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PRESENTS

Aluminium

LeaderSpeak 2023

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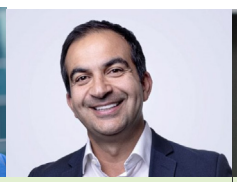
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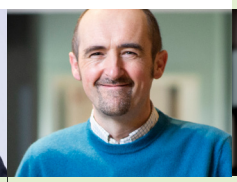
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GLOBAL ALUMINIUM INDUSTRY

OUTLOOK 2023

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Editorial

Dear Readers,

The soaring energy costs due to crippled supply, the geopolitical crisis between Ukraine and Russia, the intermittent COVID outbreak in China, high inflation, and the continuing threat of recession made the global aluminium industry juggled through several challenges in 2022. But now that we are in 2023, the industry looks forward to optimistic changes. Needless to say, decarbonising aluminium will be the industry's top-most priority and is expected to be a game-changer across the value chain.

With many corporates and countries increasing investments in renewable energy and sustainable technologies to achieve net-zero emissions, the mid to long-term outlook of the aluminium industry looms brighter. Countries across the world have renewed their carbon neutral targets as they race towards achieving their respective zero emission goals.

To throw in-depth insights into such strategic investments and potential growth from them, we bring the fifth edition of our flagship e-Magazine “LeaderSpeak 2023”. This annual e-Magazine is a platform offered to leaders from the entire aluminium value chain where they can share their views and opinions on current affairs and developments and project outlook to the industry.

This year, we have with us the companies and associations like REEL, Hwapeng Machinery, Linde, MQP, Emirates Global Aluminium, Bathco Group, Federal Metal Company, Alupro, European Aluminium, Australian Aluminium Council, Dynamic Concept and many more. They have unanimously spoken about sustainability, highlighting their strategies around it. Some have contributed articles, while some have taken part in interviews.

A key takeaway of every conversation is net-zero emission, circular economy, and digitisation are the three main poles for the future aluminium industry. To know more, please continue reading the e-Magazine: “LeaderSpeak 2023”.

Best Wishes and Happy Reading!

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Patrik Ernst,
Director Aluminium Division at REEL International

"So far, the aluminium industry has been resilient to the current geopolitical challenges and threats of high inflation."

AlCircle: Do you think the current economic slowdown in Europe will lead to weaker investments in technology and equipment by aluminium companies?

Patrik Ernst: So far, the aluminium industry has been resilient to the current geopolitical challenges and threats of high

inflation in various countries. We still see several medium and large sizes projects on the horizon, mainly linked to nearshoring strategies.

AlCircle: Will you develop any new solution for the aluminium industry this year to boost productivity at a lower cost, given the current inflation scenario?

Patrik Ernst: At REEL, we continuously strive for lower cost and higher productivity by adapting the organization to an ever changing market environment and by implementing lean tools and processes in the various departments of the organization. Further we have improved our equipment and process plants by implementing industry 4.0 methods such as our new IOT platform which allows our customers to reach higher productivity rates and to better maintain the REEL equipment.

AlCircle: Is your company planning to introduce equipment with zero carbon emissions and contribute to the aluminium industry's sustainability goals?

Patrik Ernst: REEL offers unique carbon emission control solutions, such as our state-of-the-art Gas Treatment Centers and Fume Treatment Centers. However a lower carbon footprint is essential for the aluminium industry, and REEL, therefore, is constantly improving the carbon footprint by offering solutions which have a lower energy consumption and further reduce carbon footprint during the execution of a project, looking at all steps of the project. In addition, we invest with our partners into the next generation of aluminium production facilities with a zero carbon footprint.

AlCircle: How do the production cuts at aluminium smelters in Europe and North America impact your business performance?

Patrik Ernst: It is correct that some smelters had to reduce production due to higher energy cost. However, nearshoring, green aluminium, restart and expansion of smelters/potlines in other parts of the world will further increase our project activities. We therefore do not see the reduced smelting capacity in Europe and North America as a threat, but as an opportunity.

AlCircle: How do you think the global aluminium industry will respond to technology adoption in 2023?

Patrik Ernst: Acceptance of new products and technology is key for our customers and own employees to not fall behind other industries. We need to be aware that in our teams, there are different adopter groups. To maximise ROI and reduce resistance against new technologies, companies need to set up a technology adoption program which personalises and customises the roll out of new technologies.

TOGETHER
TOWARDS
PERFORMANCE

NOW IS THE TIME TO ACT

REEL is on a journey contributing towards a net-zero Aluminium Industry.

ALESA NIKMI NOELL MÖLLER

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

Abdulnasser Bin Kalban,
CEO of Emirates Global Aluminium (EGA)

“The immediate outlook for aluminium remains under some pressure due to its close correlation to the health of the global economy.”

Abdulnasser Ibrahim Saif Bin Kalban is the Chief Executive Officer of Emirates Global Aluminium (EGA). Before becoming CEO in 2020, Mr Bin Kalban had served as an Alternate Board Member of EGA since May 2017. He is a member of EGA’s Technical and Project Committee and its Finance and Commercial Committee. However, he also sits on the Board

of Guinea Alumina Corporation (GAC), EGA's bauxite mining subsidiary.

AlCircle: Could you please briefly tell us about EGA's performance and growth in 2022?

Abdulnasser Bin Kalban: Last year was another extraordinary one for our industry. At EGA, we delivered our best-ever financial results by focusing throughout the year on what we control - the safety of our people, operational excellence, our costs, and our commercial relationships with our long-term global customers.

We achieved production records at every step of our value chain.

Cast metal sales were up seven per cent to 2.72 million tonnes. Some 78% of our sales were value-added products or 'premium aluminium'.

Hot metal production was recorded at 2.65 million tonnes. During the year, we surpassed 40 million tonnes of hot metal produced since

the start-up of Jebel Ali in 1979.

Alumina production at the Al Taweelah alumina refinery was a record 2.43 million tonnes and met 47% of our total alumina needs.

Bauxite exports from Guinea were up 16% to a record 14 million wet metric tonnes.

AlCircle: What is your outlook for the aluminium industry in 2023 and the future in general?

Abdulnasser Bin Kalban: First of all, our performance last year demonstrated our resilience throughout the economic cycle. I am confident that EGA will continue to deliver another competitive performance in 2023 compared to peers in the sector.

The immediate outlook for aluminium remains under some pressure due to its close correlation to the health of the global economy. More broadly, the prospects for EGA and our sector are very strong due to aluminium's role in decarbonisation economy-wide. EGA will capitalise on this significant opportunity.

AlCircle: In addition to the planned recycling facility and the bauxite residue pilot plant announced last year, what other initiatives has EGA undertaken to promote the circular economy in the UAE?

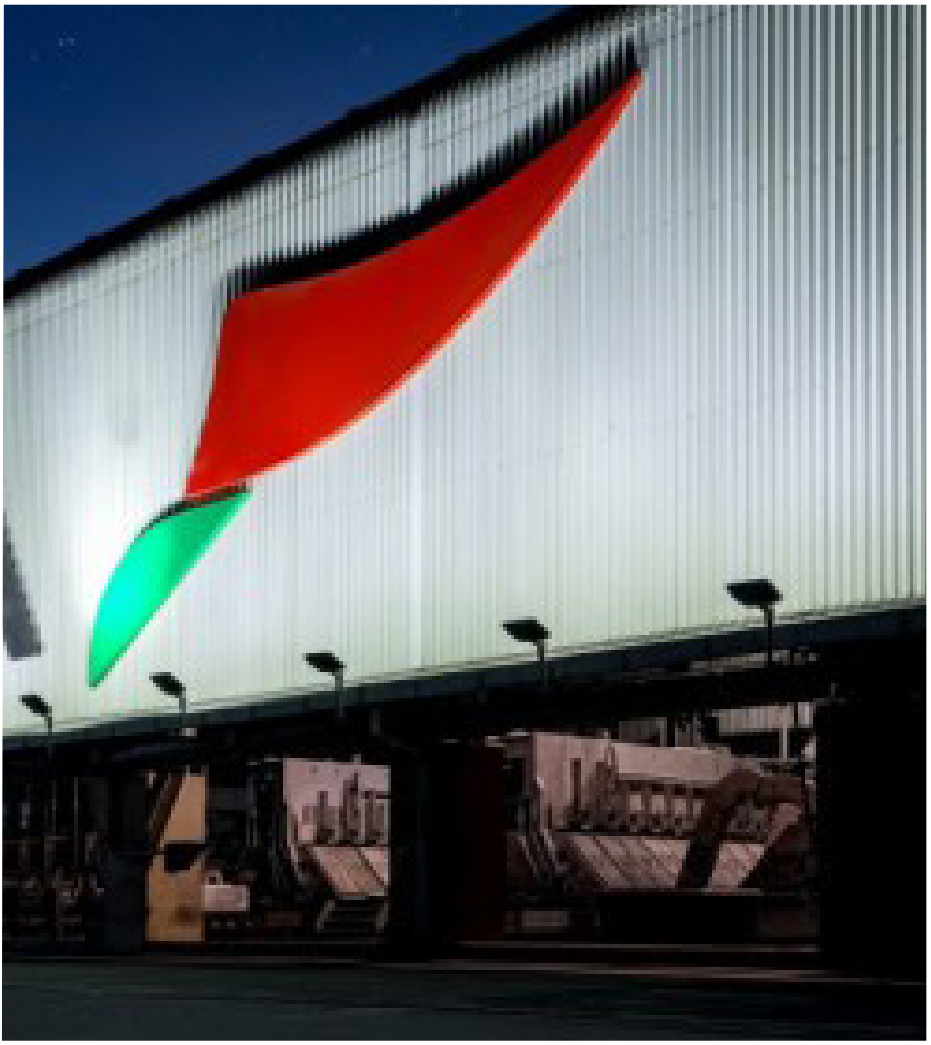
Abdulnasser Bin Kalban: Aluminium's infinite recyclability is a key reason our material is essential to the development of a more sustainable society. Secondary metal is clearly a growth area for our industry and for EGA. Last year we announced our plan to build the UAE's largest aluminium recycling facility. We have made good progress with feasibility studies and should have more to say about this soon.

We are also working with partners in waste management, can-making and beverage production to promote a culture of aluminium recycling in the UAE. Segregating waste is quite advanced in the UAE, but there is still room for consumers to play their part more effectively. Too much aluminium is thrown away and then needs to be found for recycling within the waste management system.

There are also circular economy opportunities in the management of our waste. In 2022, EGA supplied 203,000 tonnes of waste as feedstock to other industries, doubling our volume from 2021 as industries recovered from COVID-19. We have been collaborating with

UAE industries for over a decade to find productive uses for by-products from aluminium production, such as spent pot lining.

I am also excited about our work on bauxite residue. Our goal is to find productive uses for this material within the UAE. We have a dedicated team of scientists working on thisandhavedeveloped some breakthrough solutions. Just one of these is to reuse bauxite residue in soil products. The UAE imports a lot of soil, which is a non-renewable resource. Our game-changing process converts bauxite residue in its entirety in hours into an environmentally-benign, plant-friendly soil. We are working on upscaling this process now.



AlCircle: In 2021, EGA became the first company globally to produce aluminium commercially using solar energy, marketing it under the product name CelestiAL. What are the latest updates and developments on CelestiAL? What other initiatives did you take in 2022 to advance the industry's decarbonization?

Abdulnasser Bin Kalban: We produced 57 thousand tonnes of CelestiAL solar aluminium last year, an increase from nearly 39 thousand tonnes in 2021. BMW Group is our largest customer. During the year, we announced additional CelestiAL sales agreements with tier-1 suppliers of Mercedes-Benz and Nissan.

Demand for CelestiAL is high, and we could sell much more. We are working on a strategic initiative to divest our natural gas-fired power plants, and instead source the electricity we need from the grid, including an increasing proportion of clean energy. This was allowing us to vastly increase our production

of CelestiAL and is a major step in our decarbonisation trajectory.

We recognise that decarbonisation is our essential challenge, and as a major UAE company we are in full support of the UAE's Net Zero by 2050 Strategic Initiative. My role as CEO is to ensure that EGA is as successful for the next 40 years as it has been for the last four decades.

We have developed a road map to decarbonise by 2050, engaging both internal and external engineers, technologists and economists. We are also active members of the International Aluminium Institute, which has developed greenhouse gas reduction pathways for our industry as a whole, and we have endorsed the Mission Possible Partnerships roadmap for the aluminium sector.

Kamal Prakash,
Founder, AlCircle

Aluminium Industry - Key global challenges and opportunities

Globally, the aluminium industry is facing unprecedented challenges. Light metal demand is primarily driven by the development of transport, energy, electronics, building & construction, and other industries that require increased energy efficiency. There are, however, some issues that need to be taken seriously. These include the environment and climate change, population growth and urbanization, innovations and new products and technologies, to name a few.

In the years leading up to 2050, aluminium demand is anticipated to grow by more than 70%-75%, while overall sector emissions are expected to decrease by around 80%. Several aspects of this reduction can be achieved by decarbonizing the power sector, but additional breakthrough technologies are also required.

Climate:

While Industry needs to decarbonise, it is important that while calculating the 'Carbon Footprint', the complete life cycle is calculated of the metal or metal products that need to be considered, starting from bauxite mining, shipping, alumina production its transportation to the smelter and finally carbon footprint of all the inputs including and the energy used in the production of the primary metal and direct downstream product. As a result, various stakeholders in the value chain would be provided with a level playing field, and there would also be an opportunity and challenge to reduce carbon emissions.

The current system is heavily tilted towards a few primary producers with nature-gifted hydropower and geothermal energy and enjoy significant advantages over those dependent on hydrocarbon and fossil fuel.

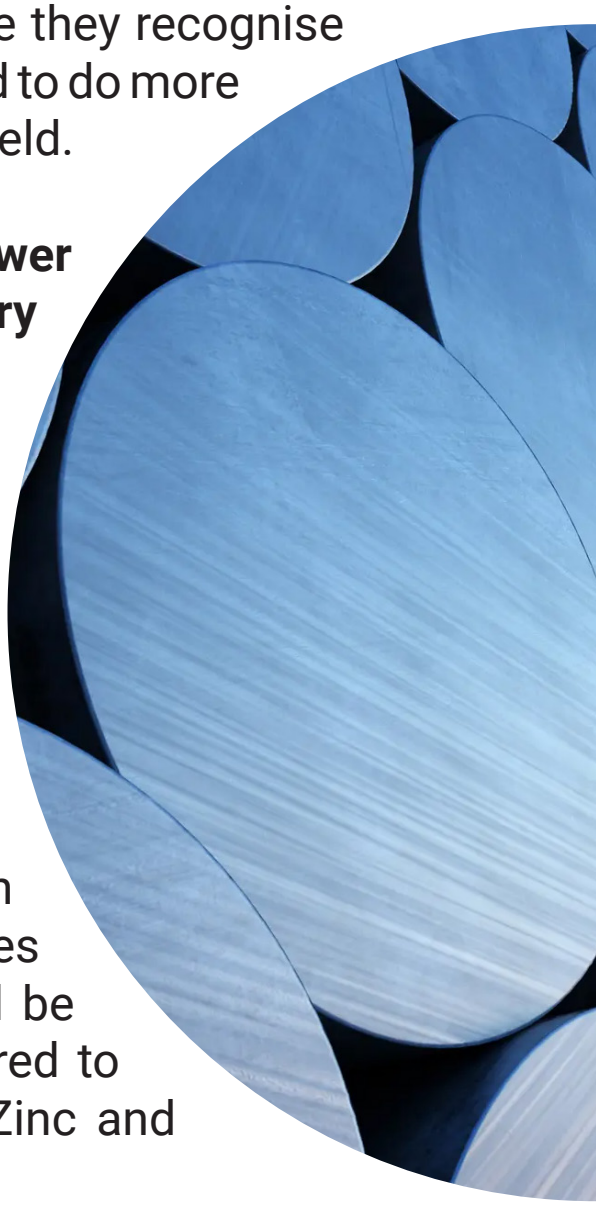
Even governments and industry have to rationally look if the countries with hydropower and geothermal energy can meet the growing demand for aluminium.

Branding of aluminium as a green metal:

Suppose one looks at the total life cycle of aluminium and its

ability to be recycled infinite times, its character light weight Helping Carbon footprint and energy reduction in its usage, its thermal and electrical properties, and its easy formability. In that case, it makes true sense to a 'Green' and infinite metal, and no other metal comes closer to it. Hence 'Green' tagging of all aluminium products is a must.

Industry, Advocacy Groups, Govts., while they recognise aluminium as a strategic metal, they need to do more to promote its usage in every possible field.



R&D in accelerated development of newer processes for the production of primary aluminium

The fact that Aluminium as a metal is the most abundant element in the earth's crust would not only increase its usage but would also fuel R&D in terms of the development of newer processes to produce Aluminium in the most cost-effective and environment-friendly (Carbonless) manner. Surprisingly, in two centuries, no alternative processes of primary aluminium production could be developed and commercialised compared to what could be done in Steel, Copper, Zinc and lead production.

With renewable energy becoming more and more affordable, though it has limitations of stable and continuous supply and storage, renewed research on the development of carbonless

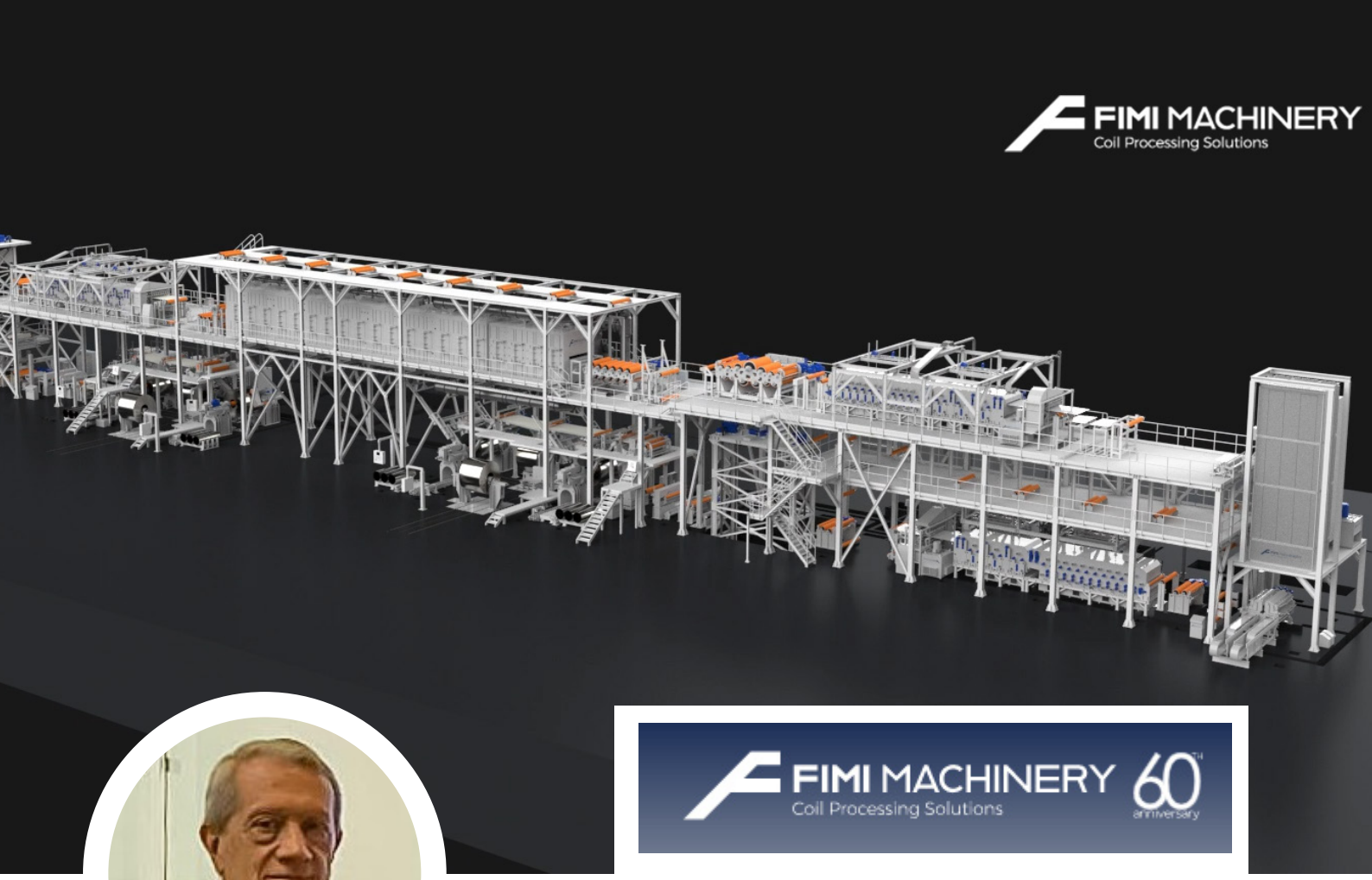
and energy-efficient chemical reduction, direct reduction through solar, and many more should be undertaken across the world besides what is being pursued now like inert anode.

Aluminium: Strategic metal for the global ecosystem

As the global aluminium ecosystem represents more than 1% of global GDP, now a trillion-dollar-plus economy with consistent growth, employing tens of million people across the world, supporting the globe in every possible way for climate sustainability, should get its due place in every country and ecosystem, which would then propel its usage, help in climate sustainability and global prosperity.

Final words

The need for zero-carbon technologies for aluminium production is a significant obstacle. The aluminium sector must therefore devise a strategy that balances the pressing need to cut emissions with the rising demand for aluminium. Collaboration and legislative incentives that permit the enormous investments required can make it possible. Our industry increasingly understands that changes need to be made, and there is a level of urgency. However, metal manufacturers begin at different positions, and the journey to zero is more difficult for some. Still, I believe the full life cycle of aluminium products vis-a-vis products made with other metals, aluminium stands out.



Antonio Perego,
Sales manager at FIMI Group

FIMIGroup is at the top for finishing and processing plants in the aluminium sector

Strong know-how, an experience of over sixty years and a tailored range of solutions designed to meet the most demanding requests.

This is FIMIGroup, not a simple manufacturer of metal processing equipment and plants, but a high value-added group of companies composed of 3 divisions, 8 sites, and

200 employees with more than 1.500 plants installed worldwide.

The core business is the design, construction and start-up of plants for the processing and treatment of coil-rolled metals in different types of material: aluminium, high carbon steel, stainless steel, copper and brass.

FIMI product is the result of a process through which the company and the customer are synergically involved, from the first planning phases to the complete development of the plant. The service that FIMI offers its customers starts in this phase and proceeds after the installation with assistance, training of customer's staff and a series of periodic checks to monitor the efficiency level of the systems. The so-called "digital servitization" that FIMIGroup offers its customers.

Particularly for the aluminium sector, FIMI Group produces:

- Tension levelling lines, provided with the Proflexroll® innovative system
- Degreasing and pre-treatment lines are distinguished by their ability to process even thin thicknesses with maximum eco-compatibility of processes
- Slitting lines (slitter) and trimming lines
- Cut to length lines

In recent years, aluminium has become increasingly important in the worldwide context.

In the automotive industry, aluminium components are growing in demand, for example, in the production of electric batteries

or other innovative applications; for this reason, we are producing increasingly high-performance and complete plants for processing this material.

Of particular interest is also the food business, where lines for the packaging material production are high demanded. This is an extensive market, considering the increasing consumption in countries such as China and India. To operate in the food industry, many customers request aluminium cutting lines with the addition of coil degreasing and cleaning treatments. In other sectors, integration with a painting station is also required, and the plants designed by FIMIGroup can meet these needs.

A clear example is the line produced for ALUFLEXPACK NOVI D.O.O., a world leader company in aluminium foil products.

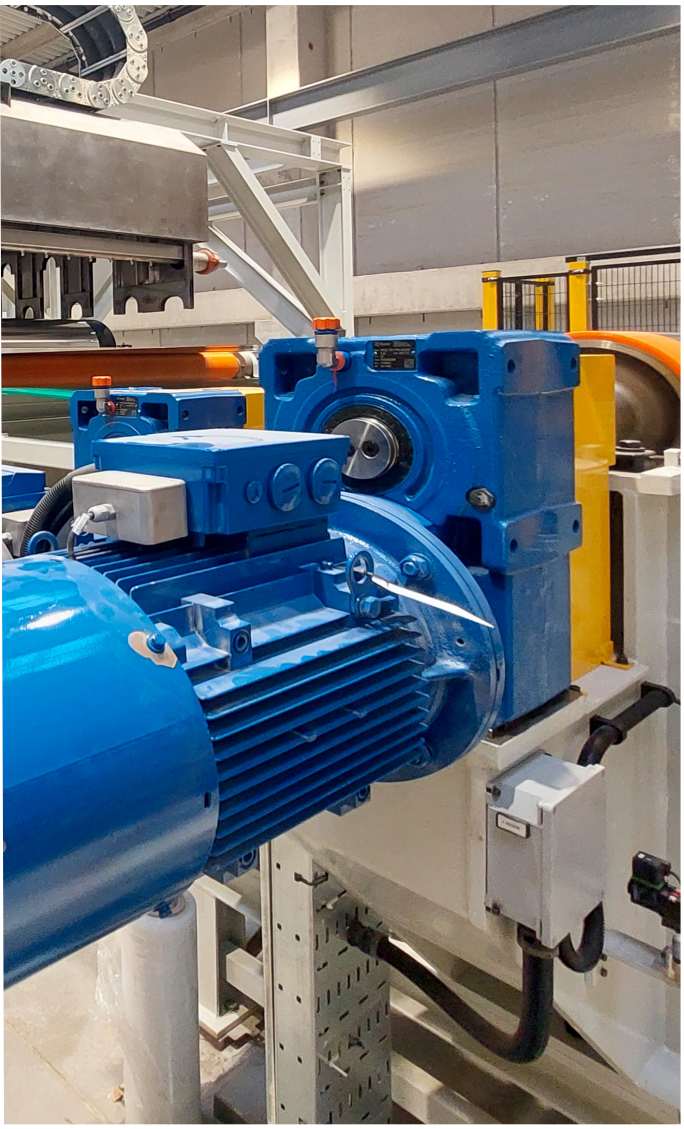
The customer's objective was to have the complete supply chain (degreasing, surface conversion, annealing of the material) to produce in-house for their customers material that conforms to the high-quality standards requested by the world's leading food industries.

The solution designed is the result of the know-how and the patented technologies that FIMIGroup has developed in the aluminium sector used to produce a unique line on the market.

In fact, it is equipped with the most advanced devices for foil processing and treatment, such as:

- Tension leveller with Proflexroll®, a Proflexroll® levelling technology with expandible roll to improve the flatness of the aluminium strip

- Multi-roll alkaline and acid degreasing systems® designed explicitly for the Cheam foil and coatings section, a revolutionary system in alkaline acid degreasing treatment which guarantees the total removal of oils and oxides without compromising the mechanical properties of the material.



- Combined alkaline and acid degreasing sections with our patented multi-roll system®, specially designed to process materials with thin thicknesses up to 10 microns that guarantee the total removal of oils and oxides without compromising the mechanical properties of the material.

- Cheam coater unit for the surface conversion of the material without the necessity for rinsing and with high precision of the product amount applied superficially.

- Particular attention was focused on sustainability and energy savings in the plant's design.

To mention a few of the solutions adopted:

- The residual fumes from the alkaline and acid treatments are collected and treated by a scrubber + demister group, significantly reducing pollutants.
- Wastewater from alkaline and acid treatments is treated with a depuration system which allows this water, once purified, to be discharged in full compliance with the most restrictive European anti-pollution norms.

- Reduced energy consumption is possible thanks to an optimal dimensioning of the drive units.

- All units subjected to heat treatments, such as degreasing tanks and ovens, have been enclosed to retain the heat generated as much as possible.

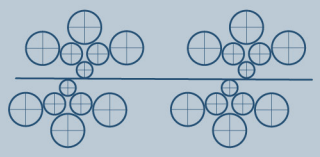
- The residual waters from heat treatments already present in the plant to heat the alkaline and acid solutions used in the degreasing line are re-used for significant energy savings.

SOLUTIONS FOR ALUMINIUM LEVELLING

The **levelling** and **tension levelling** systems designed and manufactured by FIMIGroup are **particularly suitable** for the processing of materials with delicate surfaces **(aluminium, stainless steel)** and high resistance values, covering a range of thicknesses from **12 microns up to 25 mm.**

FIMIGroup has **patented** some **devices specifically engineered** for this purpose, in order to **optimize the quality** of the final products.

PTL
Pure Tension Leveller



TLL
Tension Leveller

TDDS®
Multi Leveller with TDDS®

Main features
0,012 ÷ 25,4 mm strip thickness | **up to 2.800 mm** strip width | **up to 600 N/mm²** yield strength | **up to 800 mpm** working speed

FIMIGroup will exhibit at nxt **Aluminium China** | 5-7 July, Shanghai New International Expo Center, China
Hall 1 Stand J15

FIMI MACHINERY
Coil Processing Solutions

Paul Voss,
Director General of European Aluminium

Achieving net-zero: Bridging the gap between policy and plants

The ongoing global energy crisis has exposed the fragility of our energy systems and supply chains, putting European manufacturing industries, especially the energy-intensive aluminium sector, in a vulnerable position. Despite the growing demand for aluminium in clean technologies like solar panels, batteries, and electric vehicles, the industry is struggling to maintain production levels. In the past year alone, primary aluminium production has declined by a staggering 50%. The energy crisis has also impacted the gas-dependent

semi-fabrication and recycling sectors, which are experiencing mounting losses.

This precarious situation is further compounded by the fact that other leading economies offering low-cost energy and high levels of state aid are increasingly attracting decarbonisation investments away from European companies. If Europe fails to act now, there is a risk of excessive dependence on imports and a potential threat to its green commitments. This is particularly unwise given the challenging geopolitical realities. As such, Europe must act swiftly and decisively to ensure that its energy transition can be 'made in Europe' and that the necessary support and framework conditions are in place. Failure to do so could have significant consequences for the industry and the broader economy, making it imperative to address these challenges head-on.

Our industry needs a sturdy and reliable compass to navigate turbulent waters. An ambitious and bold EU industrial policy can provide the necessary direction and framework to reach net-zero by 2050 while remaining globally competitive.

Thankfully, the EU's recently released The Green Deal Industrial Plan provides an opportunity for Europe to support its industrial sector and drive the transition towards net-zero emissions. However, to achieve these goals, the Plan must have a comprehensive scope that includes all relevant industries, including the aluminium industry. Targeted support for deploying renewable energy infrastructure and encouraging long-term power purchase agreements for energy-intensive industries is crucial. Policymakers must also ensure that the scale of investment is sufficient to bring about real change. Furthermore, setting clear and ambitious targets for European production of raw materials and clean technologies will boost investor confidence and encourage further investments.

While an ambitious industrial policy is essential to reaching net-zero, the aluminium industry must also take proactive steps to accelerate decarbonisation efforts. Achieving our shared goal of net-zero emissions by 2050 requires courageous and concerted action, including the adoption of innovative technologies and practices and a fundamental shift in how the industry operates.

To achieve this, the aluminium industry must prioritize

investments in renewable electricity generation through long-term power purchase agreements, enabling a transition away from fossil fuels. Breakthrough innovations to further decarbonize should be at the forefront of the industry's R&D efforts. Finally, we must boost our recycling efforts to reduce the need for virgin raw materials. We are also actively working on establishing science-based decarbonization pathways for the entire value chain, incorporating intermediate milestones, alternative technologies, cost estimates, and necessary enabling conditions to attain net-zero emissions. This sectoral framework will offer companies clear guidance and support to facilitate their decarbonization efforts.

The challenge of achieving net-zero emissions by 2050 may seem daunting, but it is achievable if we act swiftly and decisively. All stakeholders, including producers, investors, and policymakers, must collaborate to bring about meaningful and lasting changes that benefit not only the environment but also the economy. Failing to take action now will have significant consequences for future generations. Instead, let us embrace this opportunity to usher in a green industrial renaissance in Europe, a chance to revitalize the industry and pave the way for a greener and more prosperous future.

Joachim von Schéele,
Global Director Commercialization, Linde

Solutions for greener aluminium production

Commitments to achieve substantial decarbonization across metal-producing industries have put a focus on energy efficiency and the use of hydrogen as a fuel. The global aluminium production's average total carbon footprint (Scope 1, 2, and 3) is approximately 12 tonnes of CO2e per ton of aluminium. The main part of this carbon footprint originates from primary operations, particularly electricity generation, which might take a long time and a considerable effort to address. However, there are great opportunities for immediate

decarbonization in remelting and recycling. We will discuss how to decrease the carbon footprint from the remelting and cast house operations, but obviously, all segments of the industry must play their part to reduce emissions.

CO_2 emissions from the cast house are almost entirely tied to the fossil fuel used to heat the furnaces. To reduce the carbon footprint, there are basically only two routes available: to reduce the energy consumption; to reduce the specific CO2 emission, i.e., g CO_2 per kWh.

When burning fossil fuel with air – containing only 21% oxygen but 78% nitrogen – up to 50% of the energy is lost through the chimney as the nitrogen is heated up in the furnace and emitted in the flue gas. Accordingly, the presence of nitrogen results in wasted energy, higher fuel consumption and CO_2 emissions. Moreover, it hampers the radiative heat transfer from the combustion products, which is the dominant mechanism at elevated temperatures. Using oxygen instead of air, called oxyfuel combustion, eliminates this nitrogen ballast.

Oxyfuel

Using oxyfuel technology, removing nitrogen from the process will effectively reduce energy consumption, thereby reducing CO_2 emission by 35%. As the flue-gas volume is substantially decreased, it also reduces the load on the filter system by about 75%.

In addition to fuel saving, avoiding the nitrogen ballast in the furnace atmosphere will increase the heat transfer to the metal in the furnace by about 40%, resulting in a 40% increased melt

rate. This will reduce the CO_2 emission even more per ton of melted aluminium.

Early attempts to apply oxyfuel in the aluminium industry suffered because these installations operated with burners with very high flame temperatures, which created hot spots and increased dross formation. However, hot spots can be avoided by using Flameless Oxyfuel, which combines the two benefits of fuel savings and melts rate increase, but at a low flame temperature. The features of Flameless Oxyfuel technology are described here, together with results from numerous full-scale installations in aluminium melting furnaces.

Low-Temperature Oxyfuel (LTOF) – technology and results

The development of LTOF is based on Linde's Flameless Oxyfuel technology platform, and it has successfully opened up the market for oxyfuel in the aluminium industry during the last 15 years. Linde´s LTOF technology uses a volume combustion regime, where the combustion products are recirculated back into the flame, thereby reducing the flame temperature very effectively. This takes place without loss of efficiency concerning fuel savings and melt rate increase.

In Flameless Oxyfuel, the mixture of fuel and oxidant reacts uniformly through the reaction flame volume, with the rate controlled by partial pressures of reactants and their temperature. In Flameless Oxyfuel, the combustion gases are effectively dispersed throughout the furnace, ensuring more effective and uniform heating even with a limited number of burners installed.

The focus of using LTOF is on reverberatory furnaces with the highest demand for thermal homogeneity. The increased melt rate has been the primary goal in most more than 50 LTOF installations worldwide. However, with the increased focus on carbon footprint reduction, fuel-saving has become a more prominent driver.

To summarize, results from installations of LTOF show the aluminium industry now has a tool to:

- Increase the melt rate by about 40%
- Reduce the energy consumption by 30-50% i.e., a 30-50% reduction of the carbon footprint
- Reduce the off-gas volume with 80-85% per ton of aluminium
- Reduce the low frequency noise in the plant, since no combustion air fans are needed

These benefits can be obtained without

- Changing the recovery of aluminium
- Increasing refractory wear

Hydrogen ready

A feature of the LTOF technology, which is becoming increasingly important, is that it is ready for using hydrogen as fuel. An LTOF system designed for a conventional fossil fuel can swiftly be converted into hydrogen, entirely or with a mix of fossil and hydrogen fuels.

LTOF has a peak temperature below the temperature for the formation of thermal NOX, supporting the reduction of NOX

emissions. Repeated tests and evaluations have confirmed that this feature is also maintained when using hydrogen as fuel.

For the aluminium industry to be ready to move towards hydrogen combustion, it is important to create a clearer understanding of the consequences of the change in the furnace atmosphere.

H2 and furnace atmospheres

In an industrial furnace, a certain amount of air in-leakage is unavoidable. The resulting atmosphere compositions when combusting natural gas using air-fuel and oxyfuel, respectively, will approximately be:

Fuel natural gas	CO_2	H_2O	O_2	N_2
Air-fuel	9%	17%	2%	72%
Oxyfuel	31%	62%	2%	5%

Switching to hydrogen as a fuel will give these atmospheres:

Fuel hydrogen	CO_2	H_2O	O_2	N_2
Air-fuel	0%	31%	2%	67%
Oxyfuel	0%	92%	2%	6%

By switching from fossil to hydrogen fuel in melting furnaces, the CO_2 footprint of a cast house can be reduced considerably. However, this will result in a substantial increase of the watervapour concentration in the furnace atmosphere and likely change the oxidation behaviour of molten aluminium alloys. To address this important topic, Linde carried out a

series of tests where Al-Mg alloys were melted in different atmosphere compositions due to fuel type and burner set-up variations. The pilot-scale tests were done together with, among others. Hydro, Alcoa, and SINTEF.

The results show that hydrogen combustion in an oxyfuel configuration leads to less oxidation on liquid Al-Mg alloys than hydrogen in an air-fuel configuration. The tests also showed that as little as 5% CO_2 in the furnace atmosphere significantly suppresses oxidation.

Hydrogen dissolution into the metal will most likely increase with the increased H_2O concentration in the atmosphere. With state-of-the-art degassing technologies, this should not be an issue; however, it must be verified in full-scale operation.

The substantially increased water vapour concentration may also affect the flue-gas treatment system. Additionally, it raises questions concerning methods for emission control and furnace diagnostics at very high water vapour concentrations.

Going carbon neutral

LTOF is the stepping stone to the carbon-free melting of aluminium with the radical reduction of CO_2 emission with fossil fuels and the fact that the technology is completely hydrogen ready. Accordingly, LTOF provides short-term fuel savings and the potential for increased melt rates and paves the way for carbon-neutral aluminium melting. Moreover, as LTOF also reduces NOx emissions even when using hydrogen as fuel, this transition can take place without any negative trade-offs. Full-scale production tests with LTOF and hydrogen are planned with multiple aluminium-producing companies.

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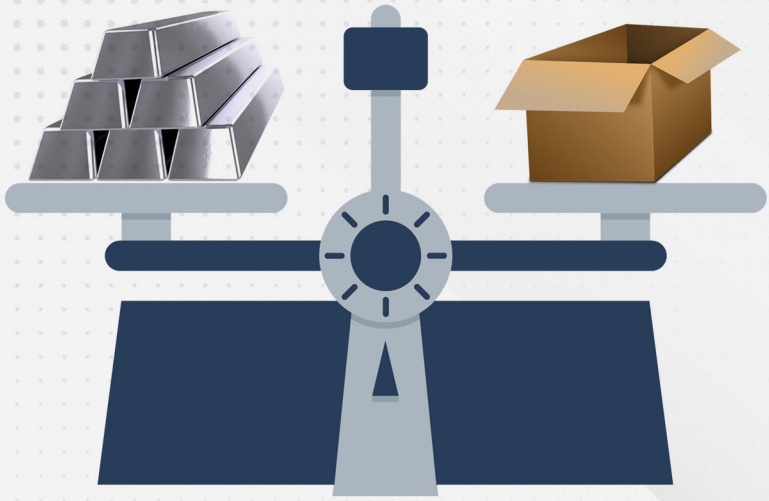

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AssanAlüminyum

Göksal Güngör,
General Manager, Assan Aluminium

Assan Alüminyum continues to invest in sustainable technologies in 2023

Assan Alüminyum, a subsidiary of Kibar Holding, is not only one of the leading flat-rolled aluminium producers in the world but also one of the two largest aluminium foil manufacturers in Europe. Its renewable energy production facility in Manavgat produces clean energy equivalent to the annual electrical energy consumption of its production facilities in Tuzla and Dilovasi. The company has more than 1700 employees. As a major global player, the company continues to make sustainable investment plans, expanding its production

capacity each year while focusing on becoming more sustainable.

Assan Alüminyum exports more than 75% of its sales to more than 70 countries worldwide. While the main export market is West Europe, the company also aims to strengthen its position in North America. While becoming more prominent in the North American market through its wholly-owned subsidiary, Kibar Americas, located in Chicago, the company is seeking new investment opportunities for further growth in the US market.

Sustainability vision

Assan Alüminyum's General Manager and Global Aluminium Foil Roller Initiative (GLAFRI) President Göksal Güngör explains: "At Assan Alüminyum, we shape all of our future plans and strategies based on our core values of reliability, flexibility, innovation and sustainability. While each of these values is the building block of our company, sustainability, in particular, is a significant guideline for our plans for the future. We adopt our sustainability motto of "producing the future, without wasting it" as a business principle and not as an obligation, as we approach sustainability on all three dimensions: governance, social and environmental."

The Kibar Group's 2025 Sustainability Vision defines sustainability priorities under the framework of "more satisfied stakeholders", "better people", and a "better world". The group determined its targets corresponding to these areas and the UN Sustainable Development Goals by focusing on the risks, opportunities and stakeholders' expectations. The business plans were then made in line with this vision and these

objectives. The company received the Aluminium Stewardship Initiative (ASI) Performance Standard Certificate for its production and recycling facilities, which confirms that the facilities operate in line with global sustainability standards.

Contributions to the circular economy

Assan Alüminyum develops its sustainability vision through this perspective and continues to enhance its sustainability-oriented products and processes. Assan Alüminyum's 3423 recycling-friendly product is one of these environmentally friendly products that the company's R&D Center developed in this respect. This product requires 95% less energy at production than those produced from primary aluminium and has a 50% lower carbon footprint than equivalent products. The company's current and future processes are also improved and shaped in line with global sustainability principles.

The company strives to minimize its environmental impact in order to contribute positively to a circular economy. With its renewable energy production, the company receives the globally recognized I-REC (International Renewable Energy Certificate) and is, therefore, able to offset its scope 2 emissions. The integrated recycling facility also allows the company to process internal and external scrap, contributing to the circular economy. Aluminium's 100% and infinite recyclability is also a major plus, as it is a naturally sustainable product.

In addition, as a result of the energy efficiency projects implemented, the company reduces natural gas and electricity consumption and ensures improved energy efficiency. The carbon reduction achieved by the projects implemented in the last 7 years is equivalent to planting more than 2.5 million

trees. In addition, a 45% increase in the use of recycled raw materials was achieved in the last 7 years. Despite the fact that the production capacity increased steadily, the water consumption per ton of production was reduced by 21% over the previous 6 years.

Agile company structure

In order to improve corporate governance, the digitalization project, DijitALiz, has recently begun. This project aims to improve all processes with the extensive use of digital technologies. This comprehensive project is expected to significantly contribute to efficiency by redefining many processes through digitalization.

Another significant contribution to the sustainability governance aspect is that Assan Alüminyum is the first producer in its industry to be certified in ISO 31000 Risk Management, as well as ISO 22301 Business Continuity Management. With a dedicated risk management team, the company is able to manage risks effectively and professionally, allowing the company to be more resilient and agile. Güngör elaborates further: “These risks include issues such as global unrest and energy crises arising from the Russian – Ukrainian war and international trade barriers, such as sanctions, tariffs and anti-dumping measures. It’s our ability to make and apply risk management plans that make us successful and our level of flexibility to adapt to unforeseen circumstances that arise abruptly. We expect supply issues to continue to be effective in 2023. However, the agile structure of our company and our highly-qualified employees give us the necessary tools for quick adaptability”.

Sustainable expansions underway

Assan Alüminyum's investment plans worth almost 100 million US dollars are underway and projected to be completed in 2024. The first phase of the investments includes the expansion of cold rolling capacities while improving the environmental sustainability of the existing facilities, including a rolling oil recycling facility, new filtration systems for casting lines and improved thin-gauge aluminium foil production capacity. The highly-efficient cold rolling line is expected to begin production in the short run. The 5 brand new casting lines will be installed by 2024, allowing Assan Alüminyum to have the largest continuous casting (CC) capacity in Europe and America, with 24 CC lines. The new rolling mill will improve the company's contribution to sustainability on multiple levels, including reduced scope 2 emissions per tonne of production through a new generation of AC motors and regenerative drive systems, as well as improved automation and machine learning abilities. An extension of the project includes the exhaust air purification system, which will allow for reusing the rolling oil on existing and new filling lines. The company's total installed annual production capacity will exceed 360,000 tonnes as a result of these sustainable expansions.

OUR FUTURE BEGINS WITH SUSTAINABILITY

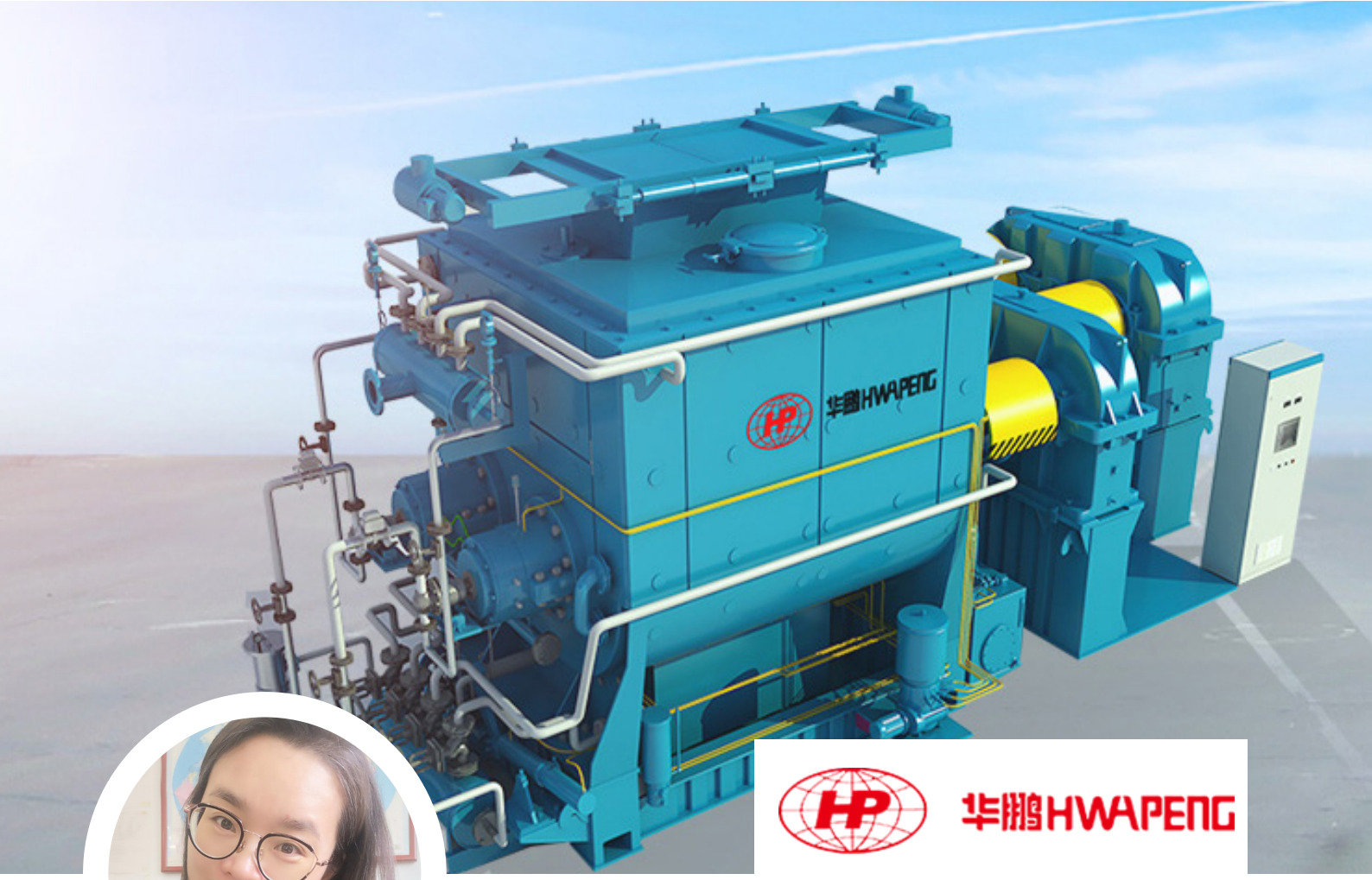
Creating a better world for future generations begins with sustainability

We believe that we can create a sustainable world together with our stakeholders.

The UN Sustainable Development Goals are our guiding corporate principles for our business processes.
By producing renewable energy, recycling aluminium in our integrated facility and by applying the global sustainability principles to our business processes, we produce the future without wasting it.

Kibar

AssanAlüminyum



Kathy Yuan,

Head of Overseas Marketing Department at Hwapeng Machinery

“In 2023, HWAPENG will still keep itself competitive, focusing on creating values for customers and continuous innovation and breakthroughs.”

AlCircle: What kind of equipment does HWAPENG supply to carbon plants? How do you foresee the year 2023?

Kathy Yuan: Since its establishment in 1994, HWAPENG has

been specializing in special purpose equipment and intelligent technologies for carbon plants manufacturing anodes, cathodes, graphite electrodes, carbon electrode paste, ramming paste and other carbon and graphite products. Our main equipment include carbon paste preparing system, vibrocompactors, baked anodes robotic cleaning system, extrusion press and hydraulic crusher. Our market share in China is over 90% at present.

In 2023, HWAPENG will still keep itself competitive, focusing on creating values for customers and continuous innovation and breakthroughs. HWAPENG will uphold the corporate value of being brave in innovation, achieve the leadership of the new generation of information technology and artificial intelligence technology, and make unremitting efforts to achieve the strategic goal of becoming a leading service provider of digital and intelligent technology and equipment in China's industrial field.

AlCircle: What are your supplies to aluminium smelters?

Kathy Yuan: For aluminum smelters, HWAPENG mainly supplies coke heaters, carbon paste kneaders, carbon paste coolers, green anode vibrocompactors, cathode vibrocompactors, robotic cleaning system for baked anodes and hydraulic crushers for anode butts. HWAPENG has been continuously researching and developing new technologies and products, and actively providing advanced technological achievements to aluminum smelters.

AlCircle: Who are your major customers in China as well as in other countries?

Kathy Yuan: Our major customers in China include CHINALCO, Fushun Aluminum, Sinosteel, China Power Investment Group, China Datang Group, East Hope, Xinfa Group, Sunstone Development, Jinan Wanfang Carbon, Jinan Chenyang Carbon, Jinan Aohai Carbon, Fangda Carbon, Chengdu Carbon, KFCC, Nantong Yangzi, Hebei Shuntian, Shanxi Sanyuan, Jiaozuo Dongxing, Shanxi Liangyu, Shanxi Sanjin, Hoshine Silicon, Japan Showa Denko Sichuan Plant.

Our major customers abroad include Korea POSCO, Brazil CarbonVix, and Elkem.

AlCircle: What are the growth points of the company's development in recent times?

Kathy Yuan: There are two growth points recently; one growing demand is intelligent and digital products. The other growing demand is special graphite paste preparing system and vibro compactors.

In recent years, HWAPENG has been focusing on research and development of intelligent and digital products and has put the products into the market. Of all the products, its baked anodes cleaning robot is in growing demand; we have supplied such robotic cleaning systems to Fushun Aluminum and Sun Stone. The digital carbon paste kneader is also one of our hot products recently. It can help users trace paste quality, collect production data, diagnose and prevent equipment malfunctions in advance, and remotely check equipment operation status.

Along with the development of electric vehicles, the demand for lithium batteries is growing. During the production of anode materials for lithium batteries, crucibles are in a large amount of consumption. Square crucibles are made of graphite blocks, which is why our vibrocompactors forming graphite blocks and special graphite paste preparing system are in hot demand.

Éloïse Harvey, EPIQ Machinery: innovation in action

In the decarbonization trend, MECFOR is working on converting its conventional heavy-duty mobile equipment to a fully electric motorization type.

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.

Over the years, her dynamism and her vision for business development led her to work her way up within the growing organization. Indeed, from 12 employees and 2 million in turnover when started, Mecfor saw its number of employees and its volume multiply by 10 during the first twenty years of Éloïse's career. In 2018, Éloïse and a group of a few operator partners bought Mecfor from Ceger.

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. This was followed, a few years later, by the merger of Mecfor and Advanced Dynamics to create the largest equipment supplier in Canada for the aluminium industry: EPIQ Machinery. Éloïse becomes CEO of EPIQ Machinery in August 2021.

AlCircle: As you always strive to integrate new technologies into equipment, how do you plan to make EPIQ AD, EPIQ Mecfor and EPIQ Brochot more technologically advanced?

Éloïse Harvey: Although AD, BROCHOT and MECFOR equipment already have a high level of automation, embedded technologies, and interconnectivity to execute their respective tasks safely, today's challenge resides in bringing hyper-connectivity and a systematic approach between all equipment fixed and mobile. Not only has that, but the communication (data exchange) between equipment needed to be done at a greater level for the plant to appreciate the Industry 4.0 shift entirely.

At EPIQ, we are closely cooperating with major primary aluminium producers to identify proper software layers for

our equipment to ensure all communicate correctly with each other and ensure the right integration of our equipment in their specific processes. The goal is to have our equipment speak the same language as the plant's matrix so that no information is lost in translation.

What we envision in the near future is the ability to gather data from our equipment, relay it back to the plant's Enterprise Resource Planning (ERP) and/or Order Management System (OMS), manage and analyze it to be able to convert it into comprehensive information to assist in producers' day to day decision making. We can also envision the idea that in the long term, it will be possible to integrate artificial intelligence (AI) to predict and optimize all the operations carried out in an aluminium smelter or casthouse based on its historical data.

AlCircle: What new solutions and technologies do you plan to launch in 2023 to help the aluminium industry increase production?

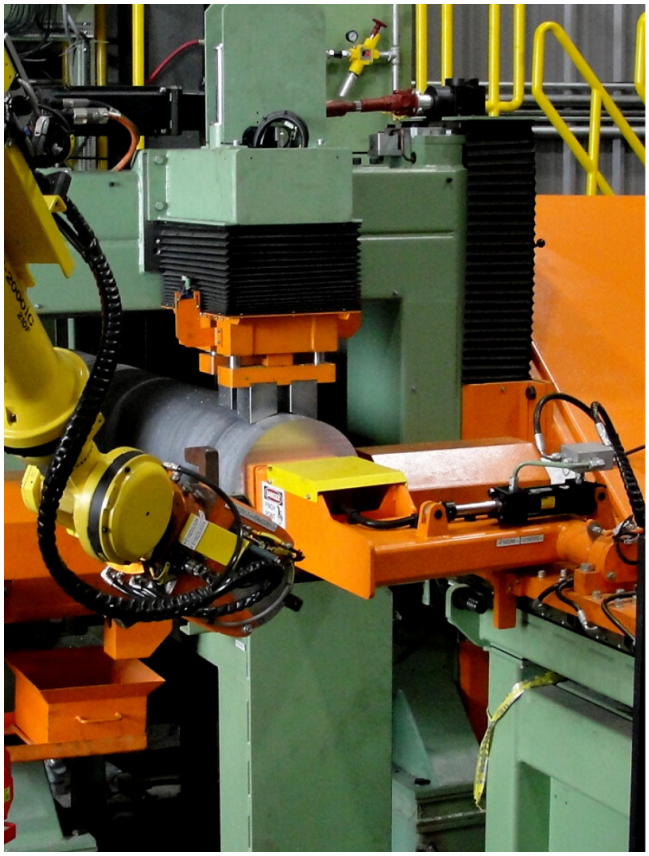
Éloïse Harvey: In the decarbonization trend, MECFOR is working on converting its conventional heavy-duty mobile equipment to a fully electric motorization type. In line with this, we plan to deliver our first MECFOR Electric Hauler, model MTE, by the end of 2023.

On the other hand, our Engineer and Design team is finalizing a new casthouse equipment called 'MECFOR Furnace Vehicle – MFV'. This equipment has a totally new design offering a cab elevation system, telescopic boom, front free wheeled axle, rear steering axle and high lifting capacity. The new MFV is compatible with MECFOR Smart Casthouse technologies

using the QuicKonnect system, Operator's assistance technology and Furnace Protection System (FPS).

For the AD and BROCHOT line of products, our team is going further into automation and robotization, improving the user-friendliness of HMI and transparency to access data. Being an accredited FANUC integrator also allows us to craft on-measure handling solutions better. The advantages of a FANUC robot are the preventive maintenance program 'Zero Down Time – ZDT' and the ability to upcycle the robot and reassign it elsewhere, contrary to dedicated equipment.

In addition, branded under EPIQ DTA, we have access to many Auto Guided Vehicle (AGV) and Autonomous Mobile Robots (AMR) solutions using the most up-to-date natural navigation system, traffic, and order management programs.



In the end, with EPIQ's extensive equipment portfolio, our objective is to come up with the best ROI addressing customers' needs by delivering a reliable, robust, and long-lasting solution.

AlCircle: Do you think the machines you offer can become more user-friendly? Would you like to dedicate 2023 to working on it?

Éloïse Harvey: EPIQ's equipment is already user-friendly with a high level of ergonomics. However, we understand our customers' concerns about the scarcity of qualified workforce and the necessity to improve their production. We constantly strive to enhance the Operator's experience and reduce the poor work environment. We believe in greater automation and better operator assistance technologies. Also, AGV/AMR equipment comes in handy for highly repetitive tasks requiring extreme constancy in execution.

AlCircle: Do you want to bring in any new changes in your quality policy this year?

Éloïse Harvey: Each of EPIQ's manufacturing sites are ISO 9001:2015 accredited. We embed a culture of continuous improvement from the root to the top. Following the merger, we have identified the need to create a new strategic corporate position that will oversee all activities of the EPIQ sites (Canada, France, India, and the Middle East) to standardize practices and make the most of each of them.

AlCircle: How much time does your equipment save compared to human working capacity? Can this be improved further?

Éloïse Harvey: Each project is unique and hard to compare or draw statistics on our customer's ROI. However, we can only presume that by coming back to EPIQ, there is already a gain in implementing our solutions.

One equipment that stands out is our EPIQ AD 'Automated Extrusion billet batch homogenizing handling system'. Automation offers constancy, reliability and a longer life cycle of the equipment. This solution offers a hands-off approach, meaning no operators are required between the ingot laydown point and the homogenizing area. This also leads through the sawing area, where an operator removes the final product.

On top of that, with EPIQ DTA AGV/AMR equipment, we trust that our customers will understand all the potential and benefits we can bring them. We are now commissioning AGVs in the finished goods sector; we're ready to support our customers' ambitions to integrate this technology in other parts of their plants.

AlCircle: As sustainability has taken a centre point in the aluminium industry, how do you want to advance your machines to help the smelters achieve zero emissions?

Éloïse Harvey: As mentioned earlier in this interview, we are working on 'electrifying' our heavy-duty haulier under model MTE. Two projects are in progress: one to transport Crucible of Molten Metal with a maximum weight of 16 MT and another for Anode Tray weighing about 17 MT.

On another token, AGV equipment is readily available with electrical motorisation.

AlCircle: Can you offer customised solutions to the European aluminium companies to save their production, as many have reduced output or closed down operations?

Éloïse Harvey: Each of our solutions are tailor-made according to the needs of our customers. We always have presented a great openness to seek solutions that will allow our customers to grow in profitability while maintaining high safety factors.

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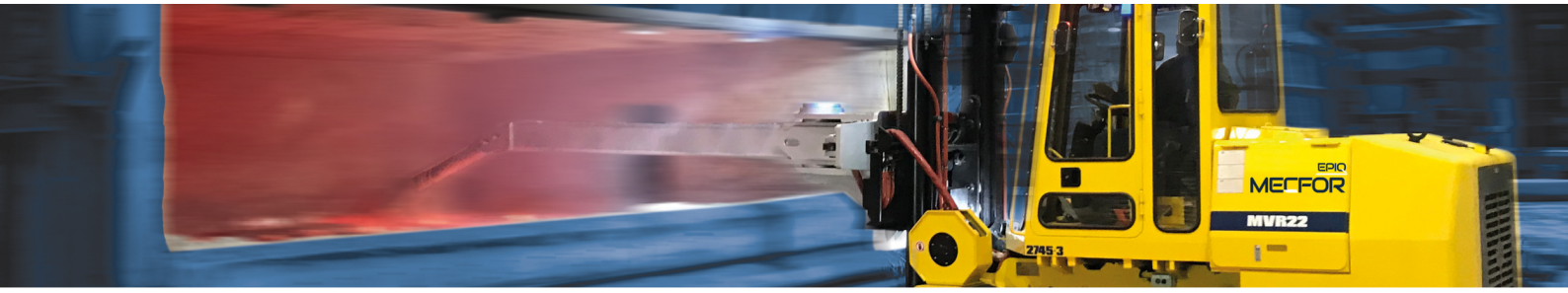

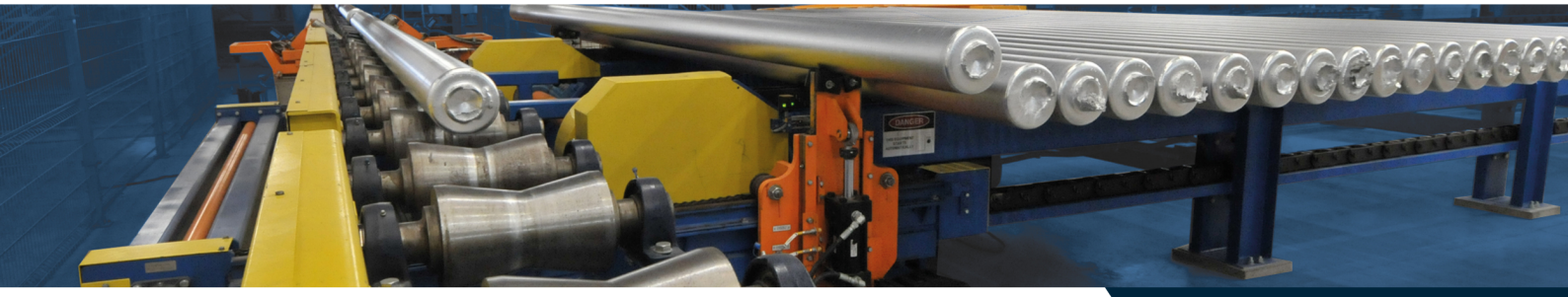

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Andreas Schwarz,
CEO of Bathco Group

"Bathco is saddened to see several of its long-standing partners in Europe shutting down, but see this situation as an opportunity to reboot the industry in Europe on a more sustainable basis".

Andreas Schwarz is the CEO of the Bathco Group, a leading solutions provider in the aluminium industry. With a background in trading functions at Rio Tinto Alcan, Andreas has extensive experience in the industry and has held positions in China,

Southern Africa, and Zurich. As CEO of Bathco, he has led the company to new heights and overseen its expansion into new markets worldwide for the last 15 years.

AlCircle: What are the core values and drivers that Bathco followed to establish its reputation as one of the aluminium industry's leading service providers?

Andreas Schwarz: Bathco has always been highly focused on the aluminium industry and has, over the years, proven its reliability

and its strength of innovation.

We have built a circular economy around various by-products in the aluminium industry as well as the supply and management of raw materials and energy-saving equipment. We are also marketing low-carbon aluminium.

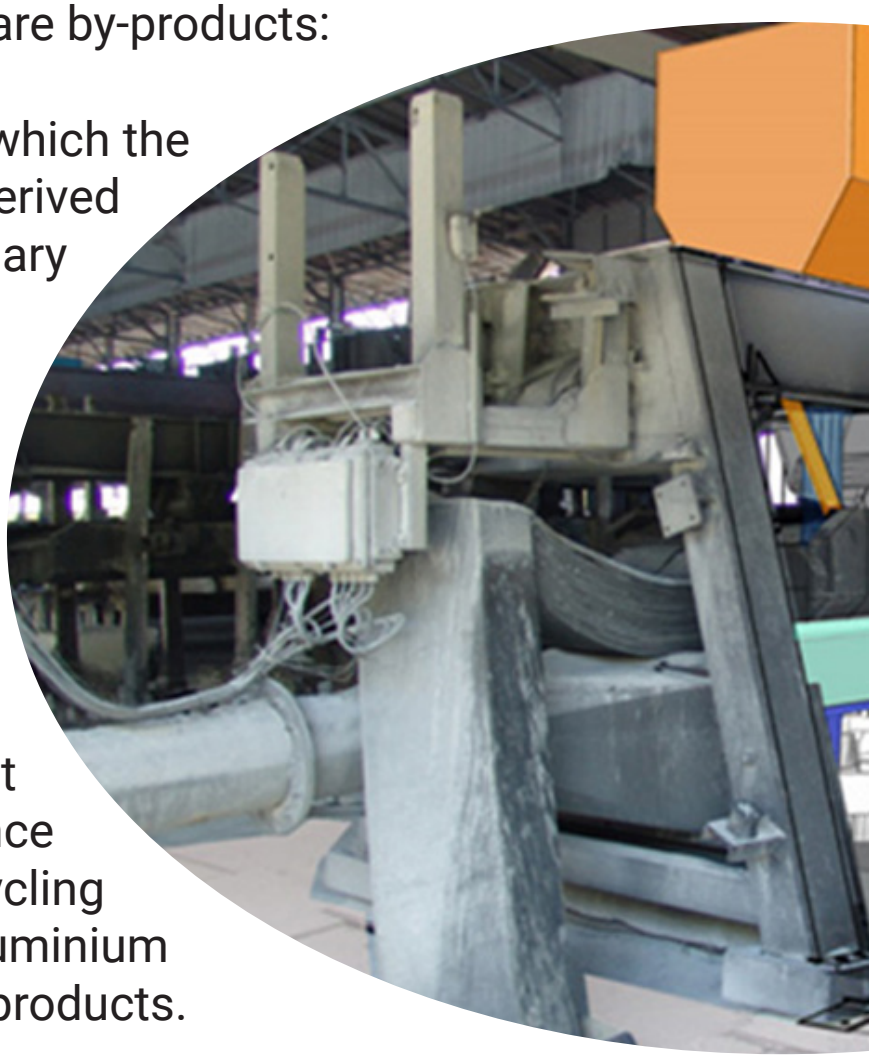
The next step is to offer comprehensive packages whereby we supply major raw materials to a smelter and offtake main by-products and metal. We manage time-critical raw material

inventories on-site. This simplifies smelters' processes and reduces costs by streamlining procurement services and providing a single point of contact for the smelters.

AlCircle: How do you define sustainability from Bathco's point of view? What are the sustainable measures Bathco has implemented while serving the aluminium industry?

Andreas Schwarz: It is worth underscoring that sustainability is at the core of Bathco's business model. Our activities are rooted in recycling by-products to avoid landfilling while producing equipment to reduce the carbon footprint of aluminium smelters.

Our primary raw materials are by-products:



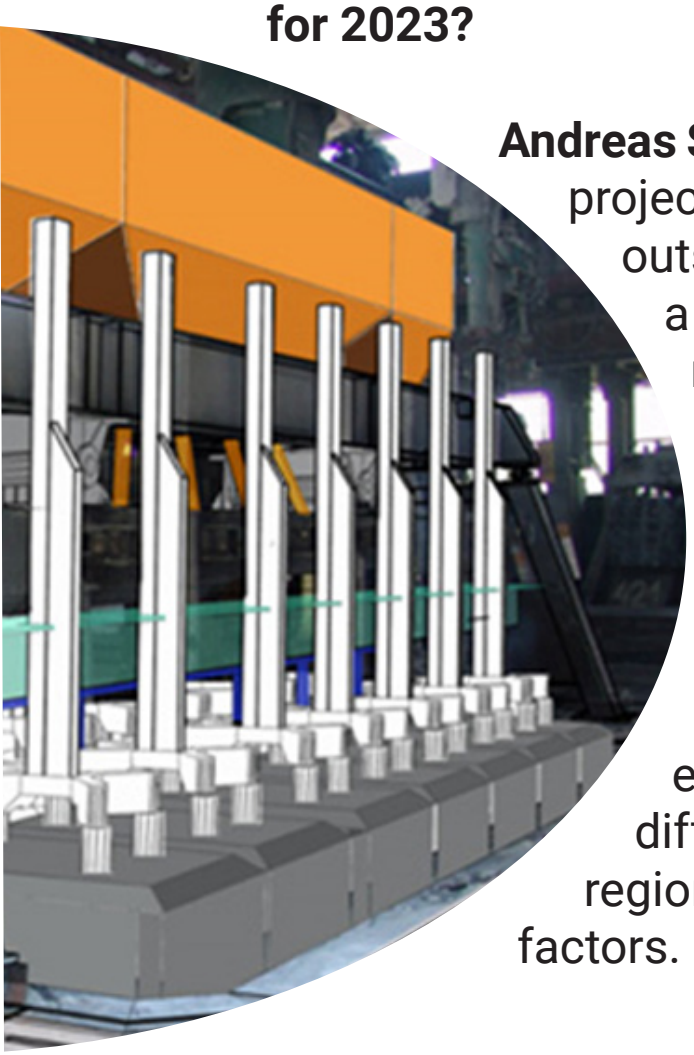
The electrolytic bath from which the name of our company is derived is a by-product of the primary aluminium process.

We move the material from bath-generating aluminium smelters to bath-consuming smelters or smelters needing a bath balance in their process.
We produce and market chemical additives to enhance the aluminium recycling process—the secondary aluminium process benefits from our products.

As stated above, we have started to market low-carbon aluminium.
With our strong global supplier/customer network and contacts, we have a unique ability to move materials most efficiently and reduce transport distances, emissions and costs.

In addition to by-products, as an OEM, we produce and market equipment to suppress GHG emissions from aluminium smelters. We also offer solutions to reducing energy consumption in the primary aluminium industry.

AlCircle: Bathco being a global leader in the Bath Material market, how do you forecast the global aluminium industry for 2023?



Andreas Schwarz: There is a lack of concrete projects for new aluminium capacities outside China, this is likely to lead to a geographical imbalance sooner rather than later. We have seen a step back from unabated globalization to a more regionalized economy, resulting in trade barriers. Sometimes, it will not be easy to compensate for local or regional supply shortages. Overall, we expect a stable LME but with widely differing premiums, depending on regional availability and other influencing factors.

AlCircle: How would you rate Bathco's performance for the year 2022? In what areas could improvements have been made?

Andreas Schwarz: Especially in 2022, we have increased the scope of our services, which allows us to offer a more comprehensive service to the smelters, supplying raw materials, taking by-products, and now also metal. The year was ground-breaking for the future of the company.

The bespoke commercial solutions we developed with our customers during 2022 allowed us to re-invest in their businesses and social programs.

Something we are proud of and will continue to expand in 2023. This "shared growth" philosophy underpins our long-term customer relationships.

At the same time, Bathco, like the industry as a whole, must do even more for sustainability. Namely, change to renewable energy, as well as to renewable raw materials in the process. These issues have a long way to go for the industry and, therefore, for Bathco.

AlCircle: What are your insights on the Chinese aluminium industry for 2023? Would power rationalization and net-zero drive impact China's primary aluminium production in the short term?

Andreas Schwarz: China will not (want to) continue to produce aluminium as a raw material for the rest of the world. This,

combined with the limited availability of power, and the need to change from fossil-based to renewable electricity, will make it likely that China will continue to slow down capacity increase and, at one point, halt expansion altogether. This may be a mid-to-long-term view rather than a short-term one.

AlCircle: Can Bathco be said to have suffered any impacts from the shutdown of the European aluminium smelters and the production cuts?

Andreas Schwarz: We are saddened to see several of our long-standing partners in Europe shutting down. The direct impact on us is limited however, mainly due to our strong diversification.

On a positive note, we believe this situation is an opportunity for the industry to reboot and restart on a more sustainable basis. For example, grid stability becomes an issue with the shift to renewable electricity. The aluminium smelters could be a solution to this by applying power modulation, for instance, with the concept as is used at Trimet Essen, the "virtual battery".

Through our sister company MetSol, we offer power modulation solutions that allow the smelter to manage and optimize electricity costs.

AlCircle: In order to produce more low-carbon aluminium, what measures need to be taken by the aluminium industry? Will it increase the price of aluminium considering the long term and short term?

Andreas Schwarz: As a first step, the aluminium industry has to embrace change with a much more open mind than in the last 140 years. Aluminium will be produced with renewable electricity going forward. This is something that the electrolysis process still needs to be prepared for. We must adapt innovative concepts like the virtual battery or our next-generation Pot control system APC+ much faster to achieve net zero. In light of the vast amounts of electricity used by our industry, we may also have to start investing more into power production, renewable, of course, ourselves, rather than using “grey” power from the grid.

The last few decades were characterized by short-term cost- and profit optimization and a focus on shareholder value. We must understand and accept that a new era has dawned and that we, as corporate citizens, are now expected to do our parts in addressing the global problems.

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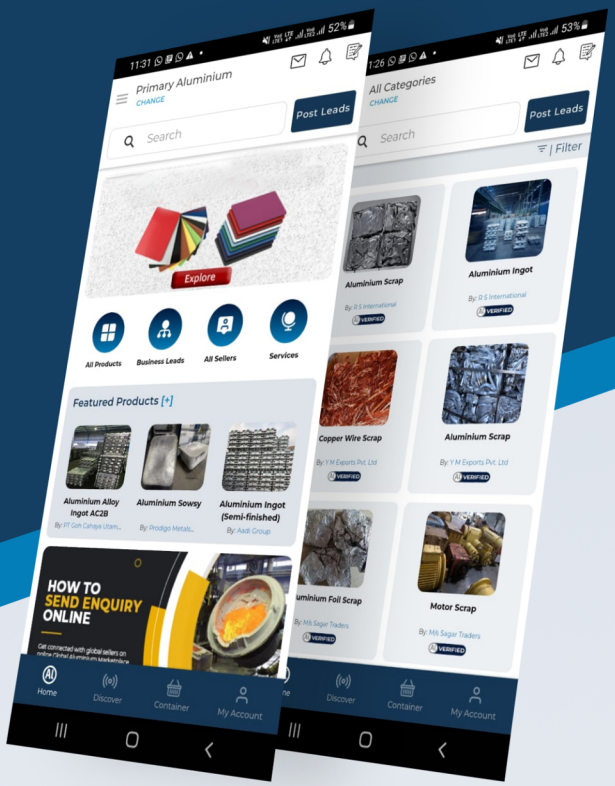

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TOMORROW TECHNOLOGY

Giovanni Magarotto
Managing Partner of T.T. Tomorrow Technology S.p.A.

"We are now celebrating our 23rd Anniversary and we try to be always a step ahead towards the integration of green technology in the aluminium sectors."

Giovanni Magarotto, 62 years old, is the founder and one of the Managing Partners of T.T. Tomorrow Technology. He has worked for 40 years in different fields of chemical,

mechanical and metal (aluminium) industries, with a degree in Marketing and Business Administration in Padova and a masters in tax advisor and organisation. In 2000, he founded T.T. Tomorrow Technology, starting his own activity in the aluminium melting and recycling business. T.T. Tomorrow Technology's core business is the design and production of special Multifunctional Furnace Tending Vehicles, Automatic Charging Systems and Automatic Skimmers, and various other transport vehicles for solid aluminium handling. The aim is to support the melting subsidiary phases of the aluminium casthouse as charging, cleaning and skimming of aluminium melting furnaces and to enhance the productivity and efficiency of the Aluminium casthouses.

AlCircle.com: What new special vehicles or equipment are you planning to manufacture in 2023 for primary and secondary aluminium sectors?

Giovanni Magarotto: Good point. So, our task for 2023 is to follow the great demand of the aluminium industry for decarbonization and reduction of energy costs in the production of primary and secondary aluminium metal. We are now celebrating our 23rd Anniversary and we try to be always a step ahead towards the integration of green technology in the aluminium sectors, in the production of primary and secondary aluminium. And for this year, we have in mind two main efforts, not only for 2023 but for the next five to ten years. There are two main tasks for the next coming years on which we have concentrated our efforts about engineering technology. The first one is to increase and improve our presence in the primary sector, supplying what we consider so far the best technology available in the world. Concerning the anodes slots

cutting technology, we are the market leader, having more than 20 installations worldwide. A couple of them are now undergoing construction in our plant. This new way to make primary aluminium is a modification of the production process in the pot operation. As a first impact, it saves 170 to 200-kilowatt hours of energy per tonne of aluminium produced. This is an immediate saving that our customer can convert

into better efficiency of the pot rooms, can transform into extra production, or can save this energy consumption. It is a one-way ticket. All the installations we have worldwide are running since almost more than 15 years and none of our customers have returned to the original situation. So, all those customers that are using slotted anodes are following this way for the future as well, increasing the depth of the slots,

reducing the thickness of the slots, but they will never go back to the standard baked anodes. This is one of the two types of equipment we are concentrating on. The second one is the electrification of all our current vehicles production range. So in the future, or from today, we can supply standard vehicles with diesel engines or provide the same equipment with an electrical battery system so that they work electrically. These

are the two main focuses for 2023. We have already completed the engineering and test phases of the electric vehicles. So, we are now in the position to supply electric vehicles together with diesel engine vehicles upon the customers' request. And we know that many primary plants and recycling or secondary aluminium plants are looking forward to this specific technology.

AlCircle.com: As recycling has taken centre stage in the aluminium industry, do you think your equipment and technology will be consumed more by secondary aluminium producers this year?

Giovanni Magarotto: Yes, especially the vehicles. We have a greater demand among secondary aluminium plants and recycling plants. The demand increased from the previous year. But it is important to note that several primary plants now have in-house recycling plants. So, they are now procuring scrap from their own customers. This is happening in India and the Middle East. It is a kind of new policy to save as much energy as possible and have a better relationship with customers. So, while companies like EGA or Hindalco in India want to sell billets, they are looking to buy back the extruded profile scrap or the scrap from their customers. So, that's why we have seen a rising demand for technology from the secondary aluminium producers this year.

AlCircle.com: Do you think your existing equipment needs updation to help your customers achieve a more seamless production and delivery process?

Giovanni Magarotto: First of all, I would like to say that lifetime all of our equipment is approximately in the range of between 15 to 20 years. We still have in operation the vehicles that we produced at the beginning of the year 2000. We are now, of course, implementing these vehicles with new features that are making their manoeuvrability and their use much more friendly. The most important upgrade that we are now installing in our vehicles is the control system. That means any vehicle is equipped with a communication system between the vehicle and the cast house. So, the cast house manager knows exactly who is on board of the vehicle and how many working hours he has provided in the cast house. They know exactly the tonnage or the weight of the solid aluminium that has been loaded into the furnace. And these data are filed in the cast house supervision system. So, they know the different types of alloy loaded into the furnaces. All these data are collected and kept in files just to be analyzed by the people at the end of the day. Another important technology implementation is the video camera system to continuously keep an eye on the operational area around the vehicle and check the furnace condition before opening the door. So, we are in the position to have a camera communication system between the melting room and the vehicle and the operator to monitor the situation inside the furnace. There are also some other

safety installations that some years ago were not required, but now are mandatory for new environmental control of the diesel engine on the emission in the atmosphere. Hence, we are keeping the vehicle as updated as possible to meet not only the environmental restrictions and regulations but also to improve the safety and the working condition of the operation inside the cast house.

AlCircle.com: Sustainability is a vital goal of the industry now. Have you started offering solutions that help primary aluminium producers reduce carbon emissions?

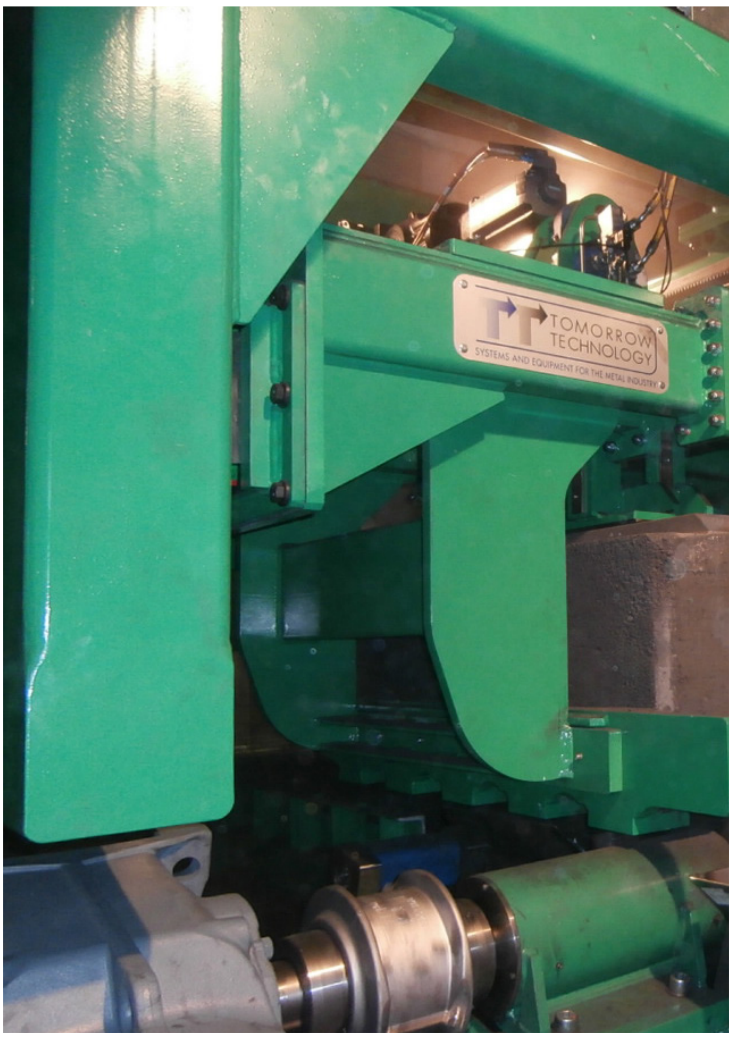
Giovanni Magarotto: Yes, this has been one of our main activities since the creation of this company. We have always been involved with the primary sector in pot room operations and pot room activities and have mainly concentrated our efforts on the carbon area technology. I want to say here that, in my experience, the anodes have not always been considered an essential part of the process. Many smelters were producing anodes in a very black and dark plant, which nobody cared for. All the efforts were concentrated on the production of pure light aluminium. However, in the last 15 years, the anodes have become an essential part of the process, and our company started to supply anodes technology since the beginning of its activity. I would like to say that about 20 years ago, we started producing our first anode cleaning machine. At that time, not many companies were considering an important task to clean the anodes before putting them in operation. Now it is a must. It is a must because cleaning the anodes means we are improving the condition, the stabilization of the pots, the conductivity of the electricity and the efficiency of the pots.

That means we are improving the quality of the anodes inside the pot room, together with the cleaning of the anodes. We are now in the position to clean perfectly the anodes and manage them in a very proper way, just to speed up the process between the baking furnaces to the rodding shop. So I would like to say that for us, it is crucial to sustain carbon production, and as far as our technology is concerned, we are involved in providing high-quality anodes, ready to be installed in the pots without any contamination from packing material and with a very good casting stub rod. This system must be then integrated with the slotting activity of the anodes. So, now most of our anode slot cutting machines are supplied with the integration of the cleaning station which is part of the package. So, this will allow our customers to save approximately 180 to 200 kilowatt hour of energy per tonne, a very important task for the smelters worldwide.

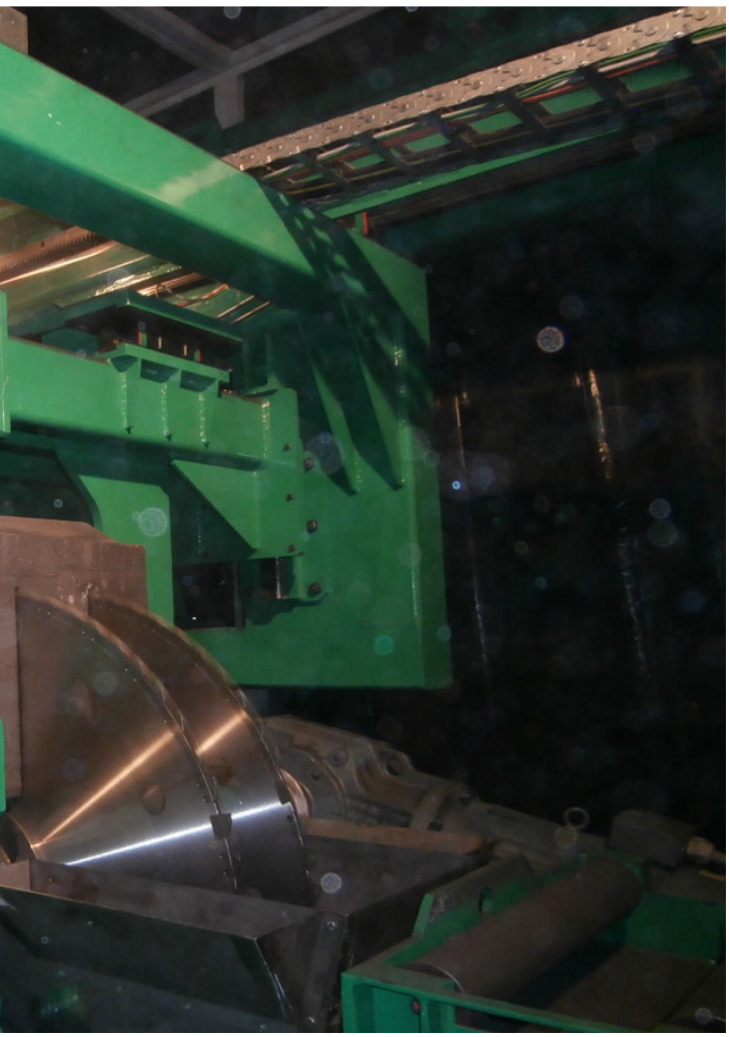
AlCircle.com: How much do you foresee primary and secondary aluminium producers will invest in technology this year to improve their operations further?

Giovanni Magarotto: I am just back from TMS in the United

States last week, and I'm not sure for this year or next year whether many plants in the world will invest in green technology without first considering a previous step. So, we have to consider for now that the production scenario of molten metal has changed worldwide after the COVID-19 pandemic and due to the ongoing geo-political conflict between Ukraine and Russia. I guess the question to make before deciding is whether to invest in technology. Many companies in the world were ready for the automotive industry or packaging, but now they have to reconsider everything because the automotive industry is not as demanding as before. The companies were ready to invest in making a lot for the automotive industry but now have to reconvert their own activity. On the other hand, new car technology and the new electric cars, which seemed to be the future, are leading us to rethink it as there are not enough energy stations worldwide. Everyone in Italy, Europe, and America is looking to own electric cars, but when you need a charging station, there is no charging station around.



However, the main point is not the charging station. The main point is the grid of the energy availability in the territory. I think primary and secondary aluminium sectors are still figuring out which product will drive customers' demand in the next couple of years before deciding where to invest their technology. For sure, in India, America, and Europe, there will be a huge demand for electrification, which can only be done with aluminium. So, I guess the future technology investment would be around wire rod production.



AlCircle.com: Of all your existing equipment and technology, which according to you, will be most saleable in 2023?

Giovanni Magarotto: In my opinion, the most saleable equipment this year and next will be our furnace tending vehicles. We have a great scenario of many customized melting furnaces able to improve the melting rate and reduce energy consumption. However, now we have a high availability of about 15% to 20% of scrap and the rest of primary aluminium. Despite the fact that we have highly technological metal furnaces, it is very important to manage these furnaces properly. So, we have now spent a lot of efforts to make our furnace tending vehicles, as much as possible,

suitable for these new furnaces with one, two or three chambers, with a very long telescopic boom up to 40ft or 12 meters, capable of skimming and cleaning in a very quick and efficient way.

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Designed & Manufactured in Italy

Patrice Côté
Dynamic Concept

The Aluminium industry is facing challenges in decreasing energy consumption and increasing the rate of recycling

Context and challenges of the industry

The situation in terms of global climate change and greenhouse emissions represents a big challenge for our modern society – which requires both real actions and new solutions. More and more socially responsible groups and companies

participate in this worldwide effort that also generates new opportunities.

Aluminium recycling is one piece of the puzzle to achieve the goal of ensuring a greener economy. Some materials are more difficult to recycle than others. It is the case for some post-consumer parts from the automotive industry, which contains specific alloys less compatible with current recycling practices. Therefore, complementary solutions are required.

Meanwhile, the industry is facing higher energy costs and this leads to increasing efforts towards energy saving initiatives. As a side benefit, this also comes with a reduction of greenhouse emissions.

Recycling and closed-loop economy

The availability of scrap has always been a challenge. In some regions, this type of scrap was shipped to recycling facilities equipped for the task. Still, the current trend is to minimize transportation and CO2 emissions by having local recycling facilities.

In many processes, an efficient way to recycle is to recover scrap generated in the same value chain. For example, an aluminium slab supplier can recover scraps from its customers and sub-customers to cast new slabs. The advantage of this is the compatibility of the products in terms of alloys and other characteristics. The required equipment is simpler, and the constant scrap supply is easier to guarantee.

For post-consumer scrap, the challenges are much more

significant. The material can contain contaminants, such as paints and/or other unwanted elements.

For scrap handling, charging, treatment and melting, many options are possible depending on the recycled material type. Some require sorting and pre-treatment; others can be directly loaded. Many melting solutions are to be considered, such as rotating or multi-chamber furnaces, post-combustion fume treatment, preheating requirements, etc.

Specific alloys for specific applications will complicate the integration in the remelting process. Essential quantities of metal are currently not being recycled because of this contamination.

The potential to recycle more scrap requires new solutions. Dynamic Concept has developed in alliance with Nature Alu, a state-of-the-art technology to purify aluminium. The primary purpose of this technology is to produce super high-purity aluminium.

However, the same technology can be used to purify contaminated aluminium.

Also, metal transfer is a crucial factor in the recycling process. In some existing plants, crucibles are already being used for molten metal transfer.

Many options are possible, and Dynamic Concept has direct experience with most of them.

DYNAFEED FC: Furnace to Crucible Metal Transfer Siphoning System

Energy saving opportunities

Energy costs have increased significantly in the last year. Aluminium producers and foundries are looking for energy-saving solutions, and those potential savings are enormous, most notably in Casthouses.

Many gas-powered components are required to run a Casthouse. Dynamic Concept proposes and supplies a series of solutions specifically designed to save energy:

- Improved control of burner systems
- Optimized furnace process control
- Accurate & more efficient molten metal temperature monitoring
- Regenerative burners
- Furnace heat recovery
- Etc.

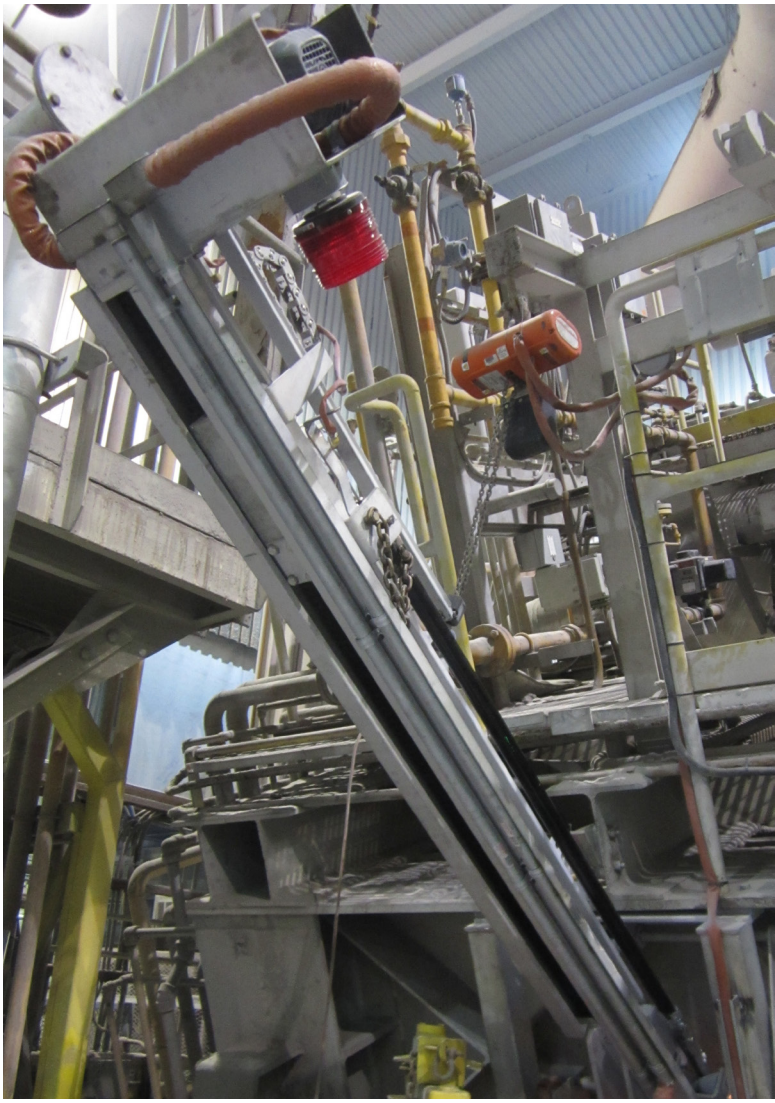
For example, the DynaProbe is a smart temperature reading system that allows accurate molten metal temperature readings into the metal bath at various depths. The furnace

control system uses the collected data to enable predictive burner control, avoiding overshooting the required process energy for every cycle.

DYNAPROBE: Intelligent and Automated Thermocouple Mechanism

Conclusion

The aluminium industry is facing new challenges that can be turned into opportunities. The increase in recycling activities helps decrease overall greenhouse emissions as well as production costs. Working to save energy actually serves a dual purpose to achieve the same goals. Dynamic Concept is positioned to support aluminium producers by bringing technical support and solutions to those new challenges.



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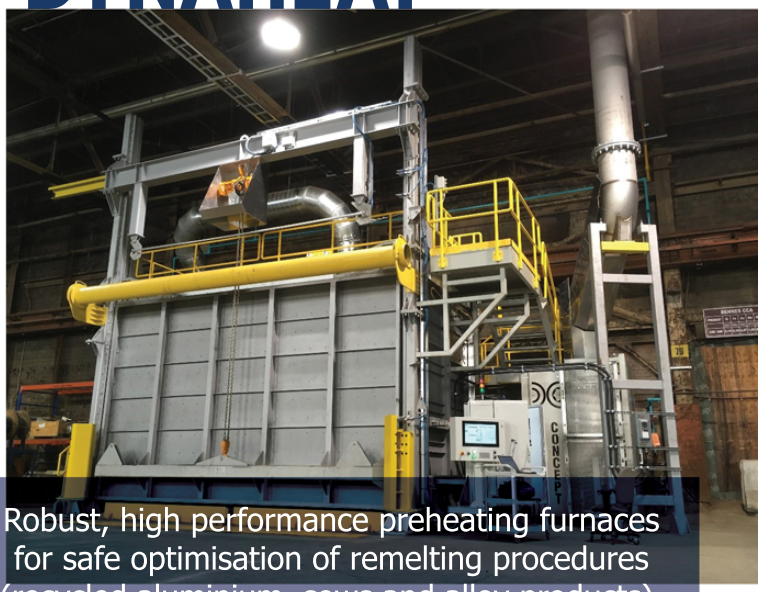

Robust, high performance preheating furnaces for safe optimisation of remelting procedures (recycled aluminium, sows and alloy products).

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PERENNIAL

PERENNIAL

C. Brian Hesse,

Co-owner, President and CEO of PerenniAL

“2023 should be a good year for the aluminium industry.”

C. Brian Hesse is co-owner, President, and Chief Executive Officer of PerenniAL, with 26 years of experience in the aluminum industry in a variety of executive leadership, sales and marketing positions. He joined PerenniAL, the then Rusal America, in May 2019 as President and CEO. He led all aspects of the business managing $950 million in revenue per year. He was hired to re-establish, rebrand and lead Rusal’s American operations (after US-imposed sanctions were lifted) for the world’s 2nd largest aluminium company. He has grown the US

team from 7 to 19 employees, created a culture of engagement, transparency, and accountability, secured ISO 9001 certification, and returned sales volumes to pre-sanction levels. Since Brian joined Rusal America, aluminium sales tonnes have grown from 129,000 tonnes per year to 346,000 tonnes per year in 2022.

As an industry-recognized leader in aluminium, he establishes, grows and scales multi-million-dollar B2B metal manufacturing and distribution companies into global competitors. Develops and implements the strategic plan, short- and long-term growth roadmap to drive brand preference and enter new markets and verticals. He integrates finance, sales, marketing, and business development strategies, catapulting sales growth YoY for high product mix businesses. Manages CAPEX and streamlines manufacturing, product development and supply chain using LEAN and Six Sigma processes to improve logistics, shipping and distribution and ensure exceptional client service delivery. During his career, Brian has had extensive global business experience in China, Europe, Mexico, India, and South Korea.

AlCircle: Could you share PerenniAL's journey from its inception? What was the reason behind entering the business of aluminium trading?

C. Brian Hesse: PerenniAL is an aluminium value added products distributor. We were formed in April 2022 as a result of a management buy out of Rusal America. PerenniAL's main purpose was to ensure we continued to serve our long standing customer base and differentiate our supply chain with global suppliers worldwide that are in good standing with the United States.

AlCircle: What are the aluminium products PerenniAL is dealing with presently? From where do you source the aluminium & why? Is PerenniAL a supplier of low-carbon aluminium?

C. Brian Hesse: PerenniAL distributes value-added aluminium products with a focus on billet, primary foundry alloy and slab. We source globally from India, South Korea, Indonesia and the US.

AlCircle: How do you envision the global aluminium industry in 2023? Which manufacturing industry would be the demand driver for 2023 and the next five years?

C. Brian Hesse: 2023 should be a good year for the aluminium industry. Even if moderate, we will see a growth in the demand for aluminium as more industries are turning to aluminium for its sustainability characteristics. Auto, EV, and building and construction should drive the need for aluminium.

AlCircle: What is your insight into the US administration's 200% tariff imposition on Russian aluminium imports? Will this sanction have an impact on the Russian aluminium industry?

C. Brian Hesse: The 200% has no bigger impact on the Russian aluminium industry than the 20% tariff that was already in place. This is simply a headline. There is no way that Russian producers can bring material into any country with a 20% tariff or a 200% tariff.

AlCircle: How would you rate your performance for 2022? Do you think aluminium is the most sustainable commodity in the metal world?

C. Brian Hesse: Our 2022 was the best year the company has had from a sales and profitability standpoint. There is no doubt aluminium is and will continue to be the most sustainable product.

AlCircle: What was the reason behind PerenniAL's acquisition of Rusal Americas?

C. Brian Hesse: The main reason was so we could continue to serve our loyal customers with a diversified supply chain and be 100% American owned and operated.

AlCircle: PerenniAL has operations in which countries? Please share with us your investment plans for 2023.

C. Brian Hesse: PerenniAL serves all of the Americas with value-added aluminium.

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Riad Faour,
CEO, Progesys

"Projects in 2023 include an increased construction activity at the PT Borneo Alumina Indonesia project for which Progesys is in a consortium providing PMC scope of work for the new Alumina refinery under construction,"

Riad is the founder and CEO of Progesys, responsible for providing leadership and managing the growth of the company. He has over 23 years of experience in project management

and executive leadership throughout North America and abroad. He started his career in the aluminium industry in Canada and then in the USA. He worked with owners of assets and projects and engineering firms before he founded Progesys in 2003 and has since been responsible for its growth and expansion to many industries and regions, including Europe, Asia, the Middle East, Africa, and South America. He received the UQAM performance award in 2016 for leadership, entrepreneurship, and international development.

Riad is a registered professional engineer. He earned a Bachelor of Engineering from École Polytechnique in Montréal, a Master of Project Management degree from the University of Quebec in Montreal, and the Harvard Business School's Owner President Management program.

AlCircle:How do you envision the global aluminium industry in 2023? What challenges will be the major to counter in the upcoming time?

Riad Faour: The global aluminium industry is expected to continue growing in the upcoming years when taking into account various developments in many industries around the world and based on current trends and forecasts. We can think of the influence of some drivers of growth of the industry in the past decade, such as the impact of emerging markets and the worldwide demand for aluminium for the construction and packaging industries and now also the increased need in transportation for aluminium in electric vehicles, it being a lightweight, durable and recyclable material.

For the challenges in upcoming years, environmental concerns

around gas emissions and overall sustainability, along with trade tensions and geopolitical risks, are expected to continue to be the top subjects to be addressed. The industry will also need to train resources and upgrade their skills to integrate new technologies.

Alcircle: How do you think the high-interest rates will impact the aluminium business as well as the other industrial sectors? Is there any impact on Progesys projects?

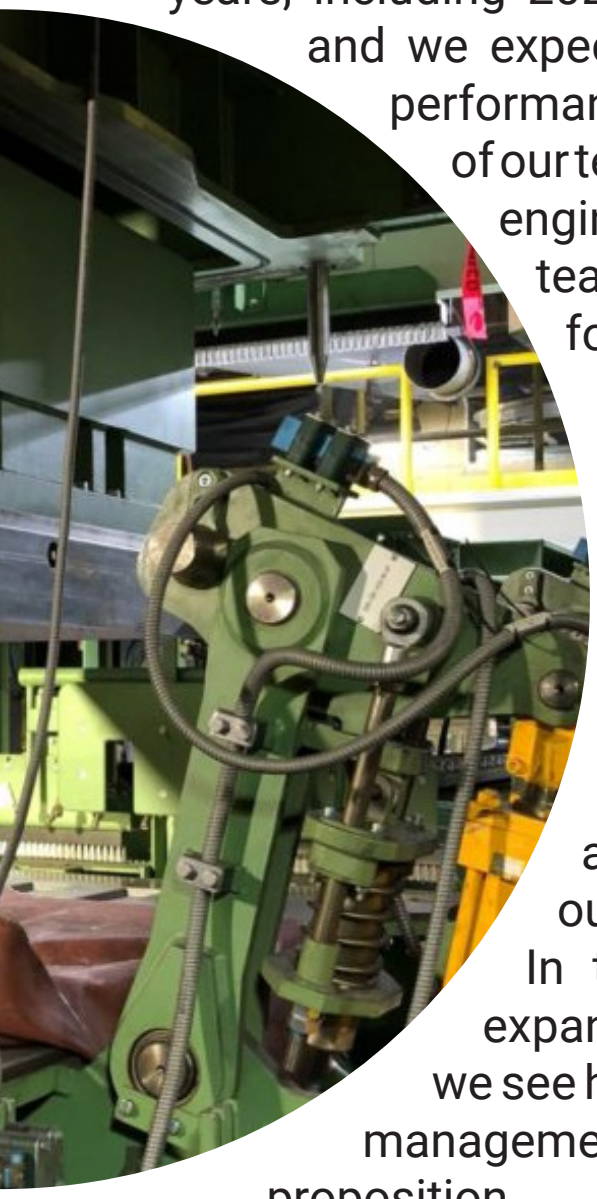
Riad Faour: Higher interest rates will have an impact on the aluminium business. The impact may be reduced profitability for producing companies because of interest on loans, more pressure on projects to get approved and possible decrease of demand due to reduced activities in many industries consuming aluminium.

The inflation experienced worldwide has an impact on the projects we're managing or contributing to. For planned projects, inflation and its impact on Capex required efforts to manage and define the financial feasibility. For ongoing projects, additional efforts are focused on mitigating the increased costs caused by inflation. The interest rates increase the pressure on planned and ongoing projects. But until now, the projects we are contributing to, in various phases, are continuing to see progress and are not put on hold or cancelled. A possible economic

slowdown because of interest rates may change the situation and impact sustaining and capital projects.

AlCircle: How would you rate your performance for 2022? What areas need to be improved on the Progesys front?

Riad Faour: Progesys provides Project Management, Construction Management, Commissioning, and Operational Readiness services to clients in many regions. In the last 3 years, including 2022, our revenues grew above 20% YoY, and we expect the same for 2023. We had a solid performance, and we have increased the capacity of our teams, welcoming 2022 many great senior engineers and bright young resources. Our teams achieved several strategic projects for our clients.



Internally we have several plans in place to improve our organization and support its rapid growth. We will continue achieving these plans in 2023. The plans include improving our training and mentorship programs and training our resources on new technologies. They also include continuous improvement to our on-boarding process of new resources. In terms of market reach, we intend to expand our activities in some regions where we see high potential for our services and project management and transition to the operations value proposition.

AlCircle: What are your insights on sustainability? How is Progesys implementing sustainable measures in its projects, preferably aluminium?

Riad Faour: Progesys works with local communities to ensure that its projects contribute to the well-being of the community. This includes respecting cultural heritage, promoting hiring in the community and supporting education programs. The benefits of these actions are felt across the organization. We have an increased understanding of community concerns and objectives and projects that are better supported. Also, our employees are from all continents and many countries and have been for many years with the company with a diverse experience which creates a unique perspective on projects and a unique value for our clients.

We also promote economic sustainability by implementing cost-effective solutions that reduce project costs and increase efficiency. This includes the use of best practices and project innovative technologies that help to optimize resource utilization and reduce waste. Examples of this work in the aluminium industry include our implication on the construction completion and commissioning as part of the amperage creep program for the Alma plant, a carbon plant, and contributing

to a major shutdown to replace existing equipment with a new system which allows the production of larger anodes that meet the new production criteria. This two-phase project first required changing the equipment and then restarting the plant, all without any impact on production. Another example is our implications on the Rio Tinto new remelt plant commissioned at its Laterrière smelter, adding 22,000 metric tons of recycling capacity to its aluminium operations in the Saguenay – Lac-Saint-Jean region of Quebec. The remelt furnace is equipped with highly efficient burners to minimize its carbon footprint.

Progesys is also committed to providing a safe and healthy work environment for all its employees, contractors, and stakeholders. This includes implementing safety procedures and training programs and continuously improving safety performance.

AlCircle: Can you share with us your new or upcoming projects?

Riad Faour: Projects in 2023 include an increased construction activity at the PT Borneo Alumina Indonesia project for which Progesys is in a consortium providing PMC scope of work for the new Alumina refinery under

construction, which PT BAI oversees developing, building, and operating. The Smelter

Grade Alumina Refinery (SGAR Project), with 1 million tonne alumina production capacity per annum, is in Mempawah District, West Kalimantan Province, Indonesia.

We have several projects in installations (smelters, hydropower installations, or alumina refineries) for our clients, focusing on Project Management and Operational Readiness. There is also the management of sustaining capital programs which we already do for clients in other industries.

This is being done in the Aluminium industry while we are also growing our services in many other industries and unlocking value in cross-collaboration between our teams.

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PROGESYS

Aitor Uranga,

Commercial Director for Africa and Asia at Insertec

The future of aluminium processing industry: The facilities of tomorrow, now

The aluminium processing industry must be able to adapt to the fast-changing environment we are facing nowadays. With the aim of helping the aluminium industry in this non-stop adaptation, Insertec is working on the definition of tomorrow´s aluminium processing facilities, focusing on three key areas: efficiency, sustainability & knowledge.

Efficiency: Efficiency goes far beyond having a plant that respects emission regulations or monitoring energy consumption. Being efficient in 2023 means making the most of the full potential of a facility: achieving optimal profitability without losing sight of the well-being of people and the protection of the environment.

Our automation department is focusing on two strategic lines to achieve the most efficient facilities: robotics and data intelligence.

Thanks to the first, we are going to achieve, apart from the automation of the processes, a minimum intervention of the operators in critical operations, as well as remote and real-time process monitoring.

Data intelligence, a perfect combination between artificial intelligence and machine learning, helps us to process huge amounts of information coming from different areas. Combining different sources of information, we get a powerful real-time facility managing tool.

Both working lines represent an incredible advance in plant efficiency, a giant step that we are already taking, together with strategic partners, with the development of solutions such as the LAU Intelligent System, IFI Robotic Process and initiatives for the incorporation of disruptive technologies in the world of metallurgy such as the digital twin of equipment and production plants.

Sustainability: Nowadays, sustainability must be an integral part of the company, not only in its production process but

also in its day-to-day activities. We have been reinventing ourselves in this sense for the last few months.

Moving towards a more environmentally friendly industry is a responsibility Insertec has been working on for some time. Internally, the company has taken a number of measures, such as digitizing catalogues and installing solar panels. But it invests significant effort and time in researching projects related to the circular economy at European and international levels. The company is involved in projects such as waste heat recovery through using heat exchangers at Etekina, using green hydrogen in combustion systems at H2-Site and H-Acero, and decarbonising production equipment in collaboration with Iberdrola.

However, we are convinced that the recovery and reuse of waste will be the key to achieve the sustainability objectives set. It is something that we are working on from our two business

divisions. Our Refractory division is involved in a project to transform a secondary aluminum oxide into an alternative raw material to bauxites www.bauxal.com At Thermal Engineering Solutions division, we work on developing facilities and equipment capable of taking advantage of the full potential of post-consumer scrap in all phases of the process, producing low carbon footprint aluminum.

Knowledge: Aluminium Metallurgy, Manufacturing Processes and Plant engineering are the strengths of our organization, essential knowledge to meet the demands of a profitable and sustainable economy.

Insertec was founded more than four decades ago with a singular goal: to improve existing industrial processes. Today, the company has become a household name, adapting to the demands of the industrial heat sector by manufacturing top-notch equipment and refractory materials.

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Gouda Refractories uses advanced production technology and applies the highest possible quality standards. Its philosophy is durability, reliability and the ability to produce at competitive conditions. Through professional cooperation with local partners, Gouda Refractories can offer a complete package, from design and production to supply, installation, aftersales and maintenance.

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Moritz Hansen, **Head of Communication & Marketing, Speira**

“We see the demand for aluminium products with a high recycling share across most of our markets, particularly in the automotive industry, the beverage cans sector, as well as the building & construction.”

An aspiring person, Moritz Hansen is in charge of communication and marketing at Speira, one of the most exciting companies

within the aluminium industry. Since 2016, he has made his way in the aluminium sector. Hansen earned an Exec MBA from Amsterdam Business School as well as a Master of Arts in Political Communication. He also serves on Speira's Executive Management Team, responsible for Marketing, Communication, and Sustainability.

AlCircle: What measures have you initiated or already undertaken to declare Speira net zero by 2045? Don't you think this commitment is too ambitious?

Moritz Hansen: We are building our net zero roadmaps on four key pillars. We will constantly reduce our direct emissions (Scope 1) and indirect emissions (Scope 2) through electrification and alternative fuels, through the increased use of renewable energy for our processes and our continued drive to make our operations more and more energy efficient. The biggest portion of our CO2 emissions arises along the value chain (Scope 3). We work diligently on our metal input mix and the development of recycling-friendly alloys (RFAs) to increase the share of secondary aluminium to be used in our processes. Additionally, we are developing a sustainable procurement strategy to push our suppliers on sustainability. We believe our targets are ambitious but achievable.

AlCircle : It's no secret that the production and consumption of secondary aluminium are on the rise. Which manufacturing sector will be the demand driver for secondary aluminium in Europe and globally?

Moritz Hansen: Yes, we see the demand for aluminium products with a high recycling share across most of our markets, particularly in the automotive industry, the beverage cans sector, as well as the building & construction and other specialities markets. We are in the middle of a major transformation of our industry towards recycling.

We are convinced that with the recent acquisition of Real Alloy Europe and the various other investments in recycling capacities, we are taking across our plants, we are well placed to meet the increased demands across all markets. This is confirmed by the increasing sales of our third-party certified product label ORBIS 75, which guarantees a minimum of 75% external scrap. They have increased heavily between 2022 and this year. And we are still early in the year.

AlCircle: How do you forecast the year 2023 for the global aluminium industry in the short and long term?

Moritz Hansen: General market sentiment in the first two quarters has been rather moderate across most of the markets we serve. All in all, we expect an increased demand during the second half of 2023.

AlCircle: How would you rate your performance for 2022? Could you like to share the production break-up of your products? What areas do you think Speira needs to improve or could have done better?

Moritz Hansen: When we started our transformation journey in 2019, we set out a four-year improvement program with the ambition to build a robust company. We can state with a portion of pride that we successfully completed our improvement program in 2022, which confirms the good performance development we have had throughout the last years. We constantly increased our performance despite macroeconomic challenges and disruptions in the global supply chains as a consequence of the Covid-19 pandemic, the Russian war in Ukraine as well as increasing energy prices and inflation rates. Despite this positive performance development, we must admit that the volatility and uncertainty we are facing constantly challenge our capabilities to predict market developments. The speed of market changes has increased strongly throughout the last three years.

AlCircle: What are your investment plans for 2023 concerning new technology development, installation of new machinery and expansions, if any?

Moritz Hansen: On April 1, we completed the acquisition of Real Alloy Europe. This acquisition is a major step in our transformation to becoming a leading aluminium rolling and recycling company and an industry benchmark in sustainability. With the acquired five facilities, three in Germany and two in Norway, we increase our recycling capacity to 650,000 tonnes annually. This will enable us to enhance our ability to deliver

low-carbon products to our customers. Additionally, we take another big step on our decarbonization path, with the target to be net zero by 2045.

AlCircle: How would you describe the atmosphere and culture at Speira?

Moritz Hansen: In Speira, we believe in the power of teams, the commitment to strong ownership, the drive that we can create through our entrepreneurial spirit and the fundamental need to build trust. I am convinced Speira is one of the most exciting companies within the aluminium industry to work for these days. We successfully took the first major step on our transformation journey throughout the last four years to build a robust company. Now we are increasing the speed to bring the company to the next level – both financially and from a sustainability perspective.

speira

Building a circular world that works

We redefine the limits of rolling and recycling aluminium,
to create innovative products & solutions and foster circularity,
for the sustainability of the planet and our company.

Speira GmbH | Aluminiumstraße 1 | 41515 Grevenbroich | Germany

speira.com

PRESEZZI® EXTRUSION

Valerio Presezzi,
Founder & President, Presezzi Extrusion

"In 2022, we developed 34 new projects, 10 of which were for new clients who chose to believe in us and 24 new orders from long-standing clients who demonstrated their unwavering trust and confidence in our reliability."

AlCircle: How do you visualize the year 2023 for the global aluminium industry, considering the extrusion sector?

Valerio Presezzi: Regarding global industry, in 2023, we are not expecting any particular downturns with respect to the trends of recent years. On the other hand, the outlook is clear and decisive in our extrusion and melting industry.

The market for system supply is going strong, actually very strong. The global market, in general, is experiencing a fundamental transformation in terms of application.

More specifically, many clients are setting themselves up best to satisfy the automotive market and its conversion to electric, as well as the market for high-speed trains and fabrications engineered in aluminium and its alloys. This entails an upwards adjustment in system sizes and, not least of all, technological advancement, a requirement that we regularly satisfy insofar as part of our mission: to provide technology combined with high energy-saving machines and systems.

AlCircle: Could you please brief us on Presezzi's performance in 2022 and how you envision 2023?

Valerio Presezzi: The Presezzi Extrusion Group's strong resilience was fully expressed during the year just ended, thanks in part to its far-sighted investments over the years in strategic products, internal processes, international patents and staff professionalism, recording a (provisional) Turnover as of 31 December 2022 of approximately +59% compared to 2021, while the forecast for 2023 is about +3%.

In 2022, we developed 34 new projects, 10 of which were for new clients who chose to believe in us and 24 new orders from long-standing clients who demonstrated their unwavering

trust and confidence in our reliability.

AlCircle: Could you detail Presezzi's plan to put effort towards sustainability and the environment in 2023?

Valerio Presezzi: To better convey how the Presezzi Extrusion Group intends to approach 2023, I would like to articulate the term Sustainability into two words: "Virtuous Future", a future where in order to be leaders, it is essential to be virtuous in directing the economic and environmental sphere.

Backed by a substantial increase in business volumes, significant market results, and confidence in the rising demand for extruded profiles in the automotive, construction and transport industries, the company has strategically invested substantial resources in the development of energy-saving technologies in the name of innovation and the ongoing quest for excellence with low-impact solutions.

Over the past year, we have successfully obtained EPD® (Environmental Product Declaration) certification for two of our flagship products: the Z.P.E. permanent magnet heater and E.S.S. Extrusion Press. 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 vital information for assessing the overall effect of the final product, further demonstrating our commitment to a sustainable future.

AlCircle: Which industrial sector do you expect to drive the demand for aluminium in 2023?

Valerio Presezzi: The number and variety of applications for extrusions in aluminium and its alloys have noticeably increased in recent years. Thanks to our expertise gained working in close contact with the production needs of individual applications, our company is frequently chosen as a technological partner, producer and supplier of extrusion lines and foundries for major extruders worldwide, leaving no industry untouched. Considering our operations on a global scale and the current situation as a whole, there has been a substantially balanced demand for systems to produce profiles for B&C (Building & Construction), Mobility / Automotive and Industry. The systems purchased over the last two years and to be supplied in 2023 are characterised by a significant increase in applications for the Mobility / Automotive industry, a trend set to continue judging by the requests we are receiving today, knowing that the systems will go into production in the second half of 2024 and 2025. Presezzi Extrusion is fully equipped to meet demand thanks to high-performance, energy-saving technologies developed specifically for this industry, process traceability systems and several process technologists directly on its team, thus offering the client added value beyond the system itself.

AlCircle: Can you share one of your recent success stories with our readers?

Valerio Presezzi: Hindalco Industries placed the order for three state-of-the-art extrusion lines with Presezzi to be delivered and commissioned during 2022 and early 2023. Despite severe supply chain disruptions, Presezzi delivered the first extrusion line on time and commissioned it ahead of schedule.

Hindalco Industries recognized this feat by Presezzi at its "Partners Meet" held in December 2022 in Mumbai, India and Mr Satish Pai, the Managing Director, presented the award to us. While presenting the award during the event, Mr Pai recognized us for our outstanding commitment and partnering with Hindalco for the supply and commissioning of a state-of-the-art Extrusion line despite supply chain disruptions.

This feat could be achieved through the commitment and well-coordinated efforts of Hindalco – Presezzi- Uniseven (Presezzi's Indian Partner).

AlCircle: What innovative products are you planning to develop for the global aluminium industry in 2023?

Valerio Presezzi: Research and development are highly important for our business as well as a smart way of seeking out all the technical moves that can generate positive actions for mankind and the environment. Our most important mission today is research into achieving increasingly safe and efficient know-how and machinery with the precise objective of energy saving, i.e. requiring less energy per ton produced.

Improving this parameter results in the following:

- Fewer CO2 emissions
- Less demand for electricity
- Less gas consumption

Saiprasad Jadhav, Group CEO, Epsilon Carbon

"Epsilon has a customer base spanning 22 countries and is dedicated to providing innovative and high-quality carbon products."

Saiprasad Jadhav looks after the overall business operations of the Group. He has around three decades of experience, more than a decade in an entrepreneurial career. During his tenure of entrepreneurship, he had run two manufacturing facilities for Fluorine-based speciality chemicals & active pharma ingredients and pharma formulations, respectively.

In his association with Epsilon, Saiprasad Jadhav has been instrumental in setting-up greenfield capacity for the Carbon Black business with a capacity of 115,000 TPA & has been mentoring the management team for the subsidiary company, Epsilon Advanced Material Private Limited in establishing Anode material business. Prior to joining Epsilon Carbon, he was associated with Deepak Nitrite Ltd as President – Fine & Speciality Division.

AlCircle: Could you share the journey of Epsilon Carbon from its days of inception? What was the story behind starting Epsilon Carbon and becoming India's leading coal tar derivatives manufacturer?

Saiprasad Jadhav: Epsilon Carbon Pvt Ltd was established in 2010 and is a leading manufacturer of coal tar derivatives. Our 320,000 TPA manufacturing capacity makes us a partner of choice for some of India's biggest names in aluminium, carbon black, tyres and mechanical rubber goods, graphite, speciality and construction chemicals, dyes and pigments, and other sectors.

Epsilon's story began with creating a value chain for a carbon derivatives market from a by-product of steel plants. We ensure sustainability at every stage of our production process using cutting-edge technologies, our state-of-the-art ZLD manufacturing facilities, greater use of renewable and waste resources for energy and compliance with global norms resulting in stakeholders' trust in us. Within a short timeframe, Epsilon became one of the largest global exporters of solid coal tar pitch (solid CTP). We are now the preferred domestic supplier for the aluminium industry, with a market share of

around 40%.

Epsilon has a customer base spanning 22 countries and is dedicated to providing innovative and high-quality carbon products. We are committed to being a responsible care company. We are proud to be rated Silver by EcoVadis in 2022 for our sustainability practices within a short period from the start of operations. Our vision is to be a leading provider of quality carbon products. Our mission is to support global industries with a reliable supply of quality carbon products that are sourced using environmentally friendly practices.

We have ISO certifications such as – 9001 for QMS, 14001 for EMS, 45001 for OH&SMS, and 50001 for Energy Management Systems. These certifications help build credibility for our product quality, process, and safe operations. Also, we are certified by IATF 16949:2016 – Automotive QMS, ISO/IEC 17025:2017, ISO 27001:2013 - Information Security Management System, and ISO 28000: 2022 – Supply Chain Security Management which highlights our approach to data credibility and integrity.

AlCircle: What are the sectors Epsilon Carbon caters to for its carbon products? Which sectors in India Epsilon Carbon's products are mostly adopted and why?

Saiprasad Jadhav: At Epsilon, we cater our products to Aluminium, Anode for Lithium-ion Batteries,

Graphite, Tyre, Dyes & Pigments, Automobile, and Construction sectors. In India, our product has a 40% market share in the Aluminium segment (CT Pitch) due to our consistent supplies, better quality, excellent customer service, and best industry standards in manufacturing, supply chain, and quality. Our commitment to quality, rigorous safety standards and practices, ethical governance standards and industry-certified processes sets us apart.

Our company's sustainable business growth is driven by quality and commitment. Our raw material security helps us with an uninterrupted and monitored supply of inputs. We believe in using sustainable production means and ensuring zero discharge at the facility. Our manufacturing facilities are strategically located to leverage supply chain advantage and service our customers seamlessly.

AlCircle: What percentage of Epsilon Carbon's production is absorbed in the aluminium sector? Kindly detail us with the supply of the product.

Saiprasad Jadhav: Epsilon's 45% production is absorbed in the aluminium sector. The main product we supply to the aluminium industry is coal tar pitch, and we have a well-established supply chain to ensure uninterrupted supply per customers' requirements.

AlCircle: How has Epsilon Carbon's supply to the aluminium industry changed the dynamics of the Indian aluminium sector? Who are your major consumers in the Indian aluminium sphere?

Saiprasad Jadhav: As the second most consumed metal, aluminium is called the "metal of the future". India was a net importer of CT Pitch before Epsilon. After Epsilon started supplying the country with the product, the import dependency was removed, and India became a net exporter. Our major customers are the key players in the Indian aluminium industry.

AlCircle: How would you rate your company's performance for FY22-23? What major areas will you invest in in the next financial year?

Saiprasad Jadhav: We made great strides in FY23 by becoming a leading organization in exports of solid CT Pitch globally.

Next fiscal year, we focus on creating India's first 'liquid CT Pitch port' for exports. With these efforts, we estimate to export around 3 Lakh MT in the next 5 years.

Additionally, we're investing heavily in R&D, digitalization, and sustainability initiatives. With the projected growth of the aluminium industry and the reduction of CT Pitch availability from China, we're planning for organic growth. We're setting up a 500 KTPA Coal Tar distillation plant at a second location in India and preparing for speciality chemicals facilities.

AlCircle: What are the sustainable measures Epsilon Carbon, as an organization, has taken?

Saiprasad Jadhav: We constantly integrate sustainability into our design & operations, and the concept of circularity has been designed to ensure minimum wastage and emissions across the manufacturing facility. Our governance principles guide us to consider the environment while making

business decisions.

Our second sustainability report was published in December of 2022 and was based on the Global Reporting Initiative (GRI) Standard. We have developed a green belt with 47,500 trees to help minimize air pollution. We are continuously optimizing our operations and usage of non-renewable utilities like water and power, as evident from our consumption trends of utilities per metric tonne year-on-year basis.

Our company is committed to sustainable business growth, providing a secure source of captive raw materials and long-term contracts. Additionally, our products reduce emissions by using cleaner fuels, low Sulphur feedstocks, and zero discharge. Our 100% backwards integrated processofmanufacturing products and using captive feedstock from our operations testify to circularity.

Gas generated during our process generates steam and electricity in our Captive Power Plant. This helps us reduce our carbon footprint significantly, to the extent that our product Carbon Black has nearly 20%

lesser footprint

than our domestic peer industries. Also, our value-added product, synthetic graphite for Anode material, has almost 77% less CO2 footprint than China.

Our CSR and CER goals are aligned with the United Nations' SDGs for Good Health & well-being. We have supported the elderly, Covid-19 care, specially-abled people, and hospitals. Over 4 Lakh lives have benefited in the last 4 years. Quality Education is another goal we are passionate about; we have upgraded teaching & learning facilities in 4 Direct Impact Zone villages and developed model libraries, which have helped more than 5000 students.

Further, we are working to support animal welfare trusts and restore ecological balance through afforestation and wildlife conservation. We have also contributed to women's empowerment, sports development, village street lighting, livelihood programs, relief funds, solid waste management programs, and many other initiatives. We are a Responsible Care logo

holder and EcoVadis -Silver Rated company. Many rating agencies well recognize our efforts towards sustainability.

We are preparing for SA 8000 certification, an international certification standard that encourages organizations to develop, maintain and apply socially acceptable practices in the workplace.

AlCircle: How do you envision the global aluminium industry for 2023?

Saiprasad Jadhav: Global aluminium demand will likely rise in 2023 due to China's economic recovery and relaxation in its Covid policies, with consumption expected to grow by 4.7 per cent. Aluminium demand in emerging nations like India with good economic growth prospects is expected to increase during 2023. Rising demand for the product in the automotive and transportation industry is one of the key drivers to surge market development.

John Courtenay, Chairman and CEO, MQP

“Casting is good one day, bad the next. But we haven’t changed anything. The most common complaint from casthouses and inconsistency of grain refiner plays a big part.”

Studying metallurgy at the University of Aston, John started at Foseco International, working his way through ONC, HNC and LIM, before being seconded to Foseco Canada for three years to work on an exciting new product for steel continuous

casting plants, going on hold a number of International marketing and technical positions before joining Foseco Japan as general manager of their steel mills division, returning to Foseco International in 1983.

In 1986, he switched from steel to aluminium, starting a long association with aluminium casthouse technology as director of technology and marketing of Foseco Aluminium. After selling this business to Pyotek, he used his experience to form MQP Limited, which celebrated its 20th anniversary in 2020.

AlCircle: What is MQP's process to make aluminium alloy production even better and less costly? What are the benefits of Optifine?

John Courtenay: "Casting is good one day, bad the next. But we haven't changed anything." This is the most common complaint from casthouses, and inconsistency of grain refiner plays a big part, leading to cracking, inconsistent or large grain size and impairment of melt quality.

We started MQP as we wanted to revolutionise our part of the industry through the development of our high-efficiency Optifine grain refiners, preventing defects in aluminium alloys and bringing addition rates right down to make cost savings for casthouses. Because grain refiners had often been inconsistent in performance, it resulted in significant waste. Still, through intensive innovation, we have changed all this. Today, we have three versions of Optifine with varying potencies for different requirements, which are used to produce over five million tonnes of alloys a year at 45 major casthouses worldwide.

Our most recent development, Optifine 5:1 125, is a game-changer. With 125% relative efficiency, it results from five years of fundamental research into nucleation with BCAST at Brunel University London. It means casthouses need up to 90% less grain refiner, helping them make cost savings while achieving excellent melt quality, especially in alloys with high tensile strength and high surface quality typically used in automotive applications. It is a premium product which gives the end user a high rate of return.

Grain refiner is, arguably, a casthouse's second biggest spend. By using Optifine instead of a standard grain refiner, customers can save up to three dollars per tonne, resulting in hundreds of thousands of dollars a year in a medium-sized plant.

To make aluminium alloy production as efficient as possible, we ensure our customers have access to stock quickly and easily. We have warehouses worldwide, including a warehouse in Rotterdam to service Europe, and one in Kentucky, where there are many aluminium processing plants, to service North America.

Customers can pick up a pallet at short notice if they need to, and if they want to put in a replacement order a few months before they need the product, we will store it for them until they want

it delivered, an extra level of certainty that the stock is there.

AlCircle: What are the ranges of other innovative solutions MQP provides to the aluminium casthouse operations?

John Courtenay: We provide a suite of casthouse solutions to improve the grain refinement part of the manufacturing process, which we have improved on or are improving. For one, we have just improved on our Optifeeder system, our high precision rod feeder that solves the problem of empty despoilers or coils not rotating, and no action being taken or alerts sounded, which can have serious repercussions, including the scrapping of a charge at the last stage of the process and the expense that follows.

We are also in the process of completely automating our Opticast system, the only system in the industry that enables cast houses to test-drive the grain refiners they are using to see if they can improve melt quality and make cost savings. Traditionally, this has been a guessing game and struggling to maintain the same grain size in the melt every time has resulted in scrapped charges, product downgrades and higher processing costs. We have specialists in laboratory equipment associated with the Brunel technology zone giving Opticast an overhaul, and a prototype is launching soon. Casthouses can buy the system themselves, too, not just have us test their grain refiners at our MQP Technology Centre, benefiting those developing new alloys which need to set new

grain refiner addition rates.

Completing the package of grain refining solutions is our Optifilter system, an efficient, low hold-up volume filtration process for frequent alloy changes or low-volume operations. The three-chamber system has a ceramic foam filter in the first stage, a TiBAl grain refiner added in the second stage and filtration completed in the third stage using an efficient cyclone. This unit is currently undergoing casthouse trials and, from customer feedback, is drastically reducing the number of inclusions in the melt.

We will promote all these to the industry over the next year to ensure casthouses can tap into a complete package of innovative solutions to improve operational efficiency.

AlCircle: What are the key sectors to which MQP is attached?

John Courtenay: We are increasingly working with major casthouses in the business of producing alloys with high tensile strength - typically higher than 400MPa (UTS) – together with enhanced recyclability, machinability and corrosion resistance. These properties are essential for high-stress components such as extrusion-based crash management systems, body-in-white structural components and battery boxes for electric vehicles.

The challenge for these casthouses is that they increasingly have to add more zirconium to melts to achieve this high tensile strength. Still, through our research at BCAST, we discovered that zirconium has a poisoning effect on grain refiner. Using

state-of-the-art electron microscopy, we saw a definite need for an ultra-potent 5:1 grain refiner to overcome the Zr poisoning effect, and Optifine 5:1 125 enables casthouses to successfully cast high-strength zirconium containing 6000 and 7000 alloys for automotive mitigating the zirconium 'poisoning' problem, as I recently demonstrated at this year's TMS.

We also work with casthouses to supply our 100% relative efficiency Optifine 5:1 100 grain refiner for producing foilstock, litho sheet, canstock and packaging and Optifine 3:1 100 for those in the business of general purpose applications and production routes.

AlCircle: How do you foresee the global aluminium industry for 2023?

John Courtenay: Many of the industry challenges of last year appear to have abated. For one, government pressure on China to look at its energy production led to a shortage in raw materials such as magnesium. Still, the major players have managed to rejig their supply chain, and hopefully, these problems will be sorted as we move more into 2023.

AlCircle: Is the global economic and geopolitical crisis, high inflation, energy price and strengthening of USD $ putting a barrier in the growth of the aluminium sector? How is MQP countering these challenges to bypass the impact on the business?

John Courtenay: Optifine is produced at the STNM plant in China, and while the cost of container sea freight was a

problem in 2022, container rates from China have dropped back to close to where they were before the pandemic, aiding the recovery in global trade. Our business is benefitting from Optifine being produced in a modern, high-capacity production plant with planned expansions, significant expenditure on R&D, coupled with new product introductions, extensive global stocking facilities, excellent quality control procedures and cost reduction due to efficient, low-cost base manufacture.

AlCircle: Could you share with us MQP's advancement of sustainable manufacturing with closed-loop production?

John Courtenay: Businesses globally are under pressure to implement sustainability strategies to stay ahead of the compliance curve and drive sustainable change. In terms of end-user behaviour, a recent report revealed that 65% of UK consumers think about the environmental impact of the items they buy, with nearly 80% of US consumers considering sustainability when buying a product.

Making vehicles lighter and creating electrical infrastructure and solar panels, aluminium is a game-changer when it comes to energy transition towards low-carbon energy sources, and we expect demand to grow massively by 2050. But the manufacturing process involves significant amounts of energy, and we strive to combat that.

We are now producing Optifine 5:1 125 with low carbon aluminium, meaning it's manufactured using hydroelectric power or wind power, which results in far lower polluting CO2

emissions. We aim to convert all our grain refiners, including Optifine 5:1 100 and Optifine 3:100, to this process in the near future.

On top of this, we are recycling customers' scraps to make our product. This means we take customers' production scrap aluminium and melt it down to create our grain refiners, as well as master alloys, which they can buy back. Making our grain refiners on a closed-loop recycling basis is very attractive as customers endeavour to improve their practices in a meaningful way that goes towards meeting emissions targets.

In addition, if the world adopted Optifine, fluoride by-products and emissions would be cut by two-thirds. The higher relative efficiency means less energy used, fewer coil changes and transportation around the casthouse and lower warehouse inventory.

AUSTRALIAN ALUMINIUM COUNCIL LTD

Mike Ferraro LLB (Hons)

President of the Australian Aluminium Council.

“Substantial growth in aluminium demand, both primary and secondary, is forecast in the coming decades, particularly from the transport, construction and electrical sectors.”

Prior to his appointment as the CEO and Managing Director of Alumina Limited in 2017, Mike was a Non-Executive Director of Alumina Limited and global head of corporate and a member of the management committee at Herbert Smith Freehills,

an international law firm. Between 2008 and 2010 Mike was Chief Legal Counsel at BHP Billiton Ltd. Mike is also a director of Alcoa Australia Ltd and the President of the Australian Aluminium Council.

AlCircle: How is the Australian Aluminium Council helping to promote sustainable bauxite mining and metal production?

Mr Mike Ferraro: Aluminium is one of the commodities most widely used in the global clean energy transition. Transitioning the world towards green energy sources will require 50% more aluminium than the electricity sector consumes today. Australia is one of the very few countries which has an integrated value chain, from bauxite mining all the way through to extrusion industries.

Today, Australia is the world's largest producer of bauxite, the largest exporter of alumina, and the seventh-largest producer of aluminium.

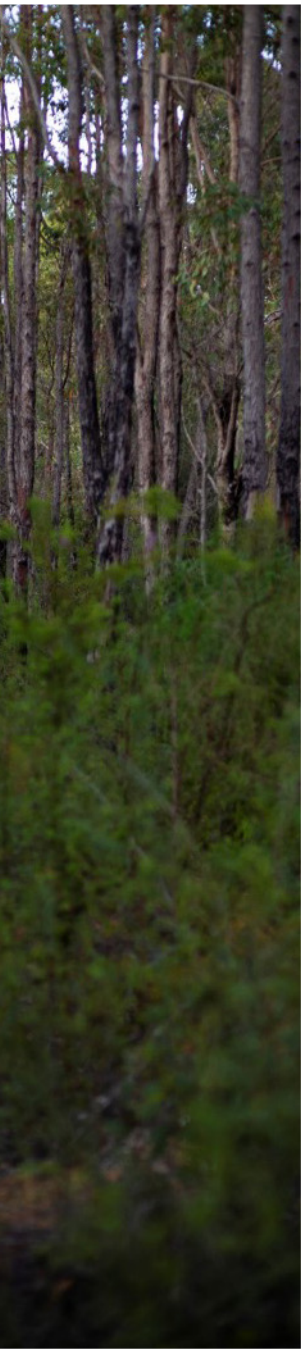
Australia has more than 60 years of technical experience in bauxite mining, alumina refining, and primary aluminium smelting, which not only helps us, but our customers, reach their sustainability goals.

Our members, such as Alcoa, Rio Tinto and South32's Worsley Alumina operations, all have their global alumina research headquarters in Australia, helping develop new technologies for the world. Our downstream members support the domestic supply of manufacturing aluminium extrusions in Australia.

Australian bauxite mining is regarded as having some of the highest sustainability standards in the world. In 2018, the Australian Aluminium Council co-authored the Sustainable Bauxite Mining Guidelines together with the International Aluminium Institute and the Brazilian Aluminium Association, aiming to share the expertise learned from decades of sustainable mining practices in Australia with the global industry. Sustainable bauxite mining is not a "one-size fits all" prescriptive process but involves risk management and applying technologies appropriate to the circumstances of each mine. The guidelines aim to identify and communicate the criteria and encourage emerging bauxite suppliers to improve their practices in line with the rest of the global industry. The guidelines were updated, and the second edition was published in February 2022.

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

AlCircle: As the Council speaks on behalf of the energy-intensive aluminium industry in Australia, can you give us an idea of the essential steps that are being taken in the region to negate carbon emissions?



Mr Mike Ferraro: Australia as a nation has committed to net zero emissions by 2050. For the aluminium sector, the biggest opportunity to reduce carbon emissions is through the decarbonisation of the electricity supply. Increased generation of renewables in the electricity sector is projected to increase to more than 80% by 2030.

Inert anodes technology could reduce more than 95% of the scope 1 emission in aluminium smelting. However, the global rollout of the technology is not expected to be widescale until post-2030.

Already having some of the lowest emission intensities in the world, Australia's alumina industry is also leading global research into new technologies to decarbonise. For example, Alcoa of Australia Limited has received funding from the Australian Renewable Energy Agency (ARENA) to test Mechanical Vapour Recompression (MVR) and Electric Calcination (EC). With electricity sourced from renewables, the two technologies could reduce a refinery's carbon emissions by 98% and reduce freshwater use by up to 70%. Additionally, Rio Tinto is in partnership with ARENA and Sumitomo to investigate the potential to decarbonise alumina calcination using renewable hydrogen.

AlCircle: With the emerging concept of decarbonisation, it is evident that recycling activities are on the rise. Does this mean it can pose a future threat to other mining and smelting activities in Australia?

Mr Mike Ferraro: Aluminium can be recycled almost infinitely, making it an incredibly sustainable material. Recycled aluminium consumes only around 5% of the energy used for primary aluminium. Demand for recycling is expected to increase due to the much lower carbon impact of melting scrap. However, there are challenges associated with the availability, collecting, sorting and recycling of secondary aluminium.

Global recycled aluminium production is expected to grow significantly in the next few decades. But it will not be enough to meet the substantial demand growth for the metal; primary aluminium is still expected to be a main source of supply in the years to come. According to International Aluminium Institute, global primary aluminium production is expected to grow by

around 15 million tonnes from 2022 to 2050.

Bauxite and alumina, being the raw material for primary aluminium production, will continue to play important roles in Australia's aluminium industry in the foreseeable future.

AlCircle: In the upcoming years, what does the Australian Aluminium Council predict to be the most flourishing sector in the aluminium value chain? What part does Australian aluminium play on a global scale?

Mr Mike Ferraro: Aluminium is an essential part of the solution for the global energy transition. The properties of aluminium deliver significant benefits to a decarbonised world. Substantial growth in aluminium demand, both primary and secondary, is forecast in the coming decades, particularly from the transport, construction and electrical sectors. Its lightweight, corrosion resistance, conductivity and infinite recyclability make it the metal for the future. Take electric vehicles as an example; on average, EVs contain over 30% more aluminium per vehicle than those powered by internal combustion.

Australia has an integrated and experienced aluminium value chain. Today, Australia's alumina already has some of the lowest emissions in the world, with an average emissions intensity of 0.7 tonnes of carbon dioxide per tonne of alumina (t CO2-e/t), compared to the global industry average of 1.2 tCO2-e/t.

There is also a focus for the entire value chain to identify technological solutions to further decarbonise, making Australia a leader in the world to make the aluminium industry more sustainable.

AlCircle: As a newly appointed head of the Australian Aluminium Council, how would you augment your organisation's functionality and propose bringing the international market into a closely-knit circle?

Mr Mike Ferraro: While being the President of the AAC, I am also a Director of the International Aluminium Institute and the Managing Director and CEO of Alumina Limited.

Our AWAC (Alcoa Worldwide Alumina and Chemicals) joint venture with Alcoa is one of the largest bauxite and alumina producers in the world. As an industry leader, all of AWAC's alumina refineries are first quartile on the refinery emissions intensity curve.

At Australian Aluminium Council, we are supportive of continuing to develop downstream manufacturing activities in Australia and to be globally competitive by supporting global carbon emissions reduction to ensure an even competitive landscape.
As the world faces more climate change challenges, I strive to work not only with the Australian industry but also with our global peers to make the global aluminium industry more sustainable through dialogue and collaboration.

For the next three decades, I firmly believe aluminium will play a critical role in global decarbonisation. Aluminium is the metal
for the future, with applications that can advance humanity.

Dr. Ashok Nandi, **President, International Bauxite, Alumina and Aluminium Society (IBAAS), India**

Guinea Bauxite Industry: Opportunities, processibility and alumina growth potential

Introduction

Guinea, a small West African nation with around 14 million population is endowed with 40 billion tonnes of low silica-medium alumina metallurgical grade bauxite resources. Most of the deposits are located within 100 to 150 km of coastline and well-developed river ports. At present Guinea is mining

and exporting about 102 million tonnes of high-quality gibbsitic bauxite per annum, dominated by mining and infrastructure companies of China. There is only one alumina refinery in Guinea (Fria), which is being run by RUSAL with a quite low production capacity. Despite having such vast metallurgical grade bauxite resources, the alumina refinery projects are only existing on paper and drawing boards. There is a large potential to set up greenfield alumina refineries in this country. The article discusses the basic features of Guinea bauxite, how this is different from other lateritic bauxite of the world, the trend of high grading by mining companies, prospects of beneficiation and alumina growth potential.

2. Guinea Bauxite – Basic facts

Guinea bauxite mostly occurs in low-lying flat-topped bauxite plateaus at an elevation of 200 to 400m above MSL. Bauxite occurs from the surface with thin soil cover (<0.5m) and low overburden (about 1m). The average thickness of the lateritic bauxite zone is about 8 to 10m. Guinea has natural low silica (2.5%) Gibbsitic Bauxite, where the reactive part is only 50% of total silica. Silica content almost remains constant in the laterite-bauxite profile and does not go down with the lowering of alumina as in the case of other lateritic bauxite deposits of the world. In this bauxite, monohydrates in the form of boehmite is, in general, lower than 2%. However, some of the Guinea bauxite have elevated Boehmite, Andalusite, Sillimanite and Pyrophyllite, which decreases the value of ore.

Fig.1. Main Bauxite Belt Guinea

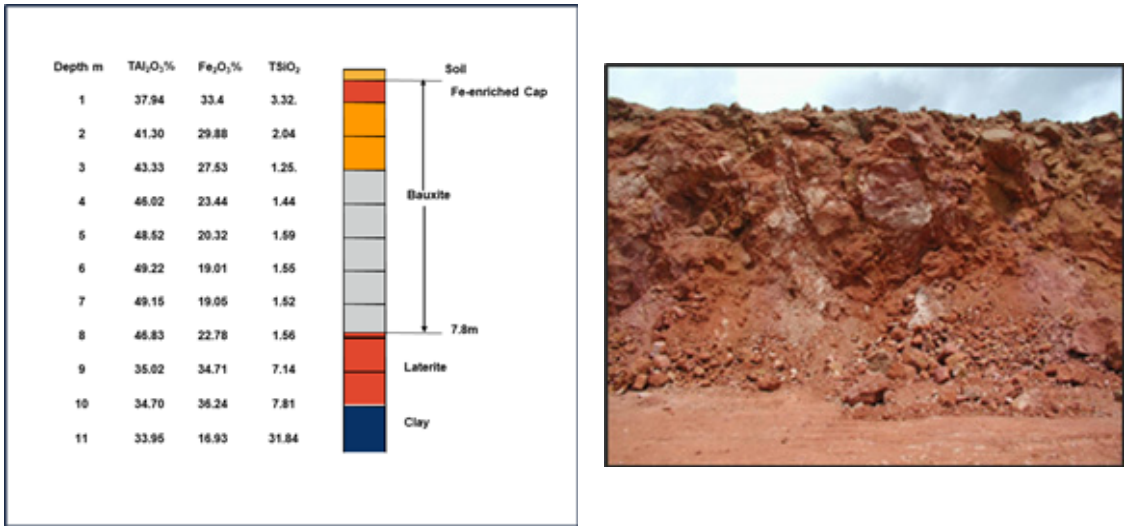


Fig.2. A typical high-grade profile and bauxite orebody

3. Bauxite mining and beneficiation

Guinea bauxite is easy to mine by a surface miner and/or drilling–blasting technique. The direct bauxite mining cost is normally less than US$3 per tonne and raw bauxite after simple crushing can be exported. Guinea has about 9 to 10 well-developed operating bauxite mines and each mine is different with specific bauxite quality, infrastructure, road/rail network and port/river jetty. As one can see in Figure-3, bauxite production is continuously increasing in Guinea and at present more than 100 million tons per annum of ore is produced.

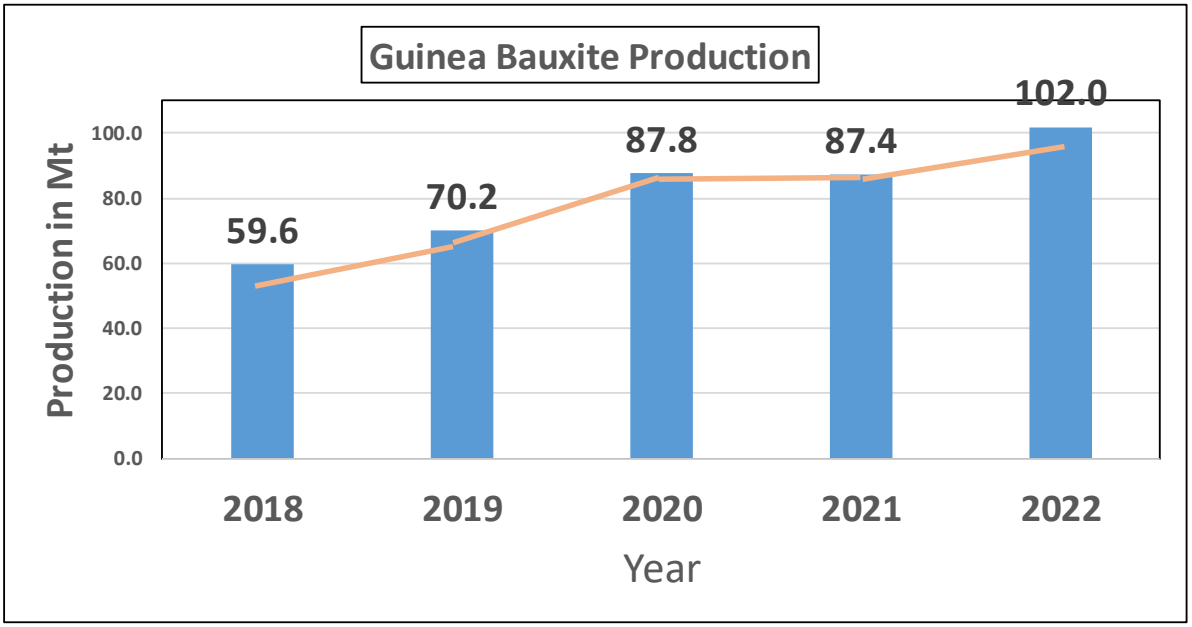


Fig.3. Bauxite Production in Guinea

In absence of any ore conservation legislation in Guinea, it is observed that most of the mining companies selectively exploit high-grade bauxite resources, leaving the vast mineralized area of medium to low alumina, in the ground. These areas later on afforested and valuable resources are lost under the forest. This is not acceptable anywhere in the world. One of the bauxite plateaux of Guinea demonstrates how the high-grade bauxite are being exploited by some mining company, leaving a large area of medium-grade bauxite.

This selective mining practice was started by CBG by adopting a high alumina cut-off grade for resource estimation and continuing by major mining companies of Guinea. This practice should be stopped as large quantities of low to medium-grade bauxite otherwise suitable for alumina production, are left over on the ground. There must be also legislation to relinquish the exploited bauxite plateaus / deposits so that this can be allotted to other interested mining companies.

It is established that Guinea bauxite is amenable to simple dry beneficiation process and iron, particularly in the form of Goethite and silica as Kaolinite can be partly removed by rejecting fines. In one of the rejected bauxite heaps of in-situ lateritic bauxite of Guinea, the following average upgradation is observed on the elimination of 10 and 20mm fines.

Table:1. Bauxite Quality in Various Size Fractions in Lateritic Bauxite

Bauxite	Recovery %	%Al2O3	%SiO2	%Fe2O3
Feed Quality Calculated	100.0	42.91	1.81	27.96
Beneficiated +5 to 100mm	76.42	43.49	1.25	27.60
Beneficiated +10 to 100mm	61.46	44.17	1.17	26.66

It is observed here that alumina can be increased by 1.26 units and silica and iron can be brought down by 0.63 and 1.30 units respectively by simply rejecting 20mm fines by vibrating the screen. Dry beneficiation is quite prevalent in lateritic bauxite mines of India, particularly in Gujarat and Western India and industrial processes are shown below.

In some of the low-lying bauxite deposits of the Boffa area, transported bauxite deposits are identified. Here bauxite has high silica (6 to 8%) content and low alumina (40-42%). These bauxites are found suitable for upgradation by simple crushing and screening process.

Fig.4. Typical Transported Bauxite in the Boffa area

Here by simple dry beneficiation process most of the fine silica, both as kaolinite and quartz, can be removed as shown in the table given below.

Table:2. Dry Beneficiation of Transported Bauxite of Guinea

Sample Id	Average Fraction	Al2O3 (%)	SiO2 (%)	Fe2O3 (%)	LOI (%)
Average-10mm	30%	35.85	18.76	23.41	19.93
Average+10-20mm	20%	45.79	5.02	21.57	25.35
Average +20mm	50%	48.04	2.57	20.28	26.61

The above table shows a significant increase in alumina and a reduction in silica by simply eliminating 50% of fine materials, occurring as cement in the transported bauxite ore. The quantitative mineralogical analyses of fine-size fractions (<10 and 20mm) clearly showed the enrichment with kaolinite, fine-grained quartz and minerals like goethite and boehmite. There also exists the opportunity to extract bauxite values from the rejected fines (<20mm) by a wet beneficiation process. The geological mapping of deposits of Guinea, particularly those occurring below the bauxite plateaus, may reveal the presence of a similar type of transported bauxite in the low-lying areas.

4. Bauxite Processing Characteristics

The majority of Guinea bauxite, particularly those occurring in Boke and Boffa areas, are suitable for low-temperature alumina refineries. A typical quantitative mineralogical analysis of Boke bauxite is shown below.

Table:3. Typical Quantitative Mineralogical Analysis of Boke, Guinea Bauxite

Chemical Constituent	Typical Value%
Total Al_2O_3	45.2
Total SiO_2	2.2
Fe_2O_3	23.5
TiO_2	2.0
LOI (105 to 1000^{0}C)	24.6
Available Alumina	40
Reactive Silica	1.2
Organic Carbon	0.09
Moisture (105^{0}C)	9.5

Constituent	Mineral Phases	Distribution%
$\%Al_2O_3$	Gibbiste	40.5
	Boehmite	2.1
	Kaolinite	0.6
	Alumogoethite	1.9
$\%SiO_2$	Kaolinite	0.7
	Quartz	1.5
$\%Fe_2O_3$	Hematite	4.5
	Alumogoethite	19.0
$\%TiO_2$	Rutile	0.5
	Anatase	1.5
%LOI	Gibbiste	21.5
	Boehmite	0.4
	Kaolinite	0.2
	Alumogoethite	2.5

Guinea bauxite with 40 to 44% available alumina (A.Al) and 1.2-1.5% reactive silica (R.Si) can be considered one of the best ore in the world for alumina refineries. The main concern for low-temperature alumina refineries is the high Goethite-Hematite ratio in Guinea bauxite causing settling issues in the plant and increasing consumption of costly flocculants. Impurities and organic carbon content are quite low in Guinea bauxite almost similar to the best lateritic bauxite of India and Brazil. As about 50% of silica is in the form of quartz in Guinea

bauxite, the fine quartz mineral grains cause abrasion in pipelines in plants and this increases the maintenance cost. Further Guinea bauxite is slightly harder and has a bond work index of about 11 to 12 kWh/ton compared to 9-10kWh for India's Odisha bauxite and softer washed ores of Trombetas, Brazil and SMHL/Vimetco, Sierra Leone. Some Guinea bauxite also has elevated Boehmite, Andalusite, Sillimanite and Pyrophyllite, which decreases the value of ore. By dry beneficiation process, silica can be brought down to below 1% in Guinea bauxite, therefore this ore can be best used by blending with local high silica low-grade aluminous laterites in India and China.

5. Why are alumina refineries not constructed?

Despite having vast metallurgical grade bauxite resources, Guinea has only one old alumina refinery, constructed in the sixties, based on Aluminium Pechiney technology of atmospheric digestion similar to the NALCO Damanjodi plant. The installed capacity of this plant is 680,000 tons/ annum but presently this old plant is not producing more than 200,000 tpa. Although Govt. of Guinea (GoG) keeps insisting mining companies set up alumina refineries, often following reasons are cited:

5.1 Country Risk: Like some other African countries, Guinea has a history of alternate democracy and military coup. On September 5, 2021, the Guinean military, led by Colonel Mamadi Doumbouya, deposed President Alpha Condé in a coup d'etat. Although there is no change in the business environment, Guinea is considered a high-risk country. CBG is mining and exporting bauxite for the last 40 years and bauxite, and gold

mining/export was never stopped due to political upheaval but it is difficult to get away from this perception. Present Government is showing a strong will for local value addition and insist bauxite mining companies set up alumina refinery.

5.2 Poor Infrastructure: Recently mining companies have built several roads/rail lines and river ports in Guinea mainly for bauxite export. These infrastructure facilities are fully occupied as the country is exporting more than 100mtpa bauxite. Guinea overall has poor infrastructure; there is no well-developed large deep-sea port and electric power infrastructure is also inadequate in the country.

5.3 Lack of Energy Sources: Guinea does not have any known energy source and the country is dependent on generators and small hydel power plants for electricity. Although talks are going on for the supply of LNG; there is no progress on the ground. Although the alumina refinery does not require a large power plant, the generation of steam and electricity for running the refinery/ township is essential. It will be necessary to set up dedicated greenfield coal or gas-based cogeneration steam-power plant for the alumina refinery in the absence of a renewable energy source.

5.4 Raw Materials: Alumina refinery requires a regular supply of caustic soda, lime, flocculants, sulphuric acid and filter cloths etc. All these raw materials including coal for the co-generation power plant, necessary for alumina production, have to be imported. Except for bauxite and water, no other raw materials are available in the country.

5.5 Qualified Manpower:

A country like Guinea in West Africa lacks industrial culture as there are no large production plants in this part of the world. Educational institutes are also limited in Guinea and people must be trained abroad to efficiently work in a chemical plant. There is a clear shortage of skilled manpower in this country. About 4-5 years back, the proposal was submitted to set up Bauxite-Alumina Institute in Guinea, however, due to lack of support, this remained in paper only.

6. Future alumina potential

Despite some negative points, there are several advantages to setting up greenfield alumina plants in Guinea and some of them are highlighted here.

6.1 Availability of Land & Water:

Guinea has plenty of suitable land for an alumina refinery along with enough sources of water near the deposits and river ports. Land can be easily acquired for alumina refinery and associated ancillary industries.

6.2 Government Incentives:

As the Government of Guinea (GoG) is keen on the value addition of bauxite in the country, they provide scores of benefits in importing equipment, machineries and raw materials for alumina production.

6.3 General Economics of Alumina Production:

In one of the projects, it was estimated that the landed cost of bauxite at a pit head refinery will be within US$5 per tonne and alumina can be produced in the cash cost of about US$150-160 per tonne. In place of exporting 2.5 to 3 tonnes of bauxite for 1 tonne of alumina, it may be cheaper to import less than 1 tonne of raw materials like high-quality coal, caustic soda, lime and other input materials for the production of 1 ton of alumina in Guinea.

6.4 Environmental Legislation:

Guinea has not yet formulated strict legislation for the disposal of bauxite residue and other waste products. However, it will be necessary to follow and maintain international standards like dry disposal of red mud and utilization of other waste products.

Investors can also look into the following advantages in Guinea:

- The government of Guinea has passed legislation that any company interested in setting up an alumina refinery in the country will be provided with a suitable quantity and quality of bauxite.
- As mentioned above most mining companies are selectively exploiting high-grade bauxite resources, leaving a large quantity of unexploited ore. These deposits may be readily available for the alumina plant.

- Several bauxite mine owners are interested in setting up alumina refineries as Govt of Guinea is putting pressure on bauxite exporters.
- It is also viable to set up a small special alumina plant in the country as Africa imports several value-added alumina products mainly for water purification and other applications.

7. Bauxite-Alumina Institute

As Guinea's future and earnings are dependent on the bauxite-alumina industry, it is necessary to set up Institute in the country on the same line as in India and Jamaica to cater for the R&D requirements of the aluminium industry. This will be the knowledge centre of Guinea on Bauxite and Alumina, where young Guineans can be trained on bauxite exploration, mining, beneficiation, ore conservation, monitoring quality and quantity of export shipments and also prepare Guineans for the construction and operation of alumina plant. Setting up new alumina refineries in the country is not easy and companies often complain that there is not enough qualified manpower in Guinea. The proposed Institute will provide training to qualified Guineans in alumina technology, develop a process flow sheet and understand whole process technology. It is important to understand the CAPEX and OPEX of alumina production in Guinea and issues associated with the lack of energy sources and disposal of bauxite residue (Red Mud). The proposed Institute will not only monitor the quality and quantity of bauxite being exported but also check the environmental aspects, starting from bauxite mining, transportation and export. The Institute will publish periodic International bauxite prices, check the freight costs and monitor the prices declared by mining/exporting companies.

8. Conclusions & Recommendations

- Guinea is endowed with large bauxite resources and offers a good opportunity for the export of quality bauxite and setting up alumina refinery.
- The most significant quality aspect is low reactive silica which can be maintained at around 1.2% in this bauxite.
- Guinea bauxite is amenable to beneficiation and about 1.5 to 2 units of alumina can be increased by eliminating Goethite and Kaolinite-rich fines.
- Some of the issues in Guinea bauxite processing are the high Goethite- hematite ratio, the abrasive nature of quartz and the presence of about 2% of boehmite.
- Bauxite mining by the surface miner or drilling blasting is easy and cheap in Guinea and this is normally <US$3 per tonne.
- It is estimated that the landed cost of bauxite at pit head refinery may be within US$5 per ton and alumina can be produced at the cash cost of about US$150-160 per tonne.
- The main reasons for the non-existence of alumina refineries in Guinea are country risks, poor infrastructure, lack of energy sources, absence of raw materials for alumina and limited qualified manpower.
- On the positive side, there is no dearth of large land and water sources in the country. Further GoG provides scores of benefits to the company investing in an alumina refinery in the country.

- Guinea should seriously consider setting up Bauxite-Alumina Institute in the country to not only train locals but also control unscientific high-grade bauxite mining, environmental protection and development of alumina refineries.
- Selective high-grade bauxite mining should be discouraged, beneficiation process can be adapted to process low and medium grades bauxite and introduce legislation for relinquishment of bauxite deposits/plateau after the exploitation.

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The confluence of knowledge and experience

Peter Nagusky, President and CEO of the Federal Metal Company

"The demand for high-quality, recycled aluminium scrap, beginning sometime in 2024 or 2025, will be greater than the supply."

Peter Nagusky is the President and CEO of The Federal Metal Company, an industry leader in cast copper-based alloys since 1913. Federal Metal has melting facilities in northeast Ohio and eastern Pennsylvania, and recently opened a new processing operation in central Arkansas that specializes in recycling aluminum copper radiators. To complement the core

business established by his great grandfather, Peter is making major new investments to supply rolling mills with high purity aluminum and copper products.

Let's hear from Peter about the demand and supply growth of aluminium scrap and how improved sorting technologies can lead to a better recycling output.

AlCircle: Recycled aluminium content in end-use products is rapidly replacing the primary metal. Is this resulting in immense responsibility for your company to deal with good quality scrap?

Peter Nagusky: There are significant economic and environmental benefits to replacing primary aluminium with scrap, but only if the scrap supply can reliably meet customer requirements. This is a huge responsibility, to be sure, and one we feel particularly well suited for. Since 1913 we have been manufacturing certified copper-based alloys for the foundry industry, made entirely from scrap and produced to very stringent specifications. Our aluminium rolling mill customers appreciate that we have this aligned perspective as a consumer of scrap ourselves. Like them, we have no tolerance for inconsistent quality in our raw material. That's why we design and maintain strict process control parameters, deploy the latest sorting technologies, and remain committed to the highest product quality standards.

AlCircle: Do you think the aluminium recycling industry is tooled with modern sorting technologies? (Kindly detail it as per your company view)

Peter Nagusky: Our expertise is processing one very specific raw material type: aluminium copper radiators used mainly in heat exchange, air conditioning, and refrigeration applications. Since we aspire to be the best in the world at recycling these post-consumer radiators, we need the best sorting technologies. We are building the most advanced recycling facility of its kind, specializing in generating large volumes of direct melt, high purity 1100 aluminium with 0.20% maximum copper. Put simply, that wouldn't have been possible ten years ago.

AlCircle: Could you please share the current status of your upcoming project in North Little Rock, Arkansas, where you plan to sort aluminium-copper radiators?

Peter Nagusky: We are currently installing the equipment and actively hiring staff. We will be operational during the third quarter of this year. This project will give us the capacity to recycle 3,000 metric tonnes per month under one roof, in a location convenient for our supplier partners and close to several key aluminium customers. This project was an outgrowth of our success in Ohio, where we recycle more than 800 tonnes per month, and where we developed our proprietary PSA® (pre-melt specification aluminium) direct melt products.

AlCircle: Besides this project, is there any other in your pipeline for this year to increase the aluminium scrap supply?

Peter Nagusky: The project in Arkansas is our primary focus this year. We are optimistic about the future of aluminium scrap recycling in the United States, though. We're currently evaluating a new project that would require additional investment and further increase our supply of high purity aluminium.

AlCircle: Can you please share your short-term and mid-term projections for the aluminium recycling industry in the United States?

Peter Nagusky: Here in the United States, we expect de-stocking to continue in the short term. A lot of inventory still needs to work its way through the system. In the midterm, though, the pendulum will start swinging in the other direction. The demand for high-quality, recycled aluminium scrap, beginning sometime in 2024 or 2025, will be greater than the supply. There are new investments in rolling mill capacity here for the first time in a generation, and domestic UBC recycling rates remain low. We expect a long-term deficit to emerge, where scrap discounts will tighten. I think it's possible you'll see historically high price levels, with some of the higher purity grades at parity or even at premiums to the Midwest transaction price.

AlCircle: Do you think global inflation will lead to more consumption of aluminium scrap to reduce the end-product price?

Peter Nagusky: I think we are definitely moving towards greater consumption of aluminium scrap worldwide, but not because of global inflation.

AlCircle: Which manufacturing industry, according to you, will drive the global consumption of recycled aluminium?

Peter Nagusky: Our focus is primarily on foil, packaging, fin stock, and beverage cans. We'll be watching those sectors carefully. But because using aluminium scrap is economically advantageous and environmentally sustainable, and because the end consumer preferences favour the most recyclable materials, there will be a lot of industry sectors contributing to increases in global consumption.


1100
ALUMINUM

Rick Hindley
Executive Director, Podback

“Podback’s vision is a world where every coffee pod enjoyed is recycled, and we’re looking at all avenues and options to make this happen.”

Rick Hindley joined Podback as executive director in May 2021, soon after the scheme launched. Rick is responsible for setting and overseeing the strategic direction of Podback, including working with local authorities, retailers and coffee brands to grow the scheme.

Rick has held several high-profile positions in the aluminium packaging sector, initiating and advising on the development of collection and recycling programmes in the UK and Europe. He joined Podback from the Aluminium Packaging Recycling Organisation (Alupro), where he had been executive director since 2007. During his tenure at Alupro, aluminium packaging saw record-breaking recycling rates. Rick previously sat on the Government's Advisory Committee on Packaging (ACP).

1. **What was the motive behind establishing the non-profit organisation, Podback? How does it suffice the basic operational expenditures?**

Podback was created by the leading pod coffee brands, Nestle and Jacobs Douwe Egberts, to provide consumers with a single and easily accessible coffee pod recycling system in the UK. The founders' vision was to establish a cross-industry scheme based on collaboration between brands. We are asking any brand that makes plastic or aluminium pods to join the scheme, and since launching, we have increased our membership, now covering 21 brands across the pod category. Podback member brands now account for over 80% of the UK pod market. The service is funded by the member brands, with each brand's contribution based on the proportion of pods they place on the UK market. This funding covers the operational costs: A nationwide collection infrastructure through partnerships with local authorities and a UK-based reprocessing infrastructure. Podback funding enables local authorities to add coffee pods to their regular kerbside recycling service at no additional cost.

2. What is the projected volume of aluminium coffee pods collected by Podback per annum, and what does it do with the haul?

Pod sales in the UK exceed 1.8 billion annually, with Podback members accounting for 80% of the market. Although we have systems in place to measure the volumes of pods collected and materials recycled via the different collection routes, we are unable to share figures due to commercial confidentiality.

We know that consumers want an effective recycling option for their pods. Research conducted for Podback showed that 90% of pod users wanted to be able to recycle their coffee pods through their usual household recycling.

Podback's vision is a world where every coffee pod enjoyed is recycled, and we're looking at all avenues and options to make this happen. But, as a start-up business, we are still on a learning curve.

We have been very encouraged by the uptake of the scheme so far; in the eleven local authorities where we have mobilised kerbside pod collections, we are seeing average participation rates, which exceed 60%. Outside the kerbside system, volumes through the Return to Yodel drop-off points are also increasing month on month and are currently up 35% in 2022.

We are committed to recycling the aluminium and plastic coffee pods and the bags used for collection in the UK.

Aluminium and plastic pods are collected separately in colour-coded recycling bags, which are provided free to the consumer. The plastic and aluminium pods are processed by specialist recycling companies based in Yorkshire and Cheshire, respectively. Bags of pods are shredded to remove the pods and then extract the coffee. The coffee grounds are sent for anaerobic digestion, which produces renewable energy (biogas) and soil improver. Plastic and aluminium are recycled and used in the manufacture of new products such as garden furniture and building products, beverage cans and car components.

All Podback bags are recycled by a facility in East Yorkshire which specialises in recycling flexible plastics, such as food wrappers and films. The facility produces plastic pellets which are used in a wide range of manufacturing industries.

3. How successful is Podback's collaboration with individual UK Councils, and what benefit does it have other than propagating environmental consciousness in the community?

We're pleased with the progress of our kerbside collection programme, which is now available to over 675,000

households in eleven local authority areas across the country. We believe these programmes will help increase the number of consumers who recycle their coffee pods. This is why our support for local authority kerbside services includes a marketing communications campaign to ensure residents are aware of the service and encouraged to recycle.

Thanks to the scheme's success so far, we have an active pipeline of local authorities who are in the process of launching the scheme in their areas. We are on course to cover 1 million households in the next few months, and our overall ambition is to provide the kerbside service to 50% of UK households within the next five years, giving more coffee lovers the option to recycle their pods through their household recycling.

4. After Morrisons and Aldi, which big supermarket chain will probably get associated with Podback?

Whilst we can't divulge details of ongoing discussions, we are currently actively engaging with major retailers, including supermarkets and coffee shops, regarding involvement with Podback. Aldi and Ocado are both members, meaning that their pods can be recycled through Podback. Morrisons is supporting the programme by making recycling bags available across their supermarket estate.

5. Will Podback ever promote its ideologies to the Eastern world after successfully initiating protocols for sustainable livelihood and proper waste collection on the European front?

Podback currently only covers the UK and Northern Ireland. Although we are exploring opportunities to expand the programme to include the Republic of Ireland, it will be some time before we look beyond this to other markets. Our founder members do run coffee pod collection programmes in other markets, but Podback is the first category-wide collection programme supported by competing brands, and as such has attracted interest from markets beyond the UK.

6. What opinion do you have about Scotland's DRS scheme? Do you think the UK Government's opposition is justified?

Pods are not considered as 'packaging' under the Government's current regulations so will not be impacted by the DRS or EPR reforms in Scotland or the rest of the UK.

However, DRS will obviously have a direct impact on local authority kerbside collections reducing the range of materials and volume of drinks containers collected. As a result, local authorities will have to redesign their collection systems, and are more likely to have additional capacity available to collect coffee pods.

Petur Blondal, Managing Director,
Icelandic Association of Aluminium Producers

"Icelandic aluminium production is nearly 900,000 tonnes, the second biggest in Europe after Norway."

Petur Blondal is the Managing Director of the Icelandic Association of Aluminium Producers. He is one of the founders and board members of the Icelandic Aluminium Cluster. Petur is a former journalist and editor at Morgunbladid, Iceland's biggest daily. He was the Head of PR and investor relations at Islandsbanki and was the founder and Head of a PR division at Gott folk McCann-Erickson. In addition to his BA in philosophy

from the University of Iceland, Petur holds an MBA from the University of Reykjavik.

AlCircle: Could you share the journey of the Icelandic Association of Aluminum Producers, Samál, from its inception? What was the primary intent behind the formation of this association?

Petur Blondal: Samal, as the Icelandic Association of Aluminium Producers is called, was founded in 2010 by the three aluminium production companies in Iceland, Rio Tinto Iceland, Nordural and Alcoa Fjardaal. The organisation's goal is to promote the interests and development of the Icelandic aluminium industry and encourage education and information flow regarding the industry.

Icelandic aluminium production is nearly 900,000 tonnes, the second biggest in Europe after Norway. The export value of Icelandic aluminium producers in 2022 was around 400 billion ISK or approximately $2.8 billion. It amounted to a fourth of the total export value of the Icelandic economy. Every year the three aluminium companies buy services and goods from hundreds of Icelandic companies. In 2015 Samál took the initiative to find a formal aluminium cluster with around forty companies and foundations.

The aluminium cluster focuses on creating a network in the industry and supporting research and development. The Innovation Day of the Aluminium cluster is held every year at the University of Reykjavik and the University of Iceland, where the newest research and developments are discussed, and students receive grants for research in the field of aluminium.

AlCircle: Interested in learning more about the Icelandic Association of Aluminum Producers?

Petur Blondal: The aluminium industry in Iceland is based on primary aluminium production. Aluminium production in Iceland began in 1969 when the Icelandic Aluminium Company (ISAl) built its plant in Straumsvik, close to the capital area of Reykjavik. The initial production capacity was 33,000 tonnes per year. Since then, the plant has expanded and increased its production capacity to 207,000 tonnes annually. Rio Tinto now owns the plant.

In 1998 production by another aluminium smelter was started, Nordural in Grundartangi, half an hour from the Reykjavik area. Nordural was then owned by the American company Columbia Ventures Corporation. The initial capacity of the plant was 60,000 tonnes per year. In 2004 the company was acquired by Century Aluminium, and its current production capacity is over 300,000 tonnes.

The newest smelter is the Alcoa Fjardaal plant in Reydarfjordur in the east of Iceland, which started its production in 2007. The Alcoa plan is the largest aluminium smelter in Iceland, with a production capacity of 350,000 tonnes.

AlCircle: In terms of primary aluminium production, what is Iceland's total capacity?

Petur Blondal: The aluminium industry in Iceland was close to total capacity in 2022. It has been investing in the value-added production of wires and alloys. In recent years the capacity has remained steady at around 850,000 to 900,000 tonnes. In a way, it's like the fishing industry, where the catch does not vary much between years, but we have learned to make products from every part of the fish, and now the fillet is the least valuable part. The produced aluminium is exported mainly to Europe, where it is used in downstream industries of various types.

AlCircle: What is your thought on low-carbon aluminium? Do Iceland's aluminium smelters produce low-carbon aluminium?

Petur Blondal: Electric power is the most significant single factor in global aluminium production's carbon footprint. In Iceland, the energy produced is renewable. This, along with stable operations and investment in solid production facilities, has ensured the carbon footprint of aluminium production is nowhere smaller than in Iceland, according to analysis from CRU.

The Icelandic aluminium industry aims for carbon neutrality and is actively involved in development and innovation projects that seek methods of capturing and sequestering or harnessing CO emitted in the production. The focus is to minimize the effect on the environment and climate – you could say it is a core competence of the industry. All the smelters in Iceland are ISO certified in various fields and ASI certified.

Icelandic aluminium is already being marketed as low-carbon aluminium, which might lead to further marketing opportunities in the future.

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Tom Giddings, Executive Director, Alupro

“Our goals towards sustainability are to see more companies embrace infinitely recyclable aluminium as their packaging material of choice.”

Tom Giddings is Executive Director of the Aluminium Packaging Recycling Organisation (Alupro), the industry-funded, not-for-profit organisation with over 30 years of experience representing the UK’s aluminium packaging industry. Working to fulfil the industry’s objectives to meet, and exceed, recycling targets for aluminium packaging, Alupro has a long history of

engaging and encouraging businesses and consumers to recycle their aluminium packaging through engagement campaigns such as Every Can Counts and Metal Matters.

Tom oversees Alupro's work to achieve these aims, joining the company in 2020 as Sustainability and Public Affairs Manager to support Alupro's members in highlighting and promoting the sustainability and circular economy credentials of aluminium packaging. Prior to this, Tom held the role of senior sustainability manager at global corrugated container manufacturer DS Smith.

AlCircle: What difference has Alupro made in 30 years of representing the UK aluminium packaging industry?

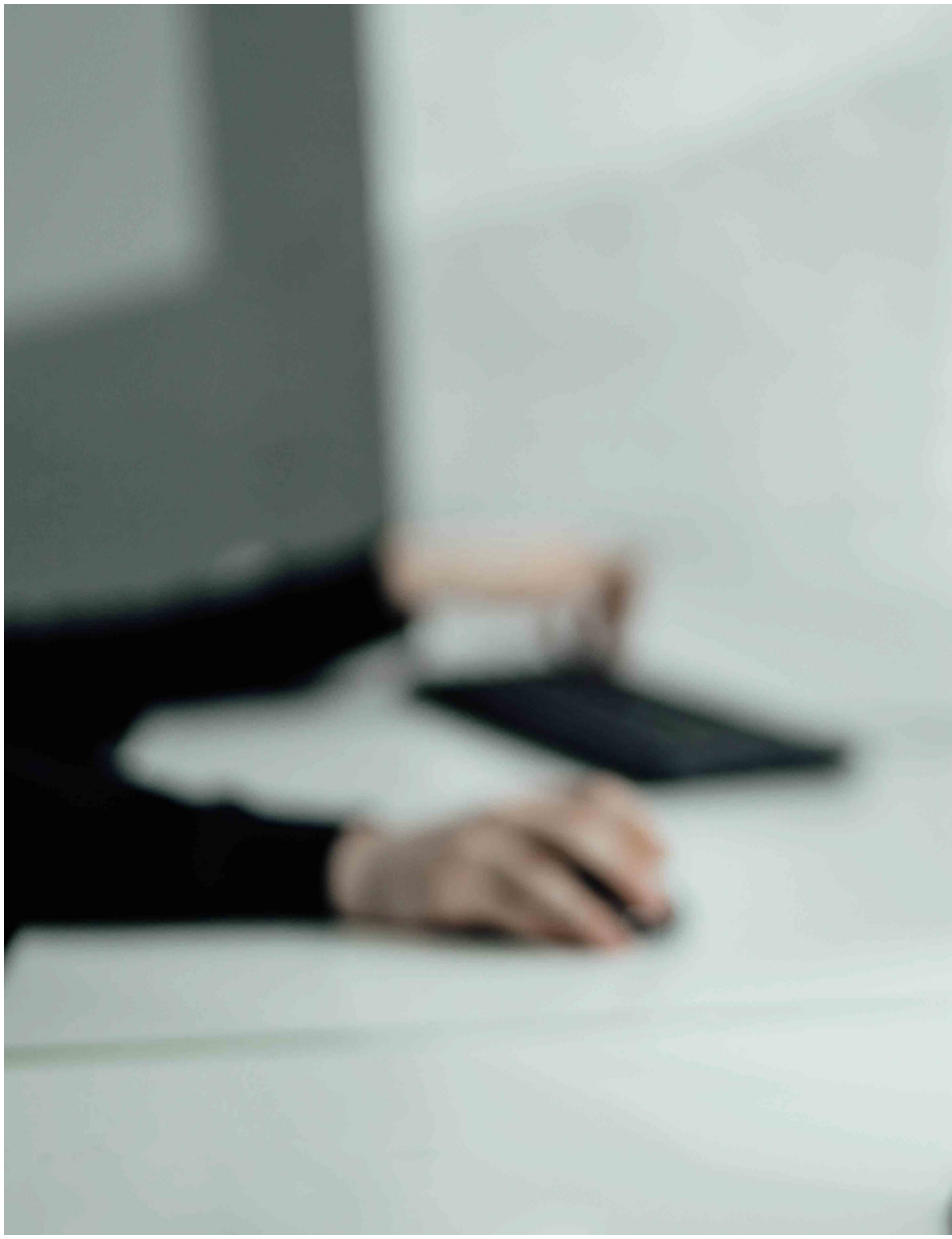
Tom Giddings: Looking back to the early 1990s, the UK had just outlined new waste disposal guidelines through the Environmental Protection Act. It had committed to tackling our national reliance on landfill in earnest. However, recycling rates sat at just 16%, and the mandated introduction of kerbside collections was still more than a decade away (Household Waste Recycling Act 2003).

We saw a significant opportunity to drive aluminium packaging recycling rates, and that's what we set out to do. When we started, our priority was simple – to improve awareness of aluminium as a recyclable material and encourage consumers to participate in 'Cash for Cans' incentive schemes. Today, we have a far wider remit.

As the independent voice of the aluminium packaging sector, we work to fulfil the industry's obligation to meet, and exceed,

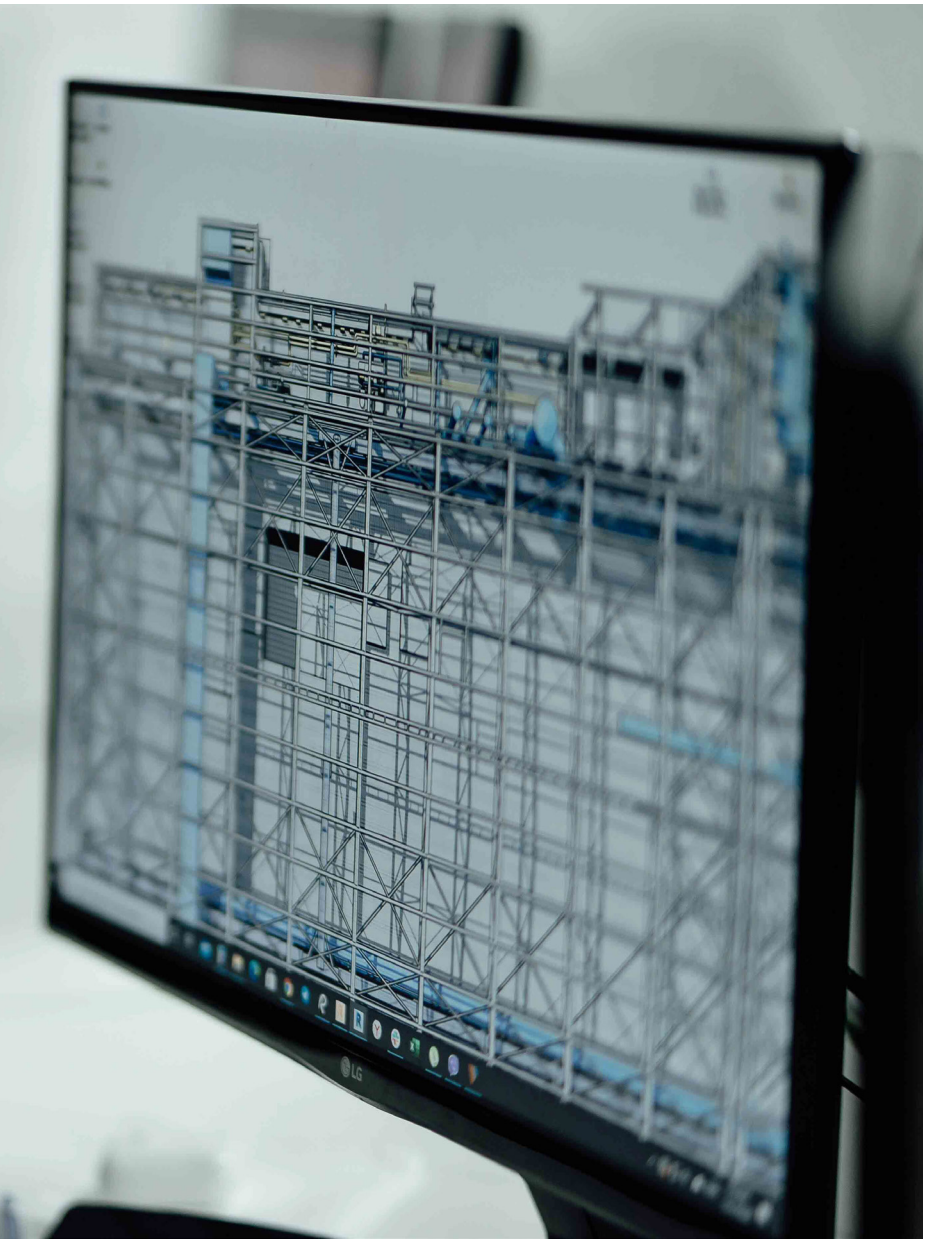
recycling targets for aluminium packaging. We are collaborating with local authorities, the waste management industry and the wider metal packaging sector to develop and stimulate the UK's collection infrastructure. We also manage and run consumer information and education campaigns to encourage participation in recycling schemes.

Over the past 30 years, we've helped inform legislation, changed public thinking, and driven a significant uplift in recycling rates through our pioneering education programmes. In 2022, the UK reported a 68% recycling rate for aluminium packaging, with an 82% recycling rate for aluminium beverage cans. We're proud of this collective achievement!



AlCircle: Could you share with us the issues of government policies and legislative developments that Alupro has voiced?

Tom Giddings: We are hugely vocal on issues of government policy and legislative development. Working on behalf of our members, we deliver a unified voice to drive positive change and maximise recycling rates. One of Alupro's most important tasks is to monitor the Packaging Recovery Note (PRN) market in the UK for aluminium packaging, ensuring it's working to deliver higher recycling rates at a reasonable cost whilst lobbying for improvements. While we've been involved in countless consultations and have put forward evidence for numerous bills, 2023 is set to be one of the most exciting years for policy change in our 30-year history.



Indeed, alongside decisions around DRS and reforms to EPR, we expect to see the government's

response to the Consistency

in Collections consultation. Collectively, these three legislative changes will have a huge future impact on the industry.

AlCircle: What are the key facts of the UK's aluminium packaging recycling rates?

Tom Giddings: The UK's aluminium packaging recycling rate currently sits at 68% (82% recycling rate for beverage cans). An estimated 75% of all aluminium ever produced is still in circulation.

According to data published by the Environment Agency, more than 156,000 tonnes of aluminium packaging is now collected for recycling on an annual basis. Materials collected through kerbside, bring and on-the-go systems totalled 112,210 tonnes of this volume, while 27% was recovered from incinerator bottom ash (IBA).

The latest data, reporting on Q3 2022, revealed that the UK saw 37,815 tonnes of aluminium packaging collected for recycling. Materials collected through kerbside, bring and on-the-go systems totalled 28,003 tonnes, while 9,491 tonnes were recovered from incinerator bottom ash (IBA) and 322 through other routes.

AlCircle: Can recycling take over the primary aluminium production, which is energy-sensitive, in the next 10 years?

Tom Giddings: Aluminium packaging recycling in the UK has come a long way and remains on a clear path to further improvement. With better infrastructure, education and

incentives, we could quickly reach the levels seen in some of the world's highest-performing countries.

In 2021 alone, more than 150,000 tonnes of aluminium packaging were collected for recycling, with just 12% exported for reprocessing and consumption further afield – everything else was reprocessed within the UK and Europe.

Aluminium is also being used at a rate we've not seen previously, with growth in many market sectors. Packaging is no different. Whilst this is positive, it also changes the equation when calculating the proportion of aluminium in a product. If there is more demand, there must be more supply of recycled aluminium, and market projections remain positive for aluminium packaging out to 2030.

We must focus on the key metric, recycling rate, rather than recycled content. Recycled content is, of course, more desirable to use from an environmental point of view. Still, there is only a point trying to deliver this with the flow of material coming in to supply the smelters and recyclers, which is why recycling rates matter more for metal.

AlCircle: Why do you think aluminium is the most sustainable metal of all? What are Alupro's goals towards sustainability?

Tom Giddings: Aluminium is widely regarded for its superior properties and enviable sustainability credentials. Alongside being extremely versatile, it is lightweight and highly durable. Being infinitely recyclable, aluminium is the perfect example of a circular packaging economy – what's more, by

recycling aluminium, you can save over 90% of the energy used in virgin production.

Our goals towards sustainability are to see more companies embrace infinitely recyclable aluminium as their packaging material of choice, as well as help the UK to move ever closer towards a 100% recycling rate for aluminium packaging – through education and legislation.

AlCircle: What areas do the government and the companies need to take a stand to increase the aluminium packaging recycling rate?

Tom Giddings: Simply put, we need to make recycling easy while continuing to educate consumers about the benefits. Unlike other materials, aluminium is infinitely recyclable

– the perfect circular economy. As such, we must ensure manufacturers prioritise aluminium as a material of choice and that regulation supports widespread aluminium recycling – not hampers it.

Over the coming months, we're set to see waste legislation change significantly. Indeed, the government is currently navigating the detail when it comes to the introduction of a deposit return scheme (DRS). The next few months will prove pivotal in ensuring its suitability. Still, several important decisions – such as the agreement of a variable rate deposit – need to be made to achieve this.

If I had one ask, it would be that the government works collaboratively with the industry to achieve the most effective outcome. Collaboration is key.

Soumyadip Chakraborty,
AL Tech

The future of AI & Exponential Technologies

Introduction

Since the last part of 2022, the world has witnessed a number of developments and conflicts in the world of technology. Those had been related to the new-age technology areas known as Exponential Technologies. It started when the San Francisco headquartered & Microsoft-backed company OpenAI launched ChatGPT, an advanced Generative Progressive Transformer (GPT-4) based chatbot. Since the launch, it has disrupted not

only the chatbot space but also the overall AI and the perception of the same. Globally the enthusiasts, testers, potential users, competitors and even the scientists started testing the beta version of ChatGPT, and across the board, mesmerisation was the consistent initial reaction. Of course, the free beta version had some limitations, like the training data set used was only based on the data till 2021 and hence some of the recent events still needed to be answered by the ChatGPT.

Transition of the reaction

Since its launch, ChatGPT has created a lot of interest, the industry and technology leaders have started using it, and advanced testing follows after the initial set of quick and easy questions. 'Advanced' in this field means areas demanding not only information but also weaving fragments of information from multiple sources, checking consistencies and then answering the questions with some aspects of decision-making or prediction.

Often such answers would require beyond the usual cognitive capabilities, and the test set comprising answers to such questions would require more work. However, the full form of GPT is Generative Progressive (Pre-trained) Transformer. The generative part takes over after a voluminous pre-training data set. The core concept of AI is that after a set of data, the model itself will be able to create answers without being fed any data, even related to the matter. Now that part is interesting and scary at the same time.

Globally, only within less than six months of its launch we started seeing the mood of the global experts changing. They

They are now into trauma from awe, advocating various reasons for how AI can pose a significant threat to humankind. Recently, a set of 1000+ advanced AI professionals like Elon Musk and Steve Wozniak put their signature in an open letter to end the advanced AI research as that will significantly impact human civilization from various aspects, many of which will dramatically impact the human civilization from multiple aspects, many which are detrimental in nature.

Why advanced AI research is viewed as a threat?

Controlling AI may have originated from many aspects, and some of them are getting deliberated at present. For example, the open letter appealing to put a pause on AI-related research focuses on the following points:

1. **AI developments may have a significant negative impact on society**

Sometimes the questions need to be answered with a deep thought of whether the question needs to be answered. The objective of the person asking the question must also be ascertained and contextualized. However, it has been thought by many users that such a thought process or judgment is very human-centric, and AI has yet to ascertain the intention behind a question.

2. **AI developments may significantly impact economic conditions and the job market**

GPT-4 based chatbots like ChatGPT are presently transforming a number of fields, like content development, marketing content

and channel selection, legal processes, exam preparation, research documentation, hiring and especially resume selection, SOP (standard operating procedure) development and the like. These use cases are already aplenty and will surely increase in the days to come. This is perceived as a significant threat to the job market, and many of the skills will gradually be imitated.

3. AI developments will have to be controlled, but we presently do not have any such mechanism

Globally there is no standard for controlling AI. There need to be guidelines to ascertain what the topics are where AI will be involved and where not. A concrete thought process has yet to be created, even at the country level. As a result, AI may be trained and utilized at any level by students as well as extremists to ask anything, and GPT-4 will do everything possible to answer the same.

4. AI advancements will be in the hand of a few companies

At present, OpenAI is led by Sam Altman, and Microsoft has a major shareholding in the organization. Google has already launched another chatbot, but that needs more improvement in the days to come. Clearly, other organizations are in the middle of their research. If OpenAI releases GPT-5, then that will be significant advancement over the rivals, and the entire AI market will advance towards a monopolistic market. This, being a technology that has the capability to shape our future, will be dangerous.

As a result, AI till now is a double-edged sword. It was always like that, but the threat was not grave until the earlier version of intelligence. However, with ChatGPT's success, the threat is currently perceived as significant.

What will be the possible impact of halting AI research?

While a number of global leaders and advanced researchers are warning against any other quick developments of AI, many others are also questioning otherwise. A few such arguments are mentioned here:

1. **Halting AI research will give other companies time only to catch up**

Many industry leaders are of the opinion that halting AI research will only serve a few companies, which are now laggards, to quickly catch up with OpenAI (backed by Microsoft) or Google, which has till now made significant progress.

2. It will be difficult to impose any such guideline

.Creating a guideline will be difficult, but imposing the guidelines will be even more challenging. Many countries may still want to continue their research and get more developed than those that would comply with such guidelines. Besides, imposing such guidelines will also involve significant resources and taxpayers' money.

3. Innovation can't be stopped

It will be very difficult for the countries or any governing body

to monitor the companies and their research facilities to ascertain whether they are continuing their research on advanced AI technologies like GPT-5.

4. Positive aspects of advanced AI can never be neglected

AI and its recent advancements are significantly impacting mankind. Apart from a few use cases mentioned above, many researchers conclude that advanced AI will be the biggest ally for mankind in the domain of research and medicinal advancements. It can also significantly improve mental health and keep company with superannuated people. Already AI-based robotic dogs are helping dementia patients find their way back home. Such cases may be addressed as well.

How this will impact the Global Aluminium industry?

Aluminium is already an ecosystem close to USD$1 Trillion globally. Like many other significant industries, it already has umpteen areas that ChatGPT can support.

The Aluminium industry is already working in multiple areas with ChatGPT. The companies with CDOs (Chief Digital Officers) or even otherwise are globally trying the various accounts of ChatGPT for recruitment (to determine the skills for the roles and selecting the CVs of the applicants), developing guidelines or SOPs, development of technical documents, enhancing marketing communications, support in data analysis for researches, development of media communication, internal knowledge portal development and many more. Any immediate halt in advanced AI research may not impact the aluminium industry significantly.

Conclusion

The CEO of OpenAI has already declared that the company is not going to focus on GPT-5 technology immediately. Globally a few technology leaders have already started mentioning that halting AI research may not be the best solution; rather, collaborating to set up standard guidelines will be more effective. Already a few countries are working towards the same. Overall, AI space will be more interesting in the days that come. Stay tuned to this AL Tech series to learn about the future.

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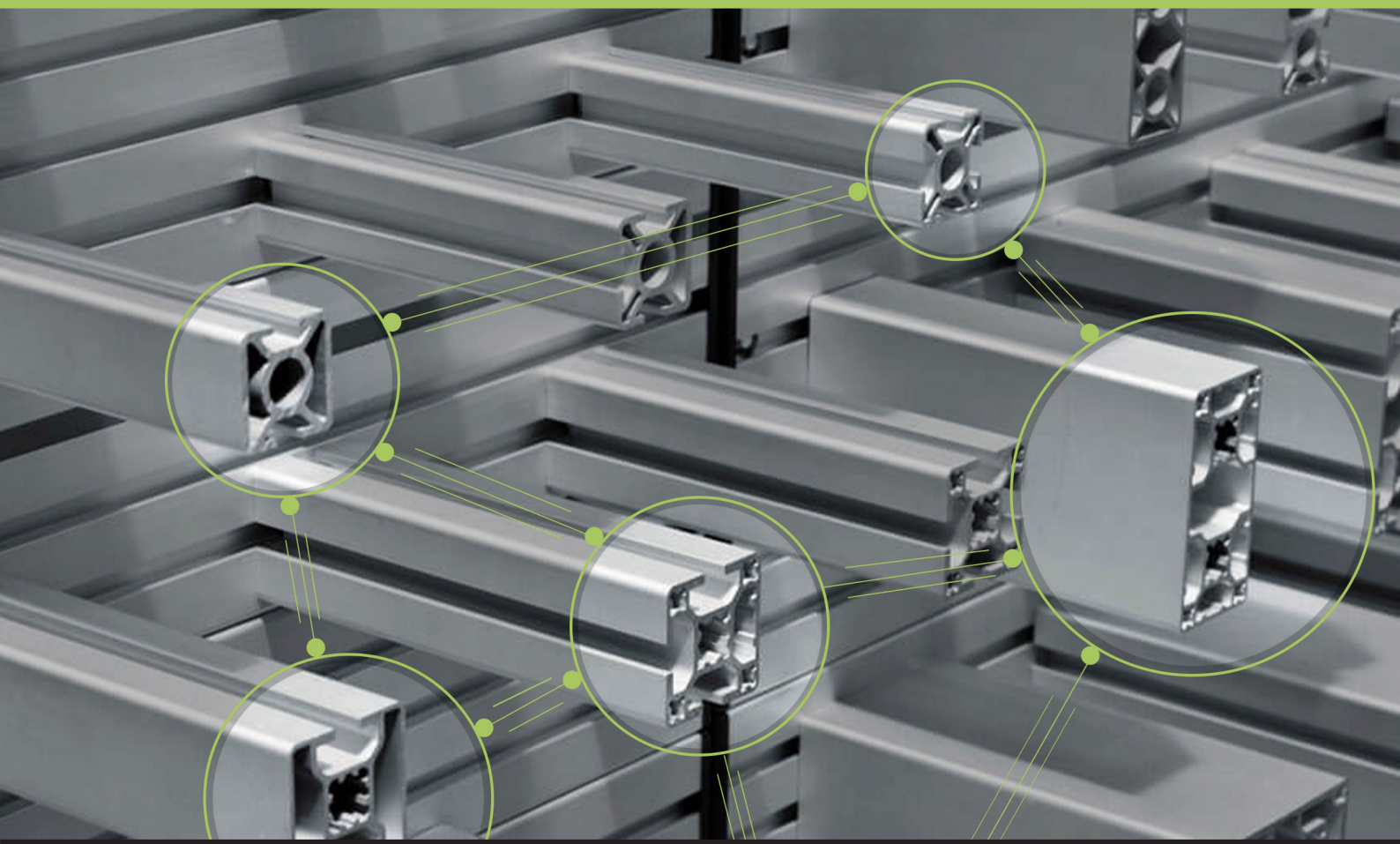

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