PRESENTS

Innovators and Trendsetters of the

Aluminium Industry

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Debanjali Sengupta

Manager - Content Development
of AlCircle

Editorial

Dear Readers,

Sustainability has become a top priority for the aluminium industry, be it the producers or consumers. And to bring it into action, every company or individual related to the industry is committed to developing, implementing, and refining business practices across the value chain. In this phenomenon, much-needed changes are occurring in the product development process, technology, and the end-use of materials. What is commonly seen is the practice of recycling to accomplish the circular economy. A planned recycling program and the implementation of closed-loop recycling across the downstream value chain can save a considerable volume of aluminium from ending in landfills.

A third-party critical-reviewed life cycle assessment (LCA) report shows the carbon footprint of recycled aluminium production in North America has dropped by 60 per cent since 1991. Technological advancements, including manufacturing process control, replacing coal-fired with renewable electricity, and many other new-age practices, have contributed to this positive trend.

To explore those new methods and who is bringing in what innovations in the industry to set the trend, the team AlCircle has come up with the thirteenth edition of the e-Magazine titled - Innovators and Trendsetters of the Aluminium Industry.

In this e-Magazine, some eminent global aluminium companies across the value chain have shared and suggested innovative methods they have adopted to reach their sustainability goals. We are delighted to have their interviews and articles to learn their ingenious approaches towards net-zero carbon emissions and greener aluminium.

We hope our new e-Magazine helps you discover some trendsetting ways and technologies to achieve the sustainability in the aluminium industry we all desire. Wish you all happy reading!

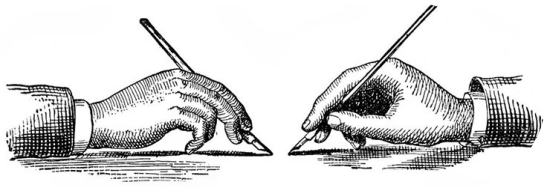

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Table of content

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Anthony Tropeano

Advisory Board Member at AlCircle and
President of TT CONSULTING INC.

Aluminium recycling: An ageing innovation driving the circular economy

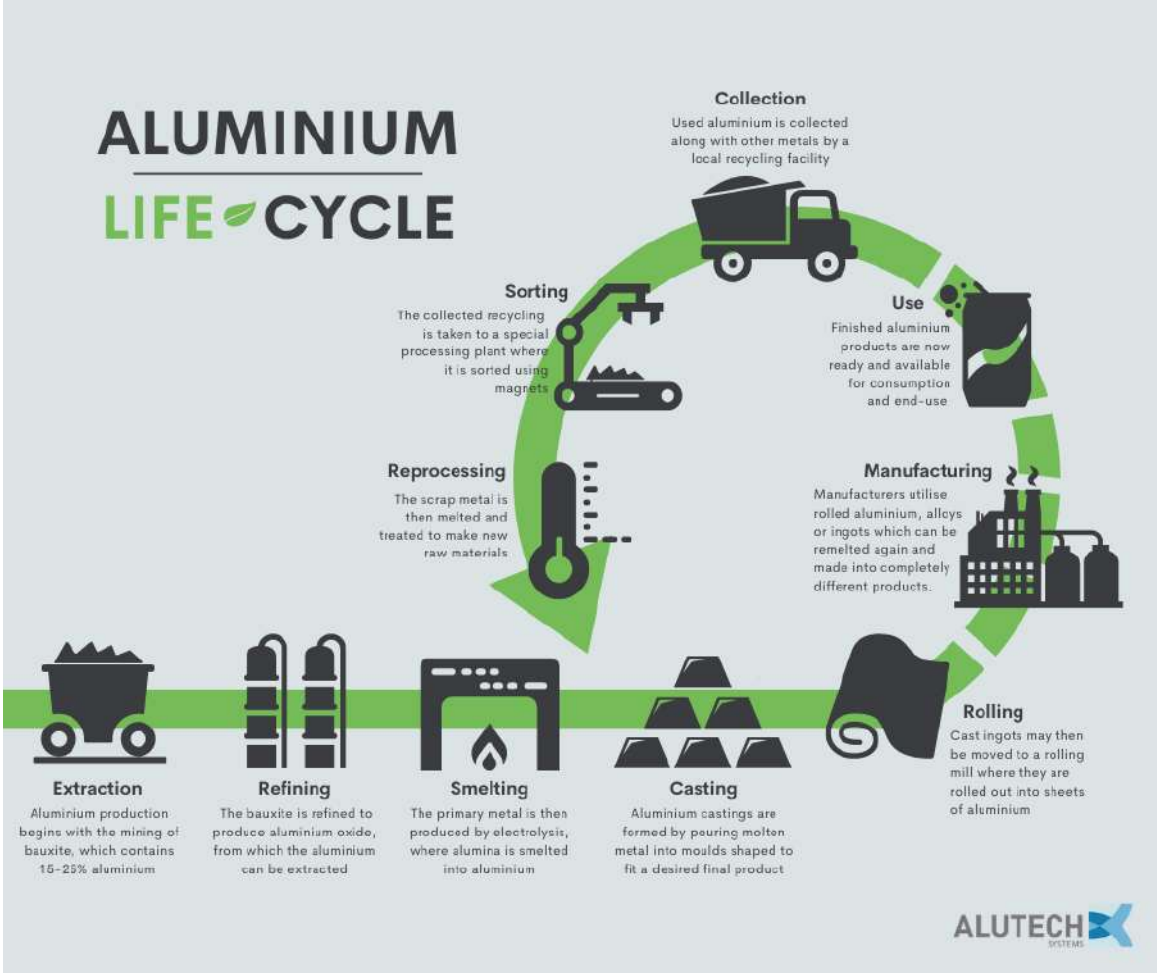
Anthony Tropeano, with over 40 years of experience in the Non-Ferrous and Ferrous industry, has developed a vast knowledge of the industry worldwide as well as a wide network of contacts. He retired from FATA S.p.A. (Part of the Danieli Group) in February 2018. During his career, he has belonged to various associations, including TMS, ECCA, AISE, and NCCA. He was on the Board of Directors and one of the founding members of E.U. Metallurgy, an Association located in Brussels.

Aluminium's availability and mechanical characteristics have made it an increasingly popular metal. Primary processes, however, involve very high transformation costs, especially regarding energy. As a

result, recycling has gained ground from an environmental and economic standpoint.

Aluminium scrap and its possibilities for recycling were introduced in the 1970s when there were signs of problems in secondary alloys resulting from various impurities generated by recycling aluminium. As early as 1979, the Financial Times discussed issues associated with domestic contaminants in aluminium recycling processes. The connection between aluminium and solar photovoltaic energy had already been studied in 1982, primarily using aluminium in the thermal processes involved.

In modern times, aluminium is one of the most recycled and recyclable materials. A recycled aluminium beverage can, car door, or window frame can often be recycled directly back into itself, and this process can last literally for a lifetime.



Source: Alutech Systems

In six continents out of seven, the metal aluminium stands out to be an essential material. The European Union seeks to build a more sustainable and resource-efficient economy, and aluminium is a solution to many societal and economic challenges.

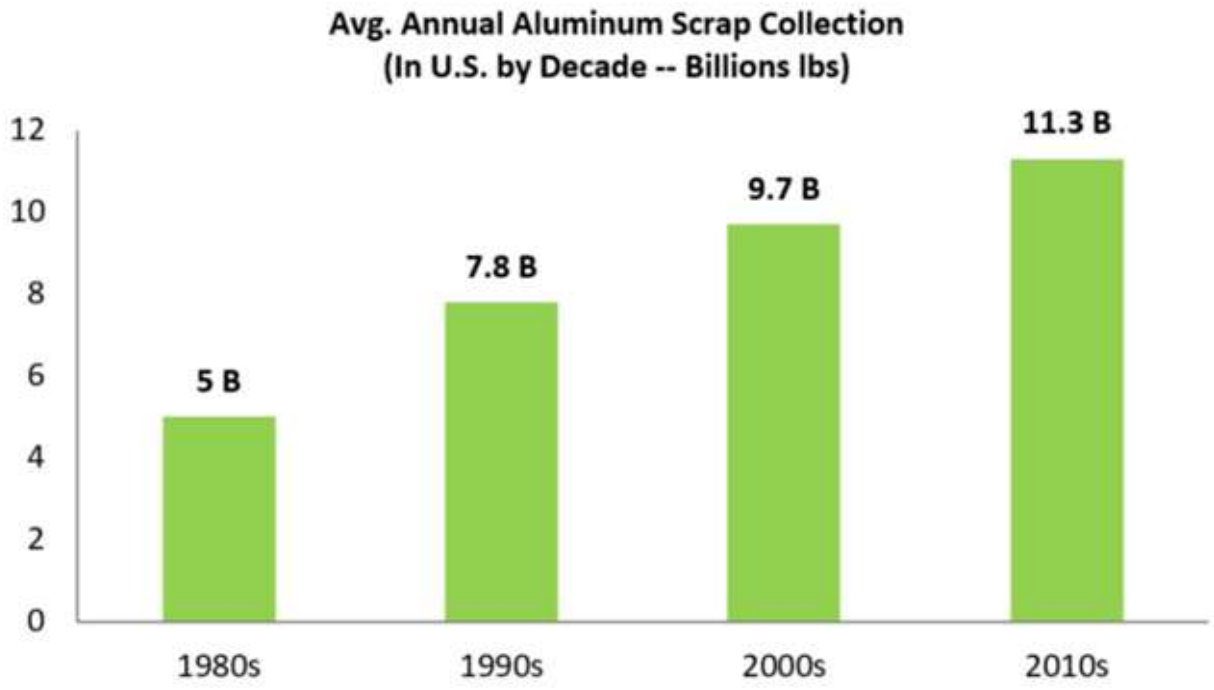
Source: www.researchgate.net

The aluminium recycling industry is part of the larger European aluminium industry, generating several billion euros in revenue annually and employing more than one million people directly or indirectly. Due to its many properties, aluminium is crucial to Europe's circular economy ambitions.

Since aluminium's essential properties don't change even after multiple recycling cycles, it is infinitely recyclable. In addition, recycling requires low energy levels compared with its manufacture, making it an "energy bank".

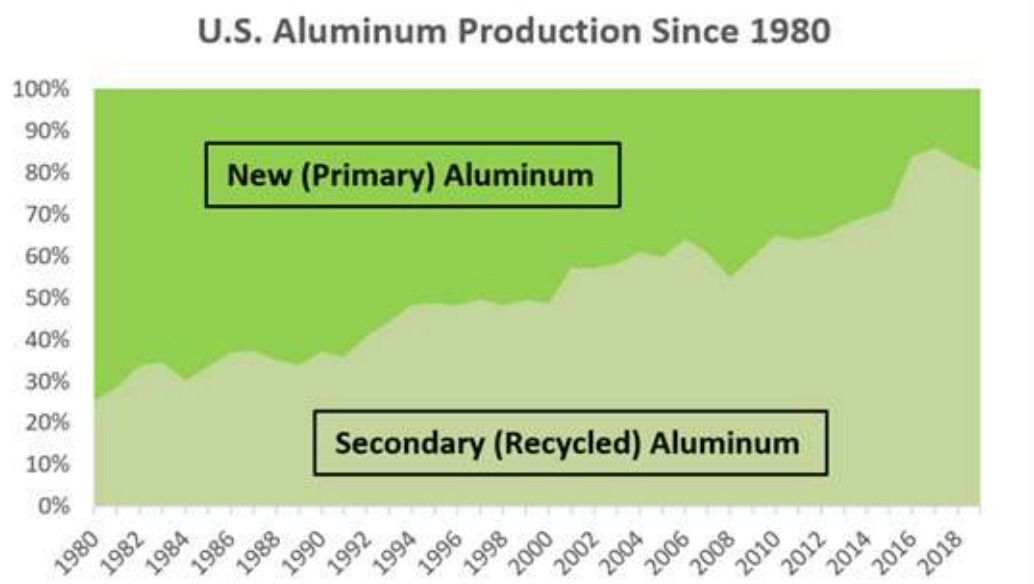
Increasing aluminium recycling

Although aluminium recycling rates in most industrial markets exceed 90%, we can do more - especially regarding aluminium beverage cans. Today, the United States collects more than twice as much aluminium as it did in the 1980s for recycling.



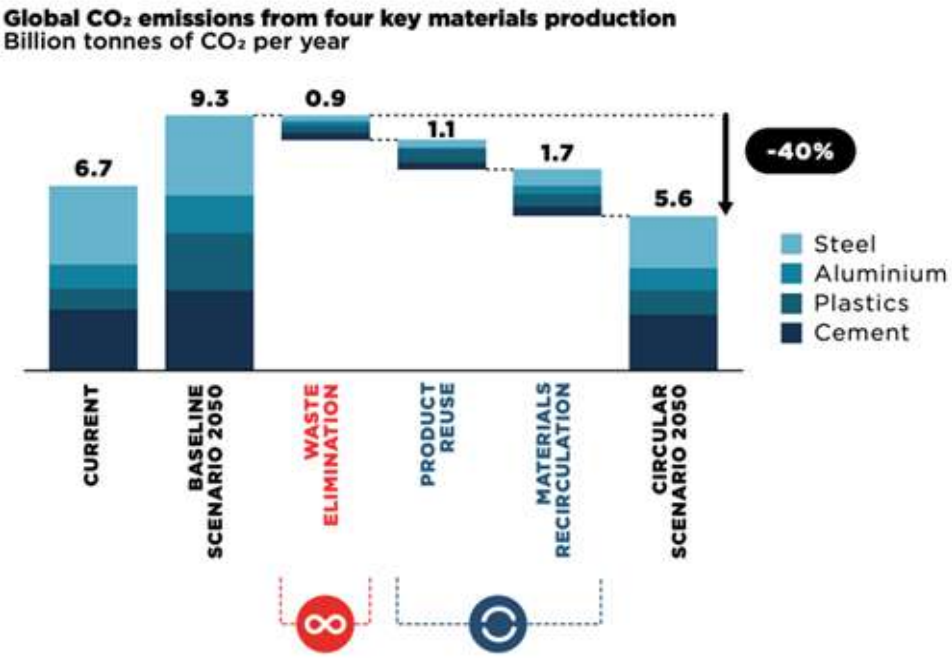
Source: The Aluminum Association

According to the Aluminium Association, scrap recycling and aluminium production are increasingly crucial to U.S. aluminium production. More than 80% of American output today is for recycled (or secondary) aluminium, even though primary aluminium production is still a crucial component of the country's aluminium supply chain. In the 1980s, recycled materials comprised 20% to 30% of total production. The United States produces more recycled aluminium than any other nation outside China.



Source: The Aluminum Association

More aluminium is recycled, which uses less energy and has a reduced carbon footprint. For instance, in the market for aluminium beverage cans, each percentage increase in the end-of-life recycling rate lowers the carbon intensity of the production of aluminium beverage cans by 1.02 kg CO2 equivalent per 1,000 cans. For the decarbonization of the entire business to continue, aluminium recovery and recycling must increase. Aluminium recovery and recycling must rise if the entire industry is to continue to be decarbonized.

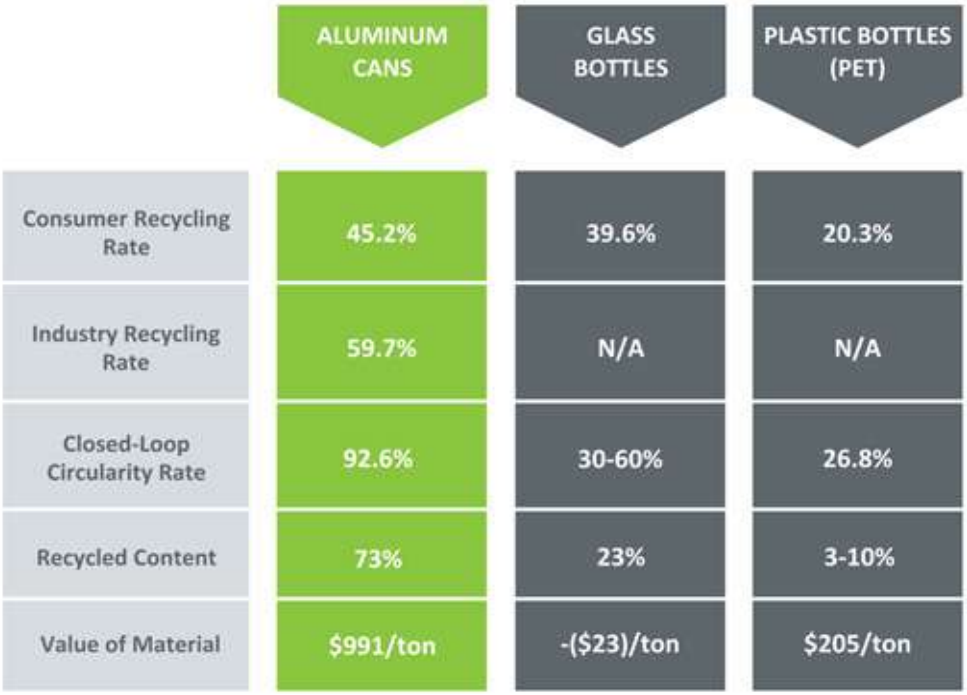


Source: Material Economics analysis for the energy transition commission

The benefits of aluminum cans

In almost every way, aluminium beverage cans are the most environmentally friendly beverage packaging. Compared to other package types, aluminium can have a better recycling rate and contain more recycled material.

Compared to glass or plastic bottles, aluminium cans are significantly more valuable, allowing companies to package and ship more beverages with less waste. They are also lightweight, stackable, and strong, which allows brands to effectively subsidise the recycling of less valuable materials in the trash by using them as packaging and transportation containers for more beverages. Most significantly, an actual “closed loop” recycling method involves recycling aluminium cans repeatedly. Usually, glass and plastic are “down-cycled” into landfill liners and carpet fibre.



Source: The Aluminum Association

Recycling aluminium can drive manufacturing growth

New opportunities for the reuse of polymer-laminated aluminium products, such as food and coffee packaging, are provided by a recycling breakthrough at the University of New South Wales (UNSW), Sydney.

The UNSW Sustainable Materials Research and Technology (SMaRT) Centre's research has discovered a method that could kickstart a new 'green aluminium' manufacturing revolution as well as industry efforts to advance Australian manufacturing and increase sustainability.

The new technique for recovering aluminium from complex, multilayered packaging is based on micro-recycling science pioneered by the SMaRT Centre's Director, Professor Veena Sahajwalla.

Innovations in aluminium recycling boosted by crystallisation research

A novel method of recycling aluminium has been boosted by research revealing the microscopic changes that occur when molten alloys cool. Dr. Biao Cai of the University of Birmingham's School of Metallurgy and Materials used high-speed X-ray imaging to record the formation of micro-crystals as alloys cool and solidify in a magnetic field.

Dr Andrew Kao of the University of Greenwich created a mathematical model to predict whether micro-crystals would form and what shape they would take. The model predicted that helical'screw-like crystals would form in solid magnetic stirring, and the high-speed X-ray confirmed this.

These beautiful crystals, which are ten times thinner than a human hair and only a few micrometres across, have ramifications for large-scale industrial processes. Biao explains, "These microscopic crystals ultimately determine the physical properties of the alloy. Adjusting their shape, structure and direction of growth will enable us to perfect processes for both manufacturing and recycling of metals and alloys".

Biao has already developed a method to enhance aluminium recycling by eliminating iron. Aluminium can become brittle when exposed to iron, a damaging element that restricts its use in high-end applications like aviation. While other methods for removing iron from recycled materials are either expensive or ineffective, Biao's straightforward, low-cost solution combines magnets and a temperature gradient to do it.

The invention has a patent and is funded by the Midlands Innovation Commercialization of Research Accelerator, which provided Biao with funding to construct a substantial prototype.

The first business in the world to benefit from the sophisticated new sensor-based sorting solution is Alutrade, the largest independent aluminium recycling company and extrusion specialist in the UK. Alutrade has achieved 99 per cent pure aluminium for secondary aluminium production thanks to the new X-TRACTTM, TOMRA's most sophisticated x-ray metals sorting device. At Alutrade's Oldbury recycling facility in Birmingham, which processes 42,000 tonnes of waste yearly, the new X-TRACTTM machine was installed in March 2021.

Metal extrusions from various post-consumer construction debris, including windows, doors, and aluminium cans, make up the plant's infeed material.

Economic benefits and circular economy driving the popularity of aluminium

Aluminium scrap in recycled form can result in significant cost savings for producers who use re-melting furnaces to process scrap; this reduces the reliance on pure metal supplied by traditional primary smelters and increases production flexibility.

Indefinitely recycling aluminium without losing its properties makes it an excellent circular material. Moving forward, economies should make scrap handling more accessible and efficient, from end-of-life scrap to reusing scrap during the manufacturing stage (in-house scrap). Aluminium can aid in the achievement of circular economy goals. Countries tailor policies to increase recycling rates, reduce the burden on natural resources such as bauxite, and use 5 per cent less energy, ensuring CO2 reduction.

Recycling accounts for approximately 20 per cent of total primary aluminium production globally. Primary aluminium contributes 80 per cent, which is expected to decrease over the next 5-10 years as recycling replaces primary aluminium due to its numerous commercial benefits and companies' carbon-free targets.

Secondary aluminium billets account for nearly 70 per cent of demand in the APAC region, with 2 million tonnes reported in 2020. It is common for the building and construction industry to exchange primary and secondary billets. This has shifted significantly in recent years in favour of re-melting products.

Ten sustainability drives in the aluminium sector setting trends before the world

Lightweight, strong, durable, and infinitely recyclable, aluminium is a sustainable metal of choice. As the world strives to achieve an energy-efficient future, aluminium continues to provide innovative solutions to businesses and consumers, offering the benefits of a circular economy to the industry by being able to go through recycling multiple times without losing any mechanical, physical or chemical properties. But the dichotomy of the metal is, whilst being a solution to a carbon-neutral world, aluminium itself is part of the sustainability challenges the earth faces.

Aluminium is a significant source of carbon dioxide, responsible for about 3 per cent of the world's 9.4 Gt of direct industrial CO2 emissions in 2021. Being an energy-intensive metal, it accounts for nearly 1.1 billion tonnes of CO2 emissions globally. The carbon footprint

of primary aluminium varies from less than 4 tonnes of CO2 per one tonne of the metal in hydropower-based regions to more than 20 tonnes of C02 in coal-power-based areas. Along with that, colossal waste and scrap generation, landfills and downgrading are other sustainability issues caused by the aluminium sector.

With a rising concern for the environment and a growing focus on carbon-neutral, eminent aluminium leaders and companies are working towards developing a sustainability roadmap for the industry, while associations are taking initiatives to acknowledge their efforts. Companies like Hydro, Rio Tinto, Emirates Global Aluminium, Constellium, and Assan Alüminyum have implemented innovative skills and technologies to reduce carbon emissions across the entire aluminium value chain, setting trends before the industry. Since this e-Magazine is about recognizing the world's leading innovators and trendsetters in the aluminium sector, let us celebrate their inventive achievements.

Big Australian alumina producers strive to achieve net-zero by 2050, shows sustainability plan published by ARENA

Australia can emerge as a leader in net-zero alumina refining worldwide if it obeys a plan developed by three major producers – Alcoa, Rio Tinto, and South32. Together, these three organizations have developed a detailed roadmap that ensures net zero emissions by 2050. According to the report published by the Federal Australian Renewable Energy Agency (ARENA), refining activities in Australia

cause up to 3 per cent of the country's total greenhouse gas emissions. But to meet the rising need for cleaner and greener aluminium in the western market, the country is exploring advanced refining and smelting technologies. The ARENA report states that low-cost wind and solar energy can morph the sector into an environment-friendly. Besides, the report suggests four prime decarbonization techniques that enable units to run on renewable energy instead of fossil fuels and lower emissions by 98 per cent in Australia's six refineries.

To know more: https://www.alcircle.com/news/arena-report-unveils-sustainability-plan-charted-by-big-australian-alumina-producers-for-net-zero-by-2050-87201

MYTILINEOS S.A. receives ASI Chain of Custody (CoC) Standard V1 (2017) Certification for upstream activities

Among the upstream companies, MYTILINEOS S.A. has bagged the ASI Chain of Custody (CoC) Standard V1 (2017) Certification for its corporate headquarters and upstream activities, including bauxite mining, alumina refining, and aluminium smelting and casting. MYTILINEOS has received the certification for bauxite mining activities at the Distomon site; refining, smelting and casthouse activities at the Aluminium Of Greece Plant; port facilities at the Aluminium Of Greece Plant; and corporate headquarters at Athens.

To know more: https://www.alcircle.com/news/mytilineos-s-a-receives-asi-chain-of-custody-coc-standard-v1-2017-certification-for-its-upstream-activities-86000

Novelis & SPS partnership starts closed-loop-recycling operation

Novelis has also initiated closed-loop recycling operations with Smart Press Shop (SPS). Novelis supplies aluminium FRPs from its Nachterstedt plant in Germany to the Smart Press Shop and collects production scrap generated at SPS during the automotive manufacturing process to convert it into high-quality rolled sheets. This process is expected to reduce carbon emissions by up to 100,000 tonnes per year, as recycling aluminium requires 95 per cent less energy than primary aluminium production.

To know more: https://www.alcircle.com/news/novelis-sps-partnership-starts-closed-loop-recycling-operation-84772

Capral offers low-carbon aluminium LocAl® to Australian manufacturers for accessing sustainable projects

Australia's leading provider of aluminium products and associated services, Capral, introduced LocAl®, a lower-carbon primary aluminium option available across Capral's locally manufactured extruded aluminium products.

The LocAl® offer includes two low-carbon aluminium options amongst the lowest carbon aluminium available globally:

- LocAl® Green with carbon emissions of 8kg CO2e/kg Al*
- LocAl® Super Green at 4kg CO2e/kg Al*

To know more: https://www.alcircle.com/news/capral-offers-low-carbon-aluminium-local-to-australian-manufacturers-for-accessing-sustainable-projects-85995

Hydro signs strategic collaboration agreement with NTNU to strengthen R&D on aluminium value chain sustainability

The European aluminium sector is staying caught up in efforts towards sustainability goals. The industry has already outlined a roadmap for climate neutrality by 2050 and wants to drive the deep transformative policies and practices needed to achieve it, mainly by cutting emissions, investing in green technologies and protecting the natural environment. Recently, Hydro, a Norwegian aluminium and renewable energy company, have signed a new strategic collaboration agreement with the Norwegian University of Science and Technology (NTNU) to build up professional collaborations to practice more R&D on aluminium and energy. They will together work on paving a path for the aluminium value chain to achieve decarburization conveniently, develop

renewable energy production, and practice aluminium recycling.

Hydro's President& CEO Hilde Merete Aasheim said, "Hydro and NTNU both recognize the importance of ensuring long-term sustainability in accordance with the United Nations' sustainability goals and wish to promote collaboration to enable this."

To know more: https://www.alcircle.com/news/hydro-signs-strategic-collaboration-agreement-with-ntnu-to-strengthen-r-d-on-aluminium-value-chain-sustainability-86055

EGA joins the First Movers Coalition to encourage decarbonization in hard-to-abate sectors

While the whole world is joining the global initiative called the First Movers Coalition, an initiative aimed at decarbonizing the heavy industry and transport sectors responsible for 30 per cent of global emissions, Emirates Global Aluminium has not remained an exception. It is the first company headquartered in the UAE to have joined the initiative, with a core commitment to a low-carbon future through reductions in energy use and greenhouse gas emissions. It is also the first company in the world to manufacture aluminium for commercial purposes using solar energy, sold under the trade name CeletisAL.

“As a UAE company, we are committed to the nation’s Net Zero by 2050 Strategic Initiative. To decarbonise our aluminium, we have to reach net zero in our operations and our supply chain. Joining the First Movers Coalition is a powerful message to suppliers in hard-to-abate sectors that we will deploy our purchasing power to encourage decarbonisation,” said Abdulnasser Bin Kalban, Chief Executive Officer of Emirates Global Aluminium.

To know more: https://www.alcircle.com/news/ega-joins-the-first-movers-coalition-to-encourage-decarbonisation-in-hard-to-abate-sectors-86010

Assan Alüminyum emphasizes ESG for its long-term strategy and future goals

Assan Alüminyum, a subsidiary of Kibar Holding and the most prominent Turkish producer of flat-rolled aluminium products, has decided to give ESG (environmental, social, and governance) high priority in its long-term strategy and future plans. To improve the sustainability of its manufacturing and recycling processes, the firm adheres to the Performance Standards of the Aluminium Stewardship Initiative (ASI). The foundation for the company’s ESG-focused future goals is laid by recent releases of sustainable products, corporate social responsibility (CSR) initiatives, and sustainable expansion plans.

To know more: https://www.alcircle.com/news/assan-aluminyum-emphasizes-esg-for-its-long-term-strategy-and-future-goals-85884

Swedish engineering company Heart Aerospace to develop the world’s first zero-emission flights

The heart of Scandinavia is bracing itself to receive the world’s first zero-emission aviation technology developed by a group of Heart Aerospace engineers. A hangar at Gothenburg is currently housing the discovery. As Fredrik Kampfe from the Swedish Aviation Industry Group correctly puts it: “If not here, where else should be first with zero-emissions aviation?”

Sweden has set an extraordinary goal where the country is on a journey towards achieving fossil-free domestic flights by 2030. The aviation industry also aims at making each outgoing flight from the country fossil-free by 2045. This is quite a giant leap for the aviation industry since, for the first time, sustainability is at the peak of everything else.

To know more: https://www.alcircle.com/news/swedish-engineering-company-heart-aerospace-to-develop-worlds-first-zero-emission-flights-84654

Constellium provides lightweight aluminium solutions for Mercedes-Benz C-Class

As the sustainability drive has touched upon the automobile industry, automotive companies seek recycled aluminium for its different body parts. This year, Mercedes-Benz C-Class models manufactured in China, Europe or South Africa sought aluminium auto body sheet solutions from Constellium SE. Constellium supplies the aluminium required to mend the Mercedes-Benz car's roof, tailgate, fenders and hood.

To know more: https://www.alcircle.com/news/constellium-provides-lightweight-aluminium-solutions-for-mercedes-benz-c-class-83579

Novelis breaks ground on a new $50 million recycling centre in South Korea to produce low-carbon sheet ingot

It is a constant strive by world aluminium companies to accelerate recycled aluminium production to meet the global need. Recently, Novelis Incorporation, the world's largest aluminium recycler and flat-rolled producer, broke ground on a new $50 million recycling centre in South Korea. The project will be able to produce 100 thousand tonnes of low-carbon sheet ingot annually by recycling aluminium, resulting in reducing Novelis' carbon emissions by more than 420,000 tonnes each year.

To know more: https://www.alcircle.com/news/novelis-breaks-ground-on-a-new-50-million-recycling-centre-in-south-korea-to-produce-low-carbon-sheet-ingot-86051

Al Tech

Soumyadip Chakraborty

Director Operations at AlCircle

To solve the conundrum of diminishing productivity with Technology

Introduction

From the dawn of the twenty-first century, work has become more interesting across various sectors and industries. In most cases, the contribution towards the excitement and exuberance came from technology. For example, at the beginning of the century, digitization took the next leap towards digitalization, and ERP (Enterprise Resource Planning) software came to the forefront. Companies like SAP, Oracle and Microsoft enjoyed huge success thanks to the high adoption rates of their respective ERP solutions. From recruitment to retirement, from receiving the order to realizing the payment, from

procurement to making payment to an invoice, transparent reporting – the reason for the wide adoption of ERP had been the aim to achieve more and more efficiency and less human error. More work could be done with less manpower and at a pace hitherto unachieved. Other technologies like business intelligence (BI) came around the same time and successfully leveraged the ERP wave.

Towards the end of the twenty-first-century first decade, the need for good infrastructure at a lower cost emerged. The server cost, network cost, and the cost of manpower to maintain such infrastructure made IT developments a reality only for a fraction of the companies. The wave of SaaS (Software as a Service) and PaaS (Platform as a Service) came to resolve the impasse. Around the middle of the second decade of the century, we witnessed the terms like SMAC (social-mobile-analytics-cloud), which empowered organizations to collect and store a high volume of data and armed them with the firepower of high computational capabilities. The pathway of Artificial Intelligence and Data Science was paved. We witnessed the glory of AI-ML-DL (Artificial Intelligence-Machine Learning-Deep Learning), Industry 4.0 and many other exponential technologies. All these transformed the way various functions work across different industries, and aluminium is no different.

With all these in the backdrop, a startling fact was revealed – the productivity of the human workforce has decreased over the last century. Even with all the gadgets like smartphones, wearables, and laptops which were practically non-existent a few decades back, the overall productivity of the human workforce has diminished. Now that is a conundrum! With the increased technical know-how, smart devices, better IT -infrastructure, and connections anywhere with Apps – we are supposed to get more done in lesser time. But the reality is just the opposite! This concern has found a place in the Future of Work Trends 2022 report by Korn Ferry, a globally reputed organizational consulting firm. The World Economic Forum has also mentioned this problem a number of times in various deliberations and reports.

Reasons behind diminishing productivity

While this is a quagmire, the reasons are relatively easy to find out. A few such factors are mentioned below:

a. ***Impact of the recent technological advancements:*** It is widely concluded that the development of Industry 4.0, Robotic Process Automation (RPA), or Artificial Intelligence (AI) are path-breaking. Still, their impact on human productivity or life has been minimal compared to the steam engine or electricity innovation. All the recent developments have considerable potential, but the use cases are yet to be established for many of them.

b. ***Complications at work:*** With continuous technology leap-frogging, human workers today are continuously moving across different platforms and technology suites. For example, the sales team uses different platforms or at least applications for keeping a tab on the sales pipeline, managing the single version of documents, discussing the live proposals and booking orders and then for order fulfilment.

   Today we have more number of companies than a few decades back. Multiple geographies mean multiple regulatory guidelines, laws to abide by, and more work. The complicated work environment demands more time to learn, unlearn and relearn. The cycles are more rapid, resulting in a loss of productivity.

c. ***Increasing interruptions:***Multiple environments and devices inevitably result in more alerts, demand more attention and result in poor attention span for a particular type of work. It is a proven fact that once we are interrupted in any work, it takes around 22-27 minutes to regain the same level of concentration.

d. ***Overall economic slow-downs & geo-political tensions:*** The workforce today is operating in an increasingly VUCA environment (Volatile-Uncertain-Complex-Ambiguous). The geopolitical tensions, the threat emerging from the scarcity of resources, the increasing carbon footprints and its adverse impact on the environment, the pressure from the regulatory bodies, and the compliance requirements – all these together are also impacting the working condition and the effectiveness and efficiency of the workforce.

The solution

The problems stated above are applicable to any sector, and Aluminium is no exception. The adoption of new technologies is increasing in the aluminium sector. The requirement for Green Aluminium is the need of the hour, and globally, consumers are increasingly demanding the same. However, the different players in the Aluminium ecosystem are in different states of adoption or usage of technology. Despite the same, the aluminium players may explore a few solutions depending on the requirement and applicability. The impact on productivity will also vary accordingly. One size will not fit all of them.

a. ***Robotic Process Automation:*** Any organization has a number of routine activities – working on the MIS, filling data tables inside ERP, creating a sales order, purchase order, invoices, and the like. Often such works are non-cerebral, mundane and manual labour intensive. This is the area where RPA or Robotic Process Automation comes in. These are set of programs which may be trained to perform a set of activities very fast and without any error. Often these need to be triggered manually, and sometimes such processes may be triggered in an automated way as well. The RPA is known as Attended or Unattended, respectively.

b. ***Industry 4.0:*** Industry 4.0 has an excellent potential to improve productivity. Successfully deployed Industry 4.0 projects to reduce unplanned breakdowns and achieve predictive maintenance. Similarly, energy reduction, production bottleneck prediction, etc., are a few other important use cases of Industry 4.0. However, like any other significant technical projects, Industry 4.0 projects take time to be conceived, planned and executed. The benefits get registered only after the projects are used as a part of the regular work. This entire journey takes time, but it adds to the efficiency once implemented.

c. ***Integrated platform for multiple applications:*** These days' organizations often get confused about using multiple platforms for multiple purposes. For example, CRM, ERP, production management systems, HRMS, Reporting systems, and many more. Sometimes managing all these becomes a big challenge for the middle management and the leadership teams. Hence many companies have started the practice of integrated platforms and unified interfaces. Unified platforms often make hovering across different systems relatively easy and increase the efficiency and morale of the workforce.

d. ***Increasing adoption of ERPs:*** Many Aluminium companies are increasingly adopting ERP. For obvious reasons, the bigger players and smelting plants or mining and equipment companies have higher adoption rates. Many of them have probably moved to the next level of business reporting and analytics. Still, the smaller counterparts and extrusion companies are yet to catch up. ERPs, once successfully implemented, make work easier and can increase efficiency.

e. ***AI & ML solutions:*** Successfully implemented AI models aid in decision-making and enabled organizations to become more effective and efficient at the same time. However, many Aluminium companies are still in the early experimentation stage with AI models.

f. ***Digital detoxication:*** Technology has become part and parcel of our life, but we should be enslaved by it. Continuous interruptions hamper the ability to concentrate. These days, organisations have started taking measures like 'no mobile in team meetings, 'no phone hour', etc. Such practices will only increase in the days to come.

It is obvious that the solutions mentioned above are just some of the ones. The organizations are also trying to deploy many other technical, managerial and behavioural techniques to enhance the workforce's productivity, machines and other resources.

Conclusion

The VUCA world is here. The business environment will keep on getting more complicated. The demand of the stakeholders will keep changing. The technology leapfrogging will continue for decades to come. Hence, productivity, as we know, will continue to remain under pressure. However, a pragmatic framework to understand which changes to embrace and which not and then a well-thought-out implementation of a selected technology will certainly enhance the productivity of the organizations. This requires specific skillsets which may not be available within the existing teams. Realizing the same, several global aluminium companies have created the position of 'CDO' (Chief Digital Officer) or 'Head of Digital Transformation over the last few years. That is a step towards the right direction. We at AlCircle, will keep an eye on those developments and keep our readers posted.

Mélanie Larouche

Communication & Public Relations
at Groupe Réfraco

Next stop: Automation

Groupe Réfraco is a leader in manufacturing refractory parts and equipment, mainly for aluminium smelting, foundry, mining and other industries operating in aggressive and high-temperature environments. It is now looking to move into the automation market. Through its subsidiary Robexco, Groupe Réfraco has been working for several years on developing robotic technologies specialized in complex processes that will allow its customers to increase productivity and partially alleviate the problem of labour shortages. The company intends to play a key role in the transition of manufacturing companies to Industry 4.0, a necessary step in which Quebec lags globally.

As a major player in the refractory industry, Groupe Réfraco has built its reputation on the quality of the raw materials it uses, the know-how of its teams and the impeccably finished products it delivers to its customers. “Réfraco’s expertise makes it the go-to supplier

for lining industrial furnaces used in the production of aluminium, steel, cement, and pulp and paper. The company is involved wherever there is a heat and extreme condition," explains CEO Jean-Benoit Pineault. "On the manufacturing side, we make all types of parts. We engineer these parts, which are destined to go into industrial furnaces, and we manufacture them. And on the service side, we maintain this equipment 24 hours a day, seven days a week."

A family business

Groupe Réfraco has its origins in a masonry company founded in Chicoutimi in 1954 by Benoit Pineault, father of the current president, Alain Pineault, and grandfather of Jean-Benoit Pineault and his brother Carol, who serves as director of large-scale construction sites. "In the 1960s, my father was asked to participate in constructing anode baking furnaces through workforce participation," recalls Alain Pineault. "Then, in the 1980s, he was asked to take on the maintenance of these furnaces. The plant then gradually took on other contracts for small industrial furnaces. In 1995, realizing a gaping hole in the local refractory market, Alain Pineault and his brother Rémi decided to officially add this new line of business to the company's range of products and services, and it proliferated from there."

In 2012, Réfraco formed a company in the Sultanate of Oman to refurbish and maintain Sohar Aluminium's anode baking furnace. This contract lasted six years and employed about 50 local workers as well as some supervisors from Quebec. This Middle Eastern aluminium smelter approached Réfraco because of its good reputation.

Since 2014, Réfraco has undertaken the construction and refurbishment of its plants and satellites, as well as seeing the arrival of the next generation, including Jean-Benoit and his brother Carol. "Our aim at that point was to go further into refractories," notes Jean- Benoit Pineault. "We stopped doing architectural masonry in 2017. Even though it was what gave birth to this company, it is no longer our vocation. Still, the company has remained dedicated to industrial furnaces construction, repair and maintenance. Today, Groupe Réfraco

has a great team, young and motivated. The next generation is getting ready to take over, with many ideas and energy, and to move in a strong and innovative direction."

The company now employs close to 250 people at its two plants in Chicoutimi and its satellites in Baie-Comeau and British Columbia. Human resources management is one of its priorities, and it spares no effort to ensure the well-being of its employees, both physically and mentally. Its reputation as a quality employer gives it substantial advantages when recruiting and retaining its valuable workforce.

Moving into automation

Réfraco's main markets are in Quebec, the northern United States and British Columbia. But the company is developing a new niche to compete in the global market. "Five years ago, we developed a robotic technology for automating various stages of production in aluminium smelters in response to the labour shortage," explains CEO Jean-Benoit Pineault. We plan to move from a refractory industrial company to a technology company specializing in the industrial sector. This is precisely where our next phase of innovation lies."

According to Pineault, not only does this new line of business represent a means of reducing the number of workers required to run the plant, but it also increases productivity and reduces the risk of injuries caused by repetitive movements. "We developed a technology platform for the installation of refractories. We started with anode baking furnaces and plan to move on to electrolysis tanks. Our goal is to automate wherever there is repetitive work in refractories. This technology is now part of our core competencies. Clients who hire us for our services can count on us to automate their facilities."

Birth of Robexco

In order to establish itself in this new market niche, Groupe Réfraco has created Robexco, with about 15 employee shareholders. "Robexco will devote half of its time to meeting Réfraco's needs to

improve its installation methods through automation and the other half working with Quebec companies that need help with their complex processes," says Jean-Benoit Pineault. "Réfraco has made complex processes its speciality. We review the process to automate it from start to finish, including integration into the customer's ERP systems. We have vision specialists and mechanical and electrical engineers, and we have assembled a great team to propel Robexco forward. This new expertise offers great technological challenges. Quebec is behind in terms of automation. We want our companies, Réfraco and Robexco, to help all of Quebec by improving the level of automation in the manufacturing sector. We want to share and develop standards, and set up a test bench so that companies can come and do tests and proof of concepts. We want to become the reference for automating complex processes related to refractories."

ROBEXCO

RĒFRACO

RBR Technology

Robotic system enabling anode baking furnace refractory brick partitions to be automatically fabricated.

- Optimal brick positioning.
- Brick defect characterisation.
- Capability to fabricate half-size, third-size, or complete internal or external partitions.
- Fabrication by a single operator in less than 24 hours.
- Patents pending.

Robotic fabrication technology

Robotic platform designed for various types of fabrication using 3D models, including machining, finishing by deburring, and sanding.

- The shape is provided by a Solidworks 3D model.
- The robotic process is supplied by Mastercam and Octopuz.
- An automated robot supplies many production cells and is capable of achieving various types of transformations.
- Objective: avoid the necessity of manually teaching each required task to the robot. This step is handled end-to-end by the designer.

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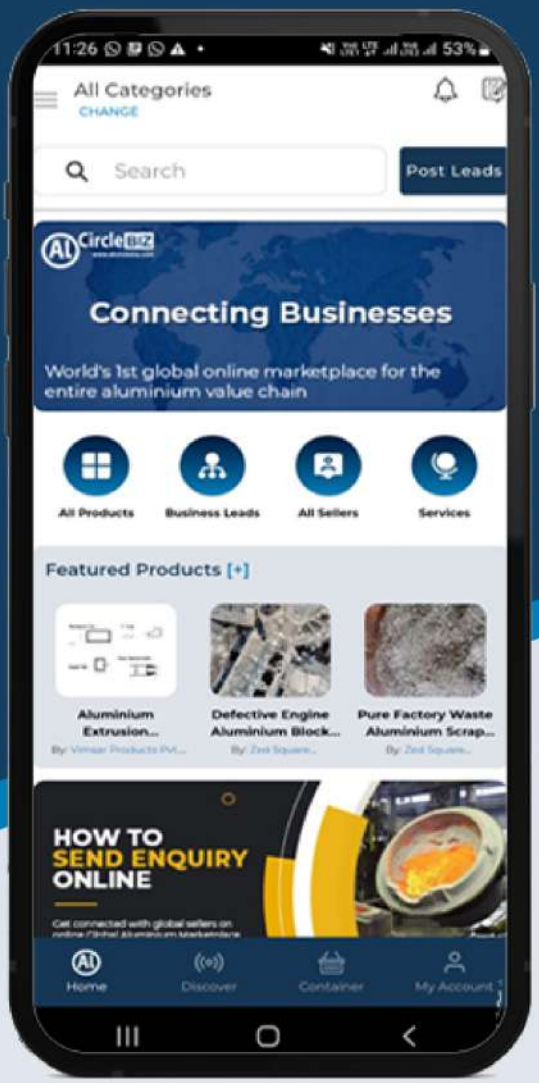

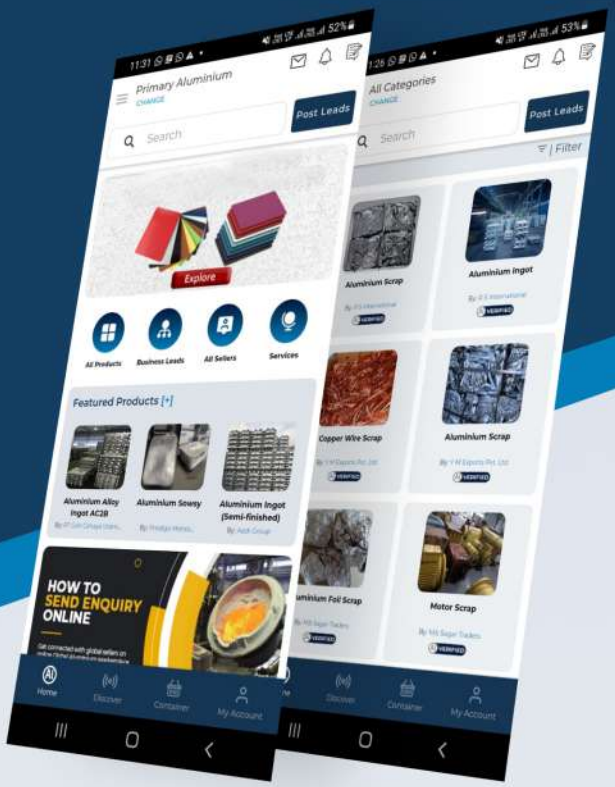

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Eloise Harvey

CEO of EPIQ Machinery

EPIQ MACHINERIE / MACHINERY

“Nowadays, not only does the equipment have to do its tasks, but it also needs to communicate with the plant and eventually make decisions with more AI.”

Born in Montreal, Éloïse Harvey obtained her Bachelor of Engineering & Management from McMaster University (Hamilton, ON). In 1999, Éloïse joined Mecfor (equipment manufacturer), the youngest of the four companies in the family group (Ceger) as a Technical Sales Representative.

The arrival of a patient financial partner who invests in the long term represents the first step towards an aggressive program of organic and inorganic growth.

AlCircle: Please share EPIQ Machinery's innovative equipment solutions, which are on trend to improve an aluminium smelter's handling and process flow.

Éloïse Harvey: Under the MECFOR brand, we have the Molten Metal Transfer by Pressurization (MMTP) that gains in popularity every year. Our customers see a true benefit in their output and the quality of metal produced. Also, the brand will soon deliver new casthouse dedicated equipment: Mecfor Furnace Vehicle (MFV10). With its unique design, the SmartConnect feature and MECFORLink, this equipment is an excellent addition to our Smart Casthouse Solutions. The vehicle will show great manoeuvrability with a high-loading capacity. The operator cab can be lifted to ensure good vision for the operator.

As for AD, the brand is increasing the level of automation and robotization in its handling systems. As more smelters and casthouses look to automate and reduce the need for operator-driven equipment, this places the AD brand in a niche area. They have the ability to integrate highly repeatable material handling equipment with the added benefit of auto-guided vehicles (AGVs) to move the product to a warehouse or storage pad.

Finally, we are revitalizing the BROCHOT line of products and are looking into embedding 4.0 technologies. This brand has been around in the aluminium industry for more than a century; it has proven its level of performance by bringing aluminium producers turnkey integrated solutions.

AlCircle: Why does EPIQ Machinery consider itself a world-class equipment designer? What is your view on exploring innovative technologies to support the global aluminium industry?

Éloïse Harvey: EPIQ Machinery finished its first year with great results. This shows us that the merger happened at the right time and was well-received within our industry. We can now position ourselves more advantageous for large turnkey projects. Grounded in our

clients' operational concerns, we offer realistic and sensible solutions.

The EPIQ Machinery team has been very supportive of integrating innovative technologies. In 2016, MECFOR conducted a market study on the electrification of our anode and crucible hauliers. Today, we are investing in R&D and making it happen. Some of our craziest ideas have seen the light over the course of the years: descaling arms, MMTP, AGV, Smart Casthouse, and more. Our passion for challenges brings us even to define some industry practices; we're proud to be a partner in crime of these changes.

AlCircle: What are your plans for 2023 concerning investment in innovation and technology advancement for more efficiency in the aluminium business?

Éloïse Harvey: Simple; continue investing as we do every year in our R & D departments and engineering teams. Did you know that we designed and manufactured new pieces of equipment each year across all our family brands? If you make the count, there is no wonder why EPIQ Machinery now has one of the most extended solutions offered in the industry.

AlCircle: Please detail more about EPIQ AD. Why do you think it is one of a kind in the industry?

Éloïse Harvey: Our ability to utilize our manufacturing facility in India for fabrication has allowed us to grow by 30% our revenue in 2022. Having access to our fabrication shop in this area of the world where the workforce is not an issue has shown to be the key to the AD line of products. We provide smart machines and complete lines (i.e. automated batch homogenizing and sawing billet line) developed by our experts in Canada and fabricated under strict quality insurance in India prior to being sent back to our Quebec-based final assembly floor for FAT and delivery to our clients around the world.

AlCircle: What challenges do you face while developing new technology for the industrial sector? What are the primary factors you focus on to overcome those challenges?

Éloïse Harvey: Challenges are numerous: the main one would be finding a customer welling to let us test in a real operation environment or even share the risk of developing new high-tech equipment. Nowadays, not only does the equipment have to do its tasks, but it also needs to communicate with the plant and eventually make decisions with more AI.

Alcircle: Why do you say EPIQ Machinery can now create an Aluminum Hub of Excellence?

Éloïse Harvey: With the increased synergies within EPIQ Machinery brands, the company is becoming an unavoidable equipment solution provider and integrator. We foster cooperation with other aluminium equipment designers and manufacturers as well as the end user in a way to bring added value to the industry.

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Anil Vitankar

Business Head at LSKB Aluminium Foils Pvt Ltd

“We have also been able to produce aluminium foils up to 5.35 microns in the shortest amount of time which is the thinnest foil produced in this segment till now in India. This will become a new trend-setting fact in the aluminium foil packing arena.”

Anil Vitankar is the Business head of LSKB Aluminium foils Pvt Ltd. He has over 26 years of experience in Aluminium foil and flat rolled products in areas of Manufacturing operations, Sales & Marketing, Supply chain, and Procurement, including Strategic Planning and Projects.

Having graduated from VNIT, Nagpur, in 1993, he started his career at an Indian Aluminium company (a subsidiary of ALCAN, a major Canadian aluminium Producer) in 1993. Later joined Pennar Aluminium and then INDAL/HINDALCO, Taloja, under the flagship of Aditya Birla Group of Industries and established himself as a team leader in Process control, Production and Projects.

AlCircle: Founded in 2018, than Covid pandemic impacted global business. What is your secret to remaining confident of becoming the leading aluminium foil/foil-based comprehensive packaging solutions provider?

Anil Vitankar: Aluminium foil being admitted as the gold standard for packaging, especially in the pharmaceutical industry, for its excellent barrier properties offered the most logical solution to some of the needs in the post Covid era.

When the Pandemic hit in March 2020, the food & beverages segment nosedived and simultaneously, the pharmaceutical industry bailed out the aluminium foil industry. Given its excellent barrier properties and being admitted as the gold standard for packaging, the Pharmaceutical Industry lapped up aluminium foils giving it exponential growth. This demand for drugs and medicines and the public's general focus on hygiene continue to push the consumption of aluminium foils.

Under this situation, the global production of aluminium foils showed a promising spike estimated to grow at a rate of 5.5 per cent CAGR, majorly driven by the consumer packaging segment and pharmaceuticals.

LSKB spotted this global trend and started a world-class manufacturing facility with technology support from M/S ACHENBACH of Germany with a foil rolling mill of 2150 mm width capable of producing the thinnest 5.35 microns of aluminium foil. The brand procures high-quality raw materials from leading manufacturers in India and abroad, offering the best quality aluminium foils. Besides, the top

class and highly motivated human resources in management & shop floor drive the manufacturing unit with deep knowledge in aluminium foil rolling. We have unique insights into customer expectations owing to our sister company Jupiter laminators, which is a big consumer of converter foil and has strength in getting access to customers worldwide.

AlCircle: What is LSKB Aluminium Foil's speciality in the aluminium foil packaging business? Do you think you are ahead of your competitors in planning?

Anil Vitankar: We offer the widest foil widths at 2150 mm wide capability offering alloy, deckle and thickness choices in the foil industry at our state-of-the-art facility located in Sonipat, Haryana, India.

We produce aluminium foil in a compact and positively pressurised plant with dust free environment. We produce foil hygienically using food-grade certified rolling oil as the foil requires in food grade-quality surface. We have DMF acknowledgement and are certified with BRCGS, SQF, KOSHER, BIS, ISO 9001:2015, ISO 14001:2015, and ISO 4500: 2018. This gives a glimpse of the quality standard of our product. We produce material as per customers' requirements with zero tolerance for quality, timely delivery and prompt service, which makes us miles ahead of our competitors.

We are also integrated to produce food grade kitchen foil and food containers under our registered brands' names like Alu-Alu and Home Foil, using state-of-the-art machines without human touch across the process.

AlCircle: Could you share your innovation and trendsetting story in the aluminium foil packing arena?

Anil Vitankar: We at LSKB are the first and only supplier to have BRC certification. This is a synonym for delivering confidence across the entire supply chain by guaranteeing the standardization of

quality, safety and operational principles. By setting the benchmark for excellent manufacturing practice, they assure customers that products are safe, legal and of high quality for our customers. We have state of the art oil fume recovery system which helps protect the environment since the fumes being discharged are free from harmful oil residue but also make a lot of economic sense in terms of oil recovery. We have also developed inert gas annealing practices that help avoid oxidation and achieve the grade dryness test necessary for our customers. We have also been able to produce aluminium foils up to 5.35 microns in the shortest amount of time which is the thinnest foil produced in this segment till now in India. This will become a new trend-setting fact in the aluminium foil packing arena. In addition, we have numerous Kaizen-driven improvements on the shop floor, driving the innovation culture and participation from our highly skilled and motivated team members. Micro embossing on kitchen foil is a significant innovation in the industry, with custom-made designs possible for each occasion.

AlCircle: What are your plans for the rest of the months of FY23 concerning investment in technology advancement for more efficient production?

Anil Vitankar: We have several firsts to our credit in our industry. We are commissioning an online surface lubrication system for a semi-rigid container using food-grade oil. This will help our customers punch the foil directly in their punching machine without adding lubricant and achieve higher productivity. We are developing nitrogen purging in an annealing furnace to get a better quality foil surface and longer shelf life of the product without surface oxidation and get con sistent A-grade dryness on the foil surface. In addition to the latest features, our new separator will offer an integrated surface inspection system and dust and burr-free slitting solutions, which will cater to the upcoming battery segment.

On the Kitchen foil and container segment, we plan to launch specially coated products for ready to cook/reheat segment with food-grade

quality. We also plan to launch wrinkle-free containers in the coming weeks.

AlCircle: Why do you think your aluminium foil packing quality is superior to others? Can you share any case studies with us?

Anil Vitankar: We produce material in a completely dust-free and hygienic environment with specially built ventilation and flooring system. The plant access is through an air tunnel which washes off the dust at the entry to the plant for all employees and visitors, and wearing headgear, safety shoes and an apron/ Uniform is compulsory for all. We strictly maintain the quality parameters as per the requirement of our customers. We have started annealing aluminium foil in an inert atmosphere by purging nitrogen gas in the annealing furnace. This will result in better surface quality after annealing and a longer product shelf life.

Our Packing mode includes standard practices like silica gel, vapour and moisture barrier films, corrugated papers etc. We also employ innovative wooden box packing, ensuring the material is safe during transit.

We organize various training and awareness programmes for our staff and consider customers' feedback for continual improvement in our procedures. All quality parameters related to packing material are being monitored strictly. These give us confidence in the quality of our product packing over any other foil manufacturer.

AlCircle: What are your contributions towards a sustainable future?

Anil Vitankar: We have arranged continuous technological support from leading experts in Industry leader's aluminium foil rolling technology towards resource conservation through product yield improvement. We have engaged experienced professionals from the aluminium foil industry in our operations and quality control team to

produce the highest level of foil quality with a keen focus on resource utilization like power, air and water with regular energy audits, air and water consumption monitoring and reduction programmes. We also focus on hiring local talent, training them for better retention, and using local vendors for supply and service, which helps sustainability in the long term. We have implemented Rainwater harvesting and now working towards solar power to cater to our daily load requirements. The entire campus is lush green with local flora and fauna using the recycled treated water from the STP plant. The in-house food preparation, as well as converting food waste into organic fertilizers for gardening, is one of the areas giving good sustainable results. The focus on paperless offices with the state-of-the-art ERP system, mobile app-based attendance, and leave and wage administration system are just a few examples. We are also continually working on packing innovations to reduce our wood and plastic consumption for foil packaging.

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LSKB produces foil in a totally hygienic environment with positive ventilated dust proof premises for various applications of aluminium foil such as Ultra-light gauge foil (5.3 to 6.5 micron), Packaging foil, Converting foil, Pharma foils (hard and soft), Lidding foil, Semi rigid container foil and Food Containers in various shapes and Kitchen Foil in Various Alloys, thickness and widths as per customer expectations with state of the art equipments, world class technology and people.

We are having DMF acknowledgement and certified with BRCGS, SQF, KOSHER, BIS, ISO 9001:2015, ISO 14001:2015, ISO 4500: 2018.

LSKB has the largest installed capacity in India for aluminium foil production designed for future expansion and scalability.

LSKB Jumbo Foil Rolls Manufactured by Achenbach Machines

Brands of LSKB

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MANUFACTURING FOR A SUSTAINABLE FUTURE

Over the years of its existence, AKFA Group has proven to be a trustworthy and responsible manufacturer. Today, the enterprise has one of Central Asia's most extensive computer-integrated manufacturing facilities.

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Rahul Sharma

CEO at Vedanta Aluminium Ltd.

Vedanta Aluminium, Manufacturing for the Future

The momentum of the global transition to clean technologies is fast increasing in response to the pressing need for urgent climate action and sustainable lifestyles. This is evident in the commitments to Net Zero and Sustainable Development Goals made by several countries and organizations globally. This shift to a net zero economy will be metal-intensive, with sustainable materials like aluminium playing a crucial role in this transition.

Aluminium's high strength-to-weight ratio, superb electrical & thermal conductivity, exceptional design flexibility, corrosion resistance and infinite recyclability will find critical applications in sunrise sectors such as high-tech manufacturing, energy and storage solutions, electric vehicles, renewable energy, low carbon or green products, green buildings and sustainable packaging. Consequently, the global

aluminium industry is poised for exponential growth to cater to the emerging demand for clean energy solutions, green technologies and sustainable systems.

The global aluminium industry is the fastest-growing metal industry today, and its demand is expected to increase from 86 million tonnes in 2020 to 120 million tonnes by 2030. India's demand is expected to double to approx. 8 million tonnes by 2030, driven by a surge in building & construction, transportation, packaging, electrical, defence and aviation.

Making in India for the world

Vedanta Aluminium, one of the world's top aluminium producers and India's largest aluminium producer, is well-resourced to meet this growing demand. In FY22, the company produced more than half of India's aluminium at 2.26 million tonnes, catering to all major growth sectors. It produced one of the largest ranges of high-quality aluminium products in the form of Restora Low Carbon or 'green' Aluminium (aluminium that has a low carbon footprint), Billets, Primary Foundry Alloy (PFA), Wire Rods, Slabs, P1020 Ingots, Rolled Products, Flip Coils, T-Ingots, Sow Ingots and hot/liquid metal.

It is the largest producer of wire rods globally (ex-China) that are used in electrical distribution and India's leading exporter of billets to developed markets like the US and Europe that are used in extrusion, buildings and construction. In the form of market-leading products, Vedanta's aluminium finds critical applications across a wide array of industries such as aerospace, automotive, building & construction, infrastructure, electricals, consumer goods, steel, renewable energy, packaging and many others, spanning over 50 countries.

Vedanta Restora, greenifying products & value-chains

Vedanta Aluminium is the first in India to launch its low carbon 'green' aluminium, branded 'Restora', to address the fast-growing global demand for low carbon footprint aluminium, driven by greater climate consciousness. In fact, it is the first major non-ferrous Indian metals producer to manufacture low-carbon products (primary aluminium), reflecting the commitment to achieving Net Zero Carbon by 2050. Under Restora, Vedanta Aluminium offers two product lines – Restora (low-carbon aluminium) and Restora Ultra (ultra-low-carbon aluminium).

Manufactured using renewable energy, Restora has a greenhouse gas (GHG) emission intensity that is well below 4 tonnes of CO2 equivalent per tonne of aluminium manufactured. 4 tonnes of CO2 / tonne of aluminium produced is the global threshold for aluminium to be considered as low carbon footprint aluminium. Restora Ultra, made with aluminium recovered from dross (a by-product of aluminium smelting), has an even lower carbon footprint that is near-zero and is amongst the lowest in the world. Restora Ultra is also a testament to the company's sharp focus on 'zero-waste' through operational efficiencies. With Restora, Vedanta's customers have the assurance that the aluminium they purchase has amongst the lowest carbon footprints in the world. The company has the capability to tailor-make Restora and Restora Ultra into various products, such as Billets, Ingots, Primary Foundry Alloys, etc., customized to the needs of the end-use industries.

Customer Obsession

Customer obsession is at the heart of Vedanta Aluminium's products, production and innovation. The company offers them the highest quality of products as well as a bundle of advantages through 360-degree holistic solutions that support them at various stages of their business aspirations. Besides investing in R&D, innovation, ESG excellence, cutting-edge technology and exceptional product & service quality, the company is working with its customers to co-cre ate product solutions through its ecosystem of technical experts and Centre of Excellence.

The company aims to convert 100% of its product portfolio into value-added products and reduce the import dependence of Indian industries for true self-reliance. For instance, Vedanta Aluminium has indigenously developed Primary Foundry Alloys (PFA), Cylinder-head Alloy for the automotive sector, and AlSi3 Ingot for the steel industry are shining examples of high-quality domestically manufactured products catering to the needs of Indian industries. These alloys were hitherto being entirely imported into India until Vedanta started manufacturing them indigenously.

Its Centre of Excellence brings together global expertise in metal, innovation, quality and R&D to develop the next big thing in aluminium. In fact, the company is launching an online sales solution that brings together all of Vedanta's offerings under one roof, backed by robust CRM, finance and logistics solutions, to provide our customers with unprecedented ease of buying.

Innovating for tomorrow

With a focus on emerging aluminium applications in a low-carbon future, Vedanta Aluminium is investing in capacity expansion, R&D, innovation, cutting-edge digital solutions and value-added products and services to cater to this growing demand with top-of-the-line aluminium products.

Vedanta Aluminium plans to fully utilize its existing aluminium smelting capacity of 2.3 MTPA, add new product lines and double the smelting capacity by another 0.5 million tonnes at BALCO over the next 3 to 4 years. These product lines will cater to the emerging demand across various industry sectors, for aluminium uses are rapidly evolving with the potential for greater applications in a sustainability-conscious world.

The relentless efforts of Vedanta Aluminium's in-house R&D team have allowed it to continually explore newer applications of aluminium by focusing on application-based development, such as special wire-rods customized for usage along coastal belts for the electrical market, crash-resistant alloys for electric vehicles, etc. Taking it a step further, the company is planning to develop one of the world's largest Aluminium Parks near its aluminium smelter at Jharsuguda, Odisha, one of the world's largest aluminium smelters. It will attract hundreds of SMEs in Extrusion, Electrical, Casting, Auto Ancillaries, Packaging, etc., to set up their plants in the park and leverage the benefits of just-in-time liquid metal. Not just that, every SME in Aluminium Park will have access to Vedanta's Centre of Excellence, R&D and innovation facilities, and an ecosystem of global experts.

This project comes with significant sustainability benefits as well. With direct transportation of hot or liquid aluminium to the downstream companies, there will be significant energy savings on both sides, thus reducing carbon footprint. Further, it will eliminate the need for cross-country logistics, thereby reducing freight burden as well as emissions from transportation. Overall, it will also reduce the total cost of ownership for the downstream players, making the entire aluminium industry more cost-competitive. By supporting aluminium-based industries in such a robust ecosystem, Vedanta Aluminium aims to establish India strongly on the global map as the aluminium hub of the world.

Development that is sustainable

Climate action can no longer be put on the back-burner. It is now a matter of how fast and efficiently countries and companies must work towards it. Vedanta Aluminium is determined to grow its business sustainably through responsible utilization of resources, the highest efficiency of assets and processes, and a relentless focus on offsetting and reducing its carbon footprint. The company has a laser-focus on developing growth plans on the bedrock of Environmental, Social and Governance (ESG) excellence.

For us at Vedanta Aluminium, business growth and sustainable development are two sides of the same coin. Our growth story over the past decade stands as testimony to the same. We run some of the most energy-efficient plants in the country. As testimony to our climate action endeavours, Vedanta Aluminium has reduced its GHG emissions intensity by 21% in the 2012-21 period while almost

tripling its production in the same period. In FY22 alone, our largest aluminium smelter has substantially reduced its carbon footprint by around 12% in FY22 over the previous fiscal while increasing production by 20%.

Operational efficiency and energy conservation initiatives have resulted in energy savings of 23 lakh Giga Joules across Vedanta Aluminium's operations in the last fiscal. Vedanta Aluminium is also India's largest consumer of renewable energy, at 3 billion units in FY22. The company has signed a Power Delivery Agreement for 380 MW of renewable energy for its aluminium smelters. This decade will also see Vedanta Aluminium redouble its efforts in water management as it strives to become Net Water Positive by 2030. As a reflection of its sustainable development practices, Vedanta Aluminium ranked 4th in the Dow Jones Sustainability Index (DJSI) 2021 world rankings for the aluminium industry.

Making operations future-ready

Vedanta Aluminium is now in a growth phase where it is poised to create the industry of the future. From assets to employees to the vertical integration of operations, the company is geared to bring a disruptive step-change and become future-ready.

We are expanding our business to unlock the full potential of our assets and add new product lines to meet the emerging demands of the market. This growth phase will see us use state-of-the-art technologies to make our operations more responsive, reliable and future-ready. Industry 4.0 is seeing us reimagine our business. Accelerating our digitalisation programmes, intelligent automation, and in-house innovations have enabled us to bolster our manufacturing excellence, use resources judiciously and boost workforce safety, making us agile in responding to market dynamics.

Vedanta Aluminium is also focused on building future-ready capabilities in its talent pool, from hiring talent in emerging tech-first

specialisations and upskilling its talent base to becoming even more digital savvy. Today, its operations are far from traditional manufacturing shop floors.

Deep learning algorithms and sophisticated modelling techniques allow Advanced Asset Performance Management at Vedanta Aluminium's smelters and power plants. Digital twin technology for predictive and prescriptive maintenance helps ensure greater efficiency, avoid downtimes and reduce safety risks with minimal or zero human touch. A robust Manufacturing Execution System gives the company visibility of all critical plant operations, allowing for remote decision-making. These are but a few examples of how the company is leveraging leading-edge technology solutions for extracting maximum productivity.

Through Vedanta Spark, the group's start-up incubator, Vedanta Aluminium is working with a whole host of new-age start-ups, leveraging the power of innovation and digitalization in manufacturing. The business cases where these start-ups are involved range from operational efficiency to energy storage solutions, water and waste management, smart inventory management, quality excellence, asset optimization & predictive maintenance, people safety & well-being, and many others. This is ushering in a fundamental shift in India's manufacturing landscape, bringing it to the same playing field as that of developed countries.

Making in India for the world

India is a land of opportunities. It has all the right levers to become the manufacturing and value-addition hub of the world – rich mineral reserves (fifth largest in bauxite & coal), strategic geographic location for trade, a young and talented workforce base, huge manufacturing capacity, a vibrant ecosystem of SMEs and downstream producers, a large captive market, and a national vision for self-reliance. And yet, India imports 60% of its aluminium demand, despite having over 4 million tonnes of manufacturing capacity.

Aluminium consumption in India, currently at about 3 kg per capita, is much below the global average of 12 kg per capita, which portends significant opportunities for growth. Even with a low per capita consumption, aluminium presently contributes up to 2% of the manufacturing GDP in India, creating more than 10 lakh direct and indirect jobs across the value chain and has developed over 4000 SMEs. This is because the aluminium industry also has a high multiplier effect leading to the development of downstream SMEs and industrial clusters like aluminium parks, thereby significantly increasing capital outlay and employment opportunities.

The Indian aluminium industry has enormous potential to contribute as a wealth creator for the nation's economic growth, with its expansive value-chain, customer and supplier ecosystems. It is an indisputable fact that India can be self-reliant on aluminium. All that is required is policy enablers to boost global cost-competitiveness and greater ease of doing business.

PRESEZZI® EXTRUSION

Our commitment to a more sustainable future

Since its establishment in 1994, Presezzi Extrusion Group has developed a reputation for producing and commissioning extrusion lines for non-ferrous metals, particularly aluminium.

With over three decades in operation, today, it is one of the world's leading manufacturers of extrusion presses. Its name has become synonymous with HIGH-LEVEL TECHNOLOGY and FLEXIBILITY in designing and constructing various presses for aluminium, hard alloy, copper and brass.

Currently, the Presezzi Extrusion Group offers turnkey extrusion lines and modern foundries for aluminium alloy logs, thanks to its ongoing commitments and investments in research and development geared

toward improving and improving the efficiency and sustainability of its machines.

In the Group's management policies, energy efficiency and savings have always been regarded as essential components and cornerstones of manufacturing and engineering.

Driven by this vision of energy saving and production efficiency, our R&D department has developed an energy-saving system, called the PE Energy Saving System (PE.E.S.S.). Presezzi developed and created the PE Energy Saving System to achieve considerable energy savings in production while maintaining and/or improving the production performance and the quality of the extrusions.

The system is based on two cornerstones: savings and technological innovation. The concept of savings does not only translate into energy savings but also into machines involving a smaller number of components necessary for their operation, which at the same time make the manufacture and installation of the press leaner and less subject to production stops and down times for maintenance.

Presezzi Extrusion Press

It is no coincidence that we were the first in our field to voluntarily develop an environment label (Environmental Product Declaration - EPD) for our products. EPDs are declarations that present clear, objective, and verified information regarding the environmental performance of a product, assessed over its entire life cycle.

To date, Presezzi Extrusion Group has published two EPDs for the products:

S-P-06355 Permanent Magnet Heater ZPE (Zero Pollution Energy)

An innovative magnetic induction heating system for billets of non-ferrous materials, where the only energy required is to drive the magnetic sectors.

POTENTIAL ENVIRONMENTAL IMPACT Global Warming Potential (GWP) 96 kg CO2eq*

* figure per tonne of heat-treated aluminium. In reference to ZPE 10", billet length 1500 mm

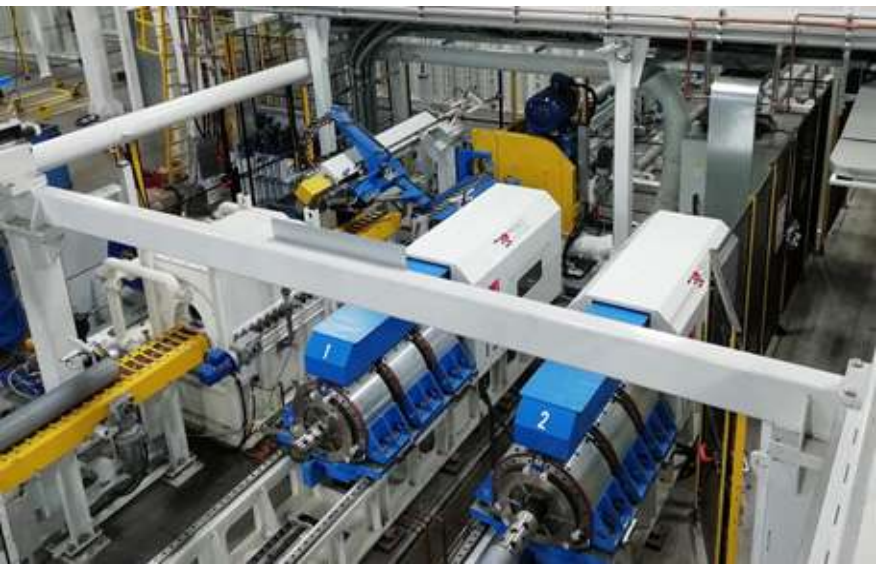
Energy Saving System (ESS)

S-P-06388 Extrusion Press ESS (Energy Saving System)

An Energy Saving System was applied to extrusion presses, allowing reduced electrical power consumption during production and the improved yield and quality of the extruded profiles.

POTENTIAL ENVIRONMENTAL IMPACT Global Warming Potential (GWP) 87 kg CO-2eq*

* figure per tonne of extruded aluminium in reference to press ESS 40MN 10", billet length 1500 mm



The aim is to offer and guide clients towards technologies capable of environmentally friendly production without needing to renounce production performance and efficiency.

With the EPD, the Presezzi Extrusion Group seeks to facilitate the virtuous conduct of its clients, providing them with a tool that certifies the environmental impact of the machine for working metal throughout its entire life cycle, thus obtaining important information for assessing the overall impact of the final product.

Various environmental impact indicators such as climate change, eutrophication, acidification, use of abiotic resources, and water scarcity are used by Presezzi Extrusion Group to assess the environmental performance of its products.

One of the fundamental premises that prompted the decision to obtain the EPD is the possibility to determine, through said EPD, the total carbon dioxide equivalent consumption, and not just of the product, offering clients the opportunity to assess their impact on the climate objectively, and therefore also act constructively to reduce and/or eliminate it.

Obtaining these EPD certifications requires a very structured and accurate process to acquire essential information needed to measure,

monitor, and implement targeted actions to reduce the impact of products on the environment and climate.

As part of the EPD development process, a Life Cycle Assessment (LCA) of the product is performed, which is compliant with international life cycle analysis standards (ISO 14040-44) and the rules of the chosen Programme Operator. In this case, the International EPD System is one of the most widely used Program Operators at the international level for environmental product declarations.

The LCA is a procedure to quantify the potential environmental impacts generated by a product or service along the entire value chain. Therefore, the LCA methodology supports innovation, eco-efficiency, the circular economy and the communication and marketing of more sustainable products.

The results of the LCA study are then carefully verified by an independent third party before being reported in the EPD, together with other information concerning the products under analysis, the company, and its environmental policies. Once ready, the EPD is registered and published on the Programme Operator's website and therefore available for anyone to consult.

Every day, Presezzi Extrusion Group demonstrates its commitment to handing over a better world to future generations: the constant search for innovative and sustainable technological solutions and obtaining these certifications are further proof of this.

Nanoprecise
Prediction with Precision

“We are defining the industry’s service standard for the monitoring & analytics of all types of industrial machines through our leading energy efficiency & health analytics platform for industrial assets.”

Nanoprecise solutions strive to create 360-degree integrated systems that can predict the remaining useful life of any asset and empower users with the right data across several industries. We implement cutting-edge technology to bring to our clients accurate prognostic and diagnostic solutions that can predict the remaining useful life of any asset with up to 99% accuracy.

AlCircle: Can you please introduce Nanoprecise to our readers?

Nanoprecise: Nanoprecise Sci Corp is an automated AI-based predictive maintenance solution provider that facilitates early detection of even small changes in machine operations before they impact production or cause downtime. Nanoprecise specializes in implementing Artificial Intelligence and IIoT technology for predictive asset maintenance and reducing the carbon footprint of manufacturing plants.

The integrated AI-based solution consists of a unique 6-in-1 IIoT sensor (Machine-DoctorTM) and an AI-based energy efficiency & health analytics platform (NrgmonitorTM).

MachineDoctorTM is the world's first IIoT hardware that offers real-time insights into the health and performance of industrial assets by measuring six crucial parameters: vibration, acoustic, speed, magnetic flux, temp, and humidity. It works on Cellular networks (3G/4G/5G) using an e-sim to connect the machines to the internet. MachineDoctor is Atex and IECEx Zone 0 certified, enabling it to be used within explosive atmospheres/hazardous industrial environments, thereby bringing productivity and safety benefits to manufacturing operations.

NrgMonitorTM is an Energy Efficiency & Health Analytics Platform that helps manufacturers track their energy efficiency & carbon footprint, along with condition monitoring of their motor-driven equipment. It determines which assets are consuming higher energy and allows maintenance teams to mitigate any inefficiency in their energy consumption. Moreover, it helps those pinpoint faults with the potential to cause downtime and identifies when a given piece of equipment is approaching the end of its Remaining Useful Life. It employs a data-driven approach to help operators achieve their Net-Zero goals while preventing unplanned downtime.

We are defining the industry's service standard for the monitoring & analytics of all types of industrial machines through our leading energy efficiency & health analytics platform for industrial assets. The solution is being deployed at scale in the field, providing a

means for companies to achieve greater sustainability and have a positive impact on reducing energy consumption & costs. The ease and speed of implementation give companies a clear means to start addressing these larger challenges today. This will significantly reduce the carbon footprint of manufacturing organizations by allowing them to move towards their emission reduction goal.

AlCircle: Industry 4.0 solutions are gradually gaining traction in the manufacturing industry. Can you please share a few use cases?
Nanoprecise: Any manufacturing operation can be categorized into 4 types:

- Constant speed and constant load
- Constant speed and varying load
- Varying speed constant load
- Varying speed varying load

The Nanoprecise solution works with machines and equipment sets used in the abovementioned categories. The predictive maintenance framework of Nanoprecise brings the sensor data from over from the site to the corporate network to help maximize the value of information. It offers meaningful insights into the health & performance of all industrial assets. It allows maintenance teams to take faster & accurate decisions, thereby improving the overall efficiency of the operations.

It allows maintenance teams to monitor every aspect of the manufacturing operation, leading to greater productivity and reduced emissions. It also helps improve the safety of the operators and operations, with real-time data and predicting issues arising from equipment anomalies/faults. In complicated manufacturing operations, this solution can efficiently monitor the health of critical assets, thereby enabling better operational oversight.

AlCircle: Can you please cite an instance where Nanoprecise solutions added significant value to an aluminium player?

Nanoprecise: We work with many of the leading players in the Aluminium manufacturing sector. Recently we helped one of the largest Aluminium manufacturing companies in Asia prevent a catastrophic failure in one of the ball mills with the help of wireless IIoT Sensors and an AI-based Analytics platform.

Ball mills are one of the critical assets in aluminium manufacturing plants. The failure of the ball mill in the grinding process will affect the output and efficiency of the entire operation. They are typically operated round the clock. Therefore, monitoring these machines is a huge challenge. Moreover, the remote location of these industrial assets leads to infrequent monitoring, and the maintenance & reliability personnel are not allowed to visit the equipment when it is running.

The wireless IIoT hardware from Nanoprecise - MachineDoctorTM detected symptoms of the improper pinion to girth gear meshing and load fluctuation in the pinion & gearbox of the ball mill. The AI-based analytics platform from Nanoprecise observed a significant change in time waveform observed in the spectrum over seven days, indicative of the abnormalities in pinion meshing/load variations.

AlCircle: Who in the Aluminium value chain may be a client of Nanoprecise?

Nanoprecise: The need for Industry 4.0 solutions can come from varied parts of the value chain in the Aluminium industry. Any organization having machines and equipment may leverage the analytical solutions like predictive maintenance and real time view of the equipment's health conditions. It may be a mine development organization deploying various mining equipment, or a primary aluminium company having smelters or an extrusion company. However, the use cases and the scope of solution may vary depending on the context. During the scope assessment phase the detailing is developed.

This early-stage fault detection helped the Aluminium manufacturer prevent 48 hours of unplanned downtime and saved $1,521,361 worth of production loss, apart from the $26,000 maintenance cost.

AlCircle: How do you see the industry 4.0 market gaining ground in the aluminium industry in the near future?

Nanoprecise: Aluminium is a versatile metal with applications in a wide variety of sectors. This makes it one of the essential metals in the world, and it has grown nearly 20x in the last sixty years. The demand for aluminium keeps increasing day by day. With the rising demand for efficiency and quality in production and manufacturing operations, unplanned downtime causes delays and customer loss for the Aluminium manufacturers, thereby hitting their bottom line. Aluminium manufacturing operators have their own set of challenges when it comes to maintaining its assets.

Companies are battling to increase production while lowering operational costs with improved worker safety. With diverse and complex equipment sets often placed in hard-to-reach, remote locations, the challenge of frequently monitoring the health & performance of machines & equipment sets is vast. Moreover, with the increased focus on reducing emissions, aluminium manufacturers worldwide are turning to digitalization, looking for cost-effective means to achieve greater sustainability and have a positive impact on reducing energy consumption & costs. Furthermore, with the advent of the digital age, the traditional levers of productivity have been exhausted, paving the way for disruptive technologies that have the potential to improve time to market and customer responsiveness significantly.

Aluminium manufacturers now realize the business potential of adopting smart manufacturing, with Industry 4.0 driving the digital transformation activities, with remote machine health monitoring, to improve asset performance and reduce their carbon footprint. Manufacturers & operators are turning to industry 4.0 technologies with an aim to move towards smart manufacturing that is highly efficient & productive. Optimizing performance with improved productivity and reduced emissions is the next step in delivering sustainable value to customers. This can only be achieved with data integration & analytics. As published by Mckinsey, a big data/advanced analytics approach can result in a 20 to 25 per cent increase in production volume and up to a 45 per cent reduction in downtime.

Industry 4.0 has already allowed aluminium manufacturers to bring the data from the shop floor to the forefront, empowering the manufacturers with the right data at the right time. It not only helps prevent unplanned downtime that results in more than $600B in supply chain disruptions but also helps reduce manufacturers' carbon footprint by identifying the assets that are consuming higher energy.

The demand for industry 4.0 solutions is only going to grow as the focus moves beyond optimizing the machine performance to encompass a wide variety of tasks such as inventory as well as quality management. Widespread adoption of such solutions aims to increase the overall efficiency & productivity on the shop floors and ensure improved worker safety.

Sam Kinsman

Vice President, Strategy & Transformation at Aludium

aludium
premium aluminium

“Aludium’s transition into a leader in sustainability began in 2015 with the decision to invest significantly in internal aluminium scrap recycling activities to reduce the amount of primary metal input.”

Sam Kinsman leads Strategy & Transformation at Aludium. He is a member of the Executive Committee and is responsible for the company-wide “ONE Aludium” program focused on Commercial Excellence, Operational Productivity, and Sustainability. Prior to Aludium, Sam held several transformations, sales, finance, and operational leadership positions at Iconex, a global paper & label converting business. Previously he worked in M&A investment banking at Goldman

Sachs in New York and transaction advisory at PWC in São Paulo. Sam is a U.S. citizen and is based in Alicante, Spain.

AlCircle: Please share the innovative journey of Aludium in the global aluminium sector. What are the contributions of Aludium regarding a sustainable future?

Sam Kinsman: Aludium has more than 65-year history in the European aluminium rolled product sector, producing custom-designed, fully recyclable aluminium specifications for its customers in speciality packaging, solar, architectural, transportation, and general engineering markets. Aludium's transition into a leader in sustainability began in 2015 with the decision to invest significantly in internal aluminium scrap recycling activities to reduce the amount of primary metal input. In addition to supporting the circular economy, recycling scrap requires 95% less energy than producing primary material, so reducing Aludium's carbon footprint is a direct benefit of recycling. As of 2021, 70% of Aludium's metal requirements were supplied from its internal cast houses, placing Aludium clearly as a leader in the industry. In 2022, Aludium committed to investing even further in recycling via an expansion of its Alicante, Spain, location cathouse.

In addition to scrap recycling, Aludium has an entire company sustainability strategy aimed at advancing the low-carbon transition and supporting its people and communities. As part of this, Aludium announced its 2025 sustainability targets, including increasing renewable electricity consumption to 100% publicly, achieving benchmark safety performance, and promoting gender equality, among others. A copy of these targets is attached, and more information, including the annual sustainability report, can be found on the company website.

AlCircle: Please detail more on Aludium's new launch, 'Aludium Eco'. Why do you think it is a trendsetting product?

Sam Kinsman: Aludium Eco is a breakthrough product because it provides customers with two significant benefits. First, absolute clarity about the product's total carbon footprint, measured using ISO-14067-1:2018 & Greenhouse Gas Protocol Standards and certified by an independent third party. This clarity is valuable to customers in a market and regulatory environment with ever-increasing requirements to report carbon footprint. Second, Aludium Eco products have a certified total carbon footprint (''cradle-to-gate'') of less than 4 tons of C02 / t Al, among the lowest in the world, representing more than 50 per cent reduction in emissions per tonne Vs comparable materials on the market. Our goal is that this reduction in C02 and greater transparency support our customers to achieve their carbon reduction targets, reduce their exposure to carbon-related regulatory costs, and more easily communicate the benefits of the product to their customers & end-users in the AL supply chain.

AlCircle: Why is the L2 rolling mill in the Alicante plant termed the most innovative and sustainable?

Sam Kinsman: It is important to note that the greatest carbon footprint as a rolling business comes from the energy-intensive upstream activities in the material we buy (also called scope 3 emissions). This means that excellence in carbon footprint is strongly driven by the ability to produce rolled products with the lowest possible material loss. Investments in high-quality assets such as the L2 rolling mill in Alicante allow us to improve our material loss in production and overall productivity, which translates to lower carbon-intensive products.

AlCircle: What are your plans for 2023 concerning investment in innovation and technology advancement for more efficient production?

Sam Kinsman: In 2023, Aludium will inaugurate the newly expanded scrap recycling operations in its Alicante plant with a capacity of approximately 3x Vs current levels and the capability to recycle a more comprehensive range of scrap, including through closed-loop relationships with its customers. Under the ONE Aludium Program, all sites are working to improve plant energy efficiency and rolling productivity to lower emissions. We are also exploring plans for on-site solar PV to supply clean electricity for self-consumption.

AlCircle: What are your thoughts regarding Aludium's performance in the last five years? What has been the impact on industry and society?

Sam Kinsman: Aludium has been a stable partner to its customers, a stable employer, and a positive member of its local communities. We are proud of these relationships and will continue to invest in safety at work, product quality and service, and sustainability leadership.

Professor Michael (Mike) Clinch

Senior Consultant & Materials Group Leader at Innoval

INNOVAL

“At Innoval, we believe innovation is a key in positioning aluminium as the material of choice in the circular economy.”

Professor Michael (Mike) Clinch is a Senior Consultant & Materials Group Leader at Innoval. He attained a PhD in Materials Engineering and Materials Design at the University of Nottingham after receiving an Industrial Fellowship from the Royal Commission for the Exhibition of 1851. In addition to his background in applied materials research, product development and process engineering, Mike has extensive experience in strategic planning, technology road mapping and innovation management from his time in senior leadership positions in business units in the US and Europe.

Mike is also a Visiting Professor of Materials Innovation and Sustainability at Loughborough University and is a passionate advocate of collaboration and partnerships to drive the development and commercialisation of new technologies. He holds advisory board positions at several universities in the UK and US and is a Vice-President of the Institute of Materials, Minerals and Mining (IOM3), where he is Chair of their Technology Communities Board.

AlCircle: To meet the worldwide increasing demand for sustainable aluminium solutions, what innovative solutions would you suggest?

Prof. Mike Clinch: Sustainable aluminium technologies are becoming increasingly important. Consumers from the end-use sectors are demanding products with a lower carbon footprint, which will help them reach their own sustainability targets. There is not one solution that we can recommend because every case is different. Instead, we work alongside our clients to help them examine their product design, material choice, method of manufacture, and their supply chain. Usually, there are many ways in which the carbon footprint of a product can be reduced. However, one clear trend we are seeing is the desire to increase the recycled content of alloys across multiple sectors. This requires careful sourcing of scrap materials and controlled manufacturing processes to achieve the desired quality and performance attributes.

Projects like this would usually be supported by a Life Cycle Assessment (LCA). This is a methodology to assess the environmental impact of a product or service by the compilation and evaluation of inputs, processes and outputs of a product system. The product system will typically include the sourcing and production of primary material and further processing of the product. It can also include transport, waste streams, and consumed end-use products.

Like most studies, the validity of the final result depends on the quality of the inputs. Therefore, when conducting an LCA, it's important to make sure you capture all the relevant processes. For a product which incorporates aluminium, this is where Innoval excels. Our specialist aluminium industry knowledge, combined with the latest Life Cycle Assessment software (GaBi), means we're perfectly placed to offer reliable and independent Life Cycle Assessments to the aluminium industry.

AlCircle: What innovative and trendsetting solution have you worked on to help the aluminium industry grow sustainably?

Prof. Mike Clinch: At Innoval, we believe innovation is a key in positioning aluminium as the material of choice in the circular economy. We're involved in many collaborative R&D programmes, many of which focus on technologies to reduce environmental impact.

Currently, there is a lot of development work focused on the design of aluminium battery enclosures for electric vehicles. One such project concluded recently is Aluminium for Ultra Low Emission Vehicles (Al-ULEV) this Innovate UK-funded project is one of the many collaborative research projects we've worked on over the last 19 years. The Al-ULEV project, which focused on the development of prototype battery enclosures and vehicle integration systems, uses predominantly extruded components. The advances from this project will help OEMs to achieve their vehicle and battery weight reduction and performance targets. Furthermore, they will allow the manufacture of lighter, safer vehicles with zero emissions at a lower cost. The Al-ULEV project consortium consisted of Constellium (Lead Partner), Gordon Murray Design, Brunel University (BCAST) and Innoval.

Innoval has long advocated for sustainability initiatives through our work on technology development for closed loop recycling in automotive, automotive lightweighting, and enhanced battery box design,

to name just a few. There are also considerable opportunities within the packaging and construction sectors. We are also proud to be part of Danieli Group which is committed to working in line with the provisions of the Paris Climate Agreement. Danieli continues to participate in the “Corporate Social Responsibility” qualification procedure on the Ecovadis platform.

AlCircle: Could you please share one of your most successful and trendsetting case studies related to aluminium rolling processes?

Prof. Mike Clinch: We’re not able to share information on individual projects without prior approval from our clients. However, there are many case studies available to read on our website (www.innovaltec.com).

What I can say is that our rolling and finishing expertise often brings a new perspective to our clients’ operations. If clients want to improve their rolling or finishing operations, there are many ways in which we can help them. For example, if they have a problem with mill vibration, we can help solve it and improve the flatness and gauge variation of sheet products. Our innovative process models can design spray cooling systems for optimum performance, and they can reduce the time and energy consumption of heating cycles.

Our Aluminium Rolling Technology Course is the only rolling course specifically for aluminium. It covers all the key aspects of hot and cold rolling of aluminium flat products. We’re especially excited about the next course in December as it will be the first in-person rolling course we’ve held since 2019! We will have engineers from twelve different rolling companies coming to Banbury, UK, for this course.

AlCircle: What innovative technology have you recently invented to support aluminium rolling in the automotive sector?

Prof. Mike Clinch: Surface cleanliness is critical to the performance of many aluminium products. This is especially true for automotive sheet where surface cleanliness influences the effectiveness of the pre-treatment and ultimately the adhesion of the final coating, be it adhesive or paint. Therefore, it's vitally important for a sheet supplier to be able to measure how clean their sheet surface is after it comes off the continuous cleaning and pretreatment line.

Dr Junjie Wang, Innoval's Technical Manager for Surface Science, does a lot of work with our clients who supply automotive sheet. Some of his work involves evaluating the effectiveness of cleaning and pre-treatment systems and recommending changes to processing parameters to produce the best surface at the fastest line speed. As part of his work, Junjie developed a new way to measure the surface cleanliness of aluminium sheet in a production environment.

The key purpose of cleaning is to remove an active disturbed layer from the aluminium sheet surfaces. The disturbed layer is present in all rolled aluminium sheet. The technique Junjie uses exploits the optical characteristics of this layer. The disturbed layer reduces the reflectivity of the sheet surface to visible light, particularly in the short wavelength range. As the surface is cleaned and the disturbed layer removed, the reflectivity (measured as total reflectance, TR) increases. Junjie's method is relatively cheap to set-up, requires little training and produces readings in a matter of seconds. We'd be happy to describe it in more detail to anyone who's interested.

AlCircle: What innovative technology have you recently invented to support light weighting in the automotive sector?

Prof. Mike Clinch: Following the successful conclusion of the Al-ULEV project mentioned earlier, we are now working on another collaborative project that will design, develop, assemble and extensively test aluminium intensive prototype battery enclosures and full-scale demonstrator enclosures for OEM produced electric vehicles, forming an integrated pathway to UK battery pack manufacture by providing the light weight enclosures aligned to current and future battery module technologies and power densities.

The project aims to take another major step with disruptive high strength aluminium alloys and their processing and joining technologies, enabling new enclosure design concepts for the manufacture of both vehicle integration structures and battery enclosures for a new generation of lightweight hybrid and electric vehicles for the UK market that will have a major impact on the UK government's carbon reduction targets for the UK vehicle fleet. The project will establish a UK based manufacturing facility for world leading cost-efficient structural aluminium battery enclosures providing an onshore resource for BEV and PHEV component manufacture, with the manufacturing concept capable of providing efficient transportation of parts for export assembly.

AlCircle: Could you please share your future investment plan to innovate new solutions and technology?

Prof. Mike Clinch: Innoval continuously seeks to improve its technical capabilities and service offerings. In addition to some of the techniques used to improve product sustainability, we are continuing to develop our modelling and simulation capabilities to provide more

efficient tools for materials process optimisation in the era of digital manufacturing. These tools and techniques are supported by our on-site materials testing, microstructural analysis and surface characterization facilities in addition to us having preferential access to state-of-the-art equipment within our strategic partner organisations.

Jeremy Keller

SVP of Business Development
at Rondo Energy

“Industries like alumina are challenging to decarbonize because alumina refineries require huge quantities of heat 24/7, often at high temperatures.”

Jeremy brings to Rondo Energy a high level of expertise in taking energy projects from ideation through deployment, including evaluation of facility energy data, financial modelling and technical scope development. Before joining Rondo, Jeremy spent ten years with the leading renewable energy and energy efficiency company Ameresco, where he developed and delivered hundreds of projects for commercial and industrial businesses. He is a licensed mechanical engineer in the State of Washington with expertise in the design and technical applications of energy storage, solar photovoltaics, microgrids,

renewable natural gas and HVAC systems. Jeremy earned an MBA from Oregon State University and bachelor's degrees in Mechanical Engineering and Physics from the University of Washington.

AlCircle: Please share the innovative journey of Rondo Heat Battery (RHB). How is it providing the world's lowest-cost, zero-carbon industrial heat?

Jeremy Keller: Rondo Energy provides zero-carbon, low-cost industrial heat to heavy industries like alumina, mining, minerals, chemicals, and food and beverage production. It does this by capturing low-cost renewable electricity in the Rondo Heat Battery (RHB), which provides on-demand delivery of high-temperature heat in the form of hot air, steam or hot water. Rondo helps customers lower operating costs while continuously powering operations with zero-carbon energy.

We use common materials and methods that have been proven for industrial use for centuries – that's the point. For example, the steel industry uses a 200-year-old technology called brick blast stoves for heat storage -- Rondo is leveraging a similar material for our bricks. These blast stoves are typically heated to about 1400 degrees Celsius, then cooled back down on about a one-hour cycle. They can last for 50+ years.

We combined this proven brick material with electric resistive heaters powered by intermittent renewable sources to deliver heat to customers at 98% efficiency. The RHB is built with materials that are intrinsically proven and bankable so that we can scale rapidly. This technology is possible today because of super computational fluid dynamics, finite element analysis and AI system controls.

AlCircle: What will be the impact following the commercial availability of the revolutionary Rondo Heat Battery (RHB), the RHB100 and the RHB300 to the heavy industries? Which specific industry is it targeting?

Jeremy Keller: A staggering 74% of industrial greenhouse gas

emissions are tied to heat – with energy-intensive processes requiring temperatures up to thousands of degrees. Stepping back and looking at a global scale, these processes account for ~23% of global carbon-dioxide emissions.

Industries like alumina are challenging to decarbonize because alumina refineries require huge quantities of heat 24/7, often at high temperatures. Decarbonizing industrial heat will require 5x more renewables than are currently deployed in the world today, with ~9000GW of new renewables needed.

Our mission is to substantially lower global CO2 emissions by unlocking decarbonization for sectors that use industrial heat or steam, like alumina, cement, steel, mining/minerals, food & beverage, district heating, chemicals, low-carbon fuels etc. We see a pathway for reducing global emissions by up to 15% in the next 15 years -- within these sectors alone.

Rondo Heat Batteries charge and discharge simultaneously and are dynamically insulated to minimize environmental losses. The bricks create an echo chamber to superheat air that passes through them. That air is sent to the customer or used in a standard boiler package to generate steam before being cycled around the system in a layer of insulation and pre-warmed by any heat that leaks through. This whole process then begins again. This dynamic insulation maximizes our efficiency, with round-trip electricity in-to-heat-out efficiency sitting at around 98%. Our typical use case involves taking an intermittent daily electrical generation, such as a solar PV array or wind farm, and dispatching it evenly over a rolling 24-hour period. This is particularly valuable for industrial heat applications looking to decarbonize their heat loads while maintaining consistent process conditions.

AlCircle: How can Rondo Heat Batteries be a game changer to the aluminium industry?

Jeremy Keller: The Rondo Heat Battery can deliver steam and hot air at the same pressure and temperature required by existing processes, delivering a pathway for 100 per cent decarbonization of alumina processing with significantly lower operating costs. It also requires less grid updates than electric boilers and limited capital costs, all while at the scale needed for the alumina industry.

AlCircle: How is Rondo Heat Battery supporting the ESG and net-zero missions?

Jeremy Keller: By leveraging already proven wind and solar, its method of generating fossil fuel-free heat is more scalable than many emerging carbon reduction technologies. Rondo's customer facilities are showing 50 per cent to 90 per cent reductions in emissions and reductions in operating costs of 30 per cent or more.

A single RHB300 eliminates more than 40,000 tonnes of CO2 per year-- more than is eliminated by 8,700 electric vehicles. Replacing just the industrial heat used today in California with RHB zero-carbon heat would eliminate five times more CO2 than all of the EVs on the road in the US today (13.6M EVs).

AlCircle: Could you detail more about Rondo's patented "brick toaster"?

Jeremy Keller: As discussed above, the Rondo Heat Battery (RHB) captures intermittent wind and solar electricity and then stores the energy from that electricity as high-temperature heat in brick materials. Its patented "brick toaster" rapidly and uniformly heats these brick materials to deliver continuous, constant temperature heat 24 hours a day.

We designed our systems using low-cost, least-risk components built to last more than 30 years. The battery uses heat storage, and transfer processes that rely on materials the metals, ceramics, and chemical industries have used for a century.

Marghanita Johnson

CEO at Australian Aluminium Council

Innovations in Australia's aluminium industry

Although the Australian aluminium industry has been operating in Australia since 1955 and now includes bauxite mining, alumina refining, aluminium smelting and downstream processing industries, it continues to innovate to meet the needs of consumers today and into the future.

Australia is leading global research in innovative alumina refining technologies

With a global focus on net zero by 2050, there is a lot of attention on decarbonising the aluminium smelting sector. Still, here in Australia, the emissions associated with bauxite mining and alumina refining are not being forgotten. Alcoa, Rio Tinto and South32's Worsley

Alumina operations have their global research headquarters in Australia, innovating to develop new alumina refinery technologies for the world.

Australia's alumina refineries are working collaboratively with the Australian Renewable Energy Agency (ARENA) on innovative processes that could enable refineries that currently use fossil fuels to use renewable electricity or hydrogen instead. For example, Alcoa is currently trialling a new way of generating steam required to refine bauxite (aluminium ore) into alumina. Known as Mechanical Vapour Recompression (MVR), this process uses renewable energy to recycle waste steam that would otherwise be exhausted into the atmosphere. 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 per cent and can significantly reduce water use in the refining process by capturing water vapour that would otherwise be lost to the atmosphere.

Alcoa is also undertaking a project in conjunction with ARENA and the West Australian Government to test electric pressure calcination. This process can produce pure, uncontaminated steam exhaust, which can be captured and reused, reducing demand for steam from natural gas boilers - potentially reducing Australian alumina refining emissions by 40% when powered by 100% renewable electricity. The project also aims to improve understanding of load flexibility and the provision of essential systems services to the electricity grid.

Rio Tinto, in partnership with ARENA, is conducting a feasibility study to investigate the technical implications of displacing natural gas with renewable hydrogen in the calcination process at its Yarwun refinery. If successful, the technical and commercial lessons from the hydrogen calcination technology could lead to its more comprehensive implementation in Australia and globally. The findings of these studies have potential innovative applications in other high-temperature manufacturing processes.

Existing industry is an enabling pathway for new economy industries

While alumina has been produced in Australia for more than fifty years and is largely supplied to the global aluminium smelting industry as metallurgical grade alumina, usually at purities of more than 99 per cent, there has been an emergence in demand for very high purity alumina (HPA). This trend is driven by increased global demand for a new world of technologies which need higher quality, purity and versatility.

HPA's properties, such as high brightness, corrosion resistance, good thermal conductivity, high melting point, chemical stability and high mechanical strength, make it suitable for manufacturing various electronic and vehicle components. It creates safer, more efficient and longer-lasting lithium-ion batteries, synthetic sapphire for LED lighting and high-technology optics.

There is a range of new Australian HPA projects in the pipeline. For example, Alpha HPA is constructing what will potentially be the world's largest HPA plant in Gladstone, with targeted production of 10,000 tonnes per annum. The Alpha HPA process will use a precursor from nearby alumina refineries in its ground-breaking "Smart SX" (solvent extraction) low emissions refining technology. Alpha HPA also collaborates with other neighbouring manufacturers so that by-products from its extraction process can be recycled, making the project an almost zero discharge facility. The solvent extraction technology, combined with renewable energy, aims to generate a range of HPA products with a carbon footprint up to 70% lower than traditional production methods.

Another key trend is circular economy and recycling. While there is a focus on recycling aluminium itself, Australian companies are pioneering new technologies to transform aluminium smelter bath into aluminium fluoride. ALCORE Limited proposes building a $16.4M aluminium smelter bath recycling plant in Bell Bay, Tasmania. The plant is proposed to transform 1,600 tonnes of bath per year into

aluminium fluoride, an essential chemical for aluminium smelting, for which Australia currently imports 100% of its requirements. The potential to establish domestic aluminium fluoride production will help increase Australia's manufacturing resilience and capability and be an excellent illustration of the circular economy.

Raymond Onovwigun

Founder & CEO at ROMCO Group

Carbon Taxes, And The Cold Front About to Hit The Aluminium Value Chain

Expanding the market share of secondary aluminium is in the best interests of the globe's green transition: governmental policies taxing high-carbon products, the legally binding Paris Climate Agreement, and the UN's Sustainable Development frameworks all tie countries to decreasing their carbon footprints.

"Greening" up the aluminium industry is a key starting point - in 2021, on average, for every tonne of primary aluminium produced, 18 tons of CO2 was emitted, totalling 1.775bn tons for the year. To put this into monetary terms, when fully implemented in 2026, the EU's Carbon Border Adjustment Mechanism will tax importers €75 per mt of CO2 (the product's embedded carbon emissions). With regards to

aluminium, this equates to 1,350€ per ton of primary, whether imported or produced in the EU. The value of this tax is projected to increase to €100 per mt of CO2 by 2030.

This will have an enormous impact on the aluminium value chain worldwide by even the mildest of measures.

In comparison, secondary aluminium, like Romco's market-leading product, emits, on average, 95 per cent less CO2 per tonne - again, a potential 95 per cent reduction in taxes. That's up to 20 times less carbon and potential tax burden on the product.

As additional taxes and regulations on carbon content inevitably intensify globally, innovation in the aluminium value chain will become more important than ever to maintain consistent and fair-priced goods. Supply and price volatility are already at peak levels due to the pandemic, conflict in Europe, and record energy prices. Questions are already being asked about the future reliability of supply and the effects of cost increases.

Sustainable low-carbon production, free of these burdens, is potentially the most important innovation for the entire value chain.

As market sentiment and laws change, low-carbon resources will be prioritised. That's what Romco has invested in; Producing low-carbon aluminium for the growing demand for materials as supplies elsewhere are limited.

In line with this thinking, the next innovation Romco is also researching is zero-carbon aluminium production — Not 'net-zero', as some in the market would tout as an effective climate mitigator — No. Completely carbon-free production of one of the most energy-intensive materials on the planet, all while removing landfill and not extracting bauxite.

Annanya Agarwal

Co-founder of Runaya

“Runaya has developed an innovative patented solution where aluminium is recovered from this dross and sent back to Vedanta for further processing for making aluminium value-added products such as briquettes or steel slag conditioner.”

AlCircle: Using technology, how is Runaya creating sustainable solutions to set industry trends?

Annanya Agarwal: Runaya Manufacturing Technologies is into

manufacturing premium products through highly innovative processes and advanced technologies. The current installed capacity is 1 million kilometres. We have also deployed licensed patented technologies to transform industrial waste, such as dross (waste generated during aluminium production), into value-added products for other industries. This, in turn, prevents a significant amount of industrial waste from going into landfills, thereby eliminating the adverse impact it could have on communities, ecology, and climate. One such technology of ours removes the usage of elements such as gas, water, salt, or heat to recover aluminium from the dross, thereby making it one of the most environmentally friendly technologies in the world, in partnership with TAHA International-dross management.

AlCircle: Could you detail more about your 'waste-to-wealth' and 'circular economy' projects?

Annanya Agarwal: Runaya Group is committed to the conversion of waste to recyclable products, thereby causing not only sustainability but also wealth. Runaya Refining is based on a circular economy model for the aluminium sector. Operations footprints are currently located at Jharsuguda and BALCO. Vedanta is one of India's highest aluminium producers yearly and generates roughly 40,000 tonnes of dross. So, this aluminium dross, which is produced in the aluminium-making process, at all primary cast houses is extremely hazardous in nature. It was being dumped into secure landfills earlier, which is not environmentally friendly. Runaya has developed an innovative patented solution where aluminium is recovered from this dross and sent back to Vedanta for further processing for making aluminium value-added products such as briquettes or steel slag conditioner. Runaya is also focused on the triple bottom line (TBL) strategy to ensure the inclusion of social, environmental and financial results as bottom lines for us as well as our partners. By 2025, waste to wealth will be as prominent as the 2% of PAT rule.

AlCircle: What is Runaya's contribution to low-carbon aluminium production?

Annanya Agarwal: Since our operations began in 2018, we have converted approximately 2500 tonnes of Industrial waste into metal and value-added products. The company increased its operational capacity to 40000 tonnes (16x) in three years (including COVID times). Therefore, we can prevent over 40000 tonnes of industrial waste from going into landfills yearly. The global dross industry is one mil tonnes a year, and Runaya aspires to make an impact of three hundred million tonnes by 2025. Runaya's entire process of Aluminium recovery and briquette manufacturing produces absolutely zero waste and has been approved by Central Pollution Control Board and aligns with the government's Standard Operating Procedures for disposing of Aluminium dross through a zero-waste process through our technologies.

AlCircle: Runaya is developing an 'Innovation Centre' in the resources sector at Jharsuguda in Odisha. What is the purpose of this initiative? Please give us more details.

Annanya Agarwal: Runaya Group is aligned with India's self-reliant mission for sustainable growth. There is a need for the development of a model that leads to the optimum utilisation of resources. With a growing population, rapid urbanisation, climate change, and environmental pollution, India must move towards a circular economy. The goal of our 'Jharsuguda Innovation Centre' is 3-fold- The first objective is to identify the most significant global challenges the resources industry faces and then partner with institutions to develop solutions that would allow us to solve these issues. For example, we currently have an ongoing project with IIT Kharagpur to understand how we could recover High Purity Alumina from Aluminium Dross. The second objective is new product development. At our FRP plant in Silvassa, our Innovation Centre is focused on developing a best-in-class value-added product portfolio enabling us to provide our customers with an integrated solution rather than just selling them a

product. The third objective is to identify areas of efficiency improvement to reduce our business risk. For example, our Dross processing “Sarah Machines” came with a capacity to process 150MT of Dross per machine per month. Through Industry 4.0 initiatives and process streamlining done by our Innovation Centre, each machine can now process over 4000MT per month, leading to lower capital costs and increased efficiency.

Julio Quintero

Business Development Manager
at HORMESA, Hornos y Metales S.A.

“Our equipment has state-of-the-art technology, from high-efficiency melting systems to energy recuperators that we sometimes use to heat and clean scrap.”

AlCircle: Please share your innovations and trendsetting case studies on nonferrous foundry equipment, especially aluminium.

Julio Quintero: Our studies on the current economy and trends in the aluminium industry are directly focused on three aspects.

1. Increased aluminium recovery efficiencies reaching up to 98% melting efficiency with our current technologies

2. Management and treatment of scrap. We believe that good practices are the basis of good efficiency.
3. Energy recovery systems to make processes and companies more efficient. Our goal is to put our customer forefront of the future economy

AlCircle: What is the reason you think your turnkey projects are highly specialized? In your opinion, what was their USP?

Julio Quintero: Our approach to the market and our customers is totally disruptive. We do not focus ourselves just on selling equipment, our focus is directly on the process, and how to make it as efficient as possible; because of this, we have defined a structure of integration of experts where we recognize the value of each speciality, with this approach we can provide customized solutions according to each customer needs.

The way we do it:

1. We focus on the client's needs and customize the solution according to their actual needs. (We do not have standards, we do everything customized)
2. We know that no one can do everything alone, which is why we integrate different experts and companies, including some competitors, to provide our customers with the most efficient solutions on the market. It is not the equipment that makes a good solution; it is the people and their experience that manage to take the solutions to another level.
3. We understand that many times what the client wants and what they really need are different. Therefore, we work hand in hand with the client, making them our partners in each project; remember, our interest is not to sell equipment, it is to make our clients grow, and the only way to do it is to work side by side on each project. We are partners of our clients, not suppliers.

Our USP is simple: we are not suppliers, we are resources for our clients, and we have the same goals in each project, and our goal is to help them grow but walk the path of growth together.

AlCircle: How has Hormesa been able to break into the aluminium industry with its smelting furnaces? Is it equipped with state-of-the-art technology?

Julio Quintero: Our equipment has state-of-the-art technology, from high-efficiency melting systems to energy recuperators that we sometimes use to heat and clean scrap or even to heat up our clients' buildings. We take the fumes generated in the melting process and pass them through specific systems that allow us to clean them and play with the temperature according to the use that will be given to them)

However, our success is not in the technology but in our support and camaraderie with our customers/partners. We understand the process. This is why we can create the perfect solution.

AlCircle: Can you please share the details with us more about your 'Salt Slag Recycling Solution' projects?

Julio Quintero: First, we need to understand that our solutions are focused on not generating this type of by-product. This is why we have developed technologies that allow us to have the highest efficiencies in terms of aluminium recovery during the melting process.

However, the generation of "Salt Slag" is a reality, and that is why our salt slag recovery process aims to give the companies we are working with that generate between 5,000 and 10,000 Salt Slag a year, to have their recycling system, granting them two things, first, aluminium recoveries between 3 to 5 per cent on the Salt Slag and second, a complete separation of the salt which can be reused in their process, for this we have focused on high-quality technologies that, in addition to being influenced by the circular economy, seeks to contribute to this industry ecologically, avoiding the poor disposal of these products, increasing the aluminium recoveries and last but not least, avoiding the use of land fields or third parties for recycling, with this, we are contributing not just to the industry but to the sustainability of the planet.

AlCircle: What are the new technologies Hormesa is planning to implement in its future endeavours?

Julio Quintero: We are working on several different approaches to making recycling processes more efficient. Now we are very focused on energy recovery systems, high-efficiency melting systems and systems that add value to finished products, such as ultrasonic de-gassers, close loop systems that allow the use of every product and by-product that is generated in the metal transformation processes, the idea is to enter the next economic era with a totally sustainable and green proposal that helps future generations to keep the planet alive without losing sight of production efficiency

Dr Mark Cooksey

Managing Director and CEO
at ABx Group

“Deployment of the Alcore technology will consume excess bath, and reduce the need for fluorspar as a feedstock for aluminium fluoride production.”

As the Managing Director and CEO of the organization, Dr Mark Cooksey joined in early 2020. He previously held process improvement and process development leadership positions with Rio Tinto, GE and CSIRO, Australia’s national science agency. Dr Cooksey has focused on process innovation throughout his 25-year career. He has extensive experience developing and commercializing new mineral industry processes, particularly in the aluminium value chain.

AlCircle: Could you share Alcore's innovative journey of building the fluorine recovery reactor? What inspired the creation of this cutting-edge technology?

Dr Mark Cooksey: The inspiration came from recognising that fluorine is the most expensive component of aluminium fluoride, fluorine is typically high-cost in Australia because it has no domestic production of fluorspar, and that excess aluminium smelter bath is possibly a viable source of fluorine.

The next steps we took were to develop a conceivable process route for recovering fluorine from the bath and constructing facilities where the process could be safely developed. We have demonstrated the technique at a laboratory scale and are currently finalising the design of our pilot-scale reactor

AlCircle: With this technology's successful development and deployment, how will it support the aluminium industry? Which raw materials for aluminium production will profoundly impact following the commercial deployment of this reactor?

Dr Mark Cooksey: This technology addresses two challenges facing the aluminium industry. Firstly, the fluorspar cost is increasing, suggesting that aluminium fluoride prices may increase over the long term. Secondly, smelters are finding it increasingly challenging to sell excess bath because the number of new smelters under construction needs to be increased to consume the entire excess bath produced by existing smelters. Deployment of the Alcore technology will consume excess bath and reduce the need for fluorspar as a feedstock for aluminium fluoride production. This further strategic advantage in Australia, where Alcore will provide the first domestic production of aluminium fluoride.

AlCircle: Please detail more on the collaboration between Alcore and BFluor Chemicals.

Dr Mark Cooksey: BFluor Chemicals is an originally South African consulting service and fluorochemical equipment manufacturing company, with extensive experience in technology implementation across the entire global fluorochemical value chain, from process conceptualisation to full-scale plant commissioning. They are an ideal partner for Alcore because they are accustomed to partnering for process development and have a combination of practical and theoretical understanding of fluorine processes. Alcore and BFluor engineers collaborate to design the pilot scale reactor to recover fluorine from the excess bath.

AlCircle: What is the update on ABx Group's Tasmanian rare earth project?

Dr Mark Cooksey: ABx Group made the first discoveries of ionic adsorption clay-hosted rare earth element (IAC REE) mineralisation in Tasmania. ABx has identified four REE discoveries distributed over 52km of northern Tasmania and is currently developing its maiden resource estimate at its Deep Leads discovery.

The composition of the target mineralisation is relatively rich in the four main permanent magnet REE, namely Nd, Pr, Tb and Dy, and very low in radioactive elements U and Th. Typical mineralisation grades are 500 to 2,000ppm TREO-CeO2 (total rare earth oxides minus cerium oxide).

IAC REE can achieve high extraction rates at low cost and are the most sought-after deposit. ABx Group has confirmed that Deep Leads possesses these true IAC REE and has achieved extraction rates of 50% to 75% of contained REE using the same low-cost leach processing techniques used in Chinese IAC REE projects.

ABx is continuing its drilling campaigns to expand resources in the mineralised corridors.

AlCircle: How are the ABx Group's bauxite projects progressing?

Dr Mark Cooksey: In Queensland, ABx has lodged a Mining Lease Application and plans to export products in Q3, 2023. The Sunrise Bauxite Project has a JORC-compliant resource of 37 million tonnes. Our joint venture partner, Alumin, is an Australian special-purpose vehicle company associated with our strategic marketing partner, Rawmin India, with extensive experience in funding long-term sustainable investments in projects involving mining and bulk-shipping metallurgical grade bauxite to end users around the world.

In Tasmania, ABx selected DL130, west of Launceston, as the preferred location for the next bauxite mining operation. ABx plans to recommence bauxite mining in Tasmania in Q3 2023. The primary products are likely to be cement-grade and fertiliser-grade bauxite.

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