



Dual-Fuel™ and Genesis Engine Technology

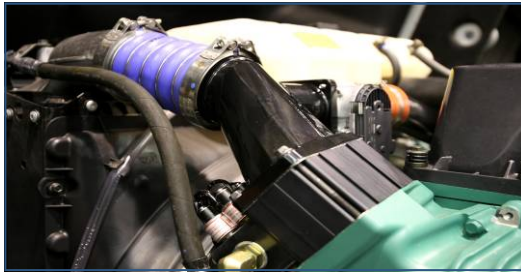


Delivering lower transport costs
& lower greenhouse gas emissions - today

Dual-Fuel™

Since 1995, when Clean Air Power filed its first Dual-Fuel™ patent in the USA, this technology has been commercially applied to over 1,700 vehicles worldwide, on 7 heavy and medium-duty diesel engine platforms from Caterpillar, Mercedes-Benz, Volvo and DAF.

Dual-Fuel™ technology enables a heavy duty diesel engine to operate on a high proportion of natural (or bio) gas. The diesel engine is unchanged and operates according to the Diesel Cycle, using a small “pilot” diesel injection to ignite a controlled mixture of gas and air.



Dual-Fuel™ Technology

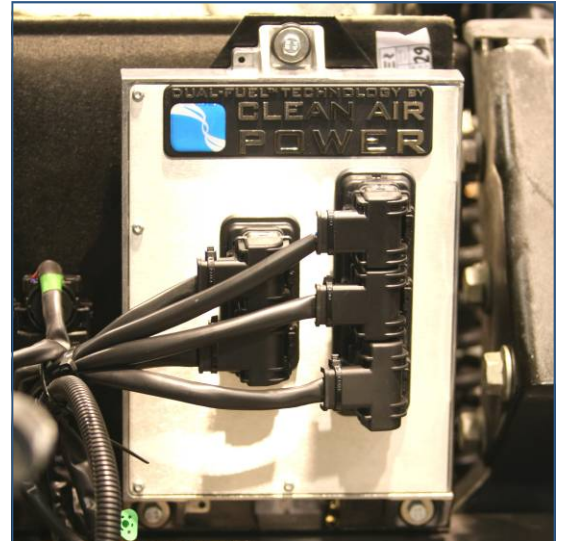
Dual-Fuel™ technology fundamentals can be outlined by the following points:

- A Dual-Fuel™ engine is a diesel engine – no basic change
- Dual-Fuel™ uses a diesel pilot injection to ignite a lean, homogeneous mixture of natural gas and air
- Available for LNG or CNG – simple on-board storage and fuel delivery
- High auto-ignition temperature of methane allows retention of diesel cycle compression-ignition and high compression ratio
- Retains diesel-cycle performance and efficiency, with low emission benefits of lean natural gas combustion with up to 85% gas substitution
- Emits lower regulated & carbon (greenhouse gas) CO₂ emissions than diesel
- Diesel “fall-back” operation is available where required, or desirable

Dual-Fuel™ technology is controlled electronically by Clean Air Power's Hawk™ electronic control unit (ECU) using patented control algorithms and Controller Area Network (CAN) communication with the OEM's engine management system (EMS).

The level of communication with the OEM's EMS defines the two main types of Dual-Fuel™ product:

- **Genesis-EDGE** – Practical retro-fit product which requires no OEM cooperation, delivering robust operation on over 60% gas;
- **Interfaced** – Directly interfaced with OEM EMS software, delivering ultimate performance, emissions and gas substitution. Requires OEM cooperation to allow ECU interface control.



Genesis-EDGE Dual-Fuel™ Technology

Genesis technology enables a rapid start-up of natural gas operation of commercial vehicle fleets.

Genesis is available on Euro 5 Volvo FH/FM13 vehicles, and Euro 3 Mercedes Axor vehicles.

Genesis is an after-market retro-fit product that delivers a robust and pragmatic first step to operate commercial diesels on natural or bio gas.

The Genesis electronic control system communicates with the vehicle control system, giving control of diesel fuelling and retaining all OEM vehicle features such as SCR (AdBlue), cruise control, traction control, electronic gear-shifting, EBS, PTO's and other electronic-controlled vehicle systems.



As Genesis operates on the vehicle's own digital data network, the system delivers the robustness of OEM vehicle systems whilst allowing complex control sophistication to communicate with OEM vehicle systems.

Genesis is currently operating in the UK and is available for operation in Europe and other regions where aftermarket systems are acceptable.



Interfaced Dual-Fuel™ Technology

Interfaced Dual-Fuel™ technology is delivered in partnership with the engine OEM. Here, the Dual-Fuel™ control system is interfaced seamlessly with the OEM's engine controller, giving ultimate control of the engine to the Dual-Fuel™ system. This level of control delivers the highest levels of performance and gas substitution, with the lowest levels of certified emissions.

Today, Clean Air Power offers US EPA 1998-2002 certified Caterpillar engines in Australia and South America with Interfaced Dual-Fuel™.

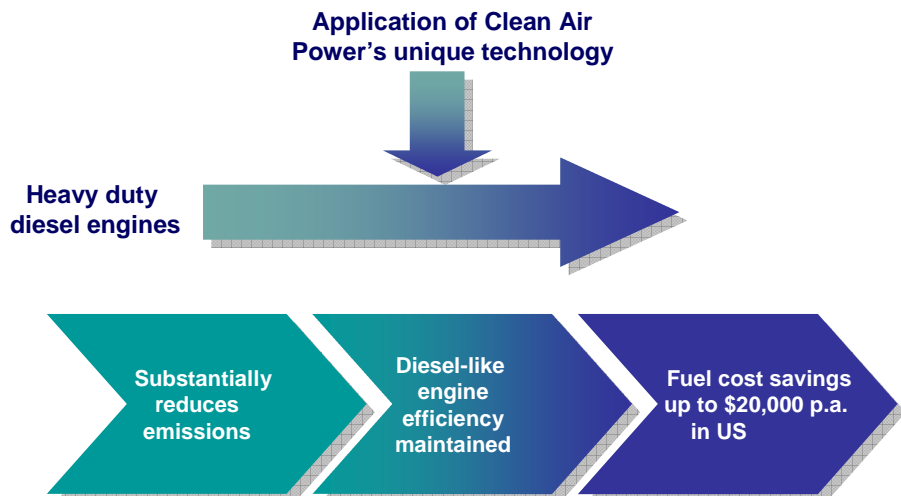
Engine availability includes the C-12 and C-15, with ratings from 400 to 500 horsepower. These engines are available to EPA 2002 Certification.



Recent Developments—Volvo Agreement

Clean Air Power announces that it has entered into a Supply and Development Agreement, initially for five years. The agreement is signed with Volvo Powertrain, a subsidiary of AB Volvo, it follows 3 years of close cooperation on a product development partnership and supersedes the Letter of Intent signed in January 2009

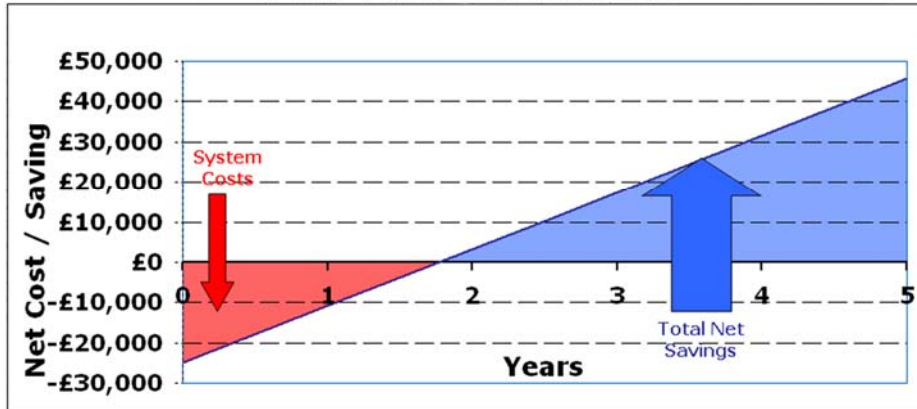
Incorporating Clean Air Power's Dual-Fuel technology into these truck engines will deliver significant greenhouse gas emission reductions and fuel cost savings compared with standard diesel engines. Additionally these Dual-Fuel trucks are expected to be around 30% more energy efficient than equivalent spark ignited natural gas engines. [Read more ...](#)



Dual-Fuel™ Financials

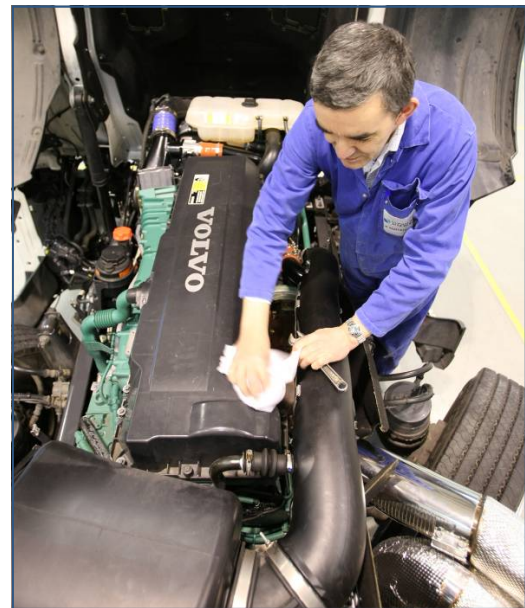
- 18 – 24 months payback in many markets
- Dual-Fuel™ technology **substitutes up to 75% of the diesel fuel with cleaner-burning natural gas**, whilst maintaining the benefits of the **lowest cost, highest efficiency platform** in the world

Dual-Fuel™ Economics



Assumptions:

- 100,000 miles per annum
- 8.5 mpg
- 0.07p per kilo gas cost
- 0.94p per litre diesel cost (Pounds Sterling)



Dual-Fuel™ Gains

- Substantially reduces emissions
- Diesel Fall-back
- Drivability is similar to diesel
- Diesel efficiency
- Extended engine life
- Less fuel storage required than dedicated
- Enhanced resale value





CLEAN AIR POWER



**Clean Air Power :: delivering lower transport costs
& lower greenhouse gas emissions - today**

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