

Reduced Fuel Consumption and Emissions due to Better Integration of Engine and Transmission

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American Gear Manufacturers Association



TECHNICAL PAPER



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ABSTRACT:

The need to reduce fuel consumption and emissions from combustion demands better integration of engine and transmission. Gears with wider ratio range have three advantages:

1. A large overdrive ratio range can reduce engine speed. The speed limit in nearly every country makes this kind of operation of great importance, since mid-size and big-size cars need low engine speed but high torque to deliver the required power. This improves thermal efficiency of diesel and gasoline engines.
2. The enlargement of the value of first gear improves acceleration without enlarging the engine, or makes a smaller engine possible if increased acceleration is not important. In either case it is necessary that the gear box efficiency be good over the entire range of ratios.
3. The wide ratio range gear box is optimal for a new hybrid driveline for passenger cars. This driveline consists of a small electric engine, a normal combustion engine and the wide ratio range gearbox. City driving, where lower power is sufficient, can use the electric engine because the gearbox will provide adequate torque at the wheels. For acceleration and driving on the road, the normal combustion engine will be activated.

With the proposed driveline, operation with partial load and poor thermal efficiency can be avoided.

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INTRODUCTION

The increase of the global CO_2 - emission and the feared influence on the climate such as the higher CO_2 - concentration induced green-house-effect in the atmosphere, gives the discussion of saving energy a new dimension. During the 70's energy reduction, especially in individual traffic, had the target of improving the private economics. The objective is now a more political economic target. Fig. 1 shows the big difference between forecast and recommendation for CO_2 - emissions in the next 30 years.

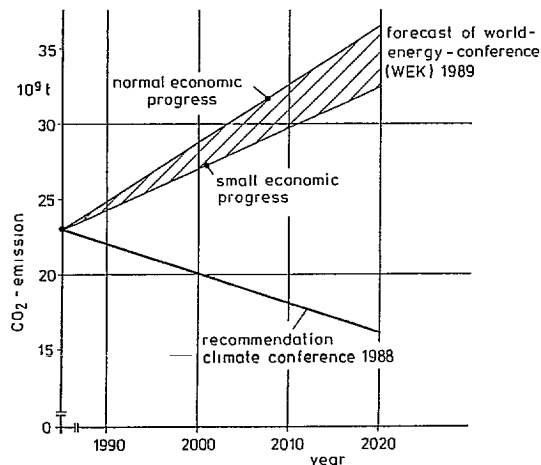


Fig. 1: CO_2 - Emission World Wide
(Global Energy Perspectives, WEK Montreal)

Many scientists predict dramatic effects on the world climate. In reality, humanity has only one option over the next 30 years. This is to reduce energy consumption. To demonstrate that it is our task to start reduction, we should remind ourselves of the fact that in the more industrialized countries, like the U.S., Western Europe and Japan, energy consumption per man is 50 times higher than in other countries.

With such circumstances, the task of reducing fuel consumption in cars will become the central target of future car development. The potential for reduction due to better drivelines will be shown in this paper. A big reduction in fuel consumption is possible if you view the whole system, which consists of internal combustion engine and transmission. The increase of the separate efficiencies of engine and transmission are very small. However, if you make an evaluation of the system, a marked contribution could be made. System-Engineering for automobile drivelines would certainly contribute to the reduction of energy-consumption. System engineering for drivelines can be divided in two parts:

- a. Wide ratio overdrive gear to reduce engine speed and increase torque of the internal combustion engine

and

- b. lower 1st gear of the transmission to increase wheel torque with less engine torque.