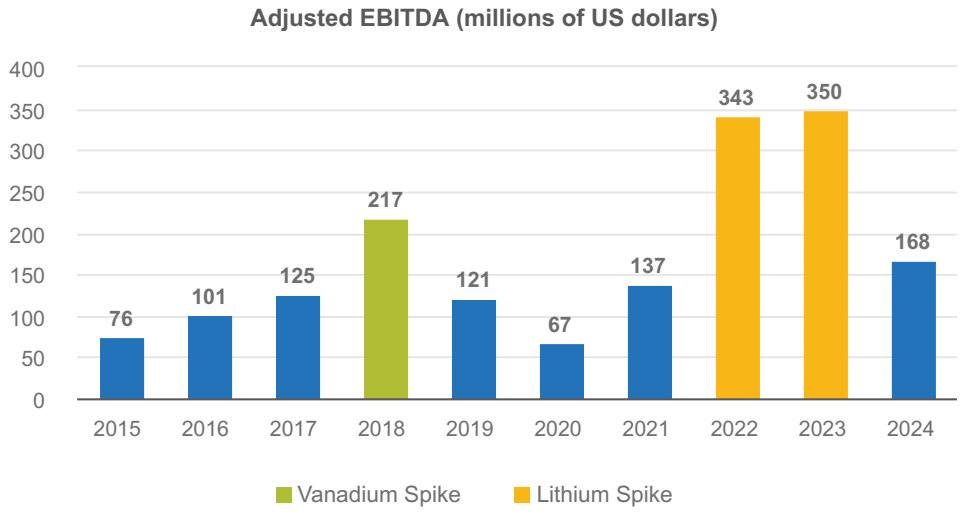
# Letter to Shareholders

**Dear fellow Shareholders,**

I am pleased to share AMG's performance in 2024, a year in which we demonstrated resilience and strategic growth despite significant downward volatility in lithium and vanadium. In the face of a 65% drop in lithium market prices and a 23% decline in ferrovanadium market prices compared to the prior year, we achieved an adjusted EBITDA of $168 million, significantly surpassing our revised guidance of "$150 million, or more."

AMG is a growth company. The 5- and 10-year compound annual growth rates (CAGR) for our adjusted EBITDA are 26% and 9%, respectively. Compared to 19 peers (AMG's peer group confirmed by a third party), our 5-year adjusted EBITDA CAGR is the second highest and our 10-year adjusted EBITDA CAGR is the third highest among this group. These results are driven by two key factors: first, our investment strategy in battery materials, initiated in 2017, and second, the advantages we realized from our critical materials portfolio.

## AMG is a Growth Company




| Compound Annual Growth Rate (CAGR) | 5-Year | 10-Year |
|---|---|---|
| 2024 AMG EBITDA | 26% | 9% |
| 2023 AMG EBITDA | 30% | 17% |

AMG's critical materials portfolio is not a conglomerate. The different constituents of the portfolio have similar business models; share the same type of market dynamics; non-conventional origins of supply; need upgrading by partly proprietary process technologies; and the marketing of the resulting materials involves technical interaction with customers (mostly industrial majors). The volatile market dynamics demand sophisticated risk management methodologies. The conversion of metallic materials into high-end applications usually requires furnaces and it is a competitive advantage to be the global leader in furnace technology. Another critical material for us is like another chemical for a chemical company: familiar territory.

We believe that AMG is undervalued. This is supported by German analyst Joerg Lang from Boerse Online, who recently observed that the present AMG market capitalization of approximately $500 million reflects only AMG Technologies. The headline for his article, "Zukunftsrohstoffe gibt's geschenkt," translates as "Materials for the future for nothing." His estimated operating income for AMG Technologies is $65 million. AMG Technologies' adjusted EBITDA in 2024 is approximately $70 million. At a multiple of 10x, AMG Technologies would be valued at around $700 million, substantially exceeding all of AMG's market capitalization of approximately $500 million. We have no explanation other than we are difficult to model by outside analysts.

In the volatile world of critical materials, the rule for AMG management is to figure out how to be the sustainable low-cost producer, creating cash flow even when the prices reach their low. AMG has successfully applied that rule for lithium and vanadium when compared to the western competitors. Commodity investors will have observed that in general share prices, including AMG's, correlate neatly with commodity price developments.

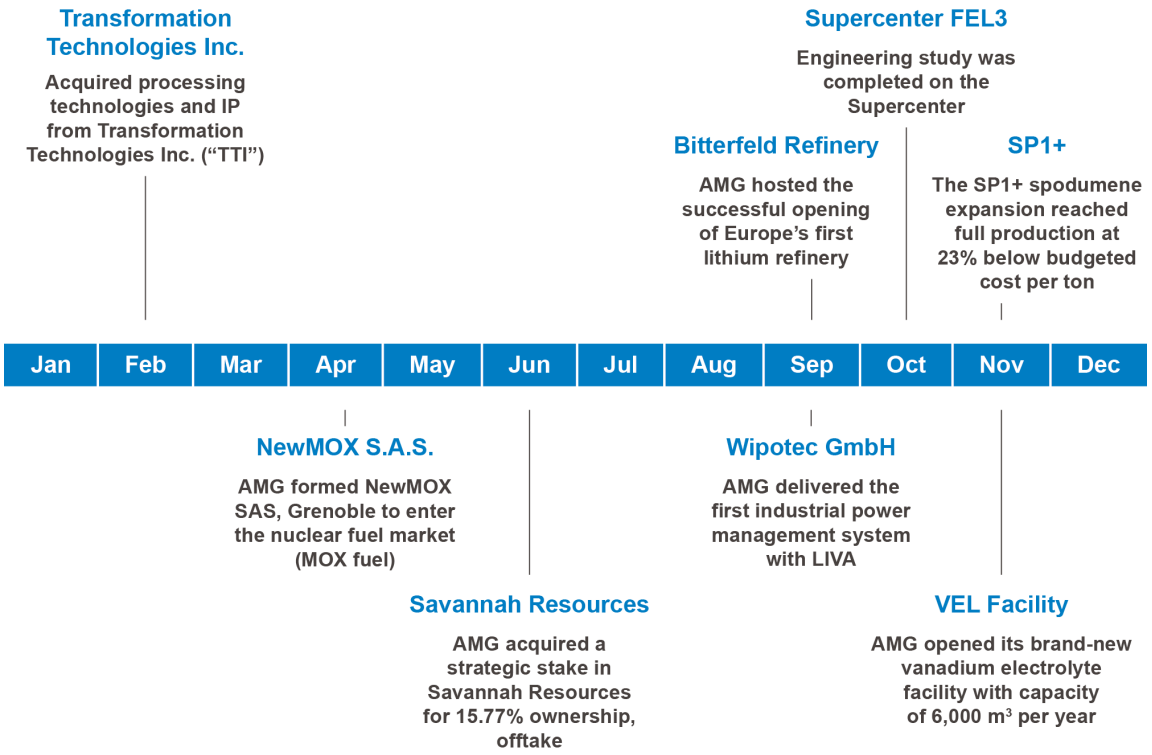
I have often reflected on the challenges of providing one-year adjusted EBITDA guidance, particularly for a company operating in markets where material prices can fluctuate dramatically within the same year. We've seen this volatility firsthand—whether in

lithium in 2022 and 2023 or vanadium in 2018—when prices surged by several magnitudes only to decline significantly. While we recognize that such guidance is often expected, it remains a complex task given these unpredictable market dynamics. For instance, our second upward revision of 2024 adjusted EBITDA guidance—from "$130 million, or more" to "$150 million, or more"—was driven by an unexpected surge in antimony prices following China's export restrictions. The continued price increases caught even us by surprise.

Looking ahead, given the evolving political and economic landscape, market disturbances are likely to become more frequent. As always, we will navigate these challenges with agility while maintaining transparency in our financial outlook.

# 2024 Strategic Highlights

### Milestones & Strategic Progress




2024 was a busy year for AMG as we engaged in a series of strategic initiatives and operational advancements designed to strengthen our position as a leader in the critical materials industry and drive sustainable, long-term growth. I will highlight some here.

## AMG Lithium

### Strategic objective: "Keep building the Brazil-Portugal-Germany lithium highway"

The opening of AMG's Bitterfeld lithium refinery in 2024 marks a pivotal moment for our company and the critical materials industry. This state-of-the-art facility represents a significant step forward in our mission to support the global energy transition by providing high-purity lithium products essential for the battery industry. In the lithium value chain, a refinery is a stabilizing element as the volatility of the "conversion premium" is relatively low (around $3,000 per ton).

The opening ceremony of the Bitterfeld refinery on September 18, 2024, was in the presence of Dr. Rainer Haseloff, Prime Minister of Sachsen-Anhalt, Germany, and Mr. Mateus Simões, Vice Governor of the State of Minas Gerais, Brazil. In my address, I said we are building a lithium highway connecting Brazil and Germany. I then noted that we will have a "refueling" station in Portugal in the form of the Lagoa spodumene plant and the Savannah mining project and will invite the Prime Minister of Portugal to join the exclusive "Highway Committee."

## AMG Vanadium

### Strategic objective: "Expanding the global leadership in circular vanadium production"

The TTI technology acquisition complements the processing options of AMG for vanadium materials. Several projects are under development that provide a regional solution for global refiners, thereby reducing risks and complexities of associated logistics and costs, linking refineries to our processing center in Ohio.

## New Electrolyte Plant in Nuremberg, Germany

In Nuremberg, Germany, we opened a new vanadium electrolyte plant for the vanadium battery feed, including LIVA batteries, marking the newest addition to the value chain of AMG Vanadium BV, incorporated in 2024. The Nuremberg facility is the largest of its kind in Europe, reinforcing our position as the leading producer of vanadium electrolytes. Given that electrolytes are liquid and costly to transport, their ability to remain in the battery throughout its lifespan and be reused in the next generation of batteries eliminates the need for recycling, making them a highly sustainable energy storage solution. As the demand for energy storage continues to drastically increase, we anticipate significant expansion in this sector.

## From Gasification Ash to Energy Storage

The Supercenter project in the Kingdom of Saudi Arabia (a project from Shell & AMG Recycling BV) is progressing. The engineering study (FEL3) was completed in October 2024. Phase 1 of this project is the building of a processing plant for the gasification ash in the Kingdom of Saudi Arabia into vanadium oxides and includes a vanadium electrolyte plant and a battery for power management. Later phases include spent catalyst recycling, fresh catalysts and more vanadium battery assembly. In preparation for the expansion of LIVA into the Middle East in a significant way, we are building a LIVA demonstration battery to assist Aramco on a solar field in Tabuk that Aramco refers to as the first net-zero project in the Kingdom of Saudi Arabia.


**1 Gasification Ash**

Technology Provider: AMG

**2 Spent Catalyst**

Technology Provider: AMG

**3 Fresh Catalyst Manufacturing**

Technology Provider: Shell Catalysts & Technologies

**4 Mass Energy Storage**

Technology Provider: AMG LIVA

## AMG Technologies

### Strategic objective: “Strengthening global leadership in vacuum furnace technology”

In April 2024, AMG created NewMOX SAS, Grenoble, France. The core objective of NewMOX SAS is to develop and operate a nuclear fuel fabrication facility for MOX fuel, using plutonium from reprocessed spent nuclear fuel, thereby promoting circularity to the nuclear fuel industry. MOX fuel supply will meet the demands of the rapidly expanding Small Modular Reactor (SMR) industry. NewMOX SAS ensures flexibility in production and fast supply of various fuel types with up to 30% plutonium content to meet SMR requirements.

The beginnings of NewMOX SAS followed the commissioning of a large nuclear waste recycling facility by a customer in China, where ALD Vacuum Technologies GmbH (Hanau) provided the crucial technology, a MOX sintering furnace. The plant produces a specific nuclear fuel called MOX (Mixed Oxides) fuel, made from plutonium recovered through spent fuel reprocessing, and depleted uranium, a byproduct from uranium enrichment.

ALD builds on a strong legacy in nuclear furnace technology. The furnace technology originated from the nuclear activities of Degussa AG, Frankfurt, and made its way to ALD before ALD was even a part of AMG. In the MOX technology, ALD is the clear technology leader, evidenced by an exhaustive reference list now complemented by the newest plant in China. We expect market demand for MOX to exceed the supply and therefore go through conceptual engineering for the building of a MOX plant on a built-own-operate basis.

AMG delivered the first industrial power management system with LIVA at Wipotec GmbH. The Wipotec battery is the center of the first LIVA Power Management System for industrial use, integrating different energy sources, including renewables, and different electricity uses. Consolidating electricity flows in an internal grid is a powerful way to save electricity. This battery is the showcase for LIVA Power Management Systems in industrial plants.

### Inside a Vanadium Flow Battery

In summary, the “2024 strategic highlights” photo illustrate steps in our strategy to occupy leading positions, specifically in lithium and vanadium, with major investments, partly in the first mover category. Accordingly, as an empirical measure, the average annual CapEx in the five years leading up to 2023 exceeded $120 million—in 2021, 2022, and 2023 it exceeded $150 million—compared to annual average CapEx of less than $50 million in the preceding years. Fortunately, the cash flow generation in 2022 and 2023 in combination with the bond issue for the Zanesville Ohio plant and excess cash flow from AMG Technologies has been available to finance these outlays and to keep our balance sheet in conservative territory.


# Commitment to Sustainability & Innovation

Early on, in 2018, we formed $ECO_2RP$, the Enabling $CO_2$ Reduction Portfolio[1], a virtual subsidiary, to consolidate innovative product lines across AMG which enable $CO_2$ reduction. We performed a stringent Life Cycle Assessment for each of these product lines and calculated the $CO_2$ reduction we enabled through our customers’ use of these products. We regularly report the resulting $CO_2$ reduction. This is evidence that our assumption that “critical materials are intrinsically related to $CO_2$ reduction” is correct. In 2024, $ECO_2RP$ recorded an astonishing 114 million tons of $CO_2$ “savings.” To focus on enabling $CO_2$ reduction is in line with the EU taxonomy language that ranks “economic activities which make substantial contributions based on their own performance” equally with “directly enabling other activities” (EU Taxonomy Article 16 and Article 9). That seems obvious. We concluded that this would be ranked equally to clean energy production. That, however, is not so. We had to realize that regulations do not even require reporting on Scope 4 efforts or results. The private carbon trading outfits, busy with opaque business models mostly related to trees in Latin America, declined to trade these enabled $CO_2$ reduction units (“too complicated”). All of that is despite “enabled” $CO_2$ reduction under Scope 4 resulting in much higher $CO_2$ reduction than what can be achieved with innovations under Scopes 1, 2, and 3.

In November 2021, we entered into a 5-year $200 million senior secured sustainability linked revolving credit facility, the interest rate of which is reduced when meeting two key performance indicators. The first is related to Scopes 1 and 2 emissions and the second is to avoid emissions. Since its inception, these KPI’s have been met, and the interest rate reduction was achieved.

[1] This metric is outside of the scope of CSRD.

Given our experiences with Scope 4, we are complementing measuring the enabled $CO_2$ savings by our customers with the measuring of the estimated saving of energy. This change reflects our commitment to providing a tangible and universally understood metric that aligns more directly with operational efficiency and sustainability and is more relevant to our customers' priorities and goals. Energy savings offer a concrete, measurable benefit that directly impacts costs and resource consumption. Additionally, with inconsistent global attention to $CO_2$ regulation, emphasizing the saving of energy ensures our efforts resonate with broader sustainability initiatives while maintaining transparency and relevance.

The largest contributor within our $ECO_2RP$ virtual segment is the Thermal Barrier Coating (TBC) of aerospace turbine blades. It accounted for approximately 76 million metric tons of enabled $CO_2$ out of the total 114 million metric tons of enabled $CO_2$ in 2024. TBCs enable higher operating temperatures in aerospace engines which reduces $CO_2$ emissions by decreasing the consumption of jet fuel. The corresponding estimated annual energy savings amount to 104,500 GWh. The estimated crude oil equivalent annual savings are 584 million barrels, or approximately 1.6 million barrels per day.

## Thermal Barrier Coating and the Saving of Energy

ALD Vacuum Technologies GmbH (Hanau), the largest company in AMG Technologies, is the world leader in building TBCs around the globe operated by our customers such as Pratt & Whitney, GE, Linde, Rolls Royce, Safran, and others.

### Thermal Barrier Coating Leadership


**1 USA**

26 in operation
1 in installation
2 in planning

**2 - 9 Non-USA**

11 in operation
4 in installation
2 in planning

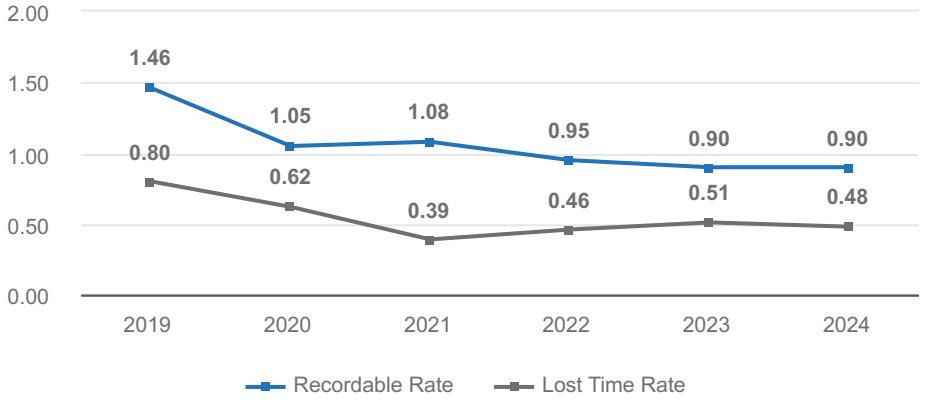
**TBC customers include Pratt & Whitney, GE, Rolls Royce, Safran and others**

## Safety

AMG has tied its all-time best recordable rate of 0.90 again this year after setting the record in 2023. Our recordable rate is 74% better than the industry average. AMG also improved its lost time rate to 0.48 from 0.51 last year, a 6% decrease. Our lost time rate is 52% better than the industry average.

As reported regularly, we relentlessly pursue the health and safety of our employees with a target of zero incidents. As evidence that our efforts bear fruit, 78% of our global facilities had zero lost time injuries in 2024.

### Our Commitment to a Safer Workplace




| Description | Industry average | AMG 2024 |
|---|---|---|
| Recordable Rate | 3.40 | 0.90 |
| Lost Time Rate | 1.00 | 0.48 |

## AMG Values

At AMG, our committed values are the foundation of everything we do, guiding our actions and shaping our culture. We are committed to acting safely, not just as a core operational principle, but as a promise to our employees, partners, and communities. Safety underpins our success and allows us to operate with the confidence and reliability expected by all who depend on us. Equally, we prioritize creating value for our stakeholders—whether they are our customers, shareholders, or employees—by delivering innovative solutions that drive growth and prosperity.

Respect for people is at the heart of our values. We believe that fostering a culture of collaboration, inclusivity, and fairness is essential to achieving our mission. We are also deeply committed to protecting our planet, enabling measurable reductions in $CO_2$ emissions through our critical materials and technologies. $CO_2$ emissions can also be expressed in energy savings as seen above. By delivering tangible environmental benefits, we play a vital role in supporting the global transition to sustainability. Finally, we act with integrity in all that we do, ensuring our business practices are transparent, ethical, and responsible. Together, these values not only define who we are as a company but also reinforce our commitment to building a better future for all. This statement includes a commitment to what is generally referred to as “Inclusion.”

We respect people, meaning all people. We believe that fostering a culture of diversity enables us to harness the full potential of our global team and drive better outcomes for our stakeholders. That also implies inclusion. We are an innovative company, and innovations originate from teamwork.

In 2024, we made significant strides in our commitment to diversity, with help from our Corporate Diversity & Inclusion Council, established in 2022. One highlight of the year was the introduction of our scholarship program for young women pursuing careers in engineering and materials science at the Colorado School of Mines. This scholarship aims to empower the next generation of female leaders in fields traditionally underrepresented by women. We are proud to announce that this initiative will become a recurring program, reinforcing our long-term dedication to gender diversity.

To better understand and support our employees, we conducted a company-wide employee engagement survey. The results were overwhelmingly positive, with an exceptional turnout that reflected the enthusiasm and commitment of our workforce. The feedback received underscored our employees' appreciation for our inclusive environment and provided valuable insights into areas for continuous improvement. These findings will guide our efforts to enhance the workplace experience for all.

This year, I am proud to share two remarkable honors that reflect AMG's commitment to excellence. AMG Brazil received the prestigious Human Being Award, recognizing our exemplary corporate culture and leadership in ESG principles. Additionally, AMG Engineering/ALD was named an industry leader by the F.A.Z. Institut for its outstanding HR policy in mechanical and plant engineering.

These awards and our other achievements this year reflect the collective commitment of our team to fostering a diverse and inclusive workplace. By continuing to champion initiatives that promote diversity and listening closely to our employees, we aim to strengthen our culture and build a brighter, more inclusive future for AMG and the communities we serve.

## Looking Ahead

In terms of a macro view, the lithium market is poised for significant developments in 2025, driven by strong demand growth and shifting market dynamics. The global EV market grew by 25% in 2024 and is expected to increase by over 20% in 2025, with China leading at +14% and Europe rebounding due to stricter $CO_2$ regulations. Battery-based energy storage systems (BESS) are the fastest-growing lithium demand segment in 2024 (+53%). Estimating the growth of this segment is particularly challenging as the ESS market is still in its early stages of development.

In the medium-term, we believe the global lithium EV battery demand will continue to grow at 20% or more. The lithium demand for stationary batteries has to be added and remains the largest unknown factor. The growth of the solar industry in China and the resulting need for BESS is also unknown. The BESS CAGR in China might exceed 30% and be on an even faster timeline than first anticipated. That could be instrumental in determining when the lithium price will take off from its present low.

BESS also drives the future demand of vanadium (including AMG's LIVA solution). The vanadium flow battery solution will benefit from this growth trend and the relative competitiveness of lithium versus vanadium batteries will partly be a function of the respective price volatilities. Most predictions state that the vanadium demand from the BESS segment in 2030 will be larger than the total vanadium demand today, which is dominated by its use in steel. This growth will require higher vanadium prices for new projects to be financed.

**Dr. Heinz Schimmelbusch**

**Chief Executive Officer**