COMMERCIAL VEHICLES & INDUSTRIAL ENGINES
The foundation of commercial prosperity and economic development includes the availability of a variety of flexible and efficient vehicles for transportation of both people as well as goods. Since the early 1930’s, the diesel engine has represented the preferred option for commercial truck propulsion and non-road utility vehicles. This dominance is based on a robust layout and superior economic performance.

Future concepts for commercial vehicles and industrial engines demand contradicting goals for development. Along with minimized fuel consumption, long term reliability and excellent driveability paired with high comfort standards have to be met at competitive costs. In addition, increasingly stringent emission legislation that varies world-wide leads to a broad range of aftertreatment system specification and an increase in system complexity.

Consequently, a major challenge is to reduce the number of variants by using the potential for synergy between on-road and non-road vehicle applications. Reaching the lowest possible emission standards can only be achieved through robust engine design layouts and proper selection of exhaust aftertreatment configuration at the earliest concept phase.

FEV, with its global presence and awareness for individual market demands, provides first class expertise in both commercial vehicle and industrial engine development from the initial design and CAE, through vehicle integration and calibration. FEV’s interdisciplinary engineering services also cover functional and durability testing, pilot engine builds and the continuation of supervision for production vehicles which includes fleet testing.
Motivated by both environmental and human health concerns, government enforced emission standards are resulting in a continuous effort to improve both global and local air quality. Significant technical efforts have been made to match the more stringent emission standards while maintaining favorable fuel consumption. Under early emission legislation, the initial steps to reduce emissions were realized through engine internal measures, such as with four-valve technology, turbocharging and intercooling, increased injection pressure and adapted bowl geometry, tailored charge motion and a precise, electronically controlled, EGR system.

Current exhaust emission standards under the European Union and the US EPA already pose significant challenges for powertrain developers; however, upcoming emission standards, with further reduction in tailpipe emission levels, will increase the efficiency requirement and thus the burden on exhaust aftertreatment. Modern aftertreatment systems must incorporate closed loop controls and detailed diagnostics to maintain high levels of emission control over the lifetime of the vehicle.

The introduction of efficient emission control systems describes a new chapter in the evolution of heavy-duty diesel engines. In addition to the demand for achieving the highest possible efficiency, the durability and reliability of the typical heavy-duty diesel engine must be maintained despite the addition of advanced exhaust aftertreatment technology.
Technical attributes such as performance, fuel consumption, emissions, reliability and costs are the most important factors for developing a competitive combustion engine. FEV has conducted numerous projects focused on evaluating production engines for the potential to reduce manufacturing costs.

FEV conducts these cost reduction projects with a team of experienced designers and specialists in the areas of production planning and cost analysis.

Concept Design & Cost Engineering

Typical activities in a cost reduction study include:
- Investigating ideas and measures to decrease manufacturing costs
- Quantifying the cost reduction potential
- Evaluating the related efforts for realizing the measures
- Estimating possible effects of the cost reduction measures on function and technical attributes of the engine
- Evaluating a given design against benchmark designs
Mechanical Development
- a Vital Ingredient for the Creation of a Successful Powertrain

CONCEPT
- Layout
- Detail Design

Prototyping
- Bench Testing
- Vehicle Testing
- SOP

Benchmarking
- CAE Refinement Level

Troubleshooting
- Testing

Virtual Development
- FEV Data Base
- Component Testing

Physical Development
- Troubleshooting
- Component Rating
Hardware-in-the-loop simulators enable the development teams to test new functionalities, I/Os, BUS-communication between different controllers and the diagnostics of controllers in a modular and reproducible environment, independent from the availability of engines or vehicles.
FEV continues to conduct full vehicle NVH development for many programs. Such programs typically are carried out in close cooperation between OEM specialists, suppliers and FEV. FEV’s project managers coordinate activities between the different working groups, ensuring a streamlined development process.

The cooperation between OEM, FEV and suppliers includes items such as:

- System and components level target setting
- Experimental and analytical component refinement
- NVH development for the OEM using OEM-specific processes and strategies
- Full-responsibility for NVH integration
- NVH robustness for production

Truck development is mainly driven by costs, fuel consumption, emissions and reliability. In addition to legislative needs for exterior noise, interior NVH/comfort is gaining importance. To achieve an overall well balanced NVH behavior, the entire vehicle has to be taken into account. It is very important to optimize all relevant NVH systems/components, such as:

- Powertrain and driveline
- Intake and exhaust system
- Chassis and mounts
- Cabin including the noise insulation

FEV’s key strengths for the optimizations are:

- Long term experience with on and off-road vehicles
- Proven CAE tools and methods
- Highly-efficient testing tools and methods

FEV’s systematic approach allows for efficient NVH development.
FEV HD Single Cylinder – Technical Data

- Bore: 95 – 150 mm
- Stroke: 110 – 170 mm
- Rated Speed: Max. 3500 rpm
- Peak Pressure: Up to 300 bar
- Crankcase: Machined steel
- Cylinder head: Production part or customized
- Valvetrain: OHV, SOHC, DOHC, alternative systems
- Crankshaft: Machined steel / 4 main bearings
- Starter: Electric starter motor on engine
- Lubrication: Test cell oil conditioning system
- Cooling: Test cell coolant conditioning system

Test Facilities

- > 100 Engine Test Benches
  (20 Heavy-Duty Capable)
  - 8 Transient test benches
  - 5 Anechoic test benches
  - 8 Motoring test rigs
  - 3 Catalyst aging test benches

- Vehicle Test Center
  - 2 Emission chassis dynamometers
  - Anechoic chassis dynamometer
  - Test track
  - Vehicle workshop
  - Climate chambers (-30 to +40 °C)

- Laboratories
  - Flow lab
  - Injection lab
  - Vibrations lab
  - Audio lab
  - Chemical lab
  - Electromechanical lab

- ucc2114E
  - Height simulation test bench
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