Felipe Toro[1], Sulabh Jain[1, 2] Dr. Felix Reitze[1], Daniel Rosende[1], *other authors will be included*

ANALYSIS OF THE TECHNOLOGICAL INNOVATION POTENTIALS IN ALTERNATIVE AUTOMOTIVE SYSTEMS AND THEIR EFFECT ON TECHNOLOGY LEARNING TRENDS

[1] IREES GmbH , Karlsruhe-Germany, +49-721-915263621, f.toro@irees.de
[2] TU Bergakademie Freiberg, Freiberg-Germany, +49-721-915263631, s.jain@irees.de

OVERVIEW:

In the framework of the ALTERMOTIVE Project contracted under the Intelligent Energy Europe Program of the EU Commission, least cost policies strategies will be derived in order to achieve a significant market share increase in innovative Alternative Fuels (AFs) and the corresponding more efficient alternative automotive technologies (AAMT) that contributes to a more sustainable individual transport system up to 2020.
Within the ongoing work of the project, selected AFs (e.g. 1st and 2nd generation biofuels, hydrogen and electricity) and their corresponding AAMT technologies such as flex-fuel vehicles, hybrids and fuel cells are identified and analyzed. The pre-selection of the various AFs and AAMTs routes is based on the analysis and results of their energetic, ecological and economic Well to tank (WTT) and Tank to wheel (TTW) assessments. Within the work package, State of the Art of selected AFs and AAMts has been done with analyzing the possibilities for their further technical improvements and innovation on WTW basis. The final outcome of this analysis is going to be an important contribution for designing the action plans and deriving least cost strategies and policy recommendations by the EU.

METHODS:

The methods implemented in this analysis correspond to a detailed literature review of the most important studies with respect to the Well–to-tank (WTT) and tank-to-wheel (TTW) analysis covering energy balances, GHG emissions and economics along the whole production chain at European level.
The literature review is extended further to analyze the existing and emerging alternative automotive technologies across the world. The potentials for technical improvements and innovation are assessed mainly by literature review along with some interviews conducted with experts in order to identify possible technologies that are currently being researched and appear promising in the future. This intensive literature study was done to explore various modifications in powertrain technologies and their potentials to improve efficiency. A wide range of energy efficiency measures are applied in various existing cars and are under development in several upcoming cars. These modifications in internal combustion engines, transmissions, and vehicle development (for example reducing vehicle weight and size) are assessed with their probability to improve vehicle performance and efficiency.

RESULTS:

Growing concerns of global warming, rapidly increasing oil prices and looming botheration for energy security have initiated various actions globally aimed at mitigation of the problems and meeting a sustainable future. The automotive internal combustion engine of passenger cars is one of the biggest sources of GHG production globally and the demand for passenger cars will keep on increasing in future. Under such circumstances alternative automobile technologies or alternative propulsion systems (AAMTs) can play vital role in future fleet improvements. Hence modifications in multiple powertrain technologies of future cars hold an important key to decrease emissions and increase fuel efficiency. This paper compiles a set

of such ICE modification and efficiency improvement technologies analyzed through different literatures. Results compiled through the study show that with the continuing trend of technological modifications, significant increase in performance and lower vehicle fuel consumption can be achieved.

Table 1. Technical improvement potentials and expected efficiency increase

Technology	Explanation	Efficiency Increase
Variable Valve Timing & Lift	Improves efficiency by optimizing the flow of fuel & air	1-9 %
Cylinder Deactivation	Saves fuel by deactivating cylinders when not in use	7-7.5 %
Turbo & Superchargers	Increase power, by downsizing of engines	2-7.5 %
Integrated Starter / Generator (ISG) Systems	turn off when the vehicle stops and restart when accelerator is pressed	0.5-8 %
Direct Fuel Injection	Fuel is injected directly into the cylinder	3-15 %
Continuously Variable Transmissions (CVTs)	Multiple numbers of "gears", provide seamless acceleration and improved fuel economy	3-8 %
Automated Manual Transmission (AMT)	Combines features of manual and automatic transmissions	7-9 %

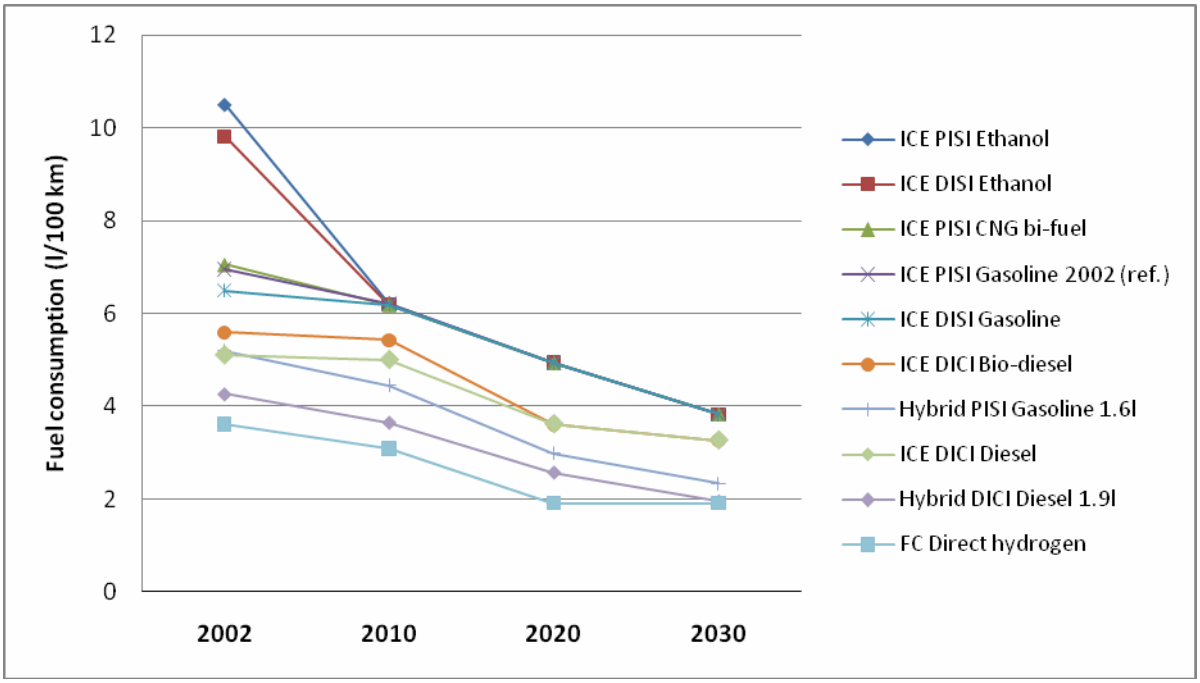

Fig. 1. Fuel consumption improvements until 2030 followed by technological learning

CONCLUSION:

Increasing energy efficiency can be achieved by improving the design and technology used in new vehicles, but vehicle technology is only one component of fleet fuel economy. Measures or policies that create strong incentives for customers to take energy efficiency into consideration when buying and operating their vehicles will be crucial for success. The technological learning based on its diffusion rate will help not only to reduce the high cost of productions of specific technologies, but also offer possible solutions for emission reduction and increasing vehicle fleet efficiency.