

CASE STUDY

152

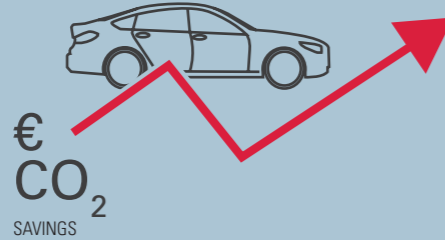
TECHNOLOGIES
CONSIDERED

10

OEM
MODELLED

4

POWERTRAIN
CONCEPTS
ANALYZED



SITUATION AND OBJECTIVE

A European automobile manufacturer intends to setup a new gasoline powertrain concept targeting requirements for 2025. The engine variants will be sold in all major markets i.e. China, US, EU and Japan.

- Which technology package should be applied for the individual markets and vehicle segments in order to achieve the CO₂ targets by a modular approach with lowest costs?
- Which level of hybridization depending on vehicle segment is necessary?
- Which fuel efficiency improvements are necessary for the specific powertrain considering its impact to auto manufacturer's fleet emission?

FEV APPROACH

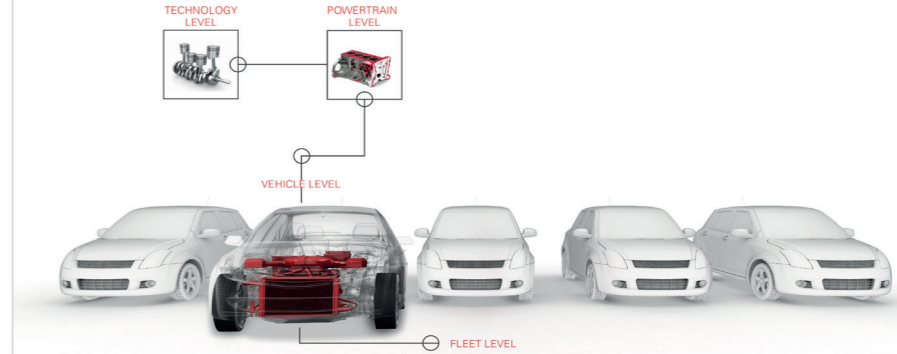
- Analyze the market and competitor strategies for the considered powertrain segment
- Definition of state-of-the-art technologies
- Apply the FEV Technology Roadmapping Process to identify technologies for the timeframe 2025 and beyond
- Apply FEV Morphological Technology Box
- Develop competing powertrain technology scenarios
- Assess these scenarios with regards to CO₂ emission and costs
- Analyze impact on CO₂ fleet emission using the FEV CO₂ Fleet Model

CONTACT

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POWERTRAIN STRATEGIES FOR CO₂ EMISSION REDUCTION



Comprehensive toolkit to meet future requirements

www.fev-consulting.com

ABOUT FEV CONSULTING

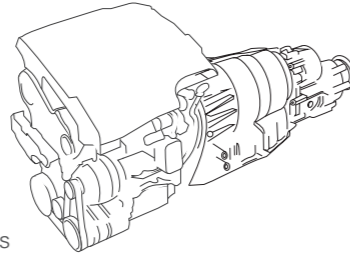
FEV Consulting combines top management consulting expertise with the technical capabilities and know-how of the FEV Group. Our deep industry knowledge enables us to create pragmatic solutions to some of the most pressing and complex issues facing today's enterprises.

Our team consists of experienced strategy consultants with deep industry knowledge and the backing of FEV's extensive technical expertise to provide solutions that are both practical and sustainable.

POWERTRAIN STRATEGIES FOR CO₂ EMISSION REDUCTION

The car manufacturers face more stringent CO₂ emission targets. Requirements set by the legal bodies are continuously tightened and in particular challenging for the timeframe 2025 and beyond. At the same time carmakers need to find technical approaches which are cost efficient without compromising customer's expectations. To overcome this trade-off, it is useful to identify promising concepts and analyze their sensitivity with regards to changing boundary conditions; typically, more than one optimum solution exists.

FEV Consulting has developed a structured and comprehensive toolkit to analyze competing technology strategies in terms of CO₂ saving potential and cost effects. Our approach results in robust powertrain and electrification strategies considering individual and regional circumstances. By modelling the carmakers specific vehicle fleet CO₂ emissions we are able to identify targets for vehicle segments and powertrain types. Resulting technology packages reflect the expected set up on an even higher level of detail.



» BENEFITS FOR YOUR BUSINESS

- Objective analysis of competing powertrain concepts
- Powertrain concept impact on vehicle fleet CO₂ emission
- Analysis of carmaker specific CO₂ emission reduction strategies
- Identify most efficient pathways

Fuel Injection System
 Rightsizing Exhaust Aftertreatment System
 Friction Reduction Measures **Hybrid Powertrain Topology**
Variable Compression Ratio Boosting Concept Cylinder Deactivation
Thermomanagement Variable Valve Lift
 Variable Valve Timing **Cooled Exhaust Gas Recirculation**
Dual Clutch Transmission **Combustion System Design**
 Model-Based Control Strategies

Powertrain Technology Strategy - Finding the Optimum Solution

The powertrain is characterized by the attributes of its main components, the internal combustion engine (ICE) and gear box. Considering hybridization concepts, this scope is extended by the powertrain topology and additional electric components. The powertrain efficiency has the main impact on CO₂ emissions along with the driver behavior and vehicle measures. This variety indicates the existence of multiple paths for complying with the tightened CO₂ emission targets. Identifying the most advantageous path depends highly on the carmakers for existing technology portfolio and competencies.

FEV Consulting has developed a structured and comprehensive method for benchmarking

competing technology strategies in regards to CO₂ saving potential and cost effects. An integral approach is applied for evaluating technologies for ICE, gear box and vehicle. Therefore, expert knowledge is leveraged in an automated and intuitive procedure. New technologies are implemented and evaluated on a continuous basis. Results support the identification of most beneficial carmaker-specific technology configuration. In addition, method allows to analyze and compare technology trends and seeks answers to challenging questions. For example, is downsizing the right approach if the EU implements the WLTP as standard drive cycle replacing the NEDC?

POWERTRAIN STRATEGIES FOR CO₂ EMISSION REDUCTION

Comprehensive toolkit to meet future requirements

CO₂ Emission Fleet Strategy - Understanding the Industry Dynamics

In all major automotive markets (China, EU and US) carmakers face significantly reduced fuel economy (CAFE) respectively CO₂ emission standards, which have to be fulfilled in order to avoid penalties. Each car maker's strategy on how to achieve the future targets will strongly vary due to their specific vehicle portfolios and technology strengths.

With this background FEV Consulting has developed a comprehensive method to estimate and model carmakers specific future strategies to achieve their individual targets until 2025. For each carmaker the individual vehicle segment portfolio as well as the most important powertrain types representing fuel type,

level of hybridization and pure electric vehicles shares are considered.

Based on the latest registration data the future vehicle segment portfolio and powertrain type distribution is forecasted for each carmaker. Specific for each segment improvements in efficiency are applied for the powertrain types including the transmission. Also improvements gained by vehicle measures are considered. The results regarding target achievement take all regional specific legislation procedures, e.g. for counting super credits or eco innovations into account. Finally, various scenarios can be simulated thus the strategy analysis identifies how efficiency technologies can be leveraged best.

