$307,200,000
OHIO AIR QUALITY DEVELOPMENT AUTHORITY
STATE OF OHIO
EXEMPT FACILITIES REVENUE BONDS
(AMG VANADIUM PROJECT)
SERIES 2019
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AMG AT A GLANCE

WHAT AMG DOES

- Expert global value chain manager in sourcing critical materials from complex locations, providing value-add processing, and serving Fortune 100 customers
- Produces market-leading vacuum furnaces for specialized alloying applications and provides heat treatment services

AMG CORE PRINCIPLES

- Leading producer in all our markets
- Low-cost producer in all our markets
- Innovation driven
- Intensive risk management system and control structure

GLOBAL TRENDS DRIVING CRITICAL MATERIALS DEMAND

GLOBAL TRENDS
Need to contain CO₂ emissions; Industrial growth and increasing affluence need a technology counterbalance

DEMAND
Material science-based solutions for energy efficiency (lighter, stronger, temperature resistant)

SUPPLY
AMG sources, processes, and supplies the materials which are critical to our customer’s end-product performance

FY 2018 REVENUE OF ~$1.3 BILLION

BY SEGMENT:
- 67% Critical Materials
- 33% Technologies

BY END MARKET:
- 40% Transportation
- 21% Specialty Metals & Chemicals
- 30% Infrastructure
- 9% Energy

BY REGION:
- 42% Europe
- 37% North America
- 16% Asia
- 5% ROW

Market leading producer of specialty metals and vacuum furnace systems
AMG BUSINESS SEGMENTS

AMG CRITICAL MATERIALS

AMG’s conversion, mining, and recycling businesses

• Spent Catalyst Recycling (Vanadium)
• Superalloys (Chrome)
• Aluminum (Master Alloys)
• Brazil (Tantalum & Lithium)
• Antimony
• Graphite
• Silicon Metal

2018 Revenue: $873 million

36% Infrastructure
22% Specialty Metals & Chemicals
10% Energy
32% Transportation

AMG TECHNOLOGIES

AMG’s titanium alloys, vacuum systems and services business

• Titanium Alloys & Coatings
• Furnaces
• Heat treatment services

2018 Revenue: $437 million

70% Transportation
15% Specialty Metals & Chemicals
4% Infrastructure
11% Energy
AMG IS A LEADER IN CO₂ REDUCTION

AMG: ENABLING TECHNOLOGIES
Products and processes saving CO₂ emissions during use:
• Aerospace Engine Fuel Efficiency
• Automotive Light-weighting

AMG: MITIGATING TECHNOLOGIES
Products and processes saving raw materials, energy and CO₂ emissions during manufacturing:
• Ferrovanadium Recycling
• Graphite Insulation Materials

<table>
<thead>
<tr>
<th>Business Unit</th>
<th>Net CO₂ Reduction (MT) *</th>
<th>Technology / Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>43.5 million</td>
<td>Thermal Barrier Coatings &amp; Turbocharger Wheel Castings</td>
</tr>
<tr>
<td>Titanium Alloys &amp; Coatings</td>
<td>5.0 million</td>
<td>Titanium Aluminides</td>
</tr>
<tr>
<td>Vanadium</td>
<td>1.2 million</td>
<td>Steel Alloying / Lightweighting</td>
</tr>
<tr>
<td>Graphite</td>
<td>1.0 million</td>
<td>Graphite Insulation</td>
</tr>
</tbody>
</table>

Total net CO₂ reduction (2018): 50.7 million MT

* Net of operating emissions
AMG STRATEGIC DEVELOPMENT TIMELINE

PORTFOLIO CREATION & INTEGRATION
Acquisition of family-run businesses benefiting from CO₂ reduction trends, 100+ years of existence, attractive valuation, high know-how, strong supply chain, and Fortune 100 customers

PRODUCT MIX OPTIMIZATION
Streamlined operations and improved operating performance by eliminating low-margin product lines

FOCUSED ON ORGANIC GROWTH
Properly positioned, financially and operationally, to pursue growth targets across portfolio

COST REDUCTION
Cost-reduction and capex discipline in response to global economic slowdown

TARGETED W/C & DEBT LEVELS
Further reduction in both working capital and net debt, strengthening the balance sheet

SPODUMENE I AND CAMBRIDGE II
Low-cost lithium and vanadium organic growth projects increasing scope and scale

$350M Adj. EBITDA in 5 years
## LOW RISK CAMBRIDGE II PROJECT INCREASES SCOPE AND SCALE

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>THE OPPORTUNITY</strong></td>
<td>• Double AMG’s spent catalyst recycling capacity in order to take advantage of the closure of a competitor and service the North American refining industry</td>
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</tbody>
</table>
| **SUPPLIER RATIONALE** | • Refineries are better off recycling their resid catalysts with AMG than landfilling  
• Zero residual liability associated with recycling (as opposed to landfilling) |
| **TECHNOLOGY** | • Technology risk is minimized, as AMG is replicating existing Cambridge I operations  
• Significant technological barriers to entry |
| **LOCATION** | • Near AMG’s current Cambridge facility – taking advantage of personnel efficiencies such as shared oversight and management / control |
| **CAPITAL COST** | • Total project costs expected to be ~$300 million |
| **PROFITABILITY** | • Spent catalyst processing fees have increased significantly |
| **TRACK RECORD** | • AMG Vanadium installed a new roaster in 2013, increasing capacity by 60%  
• AMG Brazil built and started up Spodumene I |
EXISTING CAMBRIDGE, OHIO RECYCLING FACILITY: OPERATIONAL SINCE 1952
WHAT IS VANADIUM?

**Vanadium Production**
Total 2018 Production = ~89k MT
- Recycling 17%
- Primary Mining 16%
- Iron Ore Co-Product 67%

**Vanadium Consumption**
Total 2018 Consumption = ~97k MT
- Steel 88%
- Energy Storage 3%
- Aerospace Alloys 5%
- Chemicals 4%
- Other 9%

**HOW IS VANADIUM PRODUCED?**
- Vanadium is present in the Earth’s crust and is produced either from processing iron ore or crude oil.
- Vanadium coming from iron ore is either the result of steel co-production, or primary mining.
- Vanadium coming from crude oil is either extracted using catalyst or from processing the residue of burning/gasification of heavy oil for power generation.

**WHAT IS VANADIUM USED FOR?**
- The predominant use of vanadium is as a microalloy for the production of high strength steels (e.g. rebar) and tool steels.
- In the aerospace sector, vanadium ensures low density, high strength and resiliency to high operating temperatures.
- Vanadium redox flow batteries (VRFBs) require liquid vanadium electrolyte to store energy.

**Source:** TTP Squared Inc., AMG analysis
AMG VANADIUM PRODUCTS

- The majority of profitability is associated with Ferrovanadium and Ferronickel-molybdenum
- The sale of Revan™ and LimeAdd™ allow AMG Vanadium to avoid landfilling costs

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<tr>
<th>PRODUCTS</th>
<th>VALUE PROPOSITION</th>
<th>APPLICATIONS</th>
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| Ferovan® (Ferrovanadium)      | • High strength low alloy (HSLA) steel used for construction, shipbuilding, pipeline, bridges, energy, automotive, etc.  
                                 | • Rail steels, tool and die steels  
                                 | • Rebar | | FeNiMoly® (Ferronickel-molybdenum) | Alloy addition for stainless steel and NiMo low-alloy steels | | Revan™ (Calcium Aluminate)    | Slag-conditioner for the steel industry | | LimeAdd™ (Calcium Sulfate)    | Solidification and stabilization of drilling waste | 99% of the hazardous waste that AMG Vanadium receives is converted into salable product
AMG Vanadium processes spent catalyst in a roasting facility in order to remove the sulfur.

- The roasted catalyst is then melted in an electric arc furnace (EAF) where the Ferronickel-molybdenum is extracted.
- The molten material is passed to a second EAF furnace where the ferrovanadium is extracted.
- The Ferrovanadium is sold to domestic steel producers.

AMG Vanadium is the largest processor of spent catalyst in North America.
Because of the income the refineries receive from the sale of finished products, utilizing AMG is the cheapest and most environmentally-sound way to dispose of their hazardous spent catalyst waste.

The tipping fee AMG Vanadium receives makes its operation significantly lower cost than primary mining.

AMG Vanadium and Cambridge II are profitable at all ferrovanadium prices.

AMG Vanadium business model ensures long-term profitability.
# VANADIUM MARKET DYNAMICS – SUPPLY AND DEMAND DRIVERS

<table>
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<tr>
<th>Demand</th>
<th>Supply</th>
</tr>
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<tbody>
<tr>
<td>STEEL</td>
<td>CHINESE REBAR STANDARD</td>
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<tr>
<td>• Steel production accounted for 88% of vanadium consumption in 2017</td>
<td>• The Grade 3 rebar standard in China went into effect in late 2018 and compliance will necessitate the use of an additional 20,000 MT of vanadium in 2021, compared to 2018</td>
</tr>
<tr>
<td>• Use of vanadium in steel continues to rise with market share of high strength steel</td>
<td>• Chinese environmental regulators have refused to issue permits for stone coal operations, eliminating further potential vanadium production of ~3,000 MT</td>
</tr>
<tr>
<td>• Modernization of developing countries will only further increase the demand for high strength steel</td>
<td>• Gulf Chemical, a large spent catalyst processor in North America, declared bankruptcy and shut operations in 2016</td>
</tr>
</tbody>
</table>
Slight under-supply position is forecasted to continue for the next several years, driving down global inventories to near-record lows.

Sources:
- Fe-V price: CRU Ryan’s Notes – average monthly US FeV 80% V Mid
- Inventory: TTP Squared Inc.
Ongoing market deficit expected for the next several years, continuing drawdown in global inventories

Source: TTP Squared