ECO$_2$RP... ENABLING CO$_2$ REDUCTION PORTFOLIO AT THE HEART OF OUR ESG APPROACH

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AMG’S STRATEGIC ORIGIN

- AMG was founded on the basis of a key global trend:
  - Clean energy and energy savings demand materials science-based solutions
- This global trend toward CO$_2$ abatement created additional demand for materials in the periodic table that in turn became “critical”
- AMG was formed to be the technology leader in these “critical materials”
- As a result, by design, AMG has created and continues to grow a portfolio of product lines enabling its customers to reduce CO$_2$ (ECO$_2$RP)

1) Critical Materials are those defined as such by the EU and the U.S. in the following publications: The 2020 EU Critical Raw Materials List, published September 2020; and the U.S. list of Critical Materials per the May 2018 announcement by the U.S. Department of the Interior.
We provide products that enable our customers to reduce CO₂ emissions through higher energy efficiency.

The EU regulation is working in the direction of AMG’s long-term objectives: CO₂ reduction enabling activities are at the core of the EU TAXONOMY INITIATIVE. Since 2012 we have developed a methodology to measure the enabled energy savings. In 2018 we further refined the methodology in partnership with ERM, starting to conduct Life Cycle Assessments (LCA) for each qualifying product. We have created a virtual portfolio to measure the energy saving enabled by our products and evaluate the impact on AMG’s financial performance.

ECO₂RP HAS BEEN CREATED TO REPRESENT AND QUANTIFY OUR EFFORTS TO SUSTAIN THE ENVIRONMENT. IT IS NOT INTENDED TO BE A REPORTING SEGMENT.

1) Regulation EU 2020/852 - art.16 & 69 – see appendix for further details
2) see “Enabling Metric, Please”. The Stern Stewart Institute No. 10 June 2014 pp. 58-63 by Prof. Dr. Steve H. Hanke and Dr. Heinz Schimmelbusch. For further detail, see AMG’s website.
**ECO₂RP** IS THE PORTFOLIO OF AMG’S PRODUCTS ENABLING CO₂ REDUCTION

Products are accepted in **ECO₂RP** only when the enabled CO₂ reduction effect has been established by a LCA performed by a leading third-party expert.

AMG’S enabled CO₂ emission reductions (Million MT)

- **2019**: 67.8
- **2018**: 50.8
- **2017**: 45.6

CO₂ reduction enabled by AMG’s products based on the LCAs of 2017-2019

- **26% revenue contribution by ECO₂RP products in 2019** (up from 8% in 2010)
- **33% gross profit contribution by ECO₂RP products in 2019** (up from 5% in 2010)

**~ 90 MILLION $ OF 2017-2019 AVERAGE GROSS PROFIT DERIVED FROM ECO₂RP**
**ECO₂RP** is currently composed of 6 products that enabled 67.8 million MT of CO₂ reduction in 2019.

<table>
<thead>
<tr>
<th>Enabled CO₂ Reduction (Million MT) - 2019</th>
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<tbody>
<tr>
<td>67.8</td>
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<tr>
<td>is the # of million MT of CO₂ savings enabled by AMG in 2019</td>
</tr>
<tr>
<td>1  Thermal barrier coatings, enabling fuel savings through higher operating temperatures in aircraft engines</td>
</tr>
<tr>
<td>2  Aluminum alloys, enabling reduced fuel consumption by light weighting</td>
</tr>
<tr>
<td>3  Master alloys for Ti alloys, enabling reduced fuel consumption by light weighting</td>
</tr>
<tr>
<td>4  Ferrovanadium, alloy for rebar steel, reducing quantity required for construction</td>
</tr>
<tr>
<td>5  Graphite, as insulation in buildings, enabling lower domestic heating requirements</td>
</tr>
<tr>
<td>6  Turbocharger wheel casting, turbocharges in vehicle engines enable engine downsizing fuel efficiency</td>
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A STRONG PIPELINE OF LCA CANDIDATES TO BE ADDED TO THE ECO\textsubscript{2}RP WILL ENABLE FURTHER CO\textsubscript{2} EMISSION REDUCTION…

<table>
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<tr>
<th>ECO\textsubscript{2}RP pipeline of LCA candidates</th>
<th>LCA candidates enabling further CO\textsubscript{2} reduction</th>
<th>(Million MT)</th>
</tr>
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<tbody>
<tr>
<td>MOx Fuels, nuclear power to replace fossil power in China (est. 2022)</td>
<td>7</td>
<td>12.0</td>
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<td>Titanium aluminides, enabling fuel savings through light weighting</td>
<td>8</td>
<td>4.6</td>
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<tr>
<td>Revert furnaces, recycling production scrap instead of primary mining</td>
<td>9</td>
<td>TBD</td>
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<tr>
<td>Glass coating, enabling lower cooling requirements</td>
<td>10</td>
<td>TBD</td>
</tr>
<tr>
<td>Automotive transmission heat treatment, enabling vehicle fuel savings</td>
<td>11</td>
<td>TBD</td>
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…WITH TANGIBLE RESULTS EXPECTED IN THE NEAR FUTURE

List of LCA projects enabling further CO₂ reduction

- Ferrovanadium (4)
- Thermal barrier coatings (1)
- Master alloys for Ti alloys (3)
- Graphite (5)
- Turbocharger wheel casting (6)
- Aluminum alloys (2)
- Automotive transmission heat treatment (11)
- MOx Fuels (7)
- Titanium aluminides (8)
- Glass coating (10)
- Revert furnaces (9)

2019 ECO₂RP LCA portfolio

1) Excluding CO₂ savings from energy storage contributions; see page 10
AMG STRATEGIC PRIORITIES BEYOND 2020: THE ENERGY TRANSITION PASSES THROUGH THE ELECTRICITY STORAGE

Grid Storage Batteries play a critical role in reducing CO₂. Battery-based electricity storage capacity enables additional renewable energy for the utility industry, removing a bottleneck in renewable expansion.

AMG provides raw materials for lithium, vanadium & tantalum for battery and capacitor use.

### Batteries
- **Lithium**
  - Preliminary engineering for the first battery grade lithium hydroxide refinery in Europe, to be located in Germany
  - AMG is preparing a pilot plant operation for lithium solid state batteries in Germany

- **Vanadium**
  - Planning to expand production of vanadium oxide electrolytes for stationary batteries sourced from waste streams in gasification (Germany) and refinery waste (US)
  - Overseas expansion through the JV Shell – AMG Recycling BV

- **Tantalum**
  - AMG is the world’s largest producer of conflict free tantalum at the Mibra in Brazil. It is the preferred metal for capacitor manufacturing
  - Energy is stored on the capacitor’s conductors; the larger the surface of the conductor, the more charge it can store

AMG IS CURRENTLY WORKING ON HOW TO LINK INCREMENTAL ELECTRICITY STORAGE CAPACITY WITH RENEWABLE ENERGY PRODUCTION
OUR COMMITMENT TOWARD SUSTAINABILITY CREATES SHARED VALUES ACROSS OUR STAKEHOLDER GROUP…

Suppliers

Jane Neal
VP AMG Vanadium

Employees

“Our president brings a personal philosophy that instils a spirit of inclusion in our organization by valuing people of diverse backgrounds, gender and experience. He, I and the entire AMG organization have a mission to develop our team members, providing opportunities for individuals to grow and realize their full potential.”

Customers

Supplying conflict-free critical materials

Investors

Berengberg Equity research

“Providing critical materials from conflict-free areas is important to AMG and our clients in the electronics industry. We proudly work with them to meet this goal: AMG is the world’s largest supplier of conflict-free tantalum”

Communities

Environmental education program developed by AMG Mineração in 2018, reaching >700 people from local communities and stakeholders during 2019

“Marathon delivered 5,300 metric tons of spent catalyst to AMG. AMG extracted the vanadium and other valuable metals. This reclamation process produces 41,500 less metric tons of CO₂e emissions than traditional steel manufacturing”¹)

“In 2019 MPC delivered 5,300 metric tons of spent catalyst to AMG. AMG extracted the vanadium and other valuable metals. This reclamation process produces 41,500 less metric tons of CO₂e emissions than traditional steel manufacturing”¹)
ECO₂RP has become the growth engine for AMG over the past 10 years, expanding in scale & profitability.

**ECO₂RP - Key highlights**

- Higher growth in Revenue and Gross Profit than AMG as a whole
- The gross profit of ECO₂RP is growing faster than the related revenues
- Gross margin of ECO₂RP is higher than the group as a whole

ECO₂RP has been created to represent and quantify our efforts to sustain the environment. It is not intended to be a reporting segment.
AMG’S INFRASTRUCTURE-RELATED CO₂ REDUCTION PRODUCTS ARE NOT ONLY PROFITABLE BUT VERY EFFECTIVE IN ENABLING OUR CUSTOMERS TO REDUCE CO₂ EMISSIONS
**ECO$_2$RP VALUE INDICATIONS**

AMG’s $CO_2$ offset credit valuation based on the enabled $CO_2$ emission reductions (Million MT)

- If the ECO$_2$RP enabled CO$_2$ reduction products were tradeable as European CO$_2$ Allowances, the total value of 67.8 million MT of enabled CO$_2$ reduction at € 25 / ton would be € 1.7 billion.

- The EU Taxonomy legislative efforts – embracing the “enabling CO$_2$ reduction concept” – confirms AMG’s ECO$_2$RP strategy

**ECO$_2$RP financial highlights**

- **17%**  
  2010-2019 Revenue CAGR

- **90$m**  
  2017-2019 average gross profit

- **24%**  
  2010-2019 Gross Profit CAGR
- Production of high-purity vanadium-pentoxide ($V_2O_5$) enables energy storage capabilities and renewable target to achieve GHG goals
- **Diversification** of input feeds, process routes and end market
- Significant $CO_2$ emission savings via recycling, approx. 80% lower than primary extraction
- HSLA steel enables a **20-40% reduction in steel use**, significantly reducing resource use and transport-related $CO_2$ emissions
- High purity $V_2O_5$ for VRFB energy storage applications, enabling **renewable power growth**
Over time new vanadium production will come from increased recycling of petroleum wastes and from primary mining as the demand for vanadium continues to grow. Production from steelmaking slags will gradually decline over time as BOF steelmaking is gradually replaced by mini-mills in China.

Only a very small percentage of the global vanadium supply base can produce “high-purity” vanadium compounds necessary for future VRFB system applications.

Sources: AMG Vanadium, Vanitec, Roskill, Metal Bulletin
Vanadium consumption is largely driven by China and rebar production, data indicates China will become a net importer of vanadium as consumption grows. Net exports in June 2020 were negative for example. In May 2020, the Chinese government announced fiscal stimulus of about US$500 billion which is expected to drive further steel sector and vanadium demand growth.

Despite the period of low demand outside of China we expect a demand to return to normalized levels in the short term.

Potential new demand from the emerging VRFB could result in an increased demand for high-purity vanadium compounds.

Sources: AMG Vanadium, Vanitec, Roskill, Metal Bulletin
CO2 REDUCTION ENABLING ACTIVITIES ARE AT THE CORE OF THE NEWEST EU TAXONOMY INITIATIVE


For each environmental objective, the Taxonomy Regulation (TR) recognizes two distinct types of substantial contribution that can be considered Taxonomy-aligned:

“Economic activities that make a substantial contribution based on their own performance”

<AND>

Article 16 - Enabling Activities

“An economic activity shall qualify as contributing substantially to one or more of the environmental objectives set out in Article 9 by directly enabling other activities to make a substantial contribution to one or more of those objectives, provided that such activity:

a) does not lead to a lock-in of assets that undermine long-term environmental goals, considering the economic lifetime of those assets; and

b) has a substantial positive environmental impact, on the basis of life-cycle considerations.”

## ABBREVIATION KEY

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>CE</td>
<td>Circular Economy Focus</td>
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<tr>
<td>ECO₂RP</td>
<td>Enabling CO₂ Reduction Portfolio</td>
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<tr>
<td>ERM</td>
<td>Environmental Resources Management</td>
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<td>GHG</td>
<td>Greenhouse Gas</td>
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<td>GRI</td>
<td>Global Reporting Initiative</td>
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<tr>
<td>LCA</td>
<td>Life Cycle Assessment</td>
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<tr>
<td>TBC</td>
<td>Thermal Barrier Coating</td>
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<td>VRFB</td>
<td>Vanadium Redox Flow Battery</td>
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