# FROM THE CEO Letter to Shareholders

2023 was AMG Critical Material's most successful year in terms of financial results since its inception in 2007. The adjusted EBITDA reached an all-time high at \$350 million, combined with an Operating Cash Flow of \$223 million and a ROCE of 26%. Since 2019, our adjusted EBITDA Compound Annual Growth Rate ("CAGR") is 30%.

# AMG 5-year EBITDA/Lithium EBITDA



# AMG LITHIUM

This outstanding outcome is first and foremost the result of the decision in 2016 to extract lithium - in addition to tantalum - from the complex ore and from the tailings at the Mibra mine in Brazil, with an initial production capacity of 90,000 tons per annum of spodumene (lithium concentrate). As with all major expansions, the project faced challenges. In response, AMG's team excelled, bringing the project online on time and on budget. We then proceeded to effectively operate the plant for several years, meeting design specifications and volumes year after year. I am exceptionally proud of this accomplishment because as I look around the world of lithium projects, I see an industry plagued with massive delays and overruns. Our diligence has been rewarded. It is interesting to calculate the return on the \$75 million capital expenditure. The cumulative adjusted EBITDA 2019 to 2023 from this investment was \$494 million, a payback of over six times or, in terms of PE "6X" with a long mine life to go.

In the year 2023, the adjusted EBITDA attributable to this new lithium mining activity was \$237 million or 68% of AMG's total

Mibra mine, Brazil





Lithium Hydroxide battery-grade refinery - Bitterfeld, Germany

adjusted EBITDA of \$350 million (following the 2022 lithium adjusted EBITDA contribution of \$215 million, or 63%). With that, we became a "lithium company," and our stock price is now correlated to the lithium industry. Some may claim that it's bad timing, but ours is a volatile industry. It has to be noted that the Mibra mine is one of the lowest cost lithium concentrate mines on a global scale, partly because of the sales of tantalum credited to the lithium production.

In 2022, we started the engineering for the expansion of the lithium concentrate capacity to 130,000 tons per annum. Our lithium concentrate plant will temporarily stop production to facilitate the expansion from 90,000 tons to 130,000 tons. We expect to produce 93,000 tons for full year 2024 and reach full production, or 130,000 tons, in 2025.

In 2021, we gave the go ahead to start the construction of a lithium refinery in Bitterfeld, Germany with an initial capacity of 20,000 tons of battery-grade lithium hydroxide, and an investment of \$150 million. We are presently in the process of starting up with extensive process and product qualifications and audits. We expect to be in full production later this year.

One major AMG asset that you won't see in our financial statements is our large and exceptionally experienced lithium

management team in Frankfurt. This team has taken years to build. Following Albemarle's acquisition of Rockwood, the owner of Chemetall GmbH, a renowned global leader in lithium technology and the inaugural producer of lithium salts since 1922, a skilled team became available. Numerous former Chemetall employees seamlessly transitioned to join AMG following this acquisition.

The Mibra mine and the Bitterfeld refinery are the cornerstones of AMG Lithium's transatlantic lithium value chain. The Bitterfeld refinery will be the first facility of its kind in Europe. An estimated 82% of the world's hydroxide refinery capacity is presently located in China. The layout of Bitterfeld is designed for 5 modules with an ultimate capacity of 100,000 tons per annum. That, according to estimates, would supply 17% of the estimated consumption of hydroxide in Europe by 2030.

In recent years we have assembled a unique lithium research & development team in Frankfurt around a new laboratory complex, where we operate a pilot plant for materials of the next generation lithium battery, the "solid state" battery.

We are presently finalizing the feasibility work on a lithium chemical (hydroxide/carbonate) conversion plant in Brazil to complete the value chain from Brazil to Germany. For the time being, that conversion takes place in China under long-term agreements.

## NEW CORPORATE ORGANIZATION



Since January 1, 2024, AMG Critical Materials has been operating through three wholly owned subsidiaries, AMG Lithium, AMG Vanadium, and AMG Technologies. The legal restructuring work is still ongoing. AMG Lithium BV, Amsterdam, is up and running and has been audited on a standalone basis since 2021.

The three new subsidiaries have different end markets: AMG Lithium is supplying the market for vehicle and stationary batteries, through cathode producers ("e-mobility" and "e-storage"). AMG Vanadium is supplying vanadium to the high-performance steel market and the market for stationary vanadium redox flow batteries ("e-saving" and "e-storage"). AMG Technologies' primary market is aerospace engines where high stress materials are at work ("e-saving").

The trends behind these markets are powerful and persistent, and our aggressive investment strategy has positioned these companies and AMG as a whole as a high growth company.

### AMG VANADIUM

AMG Vanadium is a holding company (in formation) with the corporate center in Cambridge, Ohio, and major wholly owned subsidiaries in Newcastle, Pennsylvania (vanadium aluminum alloys, chromium metal); Nuremberg, Germany (titanium alloys, vanadium oxide, vanadium electrolyte); and Rotherham, UK (chromium metal). AMG Vanadium oversees AMG Critical Materials' 50% interest in SARBV, Amsterdam, with its projects in the Middle East region.

During 2023, AMG Vanadium ramped up its new ferrovanadium production facility in Zanesville, Ohio, which essentially doubles our spent catalyst throughput capacity to approximately 60,000 tons per year (equivalent to about 11 million pounds of ferrovanadium). With capital expenditures of \$325 million, the Zanesville project is the largest project ever undertaken by AMG Critical Materials. It has been financed by an industrial revenue bond with a tenor of 30 years and an interest rate below 5%.

AMG Vanadium - Zanesville, Ohio, USA





Vanadium electrolyte project - Nuremberg, Germany

AMG Vanadium is the western world's low-cost producer of ferrovanadium, partly because we also extract molybdenum and nickel from the spent catalysts and partly because we receive recycling fees for our services.

The growth of AMG Vanadium is shifting from ferrovanadium to vanadium oxide which we produce in Nuremberg, Germany, in a proprietary process from a variety of vanadium-containing residues including gasification ash. Vanadium oxide is the base material for vanadium electrolytes for use in vanadium redox flow batteries. The production facilities for vanadium oxide and vanadium electrolytes in Nuremberg, Germany, are presently being expanded.

Through proprietary technology, we have successfully linked our two main vanadium plants in Ohio and Nuremberg. The facilities in Ohio apply a two-step process in treating spent catalysts, roasting first, and then melting. Instead of going to the second step, we can re-route the roasted spent catalysts and use them as a feed for the production of vanadium oxides in Nuremberg on the way to battery materials. This is where the growth is and this optionality has great strategic value.

SARBV is developing Phase 1 of the "Supercenter" project in the Kingdom of Saudi Arabia. The main objective of the project is to build a recycling facility to extract vanadium from the residues of the

Jazan gasification project of ARAMCO, based on AMG proprietary process technologies. At the end of 2023, the FEL3 feasibility study, which was contracted to Hatch Engineering, was completed and is under review. The full Supercenter project will also include the processing of spent catalysts, a Fresh Catalyst R&D facility, and a LIVA Hybrid ESS.

# AMG TECHNOLOGIES

# \$400 \$300 \$200 \$100 \$0 2019 2020 2021 2022 2023

# AMG ENGINEERING ORDER INTAKE

Contrary to its two "sister" companies, AMG Technologies is light in fixed assets – the main asset is the intellectual property which resides in the knowledge and experience of our employees. Among its end markets are the aerospace engine mainly via its turbine blade technology (Thermal Barrier Coating, or "TBC," in particular), high-performance steel, specialty alloys, and other materials requiring vacuum treatment, such as glass or new ways of reducing energy consumption/ $CO_2$  in the production of synthetic graphite from petroleum coke.

![](_page_4_Picture_1.jpeg)

AMG Engineering - Thermal Barrier Coating

An excellent illustration of the high-performance titanium product line is the recent contract to build the vacuum furnaces for the new \$500 million TIMET operation in Ravenswood, West Virginia, USA. Another is AMG Engineering's Electron Beam / Physical vapor deposition TBC process which is virtually exclusively approved in aerospace for high temperature applications. Given our world market share, when you fly, you have the comfortable feeling that the turbine blades are coated with an AMG Engineering coater.

#### LIVA

The energy storage market is poised for exponential growth, with BloombergNEF data indicating an energy storage capacity surge from 1.4GW/8.2GWh in 2023 to a projected 650GW/1,885GWh worldwide by 2030. The growth of this market is secured by the need to overcome the intermittency of solar and wind energy sources to increase the efficiency of use. Another driver is the need of manufacturing plants to connect to renewables. And finally, there is the need for rethinking grid management to handle the largescale intermittencies.

Remarkably, Germany is set to contribute significantly to this expansion, accounting for 50GW/98GWh by 2030, according to BloombergNEF. This robust trajectory reflects a remarkable 27% CAGR and stands 33% higher than the early 2023 forecast, highlighting the accelerating demand for large-scale energy storage solutions.

AMG's specific contribution to this market is the LIVA battery technology. This technology consists of three parts: a lithium battery, a vanadium battery, and a software/AI package to manage the interaction of the parts. The lithium component guarantees the instant availability of the storage system, and the vanadium part provides low-cost storage and evergreen use of the electrolyte without the need for recycling.

LIVA Power Management GmbH is located at AMG's technology & engineering center in Hanau, Germany, capitalizing on the experience there with large equipment engineering.

![](_page_4_Picture_9.jpeg)

LIVA Power Management Systems GmbH - Frankfurt, Germany

#### HEALTH AND SAFETY

In addition to the excellent financial results, AMG's year-end 2023 total incident rate performance is at record best levels. AMG delivered another strong safety record which was 58% better than industry averages. As reported regularly, we relentlessly pursue health and safety of our employees with a target of zero incidents.

![](_page_4_Figure_13.jpeg)

# AMG CO, Enabled

At the heart of AMG's core tenets is the drive to reduce  $CO_2$  and a key testament to this is  $ECO_2RP$  (our Enabled  $CO_2$  Reduction Portfolio). In 2023 alone, our innovative product lines facilitated the reduction of an astounding 110 million metric tons of  $CO_2$ .

Our planet is at a critical juncture, and the decisions we make today will shape the future for generations to come. Our company, at the forefront of the decarbonization movement, understands the gravity of the situation. We recognize that the reduction of  $CO_2$  emissions is not only an environmental imperative but also a strategic business decision that aligns with our core values.

The journey from 42 million metric tons of enabled  $CO_2$  reduction in 2015 to 110 million metric tons in 2023 showcases our relentless pursuit of innovation and sustainability. We are not just witnessing growth in numbers; we are witnessing a transformation – an evolution towards a more sustainable and eco-conscious paradigm. Our commitment to enabling  $CO_2$  reduction is not just a business strategy; it is a moral imperative, a pledge to be the architects of a healthier and more sustainable future. We foresee significant growth from the base of the 2023 level of enabled  $CO_2$ reduction, especially related to AMG's proprietary Thermal Barrier Coating technology, and – for the first time – from applications of AMG's proprietary MOX nuclear fuel technology as newly built plutonium – MOX conversion facilities are starting up. We expect that our leading presence in the MOX fuel space will be enhanced by the emerging Small Modular Reactor movement.

Over the past 19 years, many carbon reduction schemes, with both positive and negative impacts, have been created and/ or accepted by regulatory agencies to deter  $CO_2$  emissions and slow the impacts of climate change. Whether it be the EU Emissions Trading System (EU ETS) or the multitude of Carbon Credit Registries, the penalties or incentives were never capable of clearly quantifying or validating the actual contribution these programs have made to reducing the release and buildup of  $CO_2$  in the atmosphere.

Although we strongly disagree with certain carbon accounting interpretations regarding the reporting of avoided emissions, known to us as scope 4, alongside traditional scopes 1, 2, and 3 emissions, we still consider this area the cornerstone of our environmental value proposition. At AMG, we understand that our positive impact lies not in the reduction of nominal  $CO_2$  values in the hundreds of thousands of tons represented by our scopes 1, 2, and 3, but instead in the millions of tons by the scope 4 contribution we make to the planet.

In a remarkable feat of environmental stewardship, AMG has facilitated a reduction of 110 million metric tons of  $CO_2$  emissions in 2023, representing 0.27% of the world's total emissions. This achievement underscores our unwavering commitment to a

greener future, showcasing the profound impact that focused innovation and eco-conscious solutions can have on mitigating climate change.

In the past several years, I am happy to see the increasing acceptance by regulatory agencies (e.g. EU Taxonomy for sustainable activities) and industry consensus (e.g. Estimating and Reporting the Comparative Emissions Impacts of Products, World Resources Institute) recognizing the overwhelming benefit of enabling  $CO_2$  emissions. It gives me satisfaction to see the alignment of these regulatory bodies and thought leaders with AMG's core belief that the pathway to climate reduction goals is through increased investment in groundbreaking products and technologies.

# DIVERSITY

I am pleased to share the remarkable strides our company has made in fostering diversity and inclusion, a vital aspect of our corporate ethos. In 2023, AMG's Corporate Diversity Council oversaw the creation of two Employee Resource Groups to help foster inclusivity and bonds between our employees.

Our commitment to increasing the representation of women in management roles has yielded promising results. Over the past three years, we have observed a consistent uptrend, culminating in a noteworthy 24% representation in 2023. This trajectory positions us on the path towards achieving our 2030 goal of at least 30% of management roles held by women. These achievements underscore our dedication to cultivating a workplace that thrives on diverse perspectives, ensuring that our organization reflects the vibrant tapestry of talent that propels us forward. We remain resolute in our pursuit of inclusivity, recognizing its intrinsic value to both our corporate culture and overall success.

![](_page_5_Picture_11.jpeg)

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DR. HEINZ SCHIMMELBUSCH