. A higher performance metal, the push for EVs is adding importance to the role that this light and sturdy metal will play.

From helping vehicle manufacturers in reducing vehicle weight to improving the efficiency of conventional vehicles or to better the range of electric vehicles, aluminium

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extrusions are an increasing part of the solution.

This is an opportune moment for the downstream aluminium sector — which is an old partner of the automobile industry and finds its use in the making of a vehicle body, doors, trunks, hoods, bumpers, crash boxes, brakes, cables, wheels, etc. — to increase its overall usage.

However, bringing about innovation in production is the need of the hour for the Indian downstream aluminium manufacturers. Innovation in production is also crucial to

raise the average quantity of aluminium used per vehicle from India's average of 29 kg per vehicle to global usage standards of 160 kg or 250 kg as predicted for use in EVs in time to come.

Automobiles with aluminium bodies are costlier than other metals . This poses as one of the major obstacles to the aluminium market. This will be addressed once the demand for EVs picks up and costs are lowered.

As the government introduces policies that require vehicles to bring out fuel-efficient variants, fuel-saving, carbon emission, costs, including repair are areas where the downstream aluminium sector has an important role to play.

Innovation is needed and is already being done at various levels. For instance, in meeting the EV demand, the automobile industry is looking at major changes in vehicle manufacturing that will focus on improved combustion, calibration, injection, and cylinder pressure. Downstream aluminium suppliers are meeting the needs through extrusions and rolling by using technology and innovation.

New applications of downstream aluminium include lightweight battery casings and heat exchangers, besides overall structural integration. Offering a higher strength-to-weight ratio compared to other metals, the ability to absorb a larger amount of crash energy, and ensuring that vehicular performance enhancements do not come at the cost of safety is what downstream aluminium offers to the automobile industry.

All this, and the ease with which aluminium fits into creating simple and intricate shapes giving an elegant finish to the vehicle, make it an automaker's dream metal. Thus, not only will this innovation in material supplied lead to light-weighting, lowering costs, and meeting the commitments of going green, it will, through EVs, now offer a higher per-unit usage of downstream aluminium products in automobiles.

2021 EV policy: Maharashtra push for li-ion battery Gigafactory

As part of the revised electric vehicle (EV) policy, the state transport ministry on Friday made a presentation before chief minister Uddhav Thackeray for a gigafactory—the first of its kind in the state—to manufacture advanced lithium-ion batteries. The presentation also emphasised the need to improve the electric-charging station infrastructure to encourage more people to switch to electric cars and bikes by 2025.

Thackeray was positive about the project and asked for the draft policy to be submitted in the cabinet soon. There are plans to encourage e-charging points in housing societies, government buildings, and MSRTC bus stops, besides petrol pumps and at malls in future. The presentation mentioned over 2,300 charging stations. An official said: "Also, incentives are being planned to attract industries from the sector to set up in Maharashtra."

Transport commissioner Avinash Dhakne said the 2018 electric vehicle policy focussed on attracting investments and incentives, while the 2021 policy draft is keen on infrastructure. "There has to be affordability and good infrastructure to push for e-vehicles," Dhakne said, adding that the CM asked senior officials for their feedback on the proposed policy and the larger benefits to citizens.

Proliferation of battery-operated medical equipment to boost battery demand: Eveready Batteries and flashlights major Eveready Industries India Ltd on Friday said the proliferation of various battery-operated medical equipment is expected to give a fillip to battery demand, while the flashlight segment will remain steady on the back of the revival of rural economy from the adverse

impact of COVID-19 pandemic.

The company continues to witness steady demand in its categories of batteries and flashlights as there is a "sharp decrease in dumped imports from China and an overall strong demand in expectation of a near-normal monsoon", Eveready Industries India Ltd said in a regulatory filing.

In its quarterly update to the stock exchanges, the company said, "The situation in the battery segment should continue to look positive as imports continue to remain low with the BIS standards having come into force - providing a level playing field to domestic manufacturers." Furthermore, it said the "proliferation of various battery-operated medical equipment should add filip to battery demand. The flashlight segment is also likely to remain steady as the rural economy revives from the adverse impact of the pandemic." The increased focus on rechargeable flashlights is also likely to benefit the segment, the company added.

With a view to counter the sharp increases in raw material costs, Eveready Industries said it has taken a price increase of around 4-5 per cent in batteries from May 2021.

Vedanta group firm Hindustan Zinc sets up field hospital in Rajasthan

The company said it firmly supports the Rajasthan government in its efforts to provide priority medical care to COVID-affected people.

International Aluminium Institute releases Global Aluminum Industry 2050 Climate Pathways

The International Aluminium Institute (IAI) has today published the most comprehensive greenhouse gas emissions reductions pathways available to the aluminum sector over the next three decades. The pathways are based on the IAI's unrivalled data and leading analysis of the global aluminum industry. The new report, Aluminium Sector Greenhouse Gas Pathways to 2050, sets out three credible and realistic approaches to emissions reductions for the aluminum industry, in line with the International Energy Agency's Beyond 2 Degree Scenario.

While the industry works to reduce its emissions by about 80 %, demand for aluminum products is also predicted to grow. Over the coming decades, global demand for primary aluminum will increase by up to 40 % and recycled aluminum from post-consumer scrap will more than triple through to 2050, as economies grow, urbanize, and build up their infrastructure.

Rio Tinto Teams With Australian Government On Hydrogen Conversion Project For Alumina Refineries

Anglo-Australian metals miner Rio Tinto Group has joined with the Australian Renewable Energy Agency (ARENA) in a A$1.2-million study to determine the possibilities of replacing natural gas with hydrogen at alumina refineries.

Rio Tinto says it will conduct the study at the Yarwun alumina refinery at Gladstone. Work will also be carried out at Rio Tinto's Bundoora Technical Development Centre, where the firm's in-house team is now established to collect data on a possible hydrogen transition.

ARENA CEO Darren Miller said that the project is a next step toward more sustainable aluminium.

"If we can replace fossil fuels with clean hydrogen in the refining process for alumina, this will reduce emissions in the energy and emissions intensive refining stage of the aluminium supply chain. Exploring these new clean energy technologies and methods is a crucial step towards producing green aluminium."

"This study will investigate a potential technology that can contribute to the decarbonisation of the Australian alumina industry," he concluded. "If successful, the technical and commercial lessons from Rio Tinto's study could lead to the implementation of hydrogen calcination technology, not only in Australia, but also internationally."

The two-part study includes a preliminary engineering design study to determine what a demonstration project would require to be installed at Yarwun. The second part would involve establishing a lab-sized reactor at Bundoora Technical Development Centre in Melbourne.

"We see the ARENA and Rio Tinto-funded study as a step towards reducing refinery emissions and one that has the potential to play an important part in Rio Tinto's commitment to decarbonisation," explained Rio Tinto Aluminium Pacific Operations acting managing director Daniel van der Westhuizen.

"We're investing in work that needs to be done, not only to decarbonise one of our sites, but also to help provide a lower-emissions pathway for Rio Tinto and the global aluminium industry."

"We recognise we are on a long road towards reducing emissions across our operations and there is clearly more work to be done," van der Westhuizen continued. "But projects such as this are an important part of helping us

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get there."

Rio Tinto has set for itself a goal of zero emissions by mid-century. It aims for a 15-percent cut in absolute emissions and a 30-percent cut in emissions intensity by the end of this decade.

Tsingshan Planning 1 MMTPA Aluminium Smelter In Indonesia

A new entrant to the People's Republic of China's aluminium sector is planning a 1 million metric ton per annum aluminium smelter for Indonesia.

According to a report by CRU, Tsingshan Holding Group is planning to enter the field by building the new aluminium smelter in conjunction with Huafon Group. The firm operates an industrial park in Sulawesi, which is where the smelter is planned.

CRU says Tsingshan would initially produce at a rate of 500 thousand metric tons per annum by 2023, but they did not specify when full production would begin.

CRU senior consultant Ying Dai indicated that this may be the first of many new aluminium projects in Indonesia.

DGTR recommends anti-dumping duty on aluminium foil imports

The Directorate General of Trade Remedies (DGTR) has recommended imposing anti-dumping duty on imports of aluminium foils from China, Malaysia, Thailand and Indonesia to offset the injury to domestic industry from cheaper imports.

After a year-long investigation into the complaints filed by Hindalco IndustriesLtd, Raviraj Foils Ltd and Jindal India Ltd about the dumping of aluminium foil of 80 microns and below in FY20, DGTR recommended the finance ministry to impose anti-dumping duty between $93.53-$976.99 per tonne on foil.

DGTR dismissed the suggestion that Raviraj and Jindal India are importing foil stock and therefore cannot claim the status of domestic industry. However, it did not include foil stock as a separate anti-dumping investigation concerning dumped imports of foil stock is being undertaken.

The opposing parties, including domestic users, claimed aluminium foil is an eco-friendly alternative to plastic bags, and the imposition of anti-dumping duty would worsen the demand-supply gap for the subject goods. "No ADD (anti-dumping duty) should be recommended on the PUC (product under consideration) as domestic suppliers would increase the foil price disproportionately, impacting the users heavily. The last ADD imposed on China PR for foils between 5.5 microns to 80 microns resulted in domestic suppliers increasing price from ₹35 to ₹40 per kg," they added.

However, the domestic producers held that imposition of duty will not impact the demand-supply gap. "Domestic industry has recently expanded capacity, and other producers will undertake expansions. The domestic capacity is sufficient to meet the demand of the country; thus, there is no question of demand-supply gap," they submitted.

DGTR concurred with the domestic producers, holding that the purpose of the anti-dumping law is to create a level-playing field for production and consumption of the goods in the Indian market. "The imposition of ADD does not create a situation of monopoly as the imports from other suppliers, including those from the subject countries, are not prevented from competing in the Indian market," it added.

India is currently the largest user of anti-dumping measures among World Trade Organization (WTO) members.

China releases non-ferrous metals reserves to stabilize market

China is releasing national reserves of copper, aluminum and zinc to stabilize the volatile bulk commodity market, according to a statement from the State Council, China's cabinet, on Wednesday.

The statement said that the reserves will be open to public bidding from the non-ferrous metals processing industry, with details to be disclosed later on.

The move is widely expected to calm soaring commodity prices in China. Surges in the prices of non-ferrous metals, as well as other bulk commodities, have weighed heavily on manufacturers and spiked concerns of domestic inflation, according to Tian Yun, vice director of the Beijing Economic Operation Association.

In May, China's producer price index jumped 9 percent year-on-year, beating analysts' forecast of 8.5 percent.

According to the National Bureau of Statistics, the surge was largely driven by rising manufacturing material costs, including those of non-ferrous metals, crude oil, iron ore and other bulk commodities.

"Given that China's economic recovery is speeding up, demand for conventional non-ferrous metals will continue to expand, especially since overseas demand is also recovering," Tian told the Global Times.

Tian also noted that major exporters of non-ferrous metals, such as Peru, have faced supply challenges due to the COVID-19 pandemic. The limited supply has further pushed up prices.

Rising costs have led to price hikes by downstream manufacturers, and they may even prevent exporters from taking new overseas orders, said Tian.

There's also concern that China, the world's top manufacturing power, might need to export these rising costs and add to worries about global inflation.

However, it is loose monetary policy adopted by the US that has led to excess liquidity, which also pushed up bulk commodity prices, experts noted, adding that the expectations of a US economic recovery and global work resumption peaked in May.

By containing commodity prices, China is acting as a major stabilizer of the world economy, Chinese experts added.

Non-ferrous metals are significant industrial resources, and they are widely used in such industries as transportation, electricity, construction, telecommunication, energy, information technology and materials.

Previously, Chinese officials have also taken steps to curb surging prices for other raw materials such as steel. Steel prices in China have pulled back significantly after authorities launched measures against price gouging and speculation.

Hindalco Industries - Aluminium smelter expansion is last in priority - ICICI Securities

Hindalco management was categorical in underlining that 1/2 quarters of high LME doesn't impact strategy of creating more and more de-risked downstream assets as a part of portfolio. India capex of ~ US$1.1bn over the course of next 5 years of which US$650mn was targeted for augmenting finishing / extrusion / FRP / recycling assets in Aluminium stay the course. Smelter expansion is relegated to last in priority unless i) domestic power costs become competitive globally and ii) Aluminium prices staying higher for longer can be ascertained. Q4FY21 India EBITDA surprised on the back of better volume performance in Aluminium and Copper, as well as higher value added mix in both. The single minded focus on downstream, ensures that the RoE improvement for Hindalco can only accelerate in the coming year. We upgrade Hindalco to BUY from HOLD with a revised target price of Rs476 (from Rs417 earlier)

- Net debt has reduced by Rs 64bn QoQ. ND/TTM conso EBITDA at 2.6x. Of US$1090mn of domestic capex scheduled for next 5 years, Hindalco plans to spend Rs27bn in FY22 (against Rs16bn YoY). Net debt increased by ~ Rs 80bn YoY. Higher commodity prices will lead to higher working capital requirement and may lead to higher ND/EBITDA numbers for Q1FY22E.
- Aluminium sales surprised at 329kte (expected 315 kte). Higher value added sales lead to higher realized premium; higher costs though didn't allow for the integrated spreads to increase - margin increase at US$102/teQoQ was in line with LME (adj. for hedges) and MJP growth QoQ. Higher domestic sales (50% of the mix) and higher value added sales (at 28% of the mix) drove higher premium realisation. Significantly high linkage mix of 93% helped power costs - normalisation (back to 75%) is expected in Q1FY22.
- Copper EBITDA surprised despite a muted TcRc. Low TcRc is manifesting in sharp decline in premiums realized. Copper EBITDA fell by only US$30/teQoQ, partly shielded by an increase in copper sales - up nearly 47% QoQ to 107kte. Q1FY22 performance will be impacted by low demand and lower rod sales - higher copper prices being partly responsible.
- Reinforces that upstream capex is last in priority; upgrade to BUY. The cost of power in India not being competitive compared to hydro power driven/Chinese smelters, the ESG headwinds behind setting up a coal based power plant and the volatility of LME despite Chinese Aluminium cuts are some of the reasons for the relegated priority of smelter expansion. Only with sustained Aluminium prices at higher levels over couple of years, and certainty of competitive domestic power prices will allow management to seriously contemplate smelter expansion. This shows commitment to 5 year strategic vision i.e. downstream organic expansion, deleveraging and shareholder return - in that order. We upgrade to BUY, as the commitment, will ensure a steady increase in RoE and P/B.

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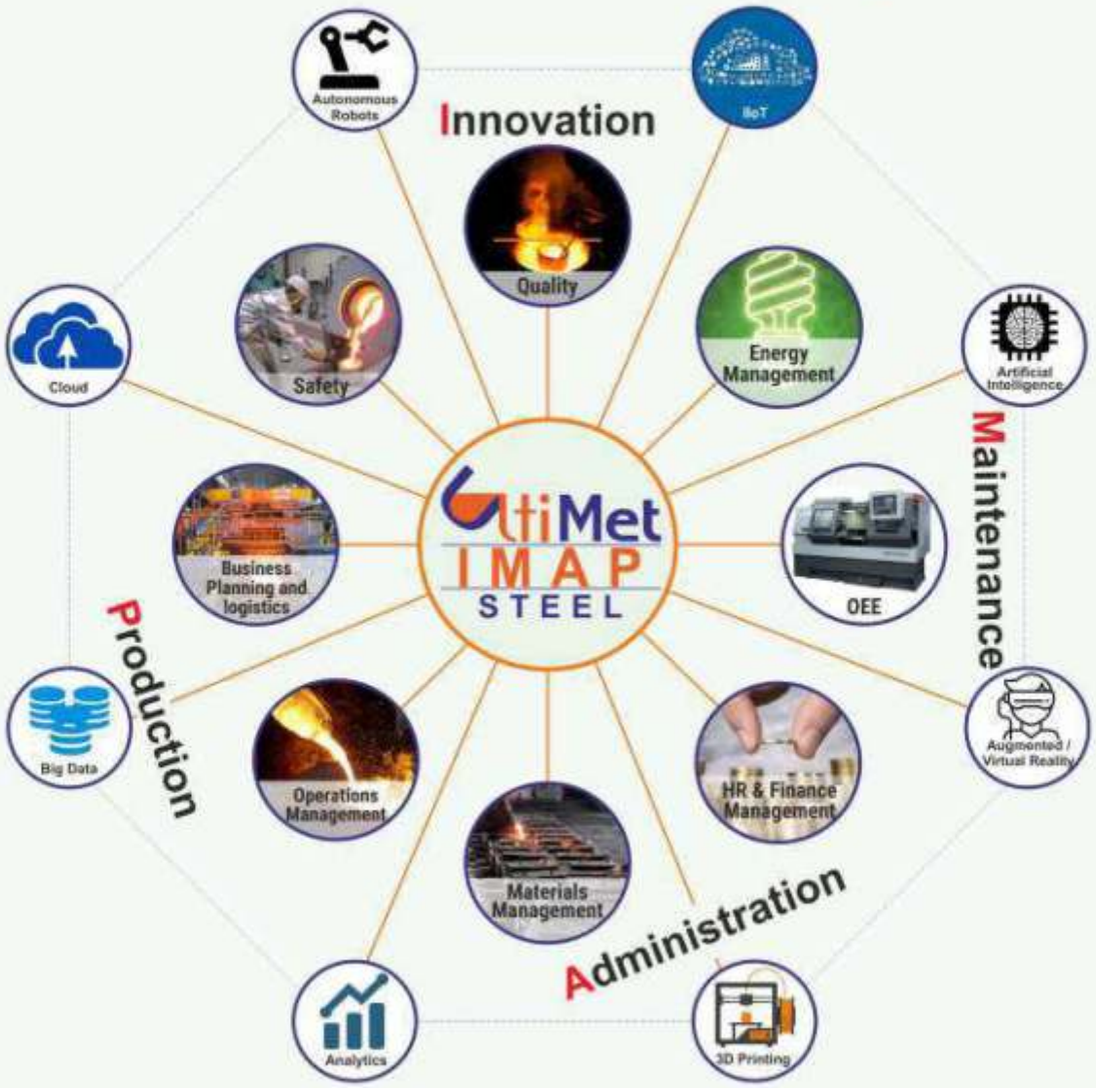

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Feature

“MELTING 4.0" – DIGITALISATION and DIGITAL CONTROL OF THE MELT SHOP OPERATIONS in FOUNDRIES AND STEEL MILLS

THE SCOPE OF FRP®.melt

As a sector-specific MES (Manufacturing Execution System), the FRP®.meltprogram package, which is a further development of the *“ksschmelze”* (“schmelze” is German for “melt”) package by ADV Schulte GmbH and is now part of the FRP® - digital system standard, provides continuous support for the melting process and is an integrated IT solution for better melting operations.

The scope of FRP®.melt is highlighted hereafter:

- MELT PROCESS PLANNING – FRP®.meltdelivers extensive melting process planning for all melting and treatment steps at charge, ladle and casting levels.
- ACCURATE CHARGE COMPOSITION AND POST CHARGE COMPOSITION – FRP®.meltoptimizes the usage of materials, especially of expensive metals, by means of accurate (post) charge composition.
- PRELIMINARY COSTING – FRP®.meltenables preliminary costing to be carried out, calculating the requirements for scrap, alloying materials and metals.
- ONLINE SUPPORT – FRP®.meltprovides online support for the smelter, reduces melt times significantly and thus increases melt capacity.
- ENERGY MANAGEMENT FRP®.meltreduces energy consumption per ton and supports energy management at the point of highest consumption, which in turn leads to considerable cost savings.
- DETAILED DOCUMENTATION – FRP®.meltis starting with the calculation of an optimal charge composition, all the steps of the melting process are recorded, documented and then made available for detailed evaluation.

Figure 1: Linking continuous and discontinuous processes, understanding batching and smelting digitally and in the real world

Christian Kleeberg
RGU ASIA Pte Ltd
Singapore

CONFIGURATION ANDMASTER DATA

The MATERIAL DATABASE

The material database, together with the target data from the test plan, describes the mechanical properties of the cast part .

The internal material number is

oriented to the production of the melt and, if applicable, to the type of heat treatment.

- Summary of several deviating specifications according to standard or customer specifications
- Consideration of metallurgical and economic aspects
- If applicable, allocation of price lists (web-based, stock market, customer)
- Several test plans with target values are possible for one alloy
- Differentiation according to standard, heat treatment levels and wall thickness.
- For the calculation of the charge, different target analyses are possible for the charge log and treatment levels (preliminary and final samples).

Different melting procedures / producer variants are possible for the same sort of melt. The same sort of melt can be allocated to different alloynumbers.

The mechanical properties depend on many factors in addition to the analysis, cast parameters, setting, cooling and heat treatment. The material test plan can also include more settings, e.g. possible welding regulations/instructions.

Melting orders are (automatically) set up in the collective melt sort orders or the charge order cost collector.

The use of material and energy is recorded:

- documenting each melt procedure / charge or period, or
- retrograde consideration of the actual consumption per period.

FRP®.melt	VS.	MANUAL PROCESS
• All Materials • Working cost optimized • All types of furnaces (e.g. EAF, BOF, Induction, Cupola, etc.) • All types of melts • Target values via digital comparison • No error possible if inputs known. • Calculated values not estimated		• Based on experience as "melt supervisor • Not working cost optimized • Takes longer more electricity consumption • More risky because of miscalculations • Error prone if not corrected with ferroalloy content

Figure 2: FRP®.melt operations vs. manual melting process operations

THE RESOURCE PLAN PER MELT

Resource plans are like a “digital twin” of operations and recorded per melt type as integrated work plans and bills of materials. The default options refer either to the production of a ton.

The following functions are supported:

- planned costs are derived on the basis of the quantity for the standard charge composition of the melt,
- calculation of the material requirements (net requirement calculation on the basis of the cast orders),
- parameters for total restrictions (threetotals as standard / five totals possible) to limit the proportions of scrap, circuits and swarf,
- minimum / maximum limitations for the use of materials,
- changes to the standard evaluation of materials (devaluation factors, melting loss for gross / net calculation),
- fixed parameters or banned materials for the charge calculation,
- formation of charge groups for the materials to enable the selection of suitable or permitted materials for each group of materials,
- specification of materials planned for the charge and post charge calculation,
- description of the melting procedure, including written test and work instructions and specifying such measures as,
  - measures to be taken after a certain time has passed (e.g. temperature measurement x minimum time from the beginning of the melt) and
  - measures when certain process values are reached (e.g. samples to be taken when a predetermined temperature is reached);
- work processes can be set up according to different units (minute, kg, ton, pulse frequency etc.)
- energy consumption can bemeasured for the individual steps (charge, melt, maintaining temperature, ladle preparation),
- visualization of several treatment steps (base melt, converter treatment, melt ready for casting).

As is the case for the product

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- AlSr / AlTi Alloys
- AlTi5B1 Coils / Ingots
- Al -Mn, Al-Cu, Al-Cr Alloys
- Al-Boron 3-10%
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planning of cast parts or other products, it is also possible to enter freely definable (linear) formulas and other configurations: for example, it is possible to take furnace parameters into account when drawing up specifications.

post charge calculations.
The FRP®.melt–Standard Test Plan has been extended with even more control parameters for charge calculations.
Specification of the base element, whereby different test groups can be entered

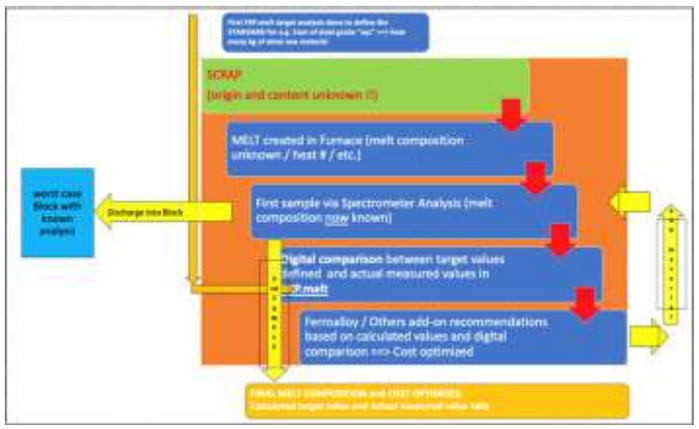

Figure 3: Simple workflow plan on melt / charge calculations using FRP®.melt

Alloy master data

The target values for the analysis of the mechanical values and the structure are entered for the tests which are to be carried out on the material or the melt. For the melting process, and in particular for the charge and post charge calculation, the target values for the chemical analysis are particularly significant. These can be formulated differently according to the treatment steps (charge, post charge, treatment/inoculation, final analysis). In the materials database it is possible to save the relevant analysis together with internal thresholds, tolerance parameters and the target values for the charge and

with different base elements.
Types of element (in particular deoxidation without taking limiting values into account).
Controls for target values (target, min/max for warning or tolerance thresholds).
Controls for target values for post charge calculation dependent on underachievingor overshooting limits.
Material management
Integrated and continuous materials management involves tracking the material flows of charge and melt materials and includes storage location and/or charge-related inventory management. The evaluation prices are formed by means of classical ERP functions.
There are different control parameters available for the charge materials according to the current status analyses, the rules for storage management and for stock withdrawals.
All the master data that are required for materials including the target and current status analyses are processed in a data entry screen in FRP®.melt.
The current status analyses for charge materials are ascertained according to various rules, e.g. according to supplier details, incoming goods checks, charge or time period. When analyses are recorded for each receipt of incoming goods, approval is carried out online if the agreed threshold values have been maintained.

THE CHARGE CALCULATION

The core of FRP®.meltis the calculation of the optimal charge-composition and recharging. There are different options available for calculating a standard composition, for evaluating material costs for the material as well as for each batch to support management of the melt.

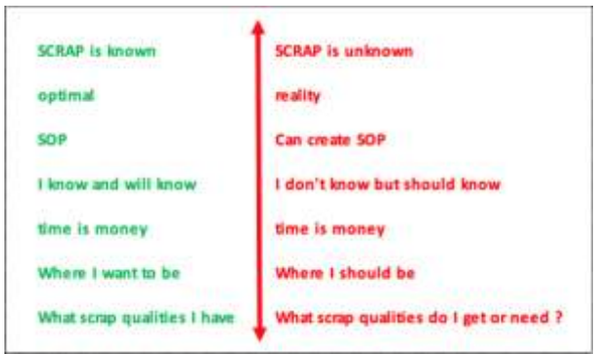

Figure 4: Importance of raw material origin and how to handle it if not known

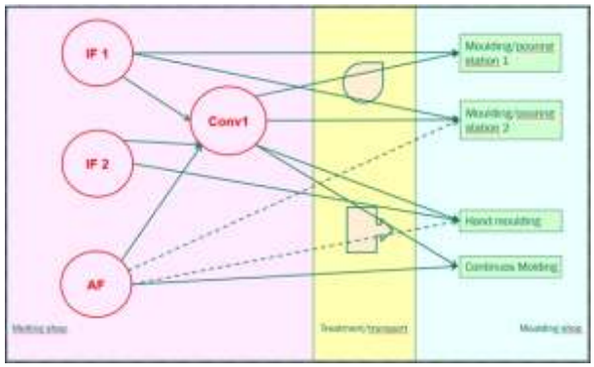

Figure 5: Melt-shop interaction with treatment and mould-shop (IF=Induction furnace; AF = Arc furnace; Conv = Converter, where applicable)

THE MELT REPORTS

The melt report provides the actual data concerning analysis, charge components, energy consumptions and any malfunctions which appeared during production etc.

It compares the actual information with the data required.

Advantages of FRP®.meltare presented in the following figure 6.

PROCESS SECURITY
COST SAVINGS VIA AVOIDANCE OFBAD MELT / CHARGE
FURNACE OPTIMIZATION
ENERGY REDUCTIONS
MAINTENANCE OPTIMIZATION
INTEGRATION TO FRP®.kompakt SYSTEM
EASIER DOCUMENTATION OF CERTIFICATES / HETS / MELT IDENTIFIER
PRODUCTIVITY ENHANCEMENTS

Figure 6: Total Benefits using FRP®.melt – the ROI can be potentially achieved within one month

CONCLUSIONS: WHY FRP®.melt?

Process reliability

- flow of information
- error avoidance
- knowledge aggregation
- traceability of material flow

Planning reliability

- planning of all treatment levels
- availability of materials
- fast response to fluctuation of material prices
- Status of melting aggregates and ladles
- reduction of smelting times
- energy saving

Cost transparency

- *cost-optimized standard recipes*
- *price comparison*
- *evaluation of circuit and swarf*
- *material and energy booking*
- melt-shop controlling

In addition, because the melt shop is the least explored area when it comes to digitalization and it has a very high potential. Big Data means Big Money – literally, in this case applied to big quantities.

Without creating a database and without bringing the meltshop data on a common and integrated platform, it will not be possible to move forward in digital decision-making.

Paper records or even only electronic spreadsheets records (e.g. Excel files) are not adequate anymore. Nothing will happen with such records unless someone puts personal efforts into them and check the content. And because nobody does that in any organization or this is becoming simply too expensive to have employees doing only that, this is no solution at all.

As a benchmark, the total cost-saving potential of 30% of total meltshop cost is achievable.

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Vedanta emerges as successful bidder for coal block for mining in Odisha

Vedanta has emerged as successful bidder for a coal block in Odisha which was put for re-bid in the second attempt of auction of blocks for commercial mining

Vedanta has emerged as successful bidder for a coal HYPERLINK "https://www.business-standard.com/topic/coal-block"bloack in Odisha which was put for re-bid in the second attempt of auction of blocks for commercial mining.

With the successful auction of Kuraloi (A) north coal mine in Odisha, the total number of mines successfully auctioned in the first tranche of auction for commercial mining is 20 out of total 38 coal mines offered, the coal ministry said in a statement.

In the first attempt of auction under 11th tranche of auction under the CM (S) Act 2015 and under first tranche of auction under the MMDR Act 1957, out of the 38 coal mines, 19 have been successfully auctioned.

Out of the remaining mines, four coal mines which had fetched single bid in the first attempt were put up for re-auction in a second attempt by Ministry of Coal with the same terms and conditions but with the highest initial offer received in the first annulled attempt of auction as the floor price for the second attempt.

"Of these four mines under second attempt of auction, one mine Kuraloi (A) North had received a bid and has now been successfully auctioned with Vedantabeing the successful bidder," the statement said.

The coal ministry had launched the auction process of 38 coal mines in the first tranche of auction for sale of coal for commercial mining).

Kuraloi (A) North with a peak rated capacity of eight

million tonnes per annum (MTPA) is the largest mine in terms of PRC of all the mines successfully auctioned in the first tranche. The mine is expected to generate an annual revenue of Rs 763 crore and also provide employment to over 10,000 people.

Metal, mining conglomerate, Vedanta Limited on Monday said it has thus far supplied over 15 lakh litres of oxygen to hospitals in various parts of the country amid the acute shortage of life-saving gas for Covid patients. Vedanta has been supporting the government in the fight against the second wave of the COVID-19 pandemic.

In his statement on Monday, Vedanta Group CEO Sunil Duggal said that "We are ensuring there is enough supply of oxygen by setting up special plants and procuring oxygen cylinders and portable ventilators. We are already taking pre-emptive and preventive measures in case of any signs of a third wave, as part of our disaster management protocol,"

As part of the Vedanta Cares initiative, the company has set up 1,410 critical care beds across 21 hospitals to lend a helping hand to ailing patients, especially from the marginalized sections. Vedanta has also provided 502 oxygen concentrators and supplied more than 10,500 PPE kits to safeguard health professionals and community workers.

During the second phase of the pandemic, Vedanta has expanded its CSR initiatives across 516 villages, thereby impacting the lives of around 4.5 lakh people across the country.

Vedanta to pay salary to families of employees dying of Covid till retirement age

Metal-to-oil conglomerate Vedanta will pay families of any of its employees dying of Covid, the last drawn fixed salary till the notional date of retirement as it expanded its pandemic cover for its employees, their families, and business partners.

It announced an ex gratia payment of Rs.10 lakh each to the families of the deceased business partners and spending of around Rs.12.6 crore to procure vaccines in bulk for the Vedanta family and all its business partners.

Also, medical insurance cover has also been enhanced to 1.5 times the existing eligibility while the COVID Kawach Insurance will be provided to business partners, the company said in a statement.

"Under the aegis of Vedanta Cares COVID relief initiatives, the company announces long-term HR benefits, on its commitment to ensuring the health and well-being of its people to include enhanced COVID insurance for its employees, their families, and business partners," it said.

www.ifcindia2022.com

70TH INDIAN FOUNDRY CONGRESS & IFEX 2022

BUSINESS BEYOND BOUNDARIES

IMPORTANT ANNOUNCEMENT

Owing to the severe pandemic situation in Mumbai, the board has unanimously decided to change the dates and venue of 70th IFC & IFEX for your safety

New Dates & Venue

18 19 20 FEB'22 | Helipad Exhibition Centre, Gandhinagar, Gujarat

• 45 Acres Campus • Over 1 Lakh sq. mts. Convention Area • 13 Exhibition Halls
• 10,000 Car Parking • 7 to 18 metres Ceiling Height • 10 Tonnes / sq mts Load-bearing Capacity

Full Refund to Exhibitors*
in case of Cancellation of the Event

• Hall plans and offer will be ready by **15th April 2021**.

• Leela (300 room 5 Star Hotel close to the venue) will be inaugurated by **Hon. Prime Minister** on **15th April**.
Plenty of other hotels suiting all budgets are available nearby. You may avail of specially negotiated rates for our event.

HIGHLIGHTS OF THE 70th INDIAN FOUNDRY CONGRESS

(Jointly organized by Mumbai and Ahmedabad Chapters with support of WR.)

• CEO level techno-commercial presentations & panel discussions are aimed at giving real value for money & time spent

• Knowledge sessions are planned till Lunch; so delegates may visit IFC & IFEX both

• **FOUNDRY TECHNICA**: A valuable reference volume covering sections of Equipment maintenance, Costing Templates, Energy Saving, Export Markets, Expansion, New Projects & ROI, Global Universities with Foundry Technology and many more will be given free to delegates who register before cut off date. This will ensure long shelf life; thereby giving our advertisers great mileage.

• Hospitality at his best with Veg | Non-Veg global cuisine

• **VISIT OF STATUE OF UNITY** (with Overnight stay):
World's tallest (182 Meters) metal statue of Sardar Patel. Chance of a life time!

Innovative slots:

BRAIN BOX (Best Practices in my Foundry by selected Foundrymen)	**ROUND TABLE** (Leading CEOs Guidance)	**FOUNDRYMEN HOUR** (Burning issues of Industry)	**SALE & BUY** (Used Equipment)	**LINKAGE** (Yong Professionals Meet)
FOUNDRY INDUSTRY AFTER 20 YEARS	**WFO HOUR**	**GLOBAL SPEAKERS THROUGH ZOOM**	**B2B MEET**	**FUTURE IS LIGHT METALS**

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Hindustan Zinc's innovative solar plant wins CII's 'Best Application & Uses of Renewable Energy' award

Exemplifying the company's motto of 'Innovating for a Sustainable Future', Hindustan Zinc's Rampura Agucha Mine has won the 'Best Application & Uses of Renewable Energy (Large Project)' award at the 5th Edition of CII National Energy Efficiency Circle Competition 2021. Agucha Mine's unique waste to wealth initiative, a solar power plant developed on a waste yard, won this award. The innovative design involved setting up of the solar power plant on a waste dump yard, with a triple benefit of – making efficient use of the waste land, saving environmental footprint through a renewable energy source and annual GHG savings of over 45,000 t CO2e.

Commenting on the achievement, CEO of Hindustan Zinc, Mr. Arun Misra, said,"At Hindustan Zinc, we have empowered our people to think of innovative ideas that contribute towards a sustainable and greener tomorrow. Our solar power plant that is developed on a waste yard at Agucha is a green energy initiative that has contributed to a carbon emission reduction of 45,528 tCO2e in just one year. This is in line with our commitment to achieve the Sustainability Development Goal of 0.5MN tCO2e GHG savings by 2025. I am proud of my Agucha team for their efforts and this achievement."

Faced with the challenge of a waste yard where any plantation or constructing any major structure due to its load-bearing capacity and height was a challenge, the team of Prafulkumar Patel, Vinoth Jaroli, Rajesh Chaudhary and Upendra Totamalla had to engineer something unique. They developed a plan to utilize this infertile land and indigenously set up a 22 MW solar plant. This ground mounted 'Gold Standard' solar plant generated 48,083 MWh green energy in FY21, contributing to 40% of RAM's energy requirement and leading to a GHG saving of 45,528 tCO2e.

Hindustan Zinc actively works on adopting renewable energy sources for captive use and has a portfolio of around 40 MW capacity solar projects across their locations in the state of Rajasthan. In FY21, the company reduced 5,51,695 MT of CO_2 through use of green power while generating 83,420 Mwh of renewable solar energy. This green energy is part the company's commitment to responsible mining and the larger purpose of running operations towards 'zero harm, zero waste, zero discharge' principle.

Furthermore, ranked first in the Asia- Pacific region and seventh globally in the metal and mining sector by the Dow Jones Sustainability Index, the company has made a name for itself in the global community. As a COP26 Business Leader, the company participated actively in shaping the agenda for tackling climate change. HZL is also among the only two mining companies globally and among only four Indian companies to be a part of the coveted CDP 'A List' 2020.

Hindalco provides 125 jumbo O2 cylinders, 20 concentrators

Hindalco Industries limited, the metal flagship company of the Aditya Birla Group, reaffirmed its support to the people of Jharkhand as the state battled the deadly second wave of Covid-19.

At the peak of the second Covid wave when the State faced a severe oxygen crunch, Hindalco ensured oxygen cylinders promptly reached key locations across Jharkhand. Hindalco's Jharkhand Mines provided 125 jumbo oxygen cylinders with a capacity of 46.7 litres each to government authorities to aid hospitals in Lohardaga, Gumla, Palamu and Latehar districts. This included 40 jumbo oxygen cylinders and 20 oxygen concentrators donated to the Health Department. Additionally, 50 beds, 1,000 face masks and isolation kits were provided to the Covid Centre at Lohardaga to boost the medical infrastructure in this critical time.

In the recently allotted Chakla Coal Mines area, the Company has provided 4 B type cylinders with a capacity of 10.5 kg per cylinder to the Latehar district administration. Other medicines were also provided to two health centres in Chakla to prevent the rise of common infections.

The Company's CSR team distributed 4,000 face masks, sanitizers and natural immunity boosters including over 6,000 capoor, ajwain and lawang packets among the community in mining areas of Lohardaga.

SIAM Annual Statistic

Auto Industry Sales Performance of May 2021

Monthly Performance: May 2021
Production: The total production of Passenger Vehicles, Three Wheelers, Two Wheelers and Quadricycle in the month of May 2021 was 806,755 units.

Domestic Sales:
- Passenger Vehicles* sales was 88,045 units in May 2021.
- Three-wheeler sales was 1,251 units in May 2021.
- Two-wheeler sales was 352,717 units in May 2021.

Commenting on the May 2021 data, Mr Rajesh Menon, Director General, SIAM said "Indian Automobile Industry stands committed to support the Government in its battle against Covid-19 pandemic through various initiatives to augment availability of oxygen, support health care infrastructure and local communities. OEMs have also taken up large scale vaccination of their employees, family members and dealer partners.
Most part of May was under lockdown in many states thus impacting overall sales and production. Many members had shut down their manufacturing plants to divert oxygen from industrial use for medical purposes.
Since, both May 2020 and May 2021 were abnormal months because of the Covid-19 situation and lockdowns, comparison of these two months holds no meaning. However, a comparison of May 2021 sales with May 2019, which was a normal year, presents a realistic picture.
So, as compared to May 2019, sales in the month of May 2021, for Passenger vehicles stood at 88,045 units (- 61.2%), for Two-wheelers at 3,52,717 units (- 79.6%) and for Three-Wheelers at just 1,251 units (- 97.6%)."

Domestic Sales

	Domestic Sales (Number of Vehicles)		
Category	**May-19**	**May-20**	**May-21**
Passenger Vehicles (PVs)*			
Passenger Cars	1,43,449	14,460	41,536
Utility Vehicles (UVs)	70,715	17,347	45,158
Vans	12,811	1,739	1,351
Total Passenger Vehicles (PVs)	**2,26,975**	**33,546**	**88,045**
Three Wheelers			
Passenger Carrier	41,529	1,406	712
Goods Carrier	10,121	1,031	539
Total Three Wheelers	**51,650**	**2,437**	**1,251**
Two Wheelers			
Scooter/ Scooterettee	5,11,724	69,196	50,294
Motorcycle/Step-Throughs	11,61,461	1,97,378	2,95,257
Mopeds	52,019	13,088	7,135
Electric Two Wheelers	-	20	31
Total Two Wheelers	**17,25,204**	**2,79,682**	**3,52,717**
Quadricycle	308	-27	-
Grand Total	**20,04,137**	**3,15,638**	**4,42,013**

Statistics

Production

	Production (Number of Vehicles)		
Category	**May-19**	**May-20**	**May-21**
Passenger Vehicles (PVs)*			
Passenger Cars	1,98,199	13,806	63,866
Utility Vehicles (UVs)	90,821	15,061	63,087
Vans	11,686	266	1,272
Total Passenger Vehicles (PVs)	**3,00,706**	**29,133**	**1,28,225**
Three Wheelers			
Passenger Carrier	79,631	25,054	44,134
Goods Carrier	11,215	1,337	2,443
Total Three Wheelers	**90,846**	**26,391**	**46,577**
Two Wheelers			
Scooter/ Scooterettee	5,38,260	20,926	79,082
Motorcycle/Step-Throughs	14,27,519	2,58,920	5,46,734
Mopeds	59,685	4,073	5,209
Electric Two Wheelers	-	-	535
Total Two Wheelers	**20,25,464**	**2,83,919**	**6,31,560**
Quadricycle	581	45	393
Grand Total	**24,17,597**	**3,39,488**	**8,06,755**

Exports

	Exports (Number of Vehicles)		
Category	**May-19**	**May-20**	**May-21**
Passenger Vehicles (PVs)*			
Passenger Cars	48,415	11,242	19,673
Utility Vehicles (UVs)	10,913	3,724	12,104
Vans	82	-	33
Total Passenger Vehicles (PVs)	**59,410**	**14,966**	**31,810**
Three Wheelers			
Passenger Carrier	38,953	17,504	43,372
Goods Carrier	564	85	1,089
Total Three Wheelers	**39,517**	**17,589**	**44,461**
Two Wheelers			
Scooter/ Scooterettee	27,084	3,056	26,126
Motorcycle/Step-Throughs	2,64,897	93,242	3,30,164
Mopeds	1,318	238	2,466
Electric Two Wheelers	-	-	-
Total Two Wheelers	**2,93,299**	**96,536**	**3,58,756**
Quadricycle	210	2	444
Grand Total	**3,92,436**	**1,29,093**	**4,35,471**

** BMW, Mercedes, Tata Motors & Volvo Auto data is not available.*

Statistics

SIAM

Summary Report: Cumulative Production, Domestic Sales & Exports data for the period of April-May 2021

Report I

(Number of Vehicles)

Category / Segment/Subsegment	Production		Domestic Sales		Exports	
	April-May		April-May		April-May	
	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22
Passenger Vehicles (PVs)*						
Passenger Cars	13,806	230,412	14,460	182,730	13,995	44,423
Utility Vehicles(UVs)	15,248	190,539	17,347	154,029	5,048	29,313
Vans	266	13,226	1,739	12,919	-	99
Total Passenger Vehicles (PVs)	**29,320**	**434,177**	**33,546**	**349,678**	**19,043**	**73,835**
Three Wheelers						
Passenger Carrier	28,080	100,528	1,406	9,960	24,685	89,114
Goods Carrier	1,437	9,633	1,054	5,019	141	1,784
Total Three Wheelers	**29,517**	**110,161**	**2,460**	**14,979**	**24,826**	**90,898**
Two Wheelers						
Scooter/ Scooterettee	20,926	446,010	69,196	350,756	4,886	66,150
Motorcycle/Step-Throughs	271,327	1,645,926	197,378	963,098	137,160	719,675
Mopeds	4,073	43,833	13,088	33,112	370	4,242
Electric Two Wheelers	-	1,444	20	848	-	-
Total Two Wheelers	**296,326**	**2,137,213**	**279,682**	**1,347,814**	**142,416**	**790,067**
Quadricycle	66	902	-27	-	140	960
Grand Total	**355,229**	**2,682,453**	**315,661**	**1,712,471**	**186,425**	**955,760**

* BMW, Mercedes, Tata Motors and Volvo Auto data is not available

Society of Indian Automobile Manufacturers (11/06/2021)

SIAM

Segment & Company wise Production, Domestic Sales & Exports Report for the month of May 2021 and Cumulative for April-May 2021

Report III

(Number of Vehicles)

Category	Production				Domestic Sales				Exports			
	For the month of		Cumulative		For the month of		Cumulative		For the month of		Cumulative	
Segment/Subsegment	May		April-May		May		April-May		May		April-May	
Manufacturer	2020	2021	2020-21	2021-22	2020	2021	2020-21	2021-22	2020	2021	2020-21	2021-22
Passenger Vehicles (PVs)*												
A: Passenger Cars												
Ford India Private Ltd	1	-	1	1,463	118	-	118	809	-	-	1,344	519
General Motors India Pvt Ltd	488	NA	488	NA	-	-	-	-	707	NA	707	NA
Honda Cars India Ltd	-	3,555	-	12,183	259	1,840	259	9,718	-	330	-	1,083
Hyundai Motor India Ltd	7,556	19,400	7,556	49,970	2,425	11,193	2,425	36,370	5,245	4,678	6,052	10,813
Mahindra & Mahindra Ltd	-	-	-	-	-	1	-	1	-	-	-	-
Maruti Suzuki India Ltd	2,514	30,560	2,514	145,242	8,449	25,452	8,449	124,378	4,288	9,174	4,860	22,430
Nissan Motor India Pvt Ltd	-	1,481	-	3,586	242	23	242	399	-	6	-	1,848
Renault India Pvt Ltd	-	728	-	4,446	684	738	684	3,974	-	73	-	681
SkodaAuto India Pvt Ltd	932	1,605	932	2,312	396	715	396	1,673	-	-	-	-
Toyota Kirloskar Motor Pvt Ltd	3	-	3	237	583	298	583	2,765	-	-	-	-
Volkswagen India Pvt Ltd	2,312	6,537	2,312	10,973	1,304	1,276	1,304	2,643	1,002	5,412	1,032	7,049
Total A: Passenger Cars	**13,806**	**63,866**	**13,806**	**230,412**	**14,460**	**41,536**	**14,460**	**182,730**	**11,242**	**19,673**	**13,995**	**44,423**
B: Utility Vehicles(UVs)												
FCA India Automobiles Pvt Ltd	67	816	67	2,229	93	475	93	1,321	-	397	6	927
Ford India Private Ltd	583	1,899	583	12,454	453	766	453	5,426	-	2,925	147	6,483
Honda Cars India Ltd	-	720	-	2,130	116	192	116	1,386	-	55	-	272
Hyundai Motor India Ltd	4,544	14,800	4,544	41,330	4,458	13,808	4,458	37,633	455	1,024	989	5,090
Isuzu Motors India Pvt Ltd	-	30	-	77	-	55	-	103	3	-	3	2
Kia Motors India Pvt Ltd	4,703	18,611	4,703	37,481	1,661	11,050	1,661	27,161	2,902	4,334	2,920	8,043
Mahindra & Mahindra Ltd	2,572	10,217	2,572	27,921	3,745	7,748	3,745	25,934	93	755	678	1,291
Maruti Suzuki India Ltd	928	9,106	928	40,165	3,636	6,355	3,636	31,839	271	1,973	305	5,798
MG Motor India Pvt Ltd	1,063	3,172	1,250	6,532	710	1,016	710	3,581	-	-	-	-
Nissan Motor India Pvt Ltd	-	1,553	-	4,839	136	1,212	136	4,205	-	285	-	413
PCA Motors Pvt. Ltd	-	59	-	346	-	40	-	270	-	-	-	-
Renault India Pvt Ltd	-	2,103	-	10,229	1,069	1,882	1,069	7,288	-	356	-	991
SkodaAuto India Pvt Ltd	-	1	-	1	112	1	112	4	-	-	-	-
Toyota Kirloskar Motor Pvt Ltd	601	-	601	4,805	1,058	409	1,058	7,563	-	-	-	3
Volkswagen India Pvt Ltd	-	-	-	-	100	149	100	315	-	-	-	-
Total B: Utility Vehicles(UVs)	**15,061**	**63,087**	**15,248**	**190,539**	**17,347**	**45,158**	**17,347**	**154,029**	**3,724**	**12,104**	**5,048**	**29,313**
C: Vans												
Mahindra & Mahindra Ltd	56	310	56	420	122	255	122	354	-	33	-	49
Maruti Suzuki India Ltd	210	962	210	12,806	1,617	1,096	1,617	12,565	-	-	-	50
Total C: Vans	**266**	**1,272**	**266**	**13,226**	**1,739**	**1,351**	**1,739**	**12,919**	**-**	**33**	**-**	**99**
Total Passenger Vehicles (PVs)	**29,133**	**128,225**	**29,320**	**434,177**	**33,546**	**88,045**	**33,546**	**349,678**	**14,966**	**31,810**	**19,043**	**73,835**
* BMW, Mercedes, Tata Motors & Volvo Auto data is not available				NA=Not Available								

SIAM

Segment & Company wise Production, Domestic Sales & Exports Report for the month of May 2021 and Cumulative for April-May 2021

Report III

(Number of Vehicles)

Category	Production				Domestic Sales				Exports			
	For the month of		Cumulative		For the month of		Cumulative		For the month of		Cumulative	
Segment/Subsegment	May		April-May		May		April-May		May		April-May	
Manufacturer	2020	2021	2020-21	2021-22	2020	2021	2020-21	2021-22	2020	2021	2020-21	2021-22
Three Wheelers												
A: Passenger Carrier												
Atul Auto Ltd	201	286	295	861	133	8	133	397	204	-	204	38
Bajaj Auto Ltd	19,849	28,357	22,781	65,209	550	406	550	6,462	13,540	29,600	19,215	60,566
Force Motors Ltd	-	200	-	419	-	-	-	-	-	154	-	336
Mahindra & Mahindra Ltd	24	575	24	2,273	39	88	39	1,269	8	26	8	74
Piaggio Vehicles Pvt Ltd	2,571	2,785	2,571	6,979	552	79	552	1,289	1,196	1,250	1,196	3,380
TVS Motor Company Ltd	2,409	11,931	2,409	24,787	132	131	132	543	2,556	12,342	4,062	24,720
Total A: Passenger Carrier	**25,054**	**44,134**	**28,080**	**100,528**	**1,406**	**712**	**1,406**	**9,960**	**17,504**	**43,372**	**24,685**	**89,114**
B: Goods Carrier												
Atul Auto Ltd	69	176	148	735	73	92	96	532	-	-	-	48
Bajaj Auto Ltd	144	1,101	165	3,851	265	82	265	1,927	-	776	56	1,236
Mahindra & Mahindra Ltd	74	623	74	2,207	-	184	-	1,046	24	3	24	18
Piaggio Vehicles Pvt Ltd	1,050	543	1,050	2,840	693	181	693	1,514	61	310	61	482
Total B: Goods Carrier	**1,337**	**2,443**	**1,437**	**9,633**	**1,031**	**539**	**1,054**	**5,019**	**85**	**1,089**	**141**	**1,784**
Total Three Wheelers	**26,391**	**46,577**	**29,517**	**110,161**	**2,437**	**1,251**	**2,460**	**14,979**	**17,589**	**44,461**	**24,826**	**90,898**

SIAM

Segment & Company wise Production, Domestic Sales & Exports Report for the month of May 2021 and Cumulative for April-May 2021

Report III

(Number of Vehicles)

Category	Production				Domestic Sales				Exports			
	For the month of		Cumulative		For the month of		Cumulative		For the month of		Cumulative	
Segment/Subsegment	May		April-May		May		April-May		May		April-May	
Manufacturer	2020	2021	2020-21	2021-22	2020	2021	2020-21	2021-22	2020	2021	2020-21	2021-22
Two Wheelers												
A: Scooter/ Scooterettee												
Hero MotoCorp Ltd	3,018	11,111	3,018	54,359	5,944	3,364	5,944	35,463	700	974	700	1,831
Honda Motorcycle & Scooter India Pvt Ltd	29	11,669	29	168,335	34,940	19,341	34,940	150,888	676	11,399	1,618	29,727
India Yamaha Motor Pvt Ltd	5,304	3,890	5,304	23,176	6,948	1,884	6,948	15,008	-	2,740	-	7,656
Piaggio Vehicles Pvt Ltd	2,039	2,939	2,039	10,490	1,300	645	1,300	4,759	1,220	1,923	1,220	4,171
Suzuki Motorcycle India Pvt Ltd	1,305	25,606	1,305	82,948	4,424	12,451	4,424	73,890	-	2,072	648	8,980
TVS Motor Company Ltd	9,231	23,867	9,231	106,702	15,640	12,609	15,640	70,748	460	7,018	700	13,785
Total A: Scooter/ Scooterettee	**20,926**	**79,082**	**20,926**	**446,010**	**69,196**	**50,294**	**69,196**	**350,756**	**3,056**	**26,126**	**4,886**	**66,150**
B: Motorcycle/Step-Throughs												
Bajaj Auto Ltd	128,593	216,277	141,000	560,980	39,286	60,311	39,286	186,371	73,512	180,212	105,521	401,815
H-D Motor Company India Pvt Ltd	160	NA	160	NA	20	NA	20	NA	117	NA	117	NA
Hero MotoCorp Ltd	96,736	146,070	96,736	525,928	102,904	156,174	102,904	466,689	3,134	22,509	3,134	51,323
Honda Motorcycle & Scooter India Pvt Ltd	4,106	12,296	4,106	146,530	19,060	19,423	19,060	127,998	144	8,006	1,832	32,623
India Kawasaki Motors Pvt Ltd	59	366	59	517	29	143	29	321	-	-	-	-
India Yamaha Motor Pvt Ltd	403	19,125	403	64,400	4,665	6,624	4,665	30,818	1,198	14,772	2,396	31,414
Royal-Enfield (Unit of Eicher Motors)	11,083	35,392	11,083	82,538	18,429	20,073	18,429	68,862	684	7,221	775	11,730
Suzuki Motorcycle India Pvt Ltd	1,109	787	1,109	9,447	630	62	630	2,502	-	4,596	1,170	11,658
Triumph Motorcycles India Pvt Ltd	25	63	25	125	36	107	36	234	-	-	-	-
TVS Motor Company Ltd	16,646	116,358	16,646	255,461	12,319	32,340	12,319	79,303	14,453	92,848	22,215	179,112
Total B: Motorcycle/Step-Throughs	**258,920**	**546,734**	**271,327**	**1,645,926**	**197,378**	**295,257**	**197,378**	**963,098**	**93,242**	**330,164**	**137,160**	**719,675**
C: Mopeds												
TVS Motor Company Ltd	4,073	5,209	4,073	43,833	13,088	7,135	13,088	33,112	238	2,466	370	4,242
Total C: Mopeds	**4,073**	**5,209**	**4,073**	**43,833**	**13,088**	**7,135**	**13,088**	**33,112**	**238**	**2,466**	**370**	**4,242**
D: Electric Two Wheelers												
Bajaj Auto Ltd	-	128	-	636	-	31	-	541	-	-	-	-
TVS Motor Company Ltd	-	407	-	808	20	-	20	307	-	-	-	-
Total D: Electric Two Wheelers	**-**	**535**	**-**	**1,444**	**20**	**31**	**20**	**848**	**-**	**-**	**-**	**-**
Total Two Wheelers	**283,919**	**631,560**	**296,326**	**2,137,213**	**279,682**	**352,717**	**279,682**	**1,347,814**	**96,536**	**358,756**	**142,416**	**790,067**
Quadricycle												
Bajaj Auto Ltd	45	393	66	902	-27	0	-27	-	2	444	140	960
Grand Total	**339,488**	**806,755**	**355,229**	**2,682,453**	**315,638**	**442,013**	**315,661**	**1,712,471**	**129,093**	**435,471**	**186,425**	**955,760**
NA=Not Available												
Society of Indian Automobile Manufacturers (11/06/2021)												

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International Lead and Zinc Study Group

PRESS RELEASE

21 June 2021

The International Lead and Zinc Study Group (ILZSG) released preliminary data for world lead and zinc supply and demand during the first four months of 2021. A brief summary is listed in the tables below. **Full details are available in the June 2021 edition of the Group's 44 page 'Lead and Zinc Statistics' Bulletin**.

World Refined Lead Supply and Usage 2016 - 2021

000 tonnes						2020 Jan-Apr	2021 Jan-Apr	2021 Jan	2021 Feb	2021 Mar	2021 Apr
	2016	2017	2018	2019	2020						
Mine Production	4713	4588	4593	4731	4520	1365	1488	360.5	340.3	393.5	394.0
Metal Production	11546	11897	12186	12195	11682	3633	4024	1018.3	947.9	1048.5	1009.1
Metal Usage	11508	12046	12232	12163	11528	3603	4005	1003.7	934.6	1064.9	1002.2

Source: ILZSG

- Provisional data reported to the ILZSG indicate that world refined lead metal supply exceeded demand by 19kt during the first four months of 2021. Over the same period total reported stock levels decreased by 21kt.
- Global lead mine production rose by 9.1%. This was primarily a consequence of increases in Australia, Bolivia, China, India, Mexico, Peru and the United States.
- A 10.8% increase in global lead metal production was mainly the result of higher output in Belgium, China, India and the Republic of Korea. Production also rose in Australia, France, Germany, Mexico, Poland and the United States.
- Refined lead metal usage increased in a number of countries including Brazil, China, India, Japan, the Republic of Korea, Turkey and the United States, resulting in an overall rise globally of 11.2%. In Europe, usage grew by a more modest 1.1%, mainly a consequence of rises in the Czech Republic, France, Italy, Poland and Spain that were partially balanced by reductions in Germany, the Russian Federation and the United Kingdom.
- Chinese imports of lead contained in lead concentrates decreased by 5.3% to 195kt. Net imports of refined lead metal totalled 8kt compared to 4kt over the same period of 2020.

World Refined Zinc Supply and Usage 2016 - 2021

000 tonnes						2020 Jan-Apr	2021 Jan-Apr	2021 Jan	2021 Feb	2021 Mar	2021 Apr
	2016	2017	2018	2019	2020						
Mine Production	12668	12681	12810	12856	12236	3713	4134	1011.4	977.4	1083.4	1061.7
Metal Production	13560	13486	13101	13480	13700	4435	4634	1175.4	1148.3	1148.2	1162.2
Metal Usage	13670	13944	13663	13737	13212	4179	4603	1179.2	1086.8	1147.5	1189.1

Source: ILZSG

- According to preliminary data recently compiled by the ILZSG, the global market for refined zinc metal was in surplus by 31kt over the first four months of 2021 with total reported inventories increasing by 142kt.
- World zinc mine production rose by a substantial 11.3%, influenced by increases in Australia, Bolivia, China, India, Ireland, Mexico, Peru, South Africa and the United States. In Canada, Finland, Kazakhstan, Namibia and Poland, however, output was lower compared to the same period of 2020.
- Higher refined zinc metal production in China, India, Italy, Japan, Peru and the United States was the main driver behind an overall rise globally of 4.5%.
- An increase of 10.1% in global usage of refined zinc metal was mainly a consequence of a substantial rise in China. Usage was also higher in a number of other countries, including Brazil, India, Japan, the Republic of Korea, Taiwan (China), Thailand and Turkey. In Europe, usage rose by 1.6% but in the United States, apparent consumption fell by 2.1%.
- Chinese imports of zinc contained in zinc concentrates fell by 9.4% to 632kt. Net imports of refined zinc metal totalled 172kt, an increase of 75% compared to the first four months of 2020.

Further details about the International Lead and Zinc Study Group (ILZSG) together with a full list of publications are available on the Group's website at www.ilzsg.org