PRESENTS

Green Initiatives:

Road to a **sustainable** aluminium industry

February 2023, Edition No.14, www.alcircle.com

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Debanjali Sengupta , Manager - Content Development of AlCircle

Editorial

Dear Readers,

Aluminium production generates around 1.1 billion tonnes of carbon di-oxide annually, contributing about 2% of global human-caused emissions. Hence, the industry has no escape from reducing its carbon footprint. As a result, leading producers across the value chain are widely undertaking key initiatives by developing advanced technology and embracing renewable energy to lessen emissions significantly. The goal is to producegreen aluminium in response to end customers,

manufacturers, and governments' push for increased sustainability and circularity.

To exchange vivid dialogue on this with industry leaders, AlCircle has brought to you the fourteenth edition of e-Magazine titled "Green Initiatives: Road to a sustainable aluminium industry." This e-Magazine aims to bring professionals and leaders from the entire aluminium value chain and interview them on their sustainability goals and roadmaps. You will find their valuable views and opinions on green aluminium and its future.

In addition, the e-Magazine has also tried to unmask the latest technical developments or technological investments of aluminium companies towards producing green aluminium and attaining a sustainable future.

You can also learn about the green initiatives of the AlCircle team, a voice of the global aluminium industry, in this e-Magazine. Being an integral part of the aluminium value chain, AlCircle has always strived to match its step with the industry. Then why not the green aluminium drive?

Thanks to your interest, AlCircle is happy to launch a sequel of its e-Magazine on ‘Green Initiatives’. We hope you also find this edition insightful.

Best Wishes & Happy Reading!

Feel free to share your comment, feedback and opinion – we will be all ears!

AlCircle Editorial Team:

Rupankar Majumder, email: rmajumder@alcircle.com
Debanjali Sengupta, email: dsengupta@alcircle.com
Sarnali Chakraborty: email: schakraborty@alcircle.com
Mayurakshi Ganguly: email: mganguly@alcircle.com

Design & Technical Team:

Snehasish Sahoo, E-mail: snehasish@alcircle.com
Arpan Dhali, E-mail: adhali@alcircle.com

Table of content

Performance Dashboard:

Previous AlCircle E-magazine

E-magazine Performance Statistics

Aluminium LeaderSpeak 2022

Total Global Reach 1021208	Total Hits 276760	Total Countries Reached 90
Facebook Reach 83555	Twitter Reach 686	LinkedIn Reach 7546
Direct Reach 3044	Instagram Reach 754	Avg Time Spent by User 05:11 (min:sec)

E-Magazine Launch Date: 22 April 2022

Statistics Reporting Date: 26 Jun 2022

Aluminium LeaderSpeak 2022: Participants

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Abhimanyu Prakash, CEO at AlCircle.com

Green, carbon footprint, energy optimization, net-zero are currently key topics across meeting rooms in most industries, particularly in our aluminium sector. While a lot of great dialogue and action has been happening in the recent past, AlCircle started to build one of many roads towards sustainability for the aluminium industry over a decade ago. Started in 2010 with a vision to bring the global aluminium value chain online, AlCircle has since established a worldwide presence, shown proof of concept and continues to innovate around how not just AlCircle, but the entire industry can work towards reducing their carbon footprint through adopting digital tools and processes. With a

vision of ‘Think Aluminium, Think AlCircle’, we are growing each day towards our ultimate goal of promoting aluminium as a sustainable material and in turn becoming the one-stop solution for the global industry.

AlCircle began as a platform to bring the industry closer and more connected with an eventual goal of faster, more efficient, and well-informed business decision-making, all activities which currently involve extensive travel, large printed directories, physical meetings and events. What started as an industry newsletter stands tall at up to 10 million online hits a month, readership across 196 countries, and diverse readership across small, medium, and large aluminium industry players. The free newsletter is AlCircle’s way of giving back to the industry through knowledge and information about every segment of the aluminium value chain and ensuring that it is not restricted to sharing about the global giants but shedding light on new innovations and developments by smaller companies in various corners of the world. AlCircle.com continues to provide these small companies with a digital channel as an affordable and accessible medium to share and promote, right beside news and promotions from larger corporations, all with a minimal carbon footprint. Furthermore, AlCircle’s digital publications, such as industry reports and theme-based e-Magazines, continue to deliver industry know-how and development suitable to customers’ email inboxes eliminating the need to do print runs, post, waste and then recycle. And all of this supports the aluminium industry in its path to net-zero and makes it all cost-effective. And AlCircle is committed to being our industry’s most affordable and sustainable solution provider for maximum outreach and impact.

Doing business is the ultimate goal of any industry, and while our aluminium sector innovates around green technologies, buying and selling continue to be integral to the industry's sustenance. To fuel this, AlCircle launched its online marketplace as the world's first such platform dedicated to a single metal and its allied sectors. AlCircleBiz was a decade-old plan that came to life recently as an effort to connect global buyers and sellers, reducing their pain, cost, and above all, carbon footprint to meet, connect and do business with each other. In a short span of time, the platform has over 1000 sellers and the largest database of aluminium industry suppliers from over 90 countries, connecting with potential customers from all corners of the world. The current political instability, environmental incidents, and supply chain disruptions over the recent past have heightened the need for all companies to build alternative sources for their consumables and buyers of their products. AlCircle's marketplace is the answer to these industry needs by opening doors to a wide range of companies from your local region and from all across the world. As the aluminium value chain pyramid is growing exponentially towards the base, it is indicative of the thousands of downstream, end user, and recycling players that are dotting the globe, and AlCircle is working towards bringing them all on one single platform for ease of access and in-turn reduce the carbon footprint of discovering them through traditional methods.

The pandemic pushed AlCircle to pivot and provide the industry with yet another first, the Global Aluminium Expo, a virtual exhibition platform for global and local players to connect alike. Pushing away expensive booths and thousands of dollars in travel, AlCircle continues to provide an opportunity for the small and medium aluminium players to present alongside the industry

veterans. While this is not a replacement for the much-loved physical expos, it is yet another opportunity for the industry to grow, connect, and learn from each other at the fraction of the cost and carbon footprint. The next one is slated for April 18-20th, 2023 and will be attended by thousands of visitors who aim to do business from sitting at their desks.

AlCircle's ulterior goal stands to be the promotion of aluminium and exponential growth of the industry, which will only be possible with the development and promotion of newer players across the aluminium value chain globally. And through the digital tools at AlCircle, all of it has been and will continue to get easier, cleaner, and greener for the aluminium industry.

Sustainability in aluminium: Top 10 green initiatives across the value chain

Sustainability, or the urge to shift towards a greener environment, has become the need of the hour. Top companies and individuals, including the aluminium sector, are leaving no stone unturned to shift towards a greener industry. Aluminium as a metal generates around 1.1 billion tonnes of carbon dioxide (CO_2) each year. However, by 2050, the demand for aluminium is anticipated to rise by 50% to 80%. As a result, the top producers and people

are taking significant actions by adopting renewable energy and producing cutting-edge technologies.

With a growing concern for the environment and an increasing emphasis on carbon neutrality, notable aluminium leaders and companies are striving to build a sustainability roadmap for the industry, while groups are taking steps to recognise their achievements. Businesses such as Alcoa, Hydro, Vedanta, Emirates Global Aluminium (EGA), Ma'aden, etc., have planned or implemented new skills and technology to cut carbon emissions throughout the aluminium value chain, defining industry trends.

Aluminium Bahrain signs MoU with Mitsubishi Heavy Industries to reduce its carbon footprint

On January 19, 2022, Mitsubishi Heavy Industries EMEA Ltd. (MHI EMEA), a division of Mitsubishi Heavy Industries (MHI) Group, and Aluminium Bahrain B.S.C. (Alba), the biggest aluminium smelter outside of China, signed a Memorandum of Understanding (MoU) to work together on strategies to lessen Alba's carbon footprint. The Agreement, the first of its type with an aluminium manufacturer, will set the stage for a feasibility study on employing CO2 capture from flue gas technology developed by MHI Group in partnership with Kansai Electric Power Co. to lower Alba's plant emissions and achieve decarbonization.

To know more: https://www.alcircle.com/news/aluminium-bahrain-signs-mou-with-mitsubishi-heavy-industries-to-reduce-its-carbon-footprint-75410

Ball Company launches lighter aerosol cans with lesser carbon footprint

Ball Corporation unveiled a new aluminium aerosol can with a carbon footprint of approximately half that of a standardised version. These most recent innovations will include low-carbon aluminium created in smelters utilising renewable, green energy sources like hydroelectric power and 50% recycled material. Also, using Ball's ReAl alloy for impact-extruded cans decreases pack weight significantly, with the new can weighing 30% less than conventional aluminium cans.

"With the impacts of climate change becoming more visible, we see a growing focus on efforts to reduce the carbon footprint of packaging. People want a more sustainable future for the planet, and they seek out brands that are leading the way. Research shows that 83% of global consumers believe it's important or extremely important for companies to design products that can be reused or recycled," said Jason Galley, the Senior Director of Sustainability at Ball Aerosol Packaging.

To know more: https://www.alcircle.com/news/ball-corporation-introduces-lightweight-aerosol-cans-with-lesser-carbon-footprint-80834

Thieves Australia introduces a sustainable recycling programme for coffee pods made of aluminium.

The 100% recyclable Nespresso-compatible coffee pods are part of a new subscription scheme from Melbourne-based coffee roasters Thieves. While aluminium makes up most of these capsules, the company also provides a free recycling service. Thieves' subscription service customers may choose from

various Australian roasters to get their beans each month. Also, they aim to draw additional coffee aficionados thanks to their capsule service options. The customer must visit the Thieves website each month to place their purchase for the amount of coffee pods and different-sized coffee bags they want. The minimum order quantity for aluminium coffee pods is ten, and the maximum shipping is five hundred.

In the latter situation, the company collaborates closely with TerraCycle to provide a free recycling service that allows the aluminium coffee pods to be effectively recycled after use. Only the aluminium coffee pods need to be sent, along with a pre-paid shipping label, and TerraCycle will handle recycling the pod from there. The programme is in charge of returning the aluminium pods to where they may be recycled, thereby reducing carbon footprints.

To know more: https://www.alcircle.com/news/thieves-australia-launches-sustainable-recycling-scheme-for-aluminium-coffee-pods-86072

Rusal initiates using aluminium scrap to make low-carbon alloys for automotive industry

RUSAL, a prominent producer of aluminium in the world and a major producer of aluminium in Russia, pioneered the production of foundry alloys for the car industry from end-of-life aluminium trash. Due to this manufacture, RUSAL decreased the new product's overall carbon footprint by over 20%. Rusal's Primary Equivalent Foundry Alloys (PEFA), produced using molten aluminium, comprise 20% aluminium waste. By the second half of 2023, the company intends to enhance PEFA manufacturing

and up the recycled content to 30%. The new product fully complies with OEM demands and satisfies their demands for recycled material and a small carbon impact. This product will meet the strategic needs related to carbon neutrality goals and ensure that Rusal, partners, and customers actively participate in the automobile industry's circular economy.

To know more: https://www.alcircle.com/news/rusal-initiates-using-aluminium-scrap-to-make-low-carbon-alloys-for-automotive-industry-89919

To minimise greenhouse gas emissions, GE signs a contract to upgrade the gas turbines of EGA's Al Taweelah power station

Emirates Global Aluminium (EGA), a major player in the Gulf aluminium industry, and GE Power, a leading energy technology provider, successfully upgraded four GE 9F gas turbines already in place at EGA's Al Taweelah power plant. This idea will help UAE achieve its intended Net-Zero strategic objectives by 2050 and lessen the severity of greenhouse gas emissions. To maintain the historical electricity production of 920 MW, greenhouse gas emissions would need to be reduced by 74,000 tonnes yearly, equivalent to removing 16,000 automobiles off UAE roads.

With hardware and software advancements, GE's AGP update on the four 9F gas turbines will boost production, efficiency, and availability. After being successfully deployed to six smaller E-class turbines, the technology is used for the first time in the UAE on an F-class gas turbine. For GE's 9F fleet, a "Live Outage" concept will also be used for the first time internationally. Live Outage lowers the possibility of mistakes and rework by switching from paper-based management to a digital platform, enabling

clients to expedite their outage process.

To know more: https://www.alcircle.com/news/ge-will-upgrade-gas-turbines-at-ega-s-al-taweelah-power-plant-to-reduce-greenhouse-gas-emission-intensity-80514

Guinea's bauxite mines to run on sustainable fuel

West Africa LNG Group (WALNG), a firm that offers a wide range of natural gas-based fuels and services, has arranged equity financing with a US-based investor group for an LNG import facility in Guinea. WALNG has created an LNG import terminal and distribution network in response to the Guinean government's need for a fuel supply that is reasonably priced and ecologically friendly. Guinea LNG will provide commercial volumes of natural gas to bauxite mining businesses in the Boké, Bel-Air, and Boffa areas for power generation and upcoming alumina refineries, enabling Guinea to directly benefit from her priceless natural resources.

According to the Center for Liquefied Natural Gas, "Natural gas is a fossil fuel – but it's cleaner and more efficient than other traditional fuels. Natural gas produces less pollution and greenhouse gases than its counterparts."

To know more: https://www.alcircle.com/news/walng-seals-lng-import-terminal-funding-guinea-s-bauxite-mines-to-run-on-sustainable-fuel-83361

Rio Tinto along with Corona Canada launches specially-marked low-carbon beverage cans utilizing ELYSIS technology

On June 29, 2022, Rio Tinto, the world's second-largest metal and mining business, revealed that it had released Canada's first specially designated, low-carbon beverage aluminium can made by Ball Corporation in collaboration with Corona Canada, a pioneer in the beer market. The cans are currently available through a trial programme in Ontario and were created with Rio Tinto aluminium by utilising the ELYSISTM technology. In addition to the restricted distribution, 1.2 million cans have QR tags attached to them to encourage buyers to learn more about the reduced carbon impact of the cans. Consumers will be given an utterly traceable beverage can due to this experimental project. Future consumers will be able to scan QR codes to get sustainability data and understand precisely how Rio Tinto's products are created from the mine to the market, thanks to the company's usage of insights from its START programme.

To know more: https://www.alcircle.com/news/rio-tinto-in-partnership-with-corona-canada-launch-specially-marked-low-carbon-beverage-cans-utilizing-elysis-technology-80846

Capral Aluminium pledges to achieve net zero emission by 2050

By 2050, Capral Aluminium promises to have zero emissions. Capral will need to use innovative and ground-breaking technical options to reach net-zero emissions in Scope 1 and Scope 2 to make this happen. The scientific community has said categorically that to confine global warming to 1.5°C and stop the negative consequences of climate change on human civilization and

ecosystems, net-zero global CO2 emissions must be reached by the middle of the century. According to Michael O'Keefe, the General Manager of Capral, the company will focus on Scope 1 and Scope 2 emissions initially as part of its net-zero pledge. Scope 1 includes direct emissions from company-owned and -controlled resources.

To know more: https://www.alcircle.com/news/capral-aluminium-pledges-to-achieve-net-zero-emission-by-2050-80572

Hylux introduces spring water in a new recyclable aluminium bottle

Hylux, a US-based manufacturer of health beverages, has introduced a new recyclable, resealable aluminium bottle for its unflavored spring water. The Boston campus of Northeastern University will be the first purchaser of the bottles, which will initially be made accessible to select organisations for sale and distribution within their networks. Hylux is already communicating with sports teams and other major organisations to increase the reach of the newly introduced bottles. The spring water will soon also be available online.

To know more: https://www.alcircle.com/news/hylux-introduces-spring-water-in-a-new-recyclable-aluminium-bottle-with-resealable-caps-and-artwork-84610

Collaboration between OZ Minerals, Boliden, and Rio Tinto to develop cutting-edge technology for sustainable mining practises

Together, OZ Minerals, Boliden, and Rio Tinto will create cutting-edge tailings management technology that will help the mining

sector to further minimise risk while obtaining the raw materials required for the energy transition from what was previously considered “trash.” As part of the Think & Act Differently (TAD) incubator initiative, the three firms previously mentioned will fund and assist innovators working to rethink mining and processing to eliminate, reduce, reuse, or discover value in mine tailings. The three businesses will work together more on initiatives to increase productivity and get advantages like reduced emissions and less waste.

To know more: https://www.alcircle.com/news/oz-minerals-boliden-and-rio-tinto-collaborate-to-unlock-innovative-technologies-for-sustainable-mining-procedures-87373

John Courtenay, Chairman and CEO, MQP

Grain refiner specialist advances sustainable manufacturing by closing the loop in the production process

Leading grain refiner specialist MQP – which is set to present new technical research at TMS 2023 in the US this month – has committed to the advancement of sustainable manufacturing by making the production of its super-efficient Optifine 5:1 125 a ‘closed loop’ process.

The award-winning British company is now not only producing its 125% efficiency grain refiner with low carbon aluminium but is recycling customers' scrap to make the cost-saving product – which customers can then buy back and improve their sustainable roadmap.

MQP chairman John Courtenay, who will be presenting the pioneering research behind Optifine 5:1 125's incredibly high efficiency at TMS, said: "Making vehicles lighter and creating electrical infrastructure and solar panels, aluminium is a game-changer when it comes to energy transition towards low carbon energy sources and we expect demand for this highly-sustainable metal to grow massively by 2050.

"This year, we have started making our Optifine 5:1 125 grain refiner with low carbon aluminium, manufactured using hydro-electric power or wind power results in far lower polluting CO2 emissions, and we aim to convert all our grain refiners, including Optifine 5:1 100 and Optifine 3:100, to this low carbon process in the near future.

"On top of this, we are rolling out a service where we take customers' production scrap aluminium and melt it down to create our Optifine grain refiners, as well as master alloys, which they ultimately buyback. Making our grain refiners on a closed loop recycling basis is very attractive as customers endeavour to improve their sustainable practices in a meaningful way that goes towards meeting global emissions targets."

Ultimately, the manufacture of grain refiners does produce noxious fluoride emissions.

To make one tonne of grain refiner, you need 117kg KBF4 and 251kg K2TiF6. This equates to 368kg of fluoride salts per ton of refiner produced, or around 36,800t consumed per year worldwide. From this 350 kg/t of KAlF4, 35,000 tonnes remains as a by-product, which has to be disposed of, most of which finds application in fluxes for treating aluminium. From the balance, a substantial amount of F2 is ultimately released into the atmosphere.

However, if the world was to adopt Optifine, fluoride by-products and emissions would be reduced by two-thirds. The 125% higher relative efficiency of Optifine 5:1 125 means less energy as less refiner needs to be added to the melt, which also means less coil changes and transportation around the casthouse and lower warehouse inventory.

John said: “With Optifine 5:1 125, casthouses need up to 90% less grain refiner, making huge cost savings while achieving excellent melt quality by preventing unwanted razor streaks, cracks and defects, especially in alloys with high tensile strength and high surface quality typically used in automotive applications.”

The Optifine product range has been developed over 10 years of working with casthouses to improve operational productivity together with five years of fundamental research into nucleation conducted at Brunel University. It is now used in the production of over five million tonnes of alloys a year at 45 major casthouses worldwide.

“By improving efficiency, we are going even further in preventing common defects such as pin holes in thin sheets and foils for food and medical packaging applications, black-line defects in

litho plates to tears in beverage cans," said John. "We are also key in ensuring excellent surface quality and extrudability in billets for automotive extrusions such as trims and rails on SUVs and high gloss surfaces for luxury and sports cars."

MQP operates through a network of consultants and distributors with representatives and offices in all parts of the aluminium world, from Australasia to South Africa, Europe to the Americas.

Find out more about how MQP, which won Most Innovative Company at the international BizX Awards 2022, can help casthouse operations. To find out more about the development of Optifine 5:1 125, the mechanism of zirconium poisoning in grain refiner and use state-of-the-art high-resolution transmission electron microscopy to unlock the secrets of nucleation at the atomic level, visit MQP's TMS symposium event page.

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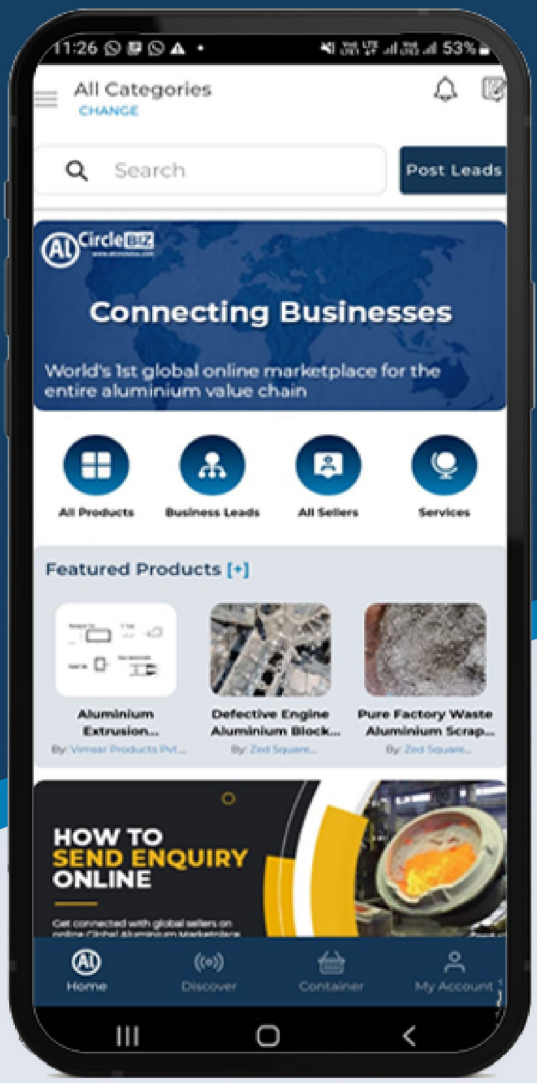

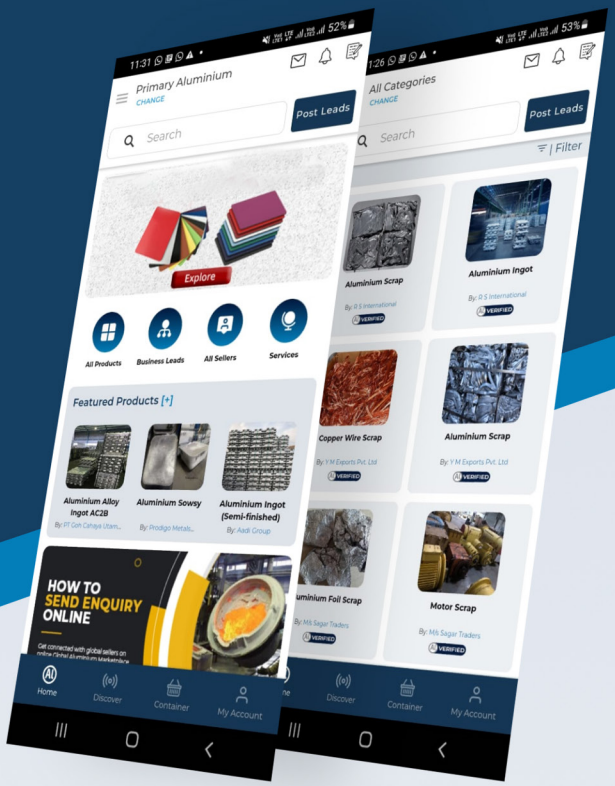

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Anode Hauling Solution: On the road to net-zero emissions

Theodore Levitt once said: ‘Creativity is thinking up new things, innovation is doing new things.’ As it relates to the electrification process of industrial vehicles, it’s a bit of both. The task is the same whether the vehicle uses a conventional diesel engine or an electric one, so you need creativity to discover the technological breakthroughs that will ensure it works just as well in application and an innovative approach to organizing its workflow to ensure its success.

This article takes stock of why 2023 seems to be the right time for an aluminium producer, Rio Tinto, to undertake an ambitious project like the electrification of an Anode Hauler fleet and the motivation behind embracing this change and the challenges of switching from diesel to electric engines from theory to reality. The enthusiasm that comes with the industrial drive towards net-zero emissions goes to show Quebec's aluminium and equipment manufacturers have a pivotal role to play.

Challenges in Anode Hauling

Hauling anodes may seem simple. However, when we take a closer look at the operating environment of aluminium producers, we quickly come to understand the complex challenges that come with operating electrified hauliers in this environment.

A host of factors need to be considered. For example, the weight of the payload, the impact of charging on continuous operations, the effect of a magnetic field on the hauler, coactivity, the payload's specific handling requirements, associated risks of hauling materials in confined spaces, etc. As such, it's essential to have a fleet of sturdy, reliable and safe haulers.

The task haulers perform can be rather repetitive. However, they are essential to the operation of the smelter and require extreme vigilance. Equipment manufacturer EPIQ MECFOR's haulers are more than just tractors and trailers, they're a key piece of the puzzle that links different parts of the aluminium smelter to make it function efficiently.

Rio Tinto is working with EPIQ MECFOR to test its Electric Anode Hauler, the model MTE, in one of its smelters, to test recharges, maintenance, and autonomy of the vehicle in an industrial

environment with magnetic fields. This is one example of how Rio Tinto supports business partners in their technological developments through financing, networking, and technological expertise.

Genesis of an industry trend and how it translates in the North American aluminium industry

Since 2016, discussions have been taking place, leading the industry to start restructuring and establishing standards to mobilize towards the decarbonization of aluminium production. Consumers want more responsible products and are asking for more traceability. Aluminium is turning green and big players are leading the way.

For example, in 2021, Rio Tinto launched its START Responsible Aluminium initiative, the first sustainability label for aluminium using blockchain technology. Now, many initiatives are converging to reduce energy consumption and new technologies are emerging with a focus on reducing carbon footprint. Put simply, the greenhouse gas reduction race is underway.

Important initiatives to reduce the overall environmental footprint of the aluminium industry are taking place across the value chain and emerge from close collaboration between smelters, customers, suppliers, equipment manufacturers, employees, and the community.

With this in mind, EPIQ MECFOR set out to understand the readiness of the industry to shift to electric engines, conducting a small-scale market study in 2019. At that time, it turned out that vehicle electrification wasn't the main priority for the industry; other major projects were on the agenda.

So too, factors such as the installation of charging stations in often crowded environments, availability of battery technology that would allow sufficient autonomy to carry heavy loads, and the requirement to recertify maintenance crews to be able to work on electrified equipment all posed barriers to adoption.

Based on discussions with industry players, EPIQ MECFOR knew it was only a matter of time before the request for electrical engine industrial vehicles would re-emerge.

The right time to live the green dream

The decarbonization of its operations is at the heart of Rio Tinto's business strategy, with clear and ambitious objectives: achieve a 50% reduction of emissions by 2030 and transition to net zero by 2050. The scale-up of the joint venture ELYSIS, a carbon-free smelting technology, will play a critical role in that strategy, as does their commitment to invest in technology and innovation across the entire aluminium production supply chain. The decarbonization of transportation is one of them.

There are multifaceted challenges to this decarbonization process across all levels. The transition to 'green' energy Anode Haulers requires facility modifications (e.g.: charging station) along with new skills for maintenance teams. The involvement and cooperation of the end-users, aka the aluminium producers, is necessary.

EPIQ Machinery followed suit by appointing a team mandated to convert its diesel engine-powered anode haulers to battery-powered. To better address the above concerns, EPIQ MECFOR partnered with Rio Tinto for the electrification project of its anode haulers, allowing testing of the EPIQ MECFOR Electric Anode Hauler, the model MTE, in a real operating environment and to develop a sensible strategy for a transitioning plan. By working together, we know that we can accelerate progress and continue to play an important role in the fight against climate change.

The leap towards electrification centres on two key aspects:

1. Analysis of vehicle usage
   Type of driving, accelerations/decelerations, speed management, energy recovery to optimize the active load of the equipment, etc.

2. Analysis of work processes and practices
   Defining a transition strategy (e.g. choice of charging strategy, charging station location, the possibility of a switch to a fleet of 100% electric haulers or necessity of a gradual transition, vehicle maintenance plan, limitations linked to space constraints, etc.).

EPIQ aims to develop equipment that will deliver the same product performance with a similar experience for the operator. Also, it is possible to consider an electric EPIQ MECFOR MTA/ MTC tractor and trailer design or to think of a non-articulated single-hulled model that would resemble the auto-guided hauler (AGV) model which could be more easily converted later. In fact, once the transition to electric equipment is well underway, some producers will be ready to step up with auto-guided haulers.

In short, there are multiple roads to net-zero emissions; converting heavy-duty mobile equipment is one of them. EPIQ Machinery is equipped to offer innovative hauling solutions. The team has the capacity and the knowledge to develop electric haulers. We appreciate the ‘close to customer’ approach with a cooperative mind-set.

EPIQ Machinery strives to be a strong link in this constantly evolving aluminium production ecosystem. We understand that saving energy is saving money and preserving our planet’s resources. In the end, efficient equipment pays off.

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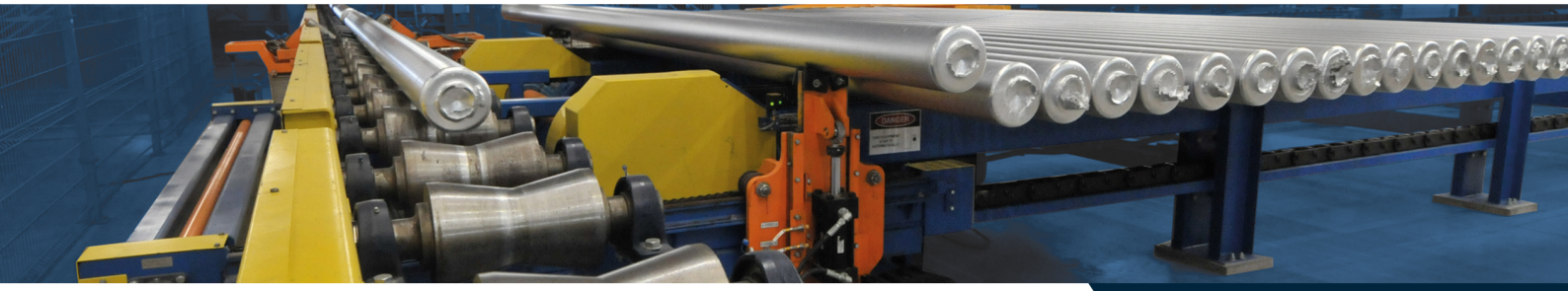

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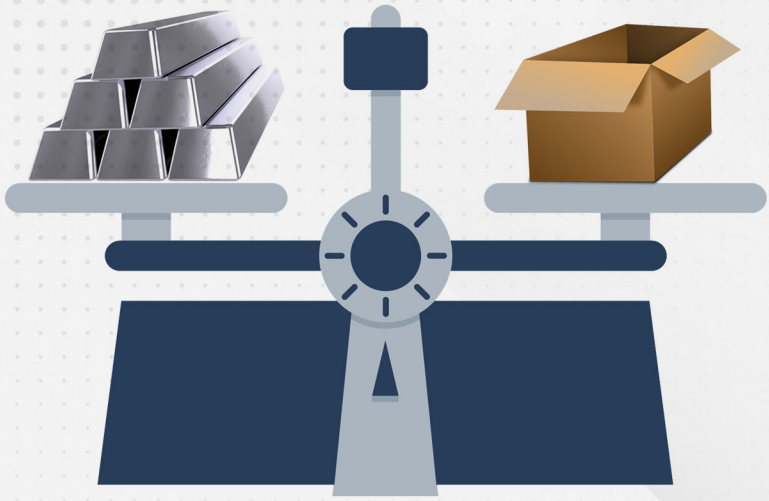

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REEL Aluminium is a major solution provider dedicated to reduce the carbon footprint in the Aluminium industry. Both internal and external partnership, new ways of understanding and innovative technological investments in the development of net-zero solutions for the Aluminium industry are the best conditions for REEL's goals to work together on its path to decarbonization and to green Aluminium future.

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Paramita Das, Head of Metals and Minerals, Marketing and ESG at Rio Tinto

“Rio Tinto is extremely proud of its ability to produce some of the highest quality, lowest-carbon footprint aluminium.”

Paramita Das is a global executive with extensive experience in the commodities segment (metal, oil and gas). She leads marketing for metals and minerals globally and the establishment of a more ESG-centric approach in the Atlantic region. Prior to

her work in the marketing and development space, Paramita was the Chief of Staff to the CEO of Rio Tinto and Chief Transformation Officer for the Atlantic Operations for the company's aluminium segment. Paramita joined Rio Tinto in 2015, before which, she worked with companies including Sumitomo/UACJ/TAA and BP. She is a passionate advocate for ESG and inclusion.

Here is an excerpt from an interview with her on green initiatives undertaken by Rio Tinto.

AlCircle: What is Rio Tinto doing to reduce its carbon footprint?

Paramita Das: Decarbonisation is an urgent priority for the planet—and that includes Rio Tinto.

We set ambitious climate targets to reduce our scope 1 and 2 emissions by 50% by 2030. And, to meet that target, we've created six large abatement programmes. They are focused in key areas including renewables, ELYSIS™, process heat, and diesel.

In our aluminium business, we are identifying a pathway to turn our Boyne Smelter (BSL) into the industry's first large scale aluminium smelter operating fully on solar and wind renewable power. We are in the process of securing 4GW of renewable power to provide a competitive future for our Queensland aluminium and alumina assets.

And, in the process heat space—at our Yarwun alumina refinery—we are working closely with partners like the Australian Renewable Energy Agency (ARENA) and Sumitomo Corporation to study whether renewable hydrogen can be used in alumina refining.

AlCircle: Rio Tinto produces one of the lowest carbon aluminium in the world. What makes this possible?

Paramita Das: Rio Tinto is extremely proud of its ability to produce some of the highest quality, lowest-carbon footprint aluminium. And this is mainly possible thanks to our hydropower operations. We all know that it takes a lot of energy to produce aluminium. Hence, it's important to look at how we power our production.

Eighty per cent of Rio Tinto aluminium is produced with green power. In fact, all our smelting capacity in Canada is hydro-powered, and collectively we have just over 4GW of capacity. Our smelters rely on enormous water sheds of several hundred thousand km2. As a result, the greenhouse gas emissions intensity of our managed Atlantic Operations smelters represents less than one-fifth of the industry average.

We continue to look at ways to improve our hydropower operations. In Saguenay, Quebec, and Kemano, British Columbia, we have a programme to both refurbish and lift the capacity of our existing hydro power stations. In 2022, we finalised the Kemano Tunnel 2 project to ensure the long-term, sustainable production of low-carbon aluminium at our smelter in Kitimat. We continue to look at ways to improve our hydropower operations. In Saguenay, Quebec, and Kemano, British Columbia, we have a programme to both refurbish and lift the capacity of our existing hydro power stations. In 2022, we finalised the Kemano Tunnel 2 project to ensure the long-term, sustainable production of low-carbon aluminium at our smelter in Kitimat.

AlCircle: Could you share more about Rio Tinto's sustainable aluminium journey?

Paramita Das: As an industry leader in responsible aluminium, we're committed to bringing sustainable aluminium to market.

We launched the industry's first certified low carbon aluminium, called RenewAL and became the first company to receive certification from the Aluminium Stewardship Initiative (ASI) as producing "responsible" aluminium".

We are also helping further develop ELYSIS™, a breakthrough smelting technology to produce aluminium with no direct greenhouse gas emissions, which is now being used in Apple products.

And in 2021, we launched START, another pioneering step in our on-going sustainability journey with our customers. Using blockchain technology, START works like a 'nutrition label' for aluminium – providing transparency and traceability across our supply chain, so end users can see environmental, social, and governance information across 14 areas including carbon footprint, water use, and recycled content.

AlCircle: Aluminium, like other critical minerals such as nickel, lithium, and cobalt, is key to the clean transition ahead of us. How is Rio Tinto helping the world move towards this transition?

Paramita Das: Rio Tinto is finding better ways to provide the materials the world needs. Our focus is to produce them in a sustainable way while avoiding harm and mitigating impacts to the people and the planet.

We work closely with our customers and their customers downstream to decarbonise the entire value chain.

In 2022, we formed a partnership with Ford to develop more sustainable and secure supply chains for battery and low-carbon materials for Ford vehicles including lithium, low-carbon aluminium, and copper.

And, with Volvo Group, our partnership covers multi-commodity supply for their green transition. As a customer of their trucks, we also collaborate on developing small, autonomous electric vehicle technology for our operations.

AlCircle: How is Rio Tinto using new technologies in its drive towards green initiatives?

Paramita Das: We use breakthrough technologies to produce sustainably made materials, in some cases without additional mining, thus maximizing the full value of our resources.

In our aluminium business, ELYSIS™ zero-carbon aluminium smelting continues to be an exciting development. The process eliminates all direct greenhouse gases from aluminium smelting

and instead produces oxygen. The ELYSIS™ R&D is progressing well with work and is now focused on scaling up the technology for even larger commercial-size cells, which should become operational in 2023.

At RTFT in Quebec, we became the first producer of scandium oxide in North America by using an innovative process we developed to extract high-purity scandium oxide from waste streams without the need for any additional mining. Scandium is an essential material in Al-Sc alloys in automotive and aerospace applications and will be a critical ingredient for net zero product applications.

Another example is carbon mineralisation. In February, the US Department of Energy's ARPA-E Innovation Challenge awarded $2.2 million of funding to a Rio Tinto-led team that is exploring carbon storage potential at the Tamarack nickel joint venture in central Minnesota. We are also contributing $4 million to the 3-year project.

Carbon mineralisation uses natural chemical reactions to convert captured carbon dioxide into rock and permanently store it underground. It has the potential to be an important technology in meeting global climate goals.

AlCircle: Speaking of technologies, can you tell us how Rio Tinto's first sustainability label based on blockchain for aluminium, START, is performing? How have customers responded?

Paramita Das: In a 2022 pilot with ABInBev, we launched a specially-marked Corona beverage can in Canada. The cans had the lowest CO2 footprint in the world – made from Rio Tinto aluminium, including ELYSIS™.

In this pilot, the cans included a consumer QR code. Scanning the code took users to a web page to learn more about the cans' low carbon footprint.

This ground breaking pilot is the next step towards putting a fully traceable beverage can in the hands of consumers.

Since START was launched in 2021, we have received overwhelmingly positive support from our customers. The high level of interest further corroborates the demand for traceability, provenance, and sustainability in the industry. Sustainability is a team sport, and we'll need more like-minded partners to come and work together with us.

AlCircle: What message would you like to share with the global aluminium industry as part of Rio Tinto's commitment to a sustainable future?

Paramita Das: For 150 years we've faced challenges, found solutions, celebrated our successes, and learned from our failures. With a new era, we face new challenges, and the one facing us right now is climate change.

Climate change is an unprecedented challenge, and a key topic for the metals and mining sector.

We have put impeccable ESG at the heart of our approach and decision-making. This means pursuing our own decarbonisation with conviction, while helping our customers develop low-carbon products and services with a focus on partnerships at all levels to solve challenges together.

Now That You're Asking Where Your Supplies Come From, We Should Talk!

As the world faces a climate crisis amidst a shortfall of energy supplies and critical metals, difficult decisions are being made to meet growing supply gaps without risking new dependencies on unsustainable producers or compromising for geopolitical factors.

Best resource practices shouldn't be dictated by current events, but that's not always simple. A hard lesson being learned in the aluminium industry with the effects of short-term thinking has been felt. In addition to the increases in inflation, energy cost rise and supply shortfalls, we have seen the EU import ban on Russian oil, the USA's proposal for a potential 200% tariff on Russian aluminium, European production closures (see below), and more scrutiny than ever on ESG credentials for investment.

European Production Closures

Norsk Hydro has closed its Slovakian plant Slovalco as well as reduced production by 110,000-130,000 across two of its Norwegian plants; Talum in Slovenia have reduced output by 80%; Alcoa's Lista smelter in Norway will reduce output by a third; Speira GmbH is contemplating halving production; G.A. Roeders GmBH plans to shift its production patterns to incorporate temporary shutdowns in order to maintain output and save on energy bills. In total, such reductions equate to 1.36 million tonnes, or a drop of 13.8% compared to total capacity.

Big Changes Underway — Where Do You stand?

Despite these problems, aluminium demand is predicted to continue rising by as much as 80% by 2050. The problem is, where will it come from, and how much will it cost the earth (and our wallets)?

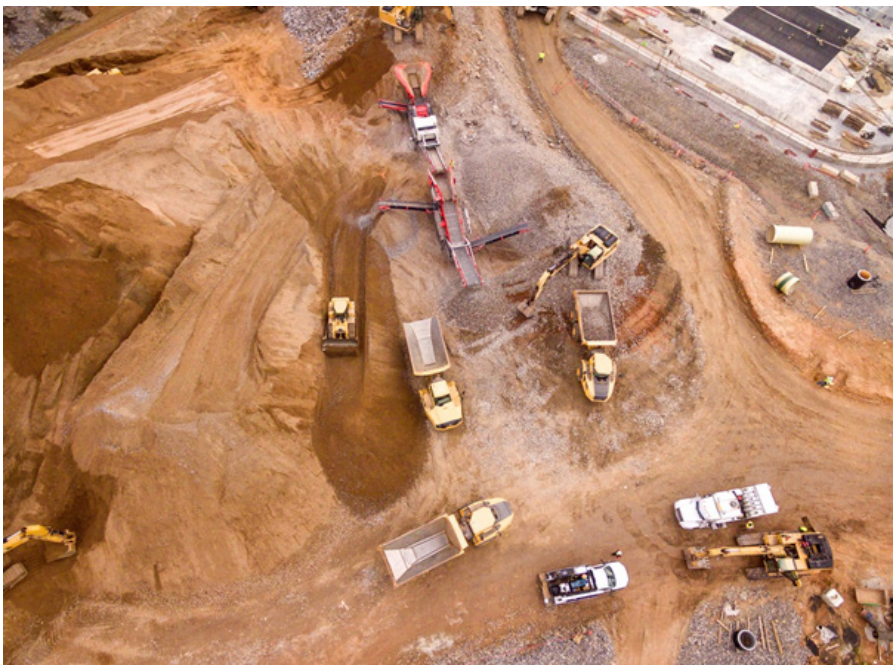
In 2021, for every tonne of aluminium produced, 18 tonnes of CO2 was emitted, totalling a grand 1.775 billion tonnes. That's roughly 2% of man-made carbon emissions, more than the entire aviation industry, to produce just one material. Aluminium is an incredibly dirty resource compared to almost any other base

metal. Why? Because not only is it an energy intensive process to produce aluminium, but currently over 60% of the energy required is produced from burning coal, the dirtiest fossil fuel.

This will have to change with the Paris Climate Agreement legally binding 196 parties to ensure climate increases are limited to 1.5 degrees Celsius and growing legislation interventions such as CBAM.

Sustainable sourcing is not just how it's made, but where it comes from. The damage to biodiversity through commodity extraction has never been greater — deforestation and land clearing for bauxite mining site is reaching new levels, having a detrimental effect on species diversity, with known and undiscovered species becoming or nearing extinction. Polluting the seas with chemicals and material waste has done the same to marine life.

Finding new and responsible methods for producing our materials has begun, but there's a long way to go. Now that you're finally asking where your supplies come from, we can have an honest conversation.



The Future of Aluminium Has To Be Green

Unlike some commodities, aluminium can be recycled, repurposed, reused, and even recycled again, with relatively zero drop in quality. The sustainable credentials are evident and needed more than ever for the future of manufacturing.

Aluminium is one of the most important elements in our efforts to decarbonise. It's vital for electric vehicles, grid expansion, sustainable packaging, replacing of plastics, sustainable housing, renewable energy, and future potential innovations.

The Romco mission is to transform the production of metals to help solve the climate crisis. We do that by producing secondary materials from emerging markets, replacing the need for environmentally costly primary production all over the world. Our aluminium and copper recycling facilities are capable of reducing over 11,200 tonnes of CO2 per month compared to primary production — that's the equivalent of saving 25,930 barrels of oil from being burned every month.

We've switched to CNG for our production to reduce our emissions further and are currently exploring the viability of green hydrogen production on the continent of Africa to further eliminate our emissions footprint. We believe Africa can be a powerhouse in sustainability, so we're starting with green aluminium.

Environmentally speaking, producing 1 million tonnes of secondary (recycled) aluminium saves 8 million tonnes of bauxite, is 95% more energy efficient, emits 95% less CO2 than primary mining, and diverts 7.62 cubic metres of landfill. There's also the benefit of not having to deal with treating toxic dross (a by-product of aluminium production). The math is simple and the

green technology has never been more crucial for a changing industry.

But to Romco, green means sustainable in a far greater sense than just emissions. We also build sustainable infrastructure for a truly circular economy in the communities where we work in. Through our Small Business Buying Program, we develop local organisations and entrepreneurs' ability to participate meaningfully in the secondary supply chain to build their businesses alongside ours — increasing agency and financial independence for responsible organisations.

It's about building a fully sustainable picture that creates longevity for green resources in a changing market.

The Big Questions

The market is changing. Are you ahead of that change? Are your resources sourced responsibly? Have you considered the emissions, production, producer, environment, and ownership of your resource partners? If you're a purchaser of aluminium, is it green? Is it ultra-low carbon? Is it sourced ethically? Is it vulnerable to future government or legislative intervention?

Yes, emissions are a huge part of why secondary materials are better for the environment than primary ones, but social responsibility, governance, wider bio-diversity and community impact are also vital considerations to making the overall 'green' product truly sustainable.

Sergey Kidakov, Founder, GreenAlum

“The main goal of the GreenAlum project is the development of innovative technologies in the aluminium industry and machine tool building.”

Sergey Kidakov holds a degree in engineering specializing in railways and automobiles. Additionally, he has a higher education degree in Information Technology (IT) in communication and telecommunications.

His experience includes supporting and developing IT startups, and he has been solving problems in the aluminium industry through the GreenAlum project for the last eight years.

AlCircle: Please share with us more about the work GreenAlum does. How is GreenAlum supporting the aluminium industry's transition to sustainability?

Sergey Kidakov: The GreenAlum project has existed since 2014. The main goal of the project is the development of innovative technologies in the aluminium industry and machine tool building. Over the past three years, energy-efficient and environmentally friendly technologies have been developed in the field of primary aluminium production and alumina production. These technologies significantly reduce energy consumption, reduce CO2 emissions to zero, optimise production processes, and obtain additional raw materials for producing iron, titanium, potassium, pure silicon, and rare earth metals. The introduction of technologies will bring large profits to enterprises by saving resources and obtaining related materials. The resulting raw materials will drastically reduce the need for mining, which will best affect the ecology of many regions of the earth.

AlCircle: What do you think about sustainable alumina production? Could you tell us about the GreenAlum project on industrial waste in the alumina industry?

Sergey Kidakov: Bauxite ore is (90%) raw material for producing alumina-aluminium. The Bayer process technology has been around for a century and a half and has mostly stayed the same. It has many disadvantages, which, with the increase in alumina production, significantly increase the cost of the

product and are very harmful to the environment around the processing plants. Now the amount of accumulated waste of red mud has assumed alarming proportions. We can avoid environmental disasters like the one that happened near the village of Kolontár in Hungary in 2010. With the advent of the technology of the non-waste processing of bauxite and red mud, there was a chance to improve nature and reduce the pathogenic impact of production and waste on humanity.

AlCircle: What environmentally friendly and energy-saving technologies can the aluminium industry implement for a green transition?

Sergey Kidakov: There are several directions for introducing environmentally friendly and energy-saving technologies in the aluminium industry: (i)Introduction of chemically neutral anodes in electrolysers to replace CO2 emissions with oxygen (ii)Rusal is the leader here. They use of “green” energy for the production of aluminium and alumina. Energy production from burning fossil fuels must stop (iii) Optimization of logistics and technological chains in production. Use of environmentally friendly transport (iv)The use of aluminium recycling instead of the primary output. This will develop gradually as aluminium waste accumulates.

AlCircle: Can the global aluminium industry move towards low-carbon aluminium production in the next ten years?

Sergey Kidakov: Maybe. This requires the efforts of both producers and legislators. Introducing new technologies at the state level and state associations may enable the timely completion of the process against the backdrop of the economic crisis. Therefore, manufacturers and policymakers must be well aware of the state of the industry and the possibilities of new

technologies. It is also necessary to shift the focus to nuclear and hydroelectric power to replace intermittent and inefficient solar and wind energy.

AlCircle: What is GreenAlum's message to the global aluminium industry for a sustainable future?

Sergey Kidakov: The potential of aluminium as a structural and building material is not fully disclosed. Production will grow, and new alloys and designs will appear. Obtaining aluminium with minimal energy use and maximum environmental protection is essential. This is a priority for the development of the industry. Those who follow preferences avoid losing competitive advantage and business.

Cameron Jones, Director – Assurance, at Aluminium Stewardship Initiative (ASI)

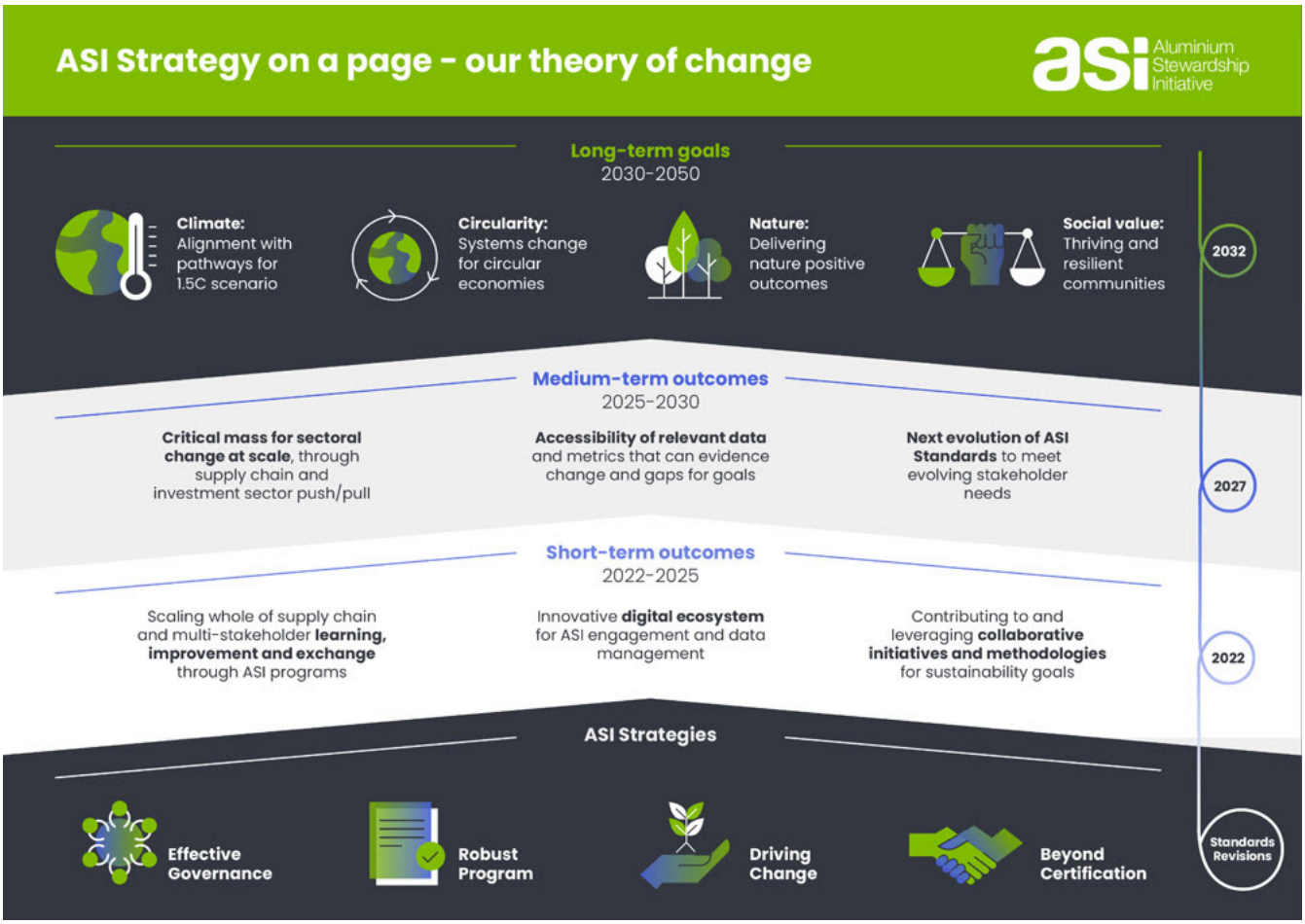
2023 – ASI's Strategy on a Page

ASI was incorporated in 2015, making 2023 the ninth year of our collective journey. We are proud now to number 275 ASI Members across our 6 membership classes. There have been 238 ASI Certificates issued to certifying Members for both Performance and Chain of Custody. But what is the direction and purpose for this increasing scale of implementation?

In October 2022, the ASI Board held a full-day workshop to

reflect on ASI's strengths, opportunities, aspirations and desired results and review the existing framework for change as part of ASI's annual strategy processes.

ASI's new Strategy on a Page below illustrates our 'theory of change' – the mechanisms through which we aim to contribute to sustainability-enhancing changes in the aluminium sector.



ASI's four strategic foundations

Effective Governance is an enabling foundation for ASI's work, focusing on multi-stakeholder decision-making at standards and corporate governance level, as well as organisational and financial resilience.

Robust Program provides the technical foundation for delivering the quality implementation of agreed standards and supporting the integrity of assurance frameworks by members and auditors.

Driving Change highlights the critical role of data and transparency to track progress, deepen insights and bring together the necessary actors to catalyse sustainability sector transformation on key sustainability topics ultimately.

Beyond Certification recognises that ASI has an opportunity to complement the Certification program through work with other stakeholders, including Indigenous Peoples and local communities, to support direct capacity building and amplify positive Change in the aluminium value chain.

Desired short-term outcomes (2022-2025)

These strategic foundations will drive ASI towards its desired short-term outcomes (2022-2025): Following the 2022 Standards launch, to build a scale of participation, strengthen engagement with collaborative initiatives and frameworks, and invest in our digital ecosystem to innovatively manage data and stakeholder processes.

Medium-term outcomes (2025-2030)

These, in turn, will position ASI for its desired medium-term outcomes (2025-2030): to further evolve its standards and certification program to meet evolving needs, enable access to relevant metrics on progress, and reach a critical mass for sectoral change at scale (through these and other drivers). The next Standards Revision will be in this timeframe. In contrast, the

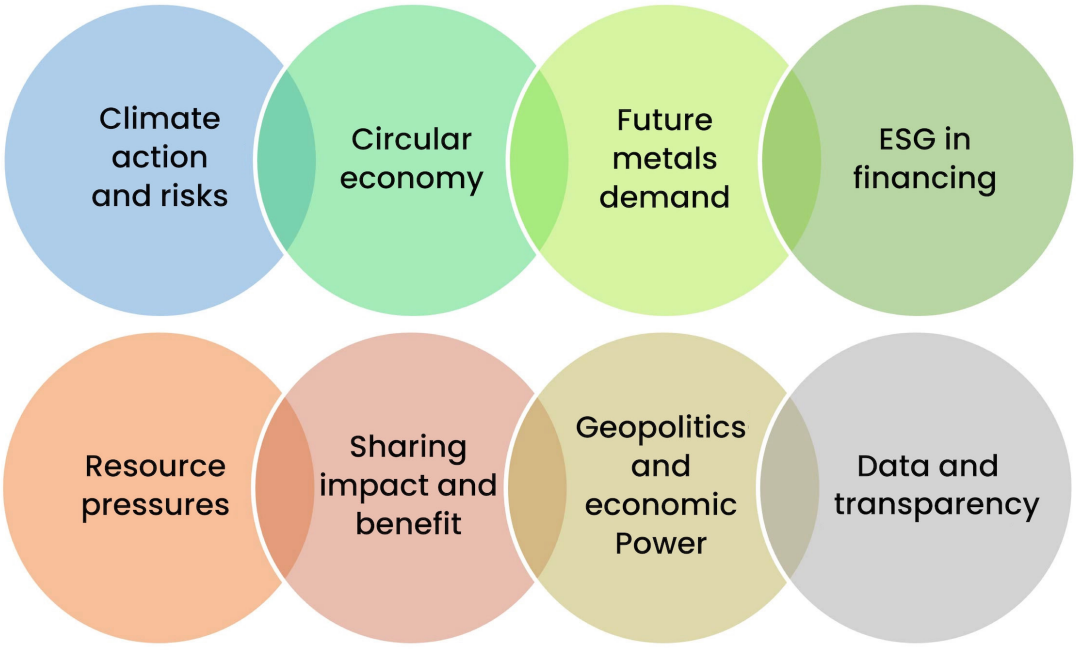
periodic major revision cycle is mapped onto the timeframes to highlight key milestones. These will be supported by more frequent guidance and learning updates.

Long-term goals (2030-2050)

Together, these outcomes will propel ASI's members and stakeholders towards our long-term goals (2030-2050) on climate, circularity, nature positive and delivering social value. As ASI's Strategy is updated annually, these goals are anticipated to become increasingly concrete (and urgent) as collective progress and effort are made across a wide range of programs.

Horizon challenges

ASI's Strategy is situated in an understanding of the big picture challenges facing the aluminium value chain. These long-term, structural challenges are the landscape and wider horizon in which ASI seeks to drive and contribute to positive change and transformation.



Irina Bakhtina, Chief Sustainability Officer at RUSAL

Building Sustainable Supply Chain in RUSAL

The sustainable development strategy of RUSAL aims at making, by decoupling business growth from the environmental footprint, sustainability affordable across the entire aluminium value chain and creating a new class of assets in the non-ferrous metal sector. This means building by 2035 such a business model that is future-fit and addresses the needs of low carbon and circular economy, is based on an agile,

fair, safe and inclusive supply chain, and is built on the most advanced technologies.

Therefore, a sustainable supply chain is at the heart of the Company's ESG transformation. Understanding our suppliers and the degree of their ESG maturity is the key element to start with.

RUSAL is sourcing raw materials, finished goods and services from as many as 16,000 large, medium and small-size suppliers from across the world, and the task is to assess their overall sustainability practices, including key impacts, risks and opportunities associated with it, never promised to be an easy one.

As a first step, the Sustainability team of RUSAL has agreed with the Procurement and Quality Management teams on a relatively focused panel of suppliers – those who supply to the Company some of the most critical non-alumina raw materials (by value) – to start with, and the methodology for a self-assessment, developed based on the core GRI standards with the help of AKRA PM – local analytical credit rating agency in Russia.

In July 2022, the invite to pass self-assessment of their ESG maturity on a specially designed online platform went to the 35 largest suppliers of the following 10 categories of non-alumina raw materials coming from Russia and China: alloys, aluminium fluoride, anode blocks, calcined petroleum coke, lignite, magnesium, manganese, pitch, raw pitch coke, and silica. The best transparency and cooperation were displayed by 14 out of 35 suppliers. For 9 other suppliers, the agency delivered research via publicly open sources, and for the remaining 10 companies,

the ESG maturity rating turned out to be unacceptable due to no data.

As part of the assessment, core RUSAL suppliers of the non-alumina raw materials had to fill in an online questionnaire covering 25 aspects (a total of 89 questions) under three topics: 'Environmental Footprint' (7 aspects), 'Social Impact' (12 aspects), 'Economic Impact and Corporate Governance' (6 aspects). For every aspect, a maximum possible score was defined as a sum of the maximum possible scores for responses to every question within the respective aspect. Based on the final score, every aspect of the company's activity got rated (80% plus – high, 50-79% – average, and below 50% – low). As a sum of all scores, every company's performance got their overall rating ranging across 5 grades (please refer to Table 1).

Table 1. Overall Rating Grades

Grades of the Overall Rating	Scores
Maximum	5 120—6 400
High	3 840—5 119
Average	2 560—3 839
Low	1 280—2 559
Unacceptable	0—1 280

The questions covered by the assessment were focused on collecting the data disclosed by the companies as part of their non-financial reporting and existing ESG practices. Our suppliers were offered an opportunity to self-assess their practices without paper submission as a matter of data confirmation since in some cases papers could not be disclosed publicly outside a procedure of regular supplier audit.

As a result of the supplier panel assessment, RUSAL got three types of reports:

1. a brief individual summary for every supplier containing detailed scores per every aspect of their ESG maturity, analysis of the best and the riskiest areas of their business in terms of sustainability, and recommendations on risk management in the most critical areas for improvement along with the link to their relevance for material ESG factors for the RUSAL supply chain. Such a summary is a solid basis for further development of a supplier-specific roadmap to improve their ESG maturity level and mitigate potential risks for the RUSAL value chain;
2. an aggregated summary per each raw material category covered with the assessment, and analysis of the most and the least favourable aspects of the Company's supply chain (including growth opportunities and on-cost risks), along with the recommendations on risk management in the riskiest areas as attributable to their potential impact on material ESG factors for the RUSAL supply chain;
3. a consolidated report 'ESG Governance Maturity at the RUSAL Suppliers' covering analysis of the most and the least favourable aspects of sustainability across all raw material categories in scope (including growth opportunities and on-cost risks), analysis of the suppliers through the lens of their 'Environmental Footprint', 'Social Impact', and 'Economic Impact and Corporate Governance' including the ranking of the top companies in every topical aspect, comparative analysis of the ESG maturity of the Russian versus Chinese companies through the same three blocks, and recommendations on the risk management improvements in the most risky areas along with the link to their relevance for material ESG factors for RUSAL supply chain and the best practices available on the market.

A threshold to single out the most problematic aspects for a particular supplier in the 'Environmental Footprint' block was set on par with a total average score aggregated by all companies inside this block, which turned out to be at 55% of the maximum possible score. In the 'Social Impact' block it turned out to be at 47% of the maximum possible score, and in 'Economic Impact and Corporate Governance' – at 60% of the maximum possible score.

For the purpose of the consolidated report, the best practices available on the market were sourced by the AKRA PM agency from the companies supplying the same categories of raw materials as RUSAL suppliers do, having public non-financial reporting and not being part of the RUSAL supplier pool.

As a result of the assessment, the average score for 25 companies who submitted their data in full or partially, reached 3,555 out of the 6,500 maximum possible. This score has been taken as a benchmark displaying the actual level of ESG maturity of the RUSAL raw material suppliers. It also serves as a threshold for the 2023-2024 roadmaps on risk mitigation, the gap to be covered by the companies whose scores happened to be below. The average score for 'Environmental Footprint' turned out to be 1,334 out of 2,500 maximum possible, for 'Social Impact' – at 1,504 out of 2,650, and for 'Economic Impact and Corporate Governance' – at 702 out of 1,250. Best transparency and maturity in the space of ESG meanwhile have been demonstrated by the Chinese suppliers of raw materials (ranging between 5,475 and 6,050 scores).

Under the 'Environmental Footprint' topic, the strongest competence of RUSAL's suppliers of non-alumina raw materials turned out to be all the aspects under the 'Waste Management' umbrella. 9% of the companies have got the maximum possible scores for this aspect. The areas for improvement defined here, are 'Materials Supplied for RUSAL Needs' meaning lack of recycled or recyclable materials, 'Greenhouse Gases' and 'Energy Sourcing'. Recommendations that are advisable to translate into the roadmap format to improve the ESG maturity of our suppliers, cover the need to increase the proportion of secondary material resources and renewable energy sources, increase the number of publicly disclosed environmental performance indicators, and develop the biodiversity conservation programs for their production sites.

Under the 'Social Impact' topic, the strongest ESG governance is observed in the aspects of 'Training and Education' where 24% of the RUSAL suppliers have got the maximum scores. Meanwhile, the areas for immediate improvement are associated with such aspects as 'Diversity and Equal Opportunities', 'Huma Rights', and 'Marketing and Labelling'. Our suppliers of critical raw materials are recommended, as part of the risk mitigation roadmaps, to pay special focus to diversifying their workforce, ensuring human rights assessment at the workplace, developing and adopting corporate policies to stop discrimination and deliver equal opportunities for their employees, as well as to regulate marketing communications.

Finally, under the 'Economic Impact and Corporate Governance' topic, the best-developed areas turned out to be our suppliers' practices of the antitrust and fair competition court dispute disclosure, as well as the investment in local communities, while the particular area for improvement is non-sufficient attention to climate risk and opportunities potent of material impact over their operations, revenue and cost (as part of the 'Economic Performance' aspect). The roadmaps to cover the gap, therefore, should be focused on an immediate and detailed analysis of the climate-related risks capable of affecting the business processes and undermining the existing operational infrastructure.

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Soumyadip Chakraborty, Director Operations at AlCircle.com

How digitalization may support Aluminium industry to reduce carbon footprint?

Introduction

We are living in an interesting time, facing a multitude of variables. On the one hand, the world is coming out of the pandemic and trying to regain the level of economic activities of the pre-pandemic time, only with more zeal and vigour. On the other

hand, ignorance cannot be an excuse; forget about bliss when it comes to the effect of greenhouse emissions on the climate and its impact. The governing bodies, activists as well as customers are being increasingly informed and asking about the carbon footprint of any product or service before reaching them and after being served. For example, before buying cloth, today's knowledgeable customers are increasingly mindful of whether the material is recycled and recyclable after usage. Before going to a hotel, some customers, if not all, check the use of solar energy along with the traditional thermal electricity by the property. This mind-set is also fuelled for the right reasons by the relentless efforts of activists, NGOs, social media campaigns and the definitive plans taken by world leaders during meetings & forums like COP26.

Aluminium, as an infinite metal, is excellently placed in this backdrop. It can be technically 100% recycled; hence, the secondary production may be deeply emphasized. Globally sustainability is becoming the main focus for many stakeholders. The aluminium industry is not an exception. Along with the various facets of the business, digitalization will play a definitive role in supporting the industry to achieve net zero or more sustainable practices. In fact, many big names in the aluminium industry have already started putting action items in vogue towards their goal of net zero. AlCircle, being dedicated to the cause, keeps celebrating such initiatives on its platform. The work done by endeavours like ASI (Aluminium Stewardship Initiative) or other consulting organizations also creates roadways for the aluminium companies who want to take the right path and calibrate their sourcing, supply chains, business operations, and the like. A few such initiatives are highlighted in the following section.

How digitalization can help

Digital may be leveraged extensively to help aluminium companies reduce their carbon footprint, regardless of their operations (primary vs secondary aluminium producers, extrusion profilers, etc.). A few such mechanisms are highlighted below.

a. **IaaS** – IaaS, or infrastructure as a service, ensures that companies look at data and software infrastructure as a cloud-based resource. Such a strategy gives flexibility and agility, refrains the organizations from building unutilized infrastructure, and drives towards a pay-as-you-go model. This reduces the carbon footprint, upfront infrastructure investment requirements, economies of scale are achieved, and business runs at its optimum simultaneously.
b. **Shifting the type of energy** – Primary aluminium production is an energy-intensive process, and due to the continuous nature of the process, some reliance on the traditional type of energy may be felt. However, it is possible to shift to solar and meet the requirements of utilities at the smelting plants. Hence sizable aluminium companies globally are shifting towards solar for their plant utilities, like lights, powering the ventilation as and where required, running the pumps, etc.
c. **Industry 4.0** – Industry 4.0 has multiple applications and use cases. Monitoring energy consumption at the various machines & equipment is one of them. Monitoring the KPIs like energy consumption/ ton of aluminium and then taking measures to reduce the same can help reduce the energy consumption. Thanks to the Industry 4.0 initiatives, the plant downtime reduces, and hence the production loss is minimised, and hence the energy consumption per tonne of aluminium production is also reduced. The global market for Industry 4.0

is projected to grow from $130.90 billion in 2022 to $377.30 billion by 2029, at a CAGR of 16.3% in the forecast period up to 2029.
(Source:https://www.fortunebusinessinsights.com/industry-4-0-market-102375)

d **Use of virtual platforms for business** – During the pandemic, the use of virtual meeting platforms had increased manifolds, and the rush towards digital transformation projects and usage of digital tools had gained significant traction. The same may be leveraged post-pandemic for the growth of the business. While travelling has started and the world is trying to return to physical interaction from digital ones, a lot of business is still being done digitally. The same will keep the aluminium industry's carbon footprint in check.

e **Turning to virtual marketplaces** – The pandemic showed us that the marketplaces, like parts of the supply chain, can also remain virtual. While the last mile may remain physical, other activities to identification, discussion, negotiation, and movement initiation may be managed virtually, with significantly higher efficiency and lesser carbon footprint.

f **Use of Chabot** – Companies across the globe are increasingly using a chatbot to drive customer engagement and provide customer information based on their requirements 24X7. The global chatbot market was valued at USD 3.78 billion in 2021, and it has been projected to register a CAGR of 30.29% over the forecast period 2022 – 2027 (Source: https://www.mordorintelligence.com/). A chatbot can drive meaningful conversation with good NLP (Natural Language Processing) capability built in and also guide the customers towards the right set of products and solutions and thereby reduces the need for physical interactions and meetings to a great extent.

g. **Use of RPA** – RPA, or Robotic Process Automation, has been discussed in the AL-Tech section in the past. The software bots may outsource non-cerebral, repetitive and manual labour-intensive tasks. The major players in this field are UiPath, Automation Anywhere, Blue Prism and the like. According to the recent report developed by Next move Strategy Consulting, the global RPA market generated USD 2.27 billion in 2021 and is projected to reach USD 18.69 billion by 2030, witnessing a CAGR of 22.5% from 2022 to 2030 (Source: https://finance.yahoo.com/news/global-robotic-process-automation-rpa-140000495.html?fr=sycsrp_catchall)

Even ERP (Enterprise Resource Planning) companies like SAP have their bots that help with the data entry and basic report generation or pre-scheduled activities to the existing licensed users, giving a lot of speed and agility to the operation and keeping the number of employees at a check and hence the related travels and other activities which generate the carbon footprint.

There are many more possibilities, and globally aluminium companies are taking steps towards them. Having a CDO (Chief Digital Officer) is one step towards commitment to digital, and having the reduction in carbon footprint or larger sustainability goals on the CDO's agenda will be the next.

Conclusion

An important question may arise, is digital the only way to reduce carbon footprint, and should there be a rush towards it? The same questions were asked when infrastructure on the cloud first came into vogue, or the digital marketing came. Those were asked around three decades back when the ERP solutions came to the market. Many companies became early adopters, taking a strategic call to watch and then deciding to become laggards. The only difference in the present context is that the cost of inaction will be significant economically and from the perspective of brand positioning and customer loyalty. Customers are increasingly more demanding and informed. The Governments and regulatory bodies are more active. The leading market exchanges already have the sustainability index to monitor and rank the listed companies. Technology helps meet the order of the day along with the various green initiatives. A platform like AlCircle also celebrates the various green initiatives across the globe, along with itself being a conduit for organizations to have greener operations. On this platform, companies can reach their customers online, participate in Expos to launch their products and obtain access to knowledge without any significant addition to their carbon footprint. Team AlCircle will remain focused and drive the usage of Aluminium, the green metal, and celebrate the sustainable measures taken by the ecosystem regularly.

Miles Prosser, Secretary General at IAI

“Aluminium is a critical enabler of sustainable economic development.”

Miles Prosser heads the International Aluminium Institute and is the key spokesperson. In addition to overall co-ordination of the IAI work program and governance issues, he also manages the work programme of the Communications & Promotions Committee.

Let us hear from him on green initiatives in the global aluminium industry to achieve a sustainable future.

AlCircle: What parameters drive the sustainability initiatives of the IAI and your member companies?

Miles Prosser: The IAI has always existed to promote solutions to sustainability issues. Decarbonisation is the most important issue, but we must also focus on other ESG issues. Many aluminium producers are already pioneering technological solutions that reduce their environmental footprint without compromising product quality. Aluminium companies are developing technologies such as inert anode electrolysis and automatic sorting of recycled aluminium alloys and making broad-scale investments in technologies such as renewable electricity generation and electrification of thermal processes. At the International Aluminium Institute (IAI), we're focused on creating pathways and fostering collaborative partnerships that enable such innovations to be trialled and tested while maintaining or advancing further the quality of our products. With the work our members are doing on workplace safety, spent pot lining and bauxite residue, we are tackling the full suite of sustainability issues. By continuing to focus on all the areas of sustainability and engaging with key stakeholders, the IAI will help the aluminium industry shape a better tomorrow.

AlCircle: As per the records maintained by IAI, how much potential does aluminium have for building a sustainable future?

Miles Prosser: Aluminium is a critical enabler of sustainable economic development. Lightweight, strong, durable, conductive and recyclable aluminium products are essential for a low-carbon future. They provide energy-efficient and carbon-saving solutions to high-emitting but critical service-providing sectors,

including energy, transportation, construction, food, and pharmaceuticals. Aluminium demand is set to increase at a substantial rate going forward, driven largely by a growing appetite for environmentally friendly solutions in transport, infrastructure, energy, and food security. According to a recent study conducted by business intelligence analysts CRU International on behalf of the IAI, aluminium demand is forecast to grow by 33.3 million tonnes in the following decade, from 86.2 million tonnes in 2020 to 119.5 million tonnes in 2030. Transportation, construction, packaging and the electrical sectors are the four key sectors that will drive demand, accounting for 75% of the total metal required. Around 37% of this growth is expected to come from China, followed by 26% from Asia (ex. China), 15% from North America and 14% from Europe. Around 75% of the almost 1.5 billion tonnes of aluminium ever produced is still in productive use today! Aluminium will continue to be a very important element in enabling and supporting environmentally sustainable solutions in many sectors.

AlCircle: What are the probable ways of restricting the outflow of bauxite residue, and what steps are associated industries taking to divert it from being stored?

Miles Prosser: Demand for aluminium is expected to grow, with supply coming from both primary and recycled sources. This means bauxite residue will continue to be generated. The IAI estimates that, by 2050, there will be as much as 10 billion tonnes of bauxite residue generated globally. The industry has been looking at various ways to close the circularity loop through more sustainable use of bauxite residue. The industry also continues to strive for Bauxite Residue Storage Facilities (BRSF) that are managed effectively until closure and rehabilitation to make them able to support vegetation and other land uses.

Our recently published Sustainable Bauxite Residue Management Guidance explores and explains the lifecycle of bauxite residue, and relevant case studies show how stakeholders can play an active role in its sustainable management. It also highlights the ongoing work in developing innovative uses of the material.

It is estimated that 3 million tonnes of bauxite residue are used annually in the production of Portland Clinker Cement. And there are other uses too such as road construction, iron production, brick production and soil improvement etc. Bauxite residue can be used as an alternative raw material in industrial processes, especially where traditional materials may become scarcer.

AlCircle: As a large number of companies are aiming for net-zero emissions, do you think recycled aluminium will surpass primary aluminium use?

Miles Prosser: In 2018, global demand for aluminium was 95 million tonnes; two thirds (64 million tonnes) of which was met by primary aluminium (produced from ore) and one third (31 million tonnes) from recycled aluminium. Rapid population and economic growth over the coming decades means global demand for aluminium will increase by up to 80% by 2050. This demand will be met by recycled and primary metal. Despite increased projected recycled metal supply, IAI estimates that up to 90 million tonnes of primary aluminium will be required per annum in 2050. In the most current reference scenario, IAI estimates that there will be a 50/50 split between recycled and primary aluminium in 2044. By 2050 we estimate recycling to surpass primary by 10 million tonnes. Even with this forecast, we still expect an increase in primary production.

AlCircle: What are the possible ways to curtail the climate depreciation caused by energy-intensive industries like aluminium?

Miles Prosser: Based on IAI's unrivalled data and leading analysis of the global aluminium industry in 2021, the IAI released the Aluminium Sector Greenhouse Gas Pathways to 2050, in which we mapped out three comprehensive GHG emissions reductions pathways critical to the sector over the next three decades. Here are the pathways:

Pathway 1 - Electricity decarbonisation

More than 60% of the aluminium sector's 1.1 billion tonnes of CO2e emissions (2018) are from the production of electricity consumed during the smelting process. Decarbonised power generation and the deployment of carbon capture utilisation and storage (CCUS) offer the most significant opportunity to reduce emissions to near zero by 2050.

Pathway 2 - Direct emissions reduction

Emissions from fuel combustion make up 15% of the industry's emissions. Here, electrification, fuel switching to green hydrogen and CCUS offer the most credible pathways. Process emissions make up a further 15% and require new technologies, such as inert anodes. These emissions and those in transport and raw materials will need to be reduced by 50-60% from a Business as Usual (BAU) baseline scenario by 2050.

Pathway 3 - Recycling & resource efficiency

Increasing collection rates to near 100% as well as other resource efficiency progress by 2050 would reduce the need for primary aluminium by 20% compared to BAU, which in turn will cut the sector's emissions by an additional 300 million tonnes of CO2e per year – a figure second in magnitude only to the first pathway, electricity decarbonisation.

We have also recently worked with the Mission Possible Partnership to map out a transition strategy for the aluminium industry to decarbonise in the next decade. The pathways will be a mix of technologies, including existing, new, under-development and yet-to-be-developed solutions. The specific decisions made by aluminium industry actors will depend on various factors, such as: unique energy endowments, raw material and scrap availability, regional policies, investment options and the availability, speed and cost of technology development and implementation. In the end, it will take sector-wide and inter-sectoral partnerships to address this large-scale emissions reduction challenge while satisfying the growing demand for aluminium.

AlCircle: Have you associated with other global aluminium forums to propagate sustainability drives throughout the value chain?

Miles Prosser: Central to IAI's work is providing a global forum for collaboration with other industry associations and sustainability oversight organisations. We work closely with the Aluminium Stewardship Initiative (ASI), an organisation dedicated to setting sustainability standards and certifying both the industry and customers. We also collaborate with the International Council on Mining and Metals (ICMM), an organisation that helps to create a safe, just and sustainable world through responsibly produced metals and minerals. Part of our role at IAI is to raise awareness of success stories and their positive impact, and engage with suppliers, customers, governments, and other stakeholders so that technologies can be implemented as quickly and efficiently as possible. The IAI has a record of transparency that builds trust with stakeholders; and a willingness to collaborate along the value chain and between producers. For this reason, we work very closely with country and regional associations around the world. You can find some of our collaborators here.

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Mohan Agarwal, MD, CMR Green Technologies Ltd.

Paving the Path Ahead ‘For a Better Tomorrow’

Climate change around the world is causing great catastrophes, with no continent left untouched. The heatwaves, droughts, typhoons, and hurricanes are causing mass destruction around the world with disasters such as the heatwave in the UK, the West’s water crisis, hurricane Ian in the US, and many more.

Countries around the globe are now shifting their focus on

sustainability with real and measurable actions. The focus is now on developing sustainable products and services and supply chain practices to increase revenue, satisfy investors and regulators, and improve their reputation. Countries as well as companies are allocating funds to addressing environmental issues. McKinsey and Company recently said that India can increase green investments up to USD 12.1 trillion by 2050 and reap many benefits.

Among the COP meetings, the game-changing COP 3 – Kyoto Protocol 1997 called upon 37 industrialised economies to bring down Green House Gas (GHG) emissions. The deliberations ended with assurances, commitments and promise to adopt graded methods to combat global warming. After the Kyoto protocol, the next tectonic commitment was made at COP 21 meeting in Paris in 2015 followed by the recent COP 26 and COP 27. COP 26 in 2021 acted as a milestone with substantial commitments from around the world along with India's 5-point pledge or Panchamrit. Taking a step further, at COP27, India submitted its Long-Term Low Emission Development Strategy (LT LEDS) to UNFCCC. These conferences have time and again stressed the need for businesses to create action plans to mitigate human influence on the climate and nature.

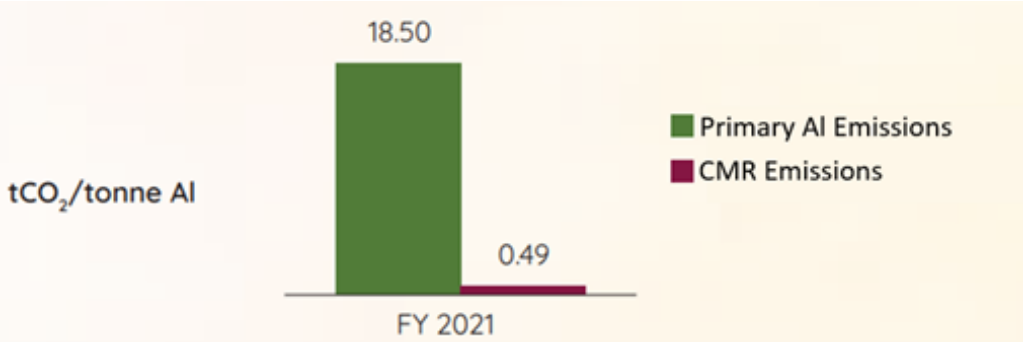
Expectations are growing for businesses to play a proactive role in driving efforts to secure a sustainable and inclusive future for the next generation. A growing coalition of countries, cities, businesses and other institutions are pledging to get to net-zero emissions. More than 70 countries, including the biggest polluters – China, the United States, and the European Union – have set a net-zero target, covering about 76% of global emissions. And more than 1000 cities, over 1000 educational institutions,and

and over 400 financial institutions have joined the Race to Zero, pledging to take rigorous, immediate action to halve global emissions by 2030.

Aluminium is one of the most sustainable materials in the world and is also highly recyclable. Recycled Aluminium meets every criterion of the 6R circular economy- reduce, reuse, recycle, recover, redesign and re-manufacture. Moreover, recycling Aluminium scrap requires only 5% of the energy used to produce the same amount of primary aluminium. With these advantages, Aluminium production through the primary route is being increasingly substituted with secondary production.

The GHG Emissions from the Secondary Production of Aluminium are substantially less concerning than those of the Primary Production of Aluminium, as is reflected in the graph below:

GHG Comparison of CMR vs Companies using Raw Aluminium:



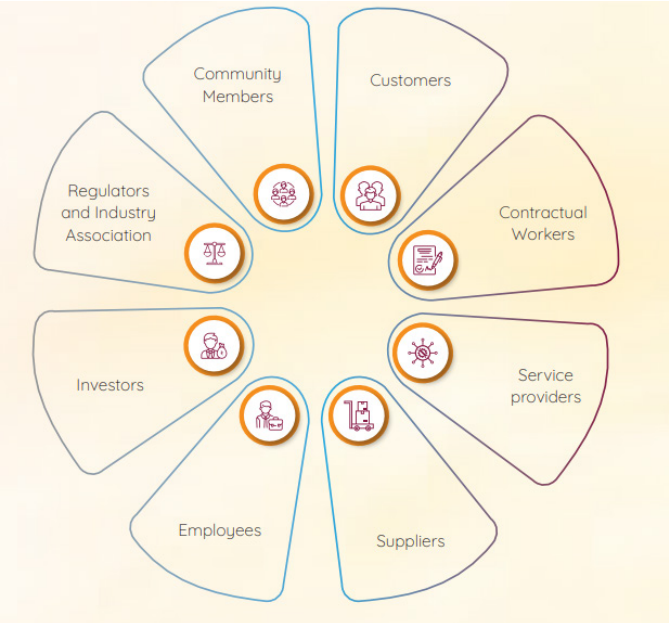
As an organization, CMR is aligned with sustainability principles as they are deeply ingrained in the organizational DNA. It is a matter of great satisfaction that the core of our business, i.e., recycling of metals, has many significant environmental benefits as sustainability is embedded in the product itself and it promotes a circular economy. Leveraging on the multiple environmental advantages which our business has to offer, we have well-planned initiatives to improve our performance in key environmental areas like emissions, solid-waste generation,

hazardous waste generation, and Greenhouse Gas (GHG) emissions to reduce the overall impact on our natural resources and environment. Also, we have created a culture that rewards talent and continuous learning for the organization to be future-ready and to meet the challenges posed by ever-changing market realities. We promote employee diversity and **nearly 50% of our workforce is women**.

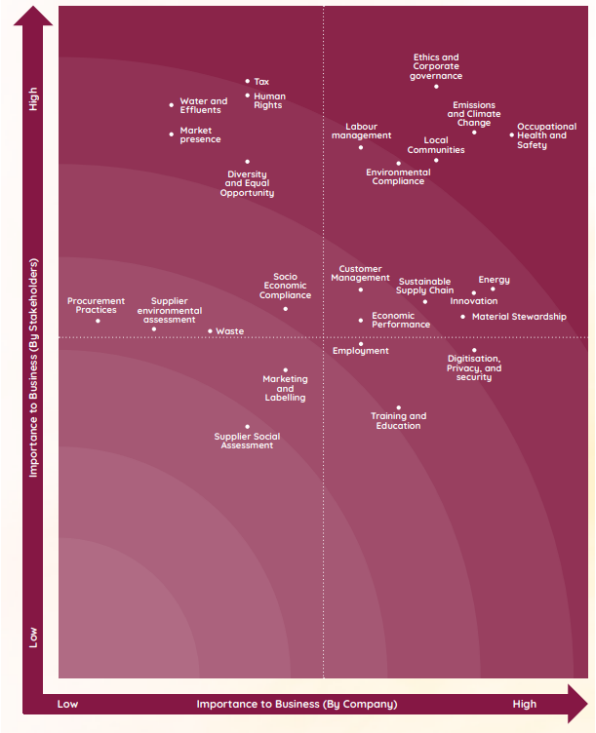
At CMR, we are establishing a long-term sustainability strategy within a robust Environmental, Social, and Governance (ESG) framework. Our Sustainability Report adheres to the reporting principles of GRI Standards addressing principles of Accountability i.e., materiality, stakeholder inclusiveness, sustainability context and completeness.

We believe that stakeholder engagement and identifying material issues are key to success for sustainable development. The expectations and the concerns of stakeholders and the extent to which the relevant issues are addressed play a vital role in influencing the sustainable growth of an organization. To identify the Material Topics, we obtained critical inputs during the engagement and consultation process with our stakeholders. The same is reflected below:

Identified Stakeholders



Material Topics



Leading to →

The above 12 essential Material Topics have been aligned with the UN SDGs.

CMR Group is a very conscious green organization focusing on the recycling of metal and has adopted world standards of emissions and zero discharge company policy. The air quality from our baghouses not only meets most of the requirements of Japanese and European standards but also is far below the accepted Indian standards for ambient air quality emissions.

We as an organization have adopted various equipment and systems to control our SOx, NOx and PM emissions, to lower environmental damages.

- **Regenerative Burners for low NOx generation -**

For reducing NOx levels, we have used regenerative burners in our furnaces that use exhaust gases to reheat the furnace hence reducing fuel consumption and at the same time providing a much cleaner output content. A regenerative burner system generally ignites a pair of burners integrated with the heat reservoirs alternately at intervals of several tens of seconds. While one burner is burning, the exhaust gas passes through and heats the other burner's heat reservoir to recover the energy of the exhaust gas. Then, when the other burner fires, the air for combustion in turn passes through the preheated heat reservoir to recover the exhaust gas energy which had conventionally been wasted, to provide highly efficient combustion. Alumina ball present in the burner reservoir, help to absorb heat which preheat the chamber air and it also absorbs harmful SOx, NOx and Carbon particle which results in the purifying exhaust gas. Table 1 provides a comparison between NOx emission as per Govt. Standard vs CMR's Emission Data.

Emission	Govt. Standard	CMR Emission OCMMS Average Data
NOx	50 mg/Nm^3	19 mg/Nm^3

Table 1 – Comparison of NOx emission of Manesar unit

- **Bag Houses of extra high capacity with lime dosing for reducing PM & SOx levels in emissions -**

The output from the regenerative burners (flue gases) is then transferred to bag houses, these bag houses have hot air passed through a tube settler and the tubes get cooled from outside by fresh air purging. A settling chamber helps to drop flue gas temperature. Typically, via an induced draft blower, the flue gas is drawn into the bag house through a duct system. The flue gas then passes through the specialised bag filters & lime powder is sprayed on them, which helps in entrapping the sulphur contents & particulate matters, thus separating the SOx & particulates from the air. Over time, the dust begins to build up and form a carbon layer on the filter surface. By offline air purging in filters, carbon layers are removed, and carbon is collected into the bags. Clean air is exhausted into the atmosphere via the chimney by a blower. Table 2 provides a comparison between SOx emission and Particulate Matter as per Govt. Standard vs CMR's Emission Data.

Emission	Govt. Standard	CMR Emission OCMMS Average Data
Particulate Matter	0 – 80 mg/Nm^3	25 mg/Nm^3
SOx	0 – 50 mg/Nm^3	23 mg/Nm^3

Table 2 – Comparison of PM & SOx emission of Manesar Unit

- **Liquid metal supply to customers which reduces CO2 emissions -**

CMR was the first to start delivering ready-to-use liquid Aluminium alloy directly to customers' production lines. CMR Group has made significant investments to introduce liquid metal supply in this industry by opening their production units near the customer facilities. This has served as an effective method for emission reduction. Liquid metal supply eliminates the entire process of ingot melting by die-caster, which would otherwise lead to wastage of fuel and loss of metal (melt loss). Around 3.6 million tonnes of CO2 saved against the production of 1.8 lac tonnes of recycled aluminium compared with manufacturing through the primary routes.

Moving with an accelerated pace, we have digitized and centralized our systems. All Plants are strategically integrated to optimize the supply chain, resulting in further reduction of Scope 3 of the GHG Protocol. Our Centralized Monitoring System implemented through the internal ERP system is used to monitor all major parameters like fuel consumption, dross generation, material movement and all major aspects of operations.

Technology Adoption:

At CMR, we always look for the best technology available worldwide and are the first to adopt it in the industry. To produce the Aluminium alloy ingots, the latest technologies are employed for sorting like dense media separators, magnetic drums, eddy current separators, colour sorters, etc. We have installed the MTS (Metal Treatment System) machine used for the effective degassing of molten aluminium which helps in improving the quality of material and reducing dross generation. We have

also changed the refractory lining of ladles to special material linings, which helps in reducing the heat dissipation per minute from ladle to transport molten metal to longer distances.

To improve the overall yield percentage, we have installed a highly efficient pump furnace for the melting of scraps. Also, the Integrated Dross Screw Machine helps in the same by increasing the recovery of aluminium from dross. Further, the scrap dryer machine for preheating and reducing the moisture from the scraps helps in reducing dross generation and thus improving the metal recovery. CMR is also in process of changing its manually operated furnaces to automatic furnaces to maintain the air-fuel ratio which helps in reducing fuel consumption along with emissions.

CMR has also incorporated the following initiatives-

- Motor Sensors help in improving energy efficiency in large motors.
- Filter press machines extract dust from the used water so the water can be recirculated to the machines for usage, and the dust collected can be used for horticulture purposes.
- Installation of Variable Frequency Drives in all heavy motors, which help in energy saving.
- Equipment Automation like interlocking of furnace doors & burners with bag house dampers so that smoke must be sucked by the ducts of the bag house & treated before emitting into the atmosphere.
- Use of decorators in furnaces results in pre-heating /decorating the feeding material by waste gases, thereby reducing fuel consumption as well as increasing yield.

Carbon Projects: CMR has been accredited by the UNFCCC (United Nations Framework Convention on Climate Change) as an environmentally clean plant, eligible for Carbon Credits in 2015.

Since then, we have undertaken Carbon Credit Projects for our existing and upcoming Plants. Some details of existing projects are:

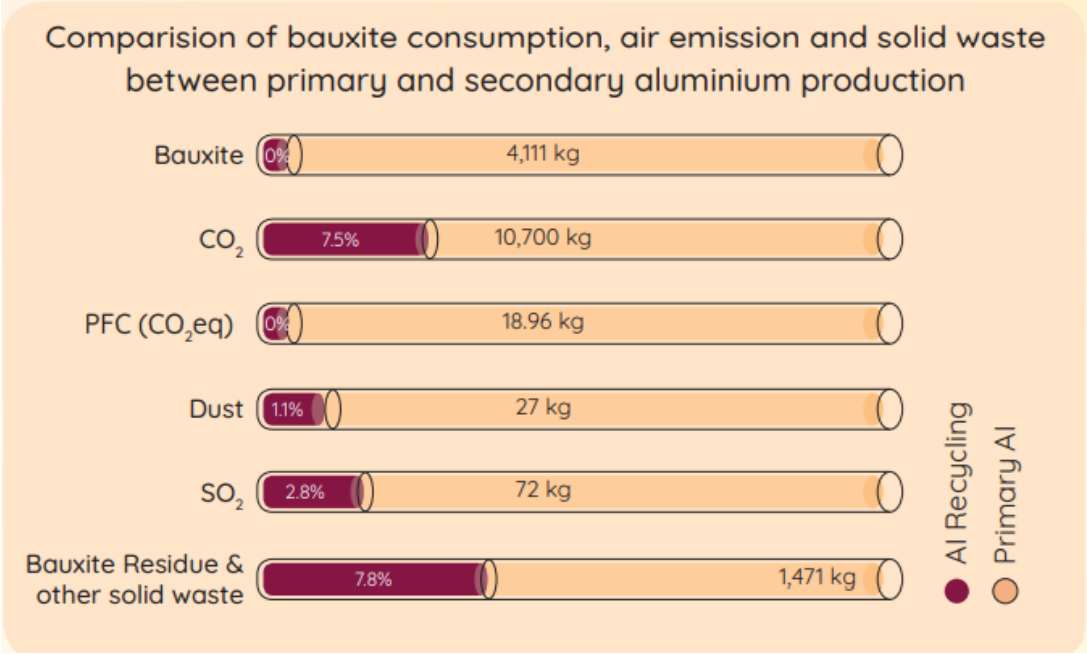
CDM: CMR has registered the Carbon Development Mechanism project at Bhiwadi, Rajasthan. The proposed project activity reduced the dependence on fossil fuel and avoid associated Aluminium metal loss due to oxidation during remelting of ingots, thereby, effecting an overall reduction in GHG emissions. Annual average GHG emission reduction because of the project activity is estimated to be about 8,713 tCO2 equivalent per year. **The total GHG emission reduction over the entire crediting period of 10 years is estimated to be about 87,130 tCO2 equivalent with one plant project alone.**

GCC: CMR has registered Global Carbon Council Project for 3 plants, for which the validation, registration and verification are ongoing.

Energy:

At CMR, our strategic commitment is to reduce specific energy consumption and increase renewable energy share across all locations. CMR laid a strong focus on optimizing energy consumption through stricter operational control and initiated several efficiency improvement actions. We give prime importance to achieving energy-saving projects. Energy-efficient heavy motors, drives, and pumps are installed at all sites while idle running of equipment is significantly reduced to curtail electricity consumption. A review of energy consumption is carried out at various levels of the organization. We continuously monitor the energy consumption across all sites in our inter-unit management review meetings.

Each tonne of aluminium is manufactured through recycling. results in a saving of 5-6 tonnes of bauxite, 1-1.5 tonnes of limestone, 20- 25 tonnes of water and~14000 kWh of energy (~90-95% of energy savings as per International Aluminium Institute). It means CMR saves approximately 2.8 Million MW of energy per annum which is equivalent to more than 50 villages' energy consumption.



CMR promotes a circular economy through the use of low-impact practices and new resource-efficient technology. Material Circularity Index (MCI) as per the MacArthur Foundation framework for primary Aluminium production in India is around 0.22. 100% circular product has an MCI of 1 while 100% linear product has an MCI of 0.1. The MCI of our product is around 0.89 while the MCI for the global aluminium mix of primary and secondary aluminium comes to around 0.56.

As a part of our **decarbonization roadmap**, some significant initiatives have been planned for the near future: With respect to Renewable Energy, CMR has an ambitious plan to install solar energy units at various locations, including Tatarpur, Bawal, Haridwar, Vanod and Pillaipakkam. In addition to this, we will be incorporating Fuel and Energy reduction measures. These will include a reduction in existing fuels i.e., Low Sulphur Heavy Stock & Fuel Oil; reduction of HSD and LDO; Conversion to Piped Natural Gas from heavy fuels; and replacements of diesel forklifts by electrical forklifts across our operations. These will significantly reduce fuel consumption and consequently GHG emissions.

On the one hand, we try to prevent uncontrolled energy use and associated emissions. While on the other hand, we expect increased use of recycled aluminium in the automobile, railway traction, packaging, and construction sectors as a preventive measure against climate change. Moreover, we are also committed to **achieving net zero emissions by 2050.**

The sustainability strategy is an integral part of CMR's business strategy. We leverage business opportunities, minimize risk and seek to respond to social and environmental challenges such as scarcity of resources and climate change at an early stage. With the growing demand for Aluminium worldwide and the increased need to meet environmental benchmarks, Green Aluminium is gaining momentum. We are also converting our Aluminium to Green Aluminium with the best possible practices, such as increasing renewable energy sources, investing in cutting-edge technologies and accelerating our decarbonization efforts.

We are sure that CMR will reach greater heights in our journey of Sustainable Development in the coming years through our well-thought-out plans and its implementation.

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AUSTRALIAN ALUMINIUM COUNCIL LTD

Marghanita Johnson, CEO of the Australian Aluminium Council

“Australia’s alumina refineries are currently undertaking a range of decarbonisation studies in conjunction with Government agencies.”

Marghanita Johnson has been the Chief Executive Officer of the Australian Aluminium Council since 2019. She has over 25 years of experience in the Australian mining and manufacturing sectors, predominantly within the aluminium industry. Earlier,

she led government engagement and advocacy on behalf of Rio Tinto's Pacific Aluminium assets and also held key climate and sustainability roles at Rio Tinto.

We are glad to have a conversation with her and get an insight into the sustainability leads taken by the Australian Aluminium Council.

AlCircle: In response to the exponentially growing efforts towards building a sustainable aluminium value chain, what guidelines would you like to introduce for the Australian bauxite miners to reduce mining impacts on the environment, society and economy as a whole?

Marghanita Johnson: Australia has a reputation as a reliable and responsible producer of bauxite, alumina, aluminium and finished goods with some of the world's most robust ESG credentials. This is particularly true for Australian bauxite mining which is regarded as having some of the highest sustainability standards in the world, particularly for rehabilitation. At the same time, changes are occurring in global bauxite supply with new countries and new operators entering the market. Sustainable bauxite mining practices are critical to the global reputation of the industry. Sustainable practices should be perceived and valued as a competitive advantage for all mining companies. In 2018, the Council co-authored the Sustainable Bauxite Mining Guidelines together with the International Aluminium Institute and the Brazilian Aluminium Association, aiming to share the expertise learned from decades of sustainable mining practices in Australia with the global industry. Sustainable bauxite mining is not a "one-size fits all" prescriptive process but involves risk management and applying technologies appropriate to the

circumstances of each mine. The guidelines aim to identify and communicate the criteria and encourage emerging bauxite suppliers to improve their practices in line with the rest of the global industry. The applicability to a range of countries has been enhanced using case studies from areas as diverse as Australia, Brazil, Jamaica, Guinea, India, Indonesia and Malaysia and has been translated into Bahasa Indonesian, Chinese Mandarin and French. The guidelines were updated, and the second edition was published in February 2022.

The Aluminium Stewardship Initiative (ASI) provides the industry with a global certification scheme which includes not just carbon content – but the full range of Environmental, Social, and Governance issues for all parts of the value chain. Many of Australia's mines, refineries, smelters and chains of custody supply chains are certified.

Noting these existing initiatives, the industry does not need any new guidelines, as these existing models will continue to be updated to meet society's expectations.

AlCircle: Please brief us on the roadmap of Australian bauxite miners and alumina refineries to attain net-zero carbon emissions in the future.

Marghanita Johnson: Globally, there is a focus across industry to find solutions for the technology challenges required to decarbonise. There is an opportunity for Australia to lead the world in development and implementation of these technologies, capitalising on Australia's national advantages, providing jobs and value to the economy. Australia has the systems and processes to extract and process critical minerals, like bauxite into alumina

and then into aluminium, safely, efficiently and sustainably. Australia is the world's largest producer of bauxite and second largest producer of alumina and is a global leader in the ethical and environmentally responsible supply of these key critical minerals.

Australia has more than 50 years of technical experience in bauxite mining and alumina refining technologies. This experience helps not only us but our bauxite, alumina and aluminium customers to reach their sustainability goals. Alcoa, Rio Tinto and South32's Worsley Alumina operations have their global bauxite and alumina research headquarters in Australia, helping develop new technologies for the world. Australia's alumina already has some of the lowest emissions in the world, with an average emissions intensity of 0.7 tonnes of carbon dioxide per tonne of alumina (t CO2-e/t), compared to the global industry average of 1.2 tCO2-e/t. Additionally, Australia's alumina producers work collaboratively through the Collaboration within the Heavy Industry Low Carbon Technology Cooperative Research Centre (HILT CRC).

The Australian Renewable Energy Agency (ARENA), in consultation with Alcoa, Rio Tinto and South32, has published a Roadmap for Decarbonising Australian Alumina. The Roadmap identifies four key themes for decarbonisation that could transform the way alumina refineries consume and use energy by enabling the uptake of renewables and removing the use of fossil fuels. It also provides a framework for future policy and investment decisions and serves as a call to action to collaboratively transform the sector into an industry at the forefront of the transition to net zero.

AlCircle: Could you please share with us about the latest technologies that Australian alumina refineries are using to reduce carbon emissions?

Marghanita Johnson: Australia's alumina refineries are currently undertaking a range of decarbonisation studies in conjunction with Government agencies:

- Case Study 1: In May 2021, Alcoa of Australia Limited (Alcoa) announced it had received funding from ARENA to test the potential use of renewable energy technology in a process known as Mechanical Vapor Recompression (MVR). Alcoa is currently conducting technical and commercial studies to adapt MVR technology to alumina refining. Electricity sourced from renewable energy would power compressors to turn waste vapour into steam, which would then be used to provide refinery process heat. If the feasibility studies are successful, Alcoa plans to install a three-megawatt MVR module with renewable energy at its Wagerup refinery in Western Australia, to test the technology at scale. The MVR technology powered by renewable energy could reduce an alumina refinery's carbon footprint by 70%. The technology also has the potential to significantly reduce water use in the refining process by capturing water vapour that would otherwise be lost in the atmosphere.

- Case Study 2: Rio Tinto announced a partnership with ARENA in June 2021 to conduct a feasibility study investigating the potential to partially decarbonise its alumina refining operations using renewable hydrogen. Rio Tinto will investigate the technical implications of displacing natural gas with renewable

hydrogen at its Yarwun alumina refinery in Gladstone, particularly focused on simulating the use of hydrogen in the calcination process. In August 2021, Rio Tinto announced a further partnership with Sumitomo Corporation to study the construction of a hydrogen pilot plant and explore the potential use of hydrogen at the Yarwun alumina refinery.

- Case Study 3: Electric pressure calcination can produce pure, uncontaminated steam exhaust, which can be captured and reused, reducing demand for steam from natural gas boilers. Electric calcination could potentially reduce Australian alumina refining emissions by 40% when powered by 100% renewable electricity. Alcoa is undertaking a $19.7 million project in conjunction with ARENA ($8.6 million) and the West Australian government ($1.7 million) to test this process. The project also aims to improve understanding of load flexibility and the provision of essential systems services to the South West Interconnected Grid (SWIS).

The findings of these studies have potential applications in other high temperature Australian manufacturing processes beyond the alumina and outside the mineral processing sectors. Additionally, if successful, the technical and commercial lessons from the hydrogen calcination technology could lead to its wider implementation not only in Australia, but also globally.

AlCircle: What is the progress of Australian refineries switching to renewable energy to decarbonise the refining process?

Marghanita Johnson: Australia's electricity markets are going through a once-in-a-century transformation, as Australia moves towards net zero emissions by 2050. Decarbonisation of Australia's electricity supply is the single biggest opportunity to decarbonise the vertically integrated domestic aluminium industry in the coming decade. Aluminium smelters already offer a range of services and functions which support the network over varying weather, network demand and operating conditions. Smelters' large and fast-acting interruptibility helps secure and restore stability to the network before and after contingencies occur. The industry has increasingly been called upon to support grid stability and reliability, as the challenges in managing the grid increase. This is helping the market operator to manage a complex and challenging system and maintain supply to domestic customers.

Alumina refineries will require technology changes to meet zero-emissions goals; either in the form of electrification or adaptation to use hydrogen for process heating. Development of this technology and its application will be stepwise as new technologies to reduce overall emissions (Scope 1 plus Scope 2) become viable. However, this relies on not only the development of commercial and technological solutions for electrification of alumina refineries but also the development of sufficient competitively priced low emission generation and storage, and transmission capacity at scale to match. The electrification of existing industry, combined with the development of new electricity intensive industries, such as hydrogen, will require substantial volumes of electricity delivered reliably, affordably

and at scale. Hopefully, some technologies for refinery digestion can be deployed before 2030. However, access to the required generation, storage, and infrastructure outside the facility could be the rate-limiting step in the electrification process.

AlCircle: How do you think sustainability goal will drive the Australian mining and refining industry in 2023?

Marghanita Johnson: Aluminium is one of the commodities most widely used in the global transition to a clean energy future. It is also recognised for its importance to both economic development and low emissions transition. It is expected that by 2050, global demand for aluminium is expected to nearly double from around 100 million tonnes per annum to around 190 million tonnes. While an increasing proportion will be met through recycled aluminium, there will still be increased production of primary aluminium requiring a comparable increase in global bauxite mining and alumina refining rates.

Looking forward, there is a growing focus on Australian manufacturing and a sentiment that “If we mine it here, we should make it here”. Australia is one of the very few countries which has bauxite mining, alumina refining, aluminium smelting and aluminium extrusion industries, making aluminium one of the few commodities in which the raw materials are mined and are processed all the way to a consumer product right here in Australia. However, there is an opportunity to leverage this existing industry further. This includes an ongoing focus on Australia’s leading global research and ESG reputation.

Carmelo Maria Brocato, Commercial & Marketing Director, Engitec Technologies S.p.A

“The Engitec proprietary technology for the secondary aluminium industry is the STE process for treating aluminium salt slag. The process is suitable for large or small productions and can be installed directly at the aluminium recyclers’ site.”

Carmelo Maria Brocato serves Engitec Technologies S.p.A. as Commercial and Marketing Director. He followed a traditional type of school education, and in 1987 he got a master's degree in mechanical engineering (power station specialization) from the Italian University – Politecnico di Milano.

As a professional, he has served an Italian OEM specializing in high-tech equipment addressed to the pharmaceutical industry, followed by the Italian OEM Continuus-Properzi, where he later joined the board. After a short experience in Danieli, in 2019, he joined Engitec Technologies.

AlCircle: Please tell us about the functionalities of your technologies used for recovering aluminium scrap. Do they aid in reducing carbon emissions?

Carmelo Maria Brocato: Since the day of its foundation – sometime in 1998 – Engitec Technologies has dedicated its research to technologies related to the circular economy applied to the nonferrous industry. After 25 years after its inception, Engitec is a well-established international global Supplier of high-tech technology and equipment dedicated to the sustainable recycling of various waste from the metallurgical and iron and steel industry, aimed at the recovery of all the components of value they contain.

I'm sure our readers are familiar with the way of saying, "it is not possible to unscramble scrambled eggs"…. Well, Engitec has denied this assumption with its CX® Plants intended for the total recovery of the lead and the other components that make up the lead/acid batteries.

The Engitec CX® Plants installed on five continents recover around 30% of the world's secondary lead.

AlCircle: What is the STE process? How is it used for the treatment of aluminium salt slag?

Carmelo Maria Brocato: Likewise, in the steel or lead industries, the greenest technology is based on the usage of secondary metal. It is well-known that the energy spent for getting 1ton of aluminium using scrap as raw material is some 95% lesser than the energy required for producing 1tonne starting from mineral. In fact, according to the most accurate statistics available, about 1/3 of global aluminium production comes from the reclamation of aluminium scraps.

For such reason, Aluminium scrap, in general, is somehow considered "the bank of energy", which includes more than forty (40) different typologies, as per the classification of the Institute of Scrap Recycling Industries (ISRI).

Just to name some of them:

- Sheets and Foils
- Used Beverage Cans [UBCs]
- Wires and Cables
- Pistons and Motors Castings
- Extruded Profiles
- Borings and Turnings
- Dross, Skimming and Similar

All materials pass through the phases of sorting, crushing, drying,

de-coating, baling etc., in order to be suitable for the smelting and alloying operations. In many cases, the smelting occurs under a layer of salt (NaCl/KCl) to prevent oxidation. The resulting slag represents a waste by-product that must undergo a dedicated recovery system.

The Engitec proprietary technology for the secondary aluminium industry is the STE process for treating aluminium salt slag. The process is suitable for large or small productions and can be installed directly at the aluminium recyclers' site.

The STE process allows the recovery of residual aluminium and salt fractions, which are re-used in the smelting process. The fine clean oxides in the slag are recovered for use in other industrial applications such as cement manufacturing.

All polluting gases generated during the aluminium salt slag leaching are combusted, and the heat generated is used for water evaporation and salt crystallization. No liquid effluents are released from the plant, and the gaseous emissions are kept within regulatory limits.

AlCircle: What R&D are you currently pursuing on technologies for aluminium recycling and sustainability?

Carmelo Maria Brocato: Engitec Technologies has its own Research Center (ERC) equipped with the most advanced laboratory instruments and benefits from the collaboration of several specialized engineers employed full-time.

A conspicuous part of Engitec's profits is devoted to research

which is carried out in the ERC (Engitec Research Center). Talking about the salt slag, each secondary producer has its furnaces type and production methodologies. Therefore, the composition of slag is expected to differ from producer to producer.

When there is a project, therefore, as a first step, Engitec requires the prospective Client to dispatch a sample of the slags that are then processed in the lab for analyzing the composition.

During the past 20 years, Engitec has delivered STE Plants for the treatment of salt slag both in Italy and in North America.

AlCircle: Do you use renewable energy for recycling processes to achieve Green Aluminium?

Carmelo Maria Brocato: Engitec supplies tailor-made plants designed and manufactured in Italy using renewable and classic energy. The user of Engitec plants will have or will not have access to renewable energy for feeding the plant according to their energy strategy. Therefore, we cannot determine which type of energy will be feeding the Engitec plants.

Anyway, since we are talking, I would like to share a few considerations about the concept of renewable energy.

Worldwide we can say that 30% of the energy consumed comes from renewable sources while 70% is from fossil fuels. Unfortunately, renewable energies are not always available, so a thermoelectric power backup is always needed.

The real energy transition towards green will occur when it is possible to implement the transition towards clean nuclear power.

AlCircle: How can technologies help the aluminium industry in achieving sustainability?

Carmelo Maria Brocato: As we have said, aluminium could be considered the bank of energy. Over the years, this bank has been fed millions of tonnes of aluminium products for which an EOL (End of Life) of 20/25 years has been considered.

I believe that the sustainability of aluminium goes through several stages, but the milestones of the agenda could be:

- Maximizing the use of aluminium scrap (bank of energy)
- The development of primary smelting technologies with higher efficiency
- Last but not least is the transition towards nuclear energy. This one will undoubtedly make the difference provided we have sufficient water.

Julian Davis, Co-Founder and CEO of Hydrova

Hydrova: Turning Dross into New Value

"Aluminum recycling is essential for sustainability," says Andrew Stein, CEO of TST. "It saves over 95 per cent of the energy to recycle aluminium versus creating new primary aluminium. However, the process of melting aluminium scrap creates dross and salt cake that is difficult to recycle without having waste end up in a landfill. [Hydrova's] technology solves that problem by utilizing 100 per cent of this co-product into valuable products."

Without recycling, it would be virtually impossible for the industry to achieve sustainability targets. However, processes for recycling aluminium generate dross and salt cake waste streams, which have long been a headache for secondary aluminium producers. Hydrova sees a unique opportunity in these materials and has developed a process to valorise what have otherwise been deemed nuisance by-products.

Hydrova's breakthrough technology transforms dross and salt cake into green hydrogen and sustainable, recycled aluminium, salt, and ingredients used in cement. This is achieved through a novel process which first recovers aluminium and then separates the remaining salt and oxide components. Hydrogen is produced during this process via a novel aluminium-water reaction technology, which utilizes unrecyclable aluminium left in the material after maximum aluminium recovery.

Hydrova is working with some of the largest aluminium producers in the world to repurpose waste using this novel approach. In a pilot project with TST, for example—California's largest aluminium recycler, Hydrova has been able to demonstrate full resource recovery and hydrogen production from their black dross.

For over 75 years, TST has been sustainably recycling aluminium and producing high-quality alloys for industries around the globe including aerospace, automotive, appliances, lighting, building products and semiconductor. TST has long sought creative solutions for managing dross with limited success prior to partnering with Hydrova. California regulations have driven an increase in dross tolling fees, creating an acute problem for TST, especially with respect to black dross.

TST partnered with Hydrova to transform their black dross waste product into meaningful value streams. With Hydrova's proprietary technology, TST is now demonstrating the production of 3 recyclable solid products along with green hydrogen. Aluminum and salt flux are recovered from the dross for direct reuse in the furnaces from which they came. Oxide products recovered from the dross provide a high-quality source of aluminium oxide, which is saleable to innovative cement producers—for example, CTS Cement, the inventors of Rapid Set cement, with whom Hydrova has built a partnership. Finally, the green hydrogen produced can be used as a clean fuel to help decarbonize TST's furnaces via natural gas blending or electricity consumption via a fuel cell. In Hydrova and TST's pilot, 100% of input material is recycled, leaving no material behind for landfill. This marks a major leap forward in bringing about a circular economy for otherwise landfilled waste.

"We are excited about our partnership with Hydrova," says Andrew Stein, CEO of TST. "Their technology taps into new value from our dross while preventing waste generation. It is a win-win."

A circular and more sustainable approach

Millions of tons of dross and salt cake go to landfill every year. Hydrova's mission is to keep this waste out of the landfill while helping customers tap into its unrealized potential. By focusing on high-quality, low-carbon products like hydrogen, aluminium alloys, and innovative cement products, Hydrova affords a second life to these waste streams in a way that is profitable to those that produce them.

To achieve net zero by 2050, aluminium producers will need new technologies that can help decarbonize their processes in innovative ways. Hydrogen will continue to be a critical clean fuel for any decarbonization strategy. At Hydrova, we believe that there is an exciting opportunity for decarbonization sitting right under our customers' noses. Hydrova's novel waste-to-hydrogen process creates a valuable decarbonization fuel, helps reduce tolling fees by recycling waste into valuable products, and improves profitability by generating these value streams, creating a win-win-win solution for climate change, waste reduction, and aluminium recyclers.

EEG
مجموعة عمل الإمارات للبيئة
EMIRATES ENVIRONMENTAL GROUP

Habiba Al Mar'ashi, Co-founder and Chairperson of Emirates Environmental Group (EEG)

"EEG strongly believes that recycling is one of the best ways to reduce the carbon footprint of the country in terms of consumption and production of materials."

Mrs Habiba Hassan Sultan Al Mar'ashi Al Hashimi is the Co-founder and Chairperson of Emirates Environmental Group (EEG), a pioneering non-government organisation established

in the United Arab Emirates (UAE) in 1991. She guided EEG to become the first environmental NGO in the world to receive ISO 14001 certification. She single-handedly established the Arabia CSR Network in 2004 as the MENA region's pioneering and only multi-stakeholder platform with local and multi-national entities. She co-founded the Emirates Green Building Council in 2006 and served it as Treasurer and Board Member.

In 2019 she was selected to come on board as a member of a high-level Global Investors for Sustainable Development (GISD) Alliance at the invitation of the UN Secretary-General. In July 2021, she was chosen as a Director of the World Green Building Council (WGBC). Currently, she is a Vice Chair of the Global Urban Development and Patronage Committee member of myclimate. Mrs Al Mar'ashi also serves as a member of advisory Boards for several Academic Institutions and other boards that deal with Sustainability in the Region and Globally.

AlCircle: What are the campaigns EEG is currently executing to promote sustainability in the United Arab Emirates?

Habiba Al Mar'ashi: Emirates Environmental Group, as the leading environmental NGO in the region, believes that an action-oriented and hands-on approach is one of the best ways to invoke sustainable values in the minds of residents in the UAE. When discussing environmental sustainability, it is one of those areas where when more sectors of society are involved, the better and faster the result will entail. However, to involve various sectors of society, different methods of teaching or spreading awareness are necessary for success. Here at EEG, our participants, volunteers, and members range from children as young as six to retired seniors. Our projects involve families, academia, corporation, governments, and international bodies.

We engage them through our Educational Programmes, Waste Management Programmes, Afforestation Programmes and Panel Discussions. Under these programmes, there are numerous projects and campaigns that target varying entities. Educational programmes were introduced to ensure the youth were empowered with the right knowledge and skills to tackle global environmental issues that humanity is facing currently.

Major projects under this programme include Environmental Drawing Competition, Inter School & Inter College Environmental Public Speaking Competitions and Student's Workshop. The waste management programmes, on the other hand, aim to involve people of all age groups and backgrounds. Currently, EEG collects eight recyclables, including paper, plastic, aluminium cans, mobile phones, glass bottles, toner cartridges, electronic waste and scrap metals. Entities are able to deposit their recyclables directly for recycling or are given opportunities to participate in EEG's waste management projects to be eligible to get additional benefits, including a certificate and an indigenous tree sapling planted in one of the public places under the participating entity's name. The projects include "One Root, One Communi-tree" (OROC), "Green Call" (GC), "Recycle. Reforest.Repeat" (3R), "Neighbourhood Recycling Project" (NRP), "Green December" (GD) and 2 nationwide campaigns- the "Can Collection Day & Can Collection Drive".

Adding on, EEG also conducts community action programmes, namely the "Clean UAE" and "For Our Emirates We Plant" that unite the country's people and give them the necessary tools to motivate, educate and accelerate the achievement of environmental sustainability goals.

AlCircle: How is EEG working towards reducing the carbon footprint in UAE?

Habiba Al Mar'ashi: EEG works towards reducing the carbon footprint of the UAE in 3 primary ways:

A. **Recycling Programmes** – EEG strongly believes that recycling is one of the best ways to reduce the carbon footprint of the country in terms of consumption and production of materials. Recycling is the easiest way to engage the mass and ensure that precious raw materials are conserved. Circular Economy and Net Zero emissions are a few of the main targets that countries are trying to establish in the coming decades. In reality, the amount of pollution and destruction of ecosystems to extract resources is quite a lot. The extraction of raw materials from the earth leaves the surrounding area with toxins and deeply impacts the biodiversity in that particular area. It also requires a lot of energy, while only 5% of energy is needed for extracting and producing aluminium cans from recycling. In another aspect, most of the resources in the UAE are imported. Recycling, therefore, not only reduces the carbon footprint but also helps the economy thrive in a sustainable niche.

B. Urban Afforestation Programme – Trees and the general presence of flora in an area has tremendous potential in terms of sustainability. Much of the terrestrial and aquatic life on the planet depends on plant life for its own survival. It provides food, shade, camouflage, shelter, and much more. Therefore, where there is plant life, in general, biodiversity will have a positive impact. This is even more beneficial when native plants are used in afforestation programmes. Moreover, these trees, act as natural carbon sinks. While there are many

ways to reduce carbon emissions, it is vital that we protect natural carbon sinks. Afforestation is one of the ways in which we can absorb carbon, which will impact the footprint of the country. This is a value on a global platform where massive deforestation continues to plague the driving and growth of the economy.

C. Awareness Programmes – As an NGO, one of the prime objectives is to increase awareness. Only through improving the environmental literacy of the people in the country and engaging them, we can truly achieve sustainability. EEG's workshops, panel discussions, presentations, conferences, forums, and other engagement platforms aid to improve environmental sustainability by ensuring people change their way of living. This, in turn, will unite various entities and drive forward collaborative efforts and implement effective solutions.

AlCircle: What was the cause behind the creation of EEG? Can you detail your journey from the day of inception and how EEG has supported the communities for better living in the UAE?

Habiba Al Mar'ashi: EEG was created out of the need to form a coalition of individuals and institutions that could deploy their interest, influence and resources for environmental activities and programmes. It started with a handful of members, who pooled in their efforts and capacity for the purpose. It operated out of a small office located within a shopping mall, and supported by a group of committed organisations. Tackling issues like waste, particularly house-hold and common wastes, EEG started to mount public campaigns and drive in order to make the community aware and also engage them in a hands-on way.

Branching out into the area of environmental education and awareness building in a big way, EEG developed a bunch of continuous and annual programmes for various academic levels. Workshops, public speaking competitions and drawing competitions were all designed to mobilise the student and youth communities around the need for pro-environmental behaviour and culture. Families and individuals were offered their own platforms of action, through multiple projects and programmes. The corporate sector, both public and private, were involved in eco-friendly green practices both at the workplace and beyond.

The key message was: “Together for a better environment.” As we all know, a better environment is crucial for better living. A healthy and thriving environment brings many advantages to the community, as a clean and green environment ensures sustainable development, which, in turn, promises economic and societal development. It is difficult to summarise EEG’s 30+ years of long journey in an apt description. However, from 12 members at inception, today EEG has thousands of members. We are playing a substantial role in the overall sustainability of the country, and indeed, we have collaborated at both the national, regional and global levels as well in our quest for a better environment for now and the future.

AlCircle: Do you think EEG’s performance has been a game changer in the sustainability programme of the UAE?

Habiba Al Mar’ashi: I would definitely think so. EEG created the first multi-sector, a civil society-led network of environmental advocates that successfully roped in corporates, academic bodies, students, individuals, and families, along with government entities and multilateral institutions. We have proved that positive

environmental action can be triggered by the right mix of platforms and avenues that provide ample opportunities for making a real difference, not only environmentally speaking, but also at the broader level. Campaigning for sustainable development when the communities in the UAE were not aware of its importance, catalysing collaboration and partnerships for shared environmental objectives, and rallying people from different backgrounds and interests in a transient environment - EEG has done it all. I am proud to say that there is no other organisation that can make a claim to the title of a game changer as deservedly as EEG.

AlCircle: What is your view of aluminium usage in our daily life as a Green Metal?

Habiba Al Mar'ashi: Aluminium is the most abundant metallic element on earth's crust. It is also a metal that is easy to work with in terms of its flexibility and strength. As mentioned before, the energy required to recycle aluminium is 95% less than what is required to mine bauxite and extract the aluminium from the ore. This is why it is called the Green Metal as recycled aluminium can be easily used in all sectors that use aluminium including the food industry. So aluminium is already used vastly in our daily lives. When discussing the food industry, aluminium is used as a packaging material to preserve food. There are many other materials that are used in the industry now. Depending on the packaging type, aluminium may be more sustainable than other materials. However, this depends on the country in question, the availability of aluminium in the country, in addition of analysing the sustainability of alternate packages, and the availability of infrastructure amongst others. Nevertheless, when discussing the UAE, EEG has a very strong aluminium industry and plastic industry, so in terms of packaging, this is still the primary mode

of packaging at least here. Thus, there should be strong recycling awareness and platforms for the same.

AlCircle: How is EEG utilising cutting-edge technology to further ecological initiatives?

Habiba Al Mar'ashi: EEG as an NGO does not have the resources and is not part of any innovative technology development and usage entity. However, despite saying that EEG works strongly with various academic and corporate entities that develop and encourage innovations. Primarily, through EEG's Inter College Environmental Public Speaking Competitions, Panel Discussions and Forums, we provide entities from the UAE and across the globe, a platform to network and share their ideas. As recycling becomes more prominent more investments can be made to research and develop technologies that can make recycling more efficient.

Despite that, it should be noted that EEG also has partnerships with various recycling facilities and is a member of the World Packaging Organisation, a strong global network comprising of leading players in the field of sustainable packaging technologies.

AlCircle: What are the main challenges EEG encounters when it comes to the collection of Aluminium Cans?

Habiba Al Mar'ashi: The challenge that EEG encounters when it comes to the collection of aluminium cans is generally the lack of public awareness. In terms of awareness, it is not the awareness of the campaign that is challenging; rather it is the element and segregation. During the Can Collection Day and Drive, it is often the case that few participants will mix tin cans

and others with aluminium cans. So, there is an inconsistency in the awareness among the participants. Aluminium cans, tin cans and or other containers with other metals will require different methods of recycling. This can only be corrected with awareness. Similarly, all the recyclable materials must be segregated at source to not only ensure awareness but to make recycling easy for the facilities and to prevent any contaminations.

Aluminium is a material that is very easy to recycle and can easily be explained to people, whether it's the energy use, or importance of recycling, or the circular economy and path to Net Zero. The UAE also has a transient society. People from across the globe fly into the country, stay, work, learn and fly back. Until and unless we can reach global environmental sustainability or at least ecological literacy, this challenge will continue to persist. Nevertheless, it is up to us to ensure that everyone in the country is at least educated on this important topic.

Øyvind Bjørnstad, Chief Sustainability Officer, Vestre

“Vestre’s commitment to becoming the world’s most sustainable furniture brand led us to seek Hydro and their CIRCAL, the 75% post-consumer scrap range”

Coming from a finance & strategy background, Øyvind has been the chief architect behind Vestre’s corporate strategy, which

has put sustainability front and centre, aiming to become the world's most sustainable furniture company. After almost seven years in the company, he has acquired detailed knowledge of all aspects of the business, from raw material to production and the use phase to the end-of-life and re-uses potential that's becoming increasingly important.

AlCircle: Could you share Vestre's journey to the world of aluminium furniture? What exactly inspired Vestre to make furniture with low-carbon aluminium?

Øyvind Bjørnstad: Most of Vestre's furniture today is steel, but we have some ranges that are based on aluminium. A big reason is its comparatively lower energy percentage to re-melt and recycle aluminium, although it has a higher initial footprint. The opportunities within recycled material are currently much higher with aluminium, as it doesn't require hot-dip galvanisation, which again requires a very specific alloy that is hard to replicate with post-consumer steel scrap. Vestre's commitment to becoming the world's most sustainable furniture brand led us to seek Hydro and their CIRCAL, the 75% post-consumer scrap range.

AlCircle: Who is your supplier of low-carbon aluminium? How do you measure the aluminium you receive for furniture production is low-carbon certified?

Øyvind Bjørnstad: We currently purchase low-carbon aluminium from Hydro. The requirement is a minimum of 75% post-consumer content, but thus far, the batches have, by and large, been above 80%. We get confirmations on the exact content of each batch from Hydro.

AlCircle: What green initiatives have Vestre taken as a responsible manufacturer?

Øyvind Bjørnstad: We continually strive to reduce our emissions and improve the quality of our products. Vestre took a significant step in 2022 when The Plus, the world's most environmentally friendly furniture factory, was opened. With this structural change, we control over 90% of our value chain. Still, more than 99% of our emissions come from scope 3. To mitigate these emissions, Vestre has for over ten years purchased high-quality verified offsets. However, we see that this is no longer enough, so in line with our Science Based Targets verified as one of the first five companies in Norway to take action, we are scoping out and executing concrete initiatives which will reduce our absolute emissions. We even use parts of the money we would have purchased offsets with to fund such initiatives in the value chain – we call these insets. Our materials represent ~90% of emissions, so we take care to source with the lowest possible impact, often locally, and scope out new technologies that can lower that further, like CIRCAL aluminium. We offer the best guarantees in the business and provide spare parts for all the products we've created – we call this Vestre Vision Zero. In general, we maintain a firm belief in quality as a precursor for sustainability and look at products from a lifecycle perspective, both in terms of cost and environmental impact.

AlCircle: What will be Vestre's message to the world as a sustainable product maker?

Øyvind Bjørnstad: Sustainability is a derivative of quality. The time aspect of products and materials needs to be taken into account. In general, we need to use those materials for a longer

time to reduce our excessive material consumption and keep them in a closed loop.

AlCircle: What percentage of Vestre's product is now made of aluminium? Do you think aluminium can be a game changing metal in the furniture world?

Øyvind Bjørnstad: Less than 5% of Vestre's revenue comes from aluminium today, but that's primarily due to the legacy of design in steel. Aluminium has slightly different qualities and will significantly complement the steel portfolio in the coming years. With the potential of reaching even higher recycling grades than we see today, the material becomes almost more precious for each iteration of recycling.

AlCircle: What more low-carbon aluminium initiatives is Vestre taking up this year? Please let us know your customer feedback on your low-carbon aluminium products.

Øyvind Bjørnstad: Vestre is working actively to track the materials of our Folk series through digital product passports together with blockchain-based startup Empower. This way, we will have an overview of our deployments to ensure that aluminium can be retained and kept in the overall global stock of aluminium. We're also working with Hydro to see whether we can get the recycled content even higher than the current 75%.

Sandy Copeman, Director of Brand and Founder of Amalgam Collection

“We recognise that climate change is the biggest threat to humanity’s future health and security, and whilst there is a significant amount of work going on to try and reduce or avoid carbon emissions.”

Sandy Copeman, Director and founder of Amalgam Collection, began his career as a professional model maker, making a

tiny model town showcasing the greatest of British architecture, and later as a professional architectural model builder. With Amalgam, he began building ties with Ferrari, Lamborghini, Mercedes, Pagani, Bentley, Rolls Royce, Bugatti, and McLaren, among many other key automotive manufacturers, as well as partnerships with all of the top F1 teams.

We are glad to have a conversation with him and get an insight into the sustainability leads taken by Amalgam.

AlCircle: What gave you the idea to launch Amalgam Collection?

Sandy Copeman: I originally co-founded Amalgam with three partners in 1985, and we focused on creating fine architectural models for leading European architectural firms, particularly Foster & Partners. We also offered product prototyping services, notably creating parts for the very first Dyson vacuum cleaners. I have always had a fascination with all things automotive and mechanical. So, after approaching the Jordan Grand Prix and Williams Formula 1 teams, I established Amalgam Collection with a focus on building fine model cars and re-establish the lost art of model making in an industry now dominated by mass-produced diecast toys.

AlCircle: Why build the Ferrari 250 GTO as a sculpture, and why did you decide to use aluminium for your replica?

Sandy Copeman: Since modelling Ralph Lauren's Ferrari 250 GTO back in 2009, as each year goes by, we've fallen ever more in love with the perfect form and beauty of the body of this most important Ferrari icon. The structure of the 250 GTO represents

more than any other the quintessence of the Ferrari brand in the collective imagination. The longer you look and the deeper you go into every detail, the more perfect the outcome of the creative work by Bizzarini, Forghieri and, probably most importantly regarding the body, the finalisation of the design by Scaglietti.

As for the use of aluminium, we are simply replicating the original material Ferrari used for the real cars all those years ago. Each body replica will be created using the traditional panel-beating methodology, forming the panels with a hammer over a buck, used by Carozzerie Scaglietti in the early 1960s.

AlCircle: Aluminium being a sustainable metal, what kind of awareness are you creating while promoting your brand?

Sandy Copeman: By using the original aluminium material used for the real car bodies, we are promoting the authenticity of our replicas and of our brand.

AlCircle: What are the limitations you are facing with using aluminium, and how do you overcome such challenges?

Sandy Copeman: We are faced with all the usual limitations associated with panel beating and use the exact same methodologies to overcome them.

AlCircle: What urged you to join hands with 'Greenr'? How much will the' Carbon-offset initiative' help your company?

Sandy Copeman: We recognise that climate change is the biggest threat to humanity's future health and security, and whilst there is a significant amount of work going on to try and reduce or avoid carbon emissions, for now, the valid answer for most individuals is to minimise their carbon footprint is to avoid carbon-intensive activity and offset their emissions. Working with Greenr connects our customers with tried, trusted and certified offsetting projects, both locally and from around the world. We know carbon offsetting isn't the answer to climate change, but it is a small contribution whilst we continue to make major changes in our business processes.

AlCircle: What steps have you taken to create awareness about sustainability and recyclability?

Sandy Copeman: We are implementing changes at the moment to use recyclable and returnable packaging made from wood, paper and other natural materials, which in all honesty, is as much driven by aesthetic considerations as moral ones, but in fact, aesthetics and moral considerations work naturally alongside each other and are a perfect fit. I think the growing desire in society and culture to change our ways and not buy, sell, or make stuff that swiftly ends up in a hole in the ground within a few years, months or even minutes, is one that we have always believed in, and that has shaped the Amalgam brand from the start. We have always believed in the maxim 'buy less and buy better'. Our models will last and give pleasure for many decades, even centuries, if properly taken care of.

Yves Occello, CEO, IB2 Technology

“IB2 Technology combines industrial innovation, resource recovery, OPEX savings, better quality alumina production and waste reduction, which makes it a green initiative.”

Yves has 45 years of experience in the bauxite and alumina industry occupying key positions at Pechiney, Alcan and Rio Tinto. He founded Amber Development in 2010, a company

specialising in technical and marketing services for the bauxite and alumina industry, where he coordinates the development of IB2™ technology, in which he operates as CEO.

Yves holds a Master's degree in Chemical Engineering from the Ecole Nationale Supérieure de Chimie of Paris and is an Honorary Director of the Chinese Academy of Sciences.

AlCircle: Please share more about IB2's innovative technology to produce alumina from low-grade bauxite.

Yves Occello: IB2 technology is an innovative solution developed by experts in the bauxite and alumina sector.

It makes possible the process and valuation of low-grade bauxite ores that a common Bayer process would not be able to manage at reasonable operating costs.

In a few words, IB2 allows you to get:

- With the same quantity of alumina produced, even better alumina quality is obtained
- Lower OPEX
- Less red muds
- A green co-product with high value: Tobermorite

This technology is based on two steps: **Improved B**auxite + **Improved B**ayer process, that's why we called it "IB2"

- The first stage consists of the raw bauxite treatment in which the silica is removed and the quantity of available alumina increased
- Based on its chemical and mineralogical composition the "improved bauxite" is then processed in the alumina refinery through the Bayer Process with the appropriate settings.

AlCircle: What are the multidimensional benefits of the IB2 solution?

Yves Occello: IB2 is a unique solution with multi-dimensional benefits:

Financial

- High opex savings through notably less raw material consumption, production increase, some impurities removal, less bauxite residue storage…
- High and quick return on investment

Strategic

- Use of low-grade domestic deposits including high Sulphur and organic carbon bauxites which allows for enlarging resources.
- Secured bauxite supply and thus independence
- Decarbonization is key for the environment and to maintaining international competitiveness

Technology

- Comprehensive and committed experts respond with the best results on the market
- Proven Technology with several pilot scale units (China, Germany, Belgium) and >450 measurements
- Easy to implement the solution: this technology requires neither significant structural changes nor high CAPEX
- It is also flexible as the IB2 unit juxtaposes with existing production units and lets refiners switch from one bauxite to another if needed.
- All in all, it is a win-win solution.

Environmental

Ib2 allows significant red mud quantity reduction, energy savings and decarbonisation. We will probably detail this benefit later. Anyway, it is a profitable and environmentally friendly solution.

AlCircle: What are the business opportunities IB2 technology opens up?

Yves Occello: IB2 technology opens up a wide range of business opportunities for different industry players including inter-alia:

- Alumina refiners (especially in China, Saudi Arabia, Kazakhstan, Turkey, Australia,…) as IB2 is a solution that promotes the circular economy
- Bauxite traders
- Bauxite miners or companies dealing with bauxite treatment
- Providers of process technologies …

Not only IB2 has no direct competitors but it is also an available technology that is ready to be implemented and adapted to each specific situation.

All make it a very attractive technology.

AlCircle: How can you count the IB2 technology as a green initiative? Could you share with us IB2's initiatives to drive the aluminium industry green?

Yves Occello: The green deal needs green and great innovations and IB2 is a tailor-made approach to solve this amazing stake that reconciles environment and profitability.

IB2 TECHNOLOGY combines industrial innovation, resource recovery, OPEX savings, better quality alumina production and waste reduction. In concrete words, what's making IB2 a green initiative?

With IB2 there are:

- Significantly less red mud compared to usual domestic bauxite
- Less raw material (caustic soda, bauxite) is needed and thus produced or mined
- Low Carbon Transportation and less dust thanks to the use of domestic bauxite instead of importing bauxite from remote deposits: no more transport on long-distance seaway and inland.
- Less impact on the environment (less desertification) as using local existing low-grade bauxite avoids opening new mines abroad

- Energy is reduced at the refinery at the Bayer unit
- And last but not least a Green Co-product is produced: it is tobermorite with decarbonization abilities and with high-value applications (in the cement industry but not only)

IB2 thus contributes to the renewal of the industry and tends to combine profitability and respect for the environment.

AlCircle: Could you share with us IB2's journey from its inception? What inspired you to develop this technology?

Yves Occello: AMBER DEVELOPMENT was aware very early of the growing demand for bauxite driven by growing aluminium production and consumption and has observed the situations of shortage of good bauxite encountered by alumina refiners.

Therefore the team worked on developing a profitable technology that would help refiners to extract alumina from low-grade bauxite. The areas covered are China, Saudi Arabia, Kazakhstan, Australia, Greece, etc.

In 2017 we transferred the technology to a specially dedicated entity, IB2, and raised fresh equity from business angels. These additional resources allowed us to finalize our R&D works and be more aggressive in marketing.

Later, we structured a convertible bond, fully subscribed by our privileged partner, to finance the development of our first unit and an additional equity fundraising from Otium Capital to strengthen our cash position given the multiple developments we have in our pipeline."

The technology would probably have already been operational if the covid period had not slowed down the implementation. Over the past few months, contacts have once again been strengthened and more and more refiners around the world are interested in learning about the evolution of technology. The fact of having taken into account further strengthens the appeal of the technology.

The IB2 team and its partners are even now in advanced discussions with several customers and fully committed to designing the 1st IB2 unit.

AlCircle: Can aluminium smelters use alumina produced from low-grade bauxite through IB2 technology?

Yves Occello: Aluminium smelters can of course use alumina produced from low-grade bauxite using IB2 technology.

It is even more attractive for aluminium smelters as this alumina is even purer.

In other words, IB2 technology is beneficial for the environment, alumina refiners and also Aluminium smelters.

Jerrod Freund, Co-Founder of Boomerang Water

“As for carbon footprint reduction, at 1MM bottles displaced per year, that equates to ~ 5 tonnes equivalent of CO_2.”

Jerrod Freund is a seasoned investment banker with over 20 years of global experience in the industry. As Co-Founder of Boomerang Water, Jerrod is a valuable asset to the Boomerang Water Leadership Team and is dedicated to helping the company achieve its mission of eliminating single-use plastic water

bottles and promoting global sustainable water management practices.

Here is an excerpt from an interview with him on green initiatives undertaken by Boomerang.

AlCircle: What inspired the creation of the Boomerang Bottling System (BBS)?

Jerrod Freund: While on multiple tours of duty for the air force in the middle east in the mid-2000s, one of our co-founders, Jason dibble, came up with the idea to bottle at the point of use utilizing reusable bottles – the idea was generated as he watched the proliferation and widespread use of plastic bottles by the US Military overseas and the subsequent disposal of the plastic bottles in burn pits and thought, there must be a better way. Upon returning to the US, he realized that consumers were doing the same thing (sans the burn pits).

AlCircle: Did Ball Corporation's initiative of producing 100% recycled cans encourage you to partner with the brand?

Jerrod Freund: The fact that Ball is so highly focused on recycled content in their products is just one facet of reasoning – there are multiple more. Still, when it comes down to it, Ball and Boomerang's interests, values, and ethics are aligned. Ball has been (and continues to be) at the forefront of cutting-edge sustainability initiatives.

AlCircle: How much plastic is this Boomerang Bottling System (BBS) negating, and in turn, how much carbon emission is being curtailed?

Jerrod Freund: Each boomerang bottling system at ~85% capacity can displace ~1MM single-use plastic water bottles. While fewer than a dozen are in operation today, boomerang is finishing dozens more. It has plans to go to hundreds, if not thousands – yet that still does not put much of a dent in the single-use bottled

water market (with over 550Bn globally). As for carbon footprint reduction, at 1MM bottles displaced per year, that equates to ~ 5 tons equivalent of Co2 (given the transportation and production of plastic bottled water is so Co2 intensive).

AlCircle: How much do you think the Boomerang Bottling System (BBS) can contribute to the United States' net-zero emission goals?

Jerrod Freund: Given the positive impact relative to single-use plastic, and the vast use of single-use plastic, we believe BBS is highly impactful. It almost acts as a double impact between the plastic waste and the carbon footprint associated with bottling water and shipping thousands of miles.

AlCircle: Do you plan on collaborating with other aluminium packaging brands, like Ball Corporation?

Jerrod Freund: Not at this time – Ball is an extremely powerful and constructive partner – they provide significant support and input, and there's no need for us to work with another aluminium packaging company.

AlCircle: Do you have any future plans to introduce your bottling solution beyond a sports field or community enclosure?

Jerrod Freund: Boomerang's core focus is on the hotel/resort and leisure industry – most of our applications are at hotels. We also focus on industrial sites, corporate campuses, and cruise ships and have begun working on getting into military applications.

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