



## PROVING IT'S POSSIBLE TO SAVE BOTH MONEY AND THE ENVIRONMENT

In Australia, GE's Evolution Series Locomotive brings advanced locomotive technology to the energy-intensive mining industry.

The Evolution locomotive is the most technologically advanced, diesel-electric, heavy-haul locomotive in the world today. The GEVO 12-cylinder engine produces the same horsepower as its 16-cylinder predecessor and it does so using less fuel and producing fewer emissions than prior models. This new generation of locomotive proves it is possible to reduce locomotive life cycle costs while meeting U.S. EPA Tier 2 emissions requirements.

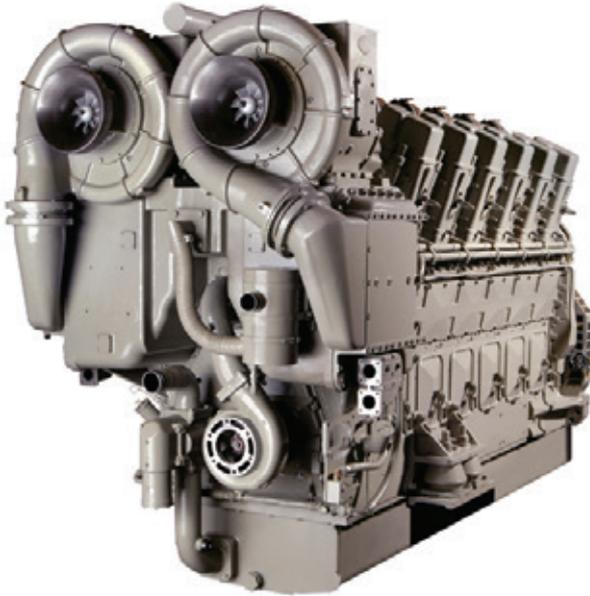
Today, more than 3,700 Evolution Series locomotives are operating in 10 countries.

### FEATURES

- 16-cylinder power with 12-cylinder economy
- Hybrid air-to-air cooling system
- Consolidated control architecture
- High-performance, reliable traction motors
- Superior dynamic braking
- Available with AC or DC traction systems
- Computer-controlled architecture

### BENEFITS & VALUE

- 40% reduction in NOx and PM emissions over predecessor operating at Tier 1
- Engineered to deliver lower life-cycle costs
- 3% savings in fuel cost compared to 16-cylinder engines
- 30% longer engine overhaul interval compared to the 7FDL™ engine
- 184-day running maintenance



**TECHNOLOGY LEADERSHIP OF THE EVOLUTION SERIES**

A closer look at the Evolution Series Locomotive reveals how GE's advanced technology brings savings in fuel and maintenance costs without costing the environment.

Powered by GE's 12-cylinder GEVO diesel engine, the Evolution Series produces the same 4,400 HP as its 16-cylinder predecessor – with less fuel. This 45-degree, 12-cylinder, 4-stroke, turbocharged engine provides efficiency, lower emissions and extended overhaul intervals. The engine also uses enhanced cooling and higher-strength materials that dramatically improve reliability and allow for future increases in efficiency.

The Evolution engine has been awarded UIC certificate E-001/2009-02, which verifies the engine's mechanical quality and compliance with the stringent demands of UIC Stage IIIa emissions standards.

**TURBOCHARGED POWER**

The GEVO-12 engine features a higher efficiency turbocharger and offers improved bearing strength for greater reliability throughout its longer, serviceable life.

**STRONGER CONNECTING RODS**

Beefy GEVO-12 connecting rods have a significantly stiffer bore. Their robust design allows for margin with growth. Two examples of how production model Evolution Series locomotives run well below design operating limits.

**ARTICULATED PISTONS**

An improved articulated piston design allows higher peak firing pressures than conventional solid designs, providing greater reliability.

**AIR-TO-AIR COOLING**

The locomotive incorporates GE's most advanced cooling system in rail transport. In addition to a standard radiator and fan configuration, locomotives powered by the Evolution engine use an advanced air-to-air cooling system for engine combustion air to enhance performance while lowering emissions.

**DYNAMIC BRAKING**

In addition to air brakes, the Evolution Series is equipped with dynamic braking technology that reduces wheel and brake shoe wear by an estimated 20 to 40%, depending on usage. Delivering up to 117,000 lbs. of (AC) braking effort, the locomotive uses proven grids and blowers from GE's AC 4400 and Dash 9 locomotives. The braking grids are also completely isolated for greater reliability and simplified maintenance.

**AC INDIVIDUAL-AXLE TRACTION CONTROL**

Evolution Series Locomotives deliver GE's industry-leading AC individual-axle traction-control technology that enables greater hauling power by significantly reducing slippage on startups, inclines and suboptimal track conditions. This technology ensures optimum performance, less wasted energy and substantially reduces maintenance costs and associated down time during the locomotive's life compared to older DC technology traction systems.

**COMPUTER-CONTROLLED ARCHITECTURE**

The locomotive features sophisticated operator controls that improve diagnostics and simplify operation. The consolidated control architecture of the Evolution Series makes it easier to upgrade software and download data. 'smart' displays eliminate several add-on black boxes in favour of a computer display combination that enhances both reliability and operator ergonomics.



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