## *Five Waves* Status Report

Introduced in 2002, the *Five Waves* strategy continues to provide the basis for how the company views the overall market development. The production status for each of the *Five Waves,* based on the annualised year-end production rate of 2.6 million Engine Equivalents, and 2018 vehicle sales, is summarised in the following table:

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| Wave 1<br>V-Diesel Passenger Vehicle Engines in Europe | Annualised year-end production: 325,000 Engine Equivalents (16,250 tonnes)<br>Series production for: Audi, Ford, Jaguar, Land Rover, Maserati, Porsche and Volkswagen<br>SinterCast-CGI Components: Cylinder blocks ranging from 2.7 to 4.4 litres<br>Overview: Increased production in 2018, despite overall reduction in diesel penetration |
| Wave 2<br>Commercial Vehicle Engines Worldwide | Annualised year-end production: 1,050,000 Engine Equivalents (52,500 tonnes)<br>Series production for: DAF, Ford-Otosan, Hyundai, Jiangling Motors, MAN, Navistar and Scania<br>SinterCast-CGI Components: Cylinder blocks and cylinder heads ranging from 3.9 to 16.4 litres<br>Overview: 40% increase in 2018 with near-term and long-term global growth opportunities |
| Wave 3<br>In-Line Passenger Vehicle Diesel Engines | Current status: Start of high volume series production for Cummins and Ram in 4Q18<br>SinterCast-CGI Components: Cummins 6.7 litre for Ram Super Duty pick ups<br>Overview: Long-term potential depends on performance demands, downsizing and emissions legislation |
| Wave 4<br>V-Diesel Passenger Vehicle Engines Beyond Europe | Annualised year-end production: 700,000 Engine Equivalents (35,000 tonnes)<br>Series production for: Ford, Kia, Nissan and Ram<br>SinterCast-CGI Components: Cylinder blocks ranging from 2.7 to 6.7 litres<br>Overview: Stable volume in 2018. Continued growth opportunity as North American pick ups provide diesel options |
| Wave 5<br>Passenger Vehicle Petrol Engines Worldwide | Annualised year-end production: 240,000 Engine Equivalents (12,000 tonnes)<br>Series production for: Ford and Lincoln<br>SinterCast-CGI Components: Cylinder blocks ranging from 2.7 to 3.0 litres<br>Overview: Stable production in 2018 with growth potential for additional engines and vehicle applications including hybrids |

## Other Growth Opportunities

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| Automotive - Other than Passenger Vehicle Cylinder Blocks | Annualised year-end production: 110,000 Engine Equivalents (5,500 tonnes)<br>Series production for: Various OEMs and Tier I suppliers including BorgWarner and Honeywell<br>SinterCast-CGI Components: Exhaust manifolds, turbocharger housings and bedplates<br>Overview: 75% growth due to exhaust component ramp-up at customer foundry in China |
| Industrial Power | Annualised year-end production: 140,000 Engine Equivalents (7,000 tonnes)<br>Series Production for: Allen Diesels, Cameron Compression, Caterpillar, Cummins, Deutz, Doosan, Federal Mogul, General Electric, Jenbacher, MAN, MTU and Waukesha<br>SinterCast-CGI components: Agricultural, marine, locomotive, off-road and stationary power applications<br>Overview: 20% growth in 2018 with opportunities for new installations and new CGI programmes. |

Note: All information as of 15 March 2019