GFEI
GLOBAL FUEL ECONOMY INITIATIVE

GFEI In-Use Fuel Economy Seminar Summary and Conclusions

The GFEI launched its 'London Seminar Series' on July 16, 2014, with a high level gathering of fuel economy experts from research organizations, NGOs, industry and government. The one-day seminar covered recent research on the gap between tested and "in-use" fuel economy, implications of this gap, and steps that could be taken to address it. The discussion was particularly focused on the European Union situation, its test procedures and future plans, although the discussion was also broadened out to cover other vehicle markets and testing systems.

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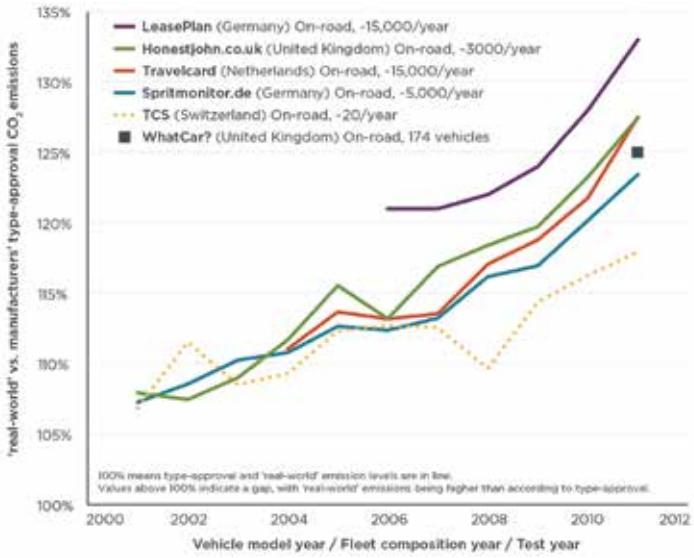
Gap between 'real-world' and type-approval emissions is continuously increasing



The Growing Gap

The discussion began by considering why there are differences between how cars perform in test conditions - using drive cycles that are developed to simulate real-world conditions - and how they actually perform when on the road, as measured by the difference in fuel consumption per kilometres?'. This 'gap' is generally considered to be around 10% historically.

However the evidence presented at the seminar indicates that the gap is growing, and in recent years growing at an alarming rate. ICCT showed results from its 2013 meta-study , including data from various EU datasets (see Figure 1 below) that reports in-use fuel economy in the EU over time, indicating that it has risen from about 8% above the tested values to about 23% in just 10 years. According to ICCT, more recent data suggests that the gap could now be over 30%.

Further, the rate of change in these values is increasing, with rapid increases over the past 5 years in most studies. A similar increase has been found in both the EU and US markets. Finally, it appears that new technologies such as hybrids and electric vehicles have a higher gap than more conventional powertrain technologies.

What is causing this growing gap?

What causes this gap and why is it growing? The discussion brought out several aspects. The principal reasons relate to differences in real-world driving conditions compared to tested conditions such as the number and extent of rapid accelerations, and whether the air conditioning system is being used (it is turned off during testing). Also important, at least in the EU, is the system of allowing manufacturers to provide the specific vehicle to be tested, which can then be designed and calibrated to be a "golden vehicle" for the test, not representative of the vehicle model family that the test is meant to measure. In the discussions, this latter issue was thought to be of increasing importance in accounting for the growing gap, along with higher shares of new technologies that do better on the test than in real-world conditions.

- The participants agreed that this growing gap represents a serious problem for several reasons. Consumers are not getting the fuel economy indicated on fuel economy labels when they buy vehicles – or claimed by manufacturers who use the official data in their marketing.
- A growing gap also suggests that the improvements in tested new car fuel economy associated with a tightening of standards may not be translated into much (or any) improvement in average in-use fuel economy.
- The much heralded progress in the tightening of standards and the success of manufacturers in meeting these standards may therefore be quite disconnected from what is occurring in the real world.

What can be done about this growing gap?

Much of the discussion at the seminar focused on the question of how to address the growing gap. This mainly involves developing better test procedures or checks on existing ones to better account for real, in-use fuel consumption rates and thus reduce this gap.

There are a number of different ways that fuel economy can be tested, for example:

1. in a laboratory on a chassis dynamometer;
2. on test tracks or actual road conditions using data-loggers to record information from the vehicle's on-board diagnostic (OBD) system,
3. using portable emissions monitoring systems ("PEMS"), typically with tailpipe sensors to record CO2 emissions that directly correlate with fuel use, or
4. having drivers keep logs of fuel purchases and linking these to odometer readings to estimate fuel use per unit travel. Some websites allow self-reporting of such exercises, and some now have tens of thousands of reports from drivers.

The first of these is the basis for all fuel economy regulatory systems in the world today; the latter three, though not perfect, all provide the possibility for more accurate "real-world" data on fuel consumption. However, in all three cases there is a serious issue of statistical "representativeness" and "repeatability". The tradeoff between these became an important topic at the meeting. A principal reason that governments use chassis dyno testing in a laboratory is repeatability; if the test is run repeated times, the results tend to be very similar. In-use testing, especially with different drivers, can yield results within a +/- 30% or greater range (as does the self-reported fuel economy for identical vehicles in self-reporting databases).

Using alternative testing systems to improve data

Several presentations at the seminar described projects using one or more of these alternative methods to test fuel economy (either OBD data logging, PEMS data logging, or self-reporting). These all offered the potential for greater insights into in-use fuel economy and the gap with laboratory tests. These could also be helpful to measure the impacts of technologies not measured in test procedures ("off-cycle"). But most are likely to involve fairly small samples, mainly due to the fairly high cost of sampling either with OBD or PEMS approaches (although it was noted that these costs can be far lower than the per-vehicle cost of laboratory testing, taking into account laboratory capital and operating costs).

Optimally, these types of in-use tests will provide not only an average fuel economy estimate across the sample of vehicles, but detailed information on how fuel economy varies by vehicle market class, fuel type (diesel/gasoline), technology type (such as manual v. automatic transmission, idle-off systems, hybrids, etc.), driving conditions, terrain, and weather conditions. With a large enough sample, an entire driving test cycle can be constructed that would capture the entire range of driving in a city or country and provide information on how individual technologies perform in a wide range of conditions and across a wide range of drivers.

However, to generate fairly robust estimates of fuel economy that also provide such information, at least several hundred, and preferably several thousand vehicles are needed, in order to have sufficiently large subsamples to capture less common vehicle types and technologies. Sampling would take place preferably over the course of a year to capture seasonal variations. Such studies can easily cost several hundred thousand dollars to undertake, including all testing and data analysis phases. This would especially be the case in studies meant to provide data robust enough to actually help set policy; for purposes of checking the accuracy of lab tests the sample sizes and costs could be smaller.

Conclusions

The discussants agreed that the current situation with laboratory testing of vehicles is unsustainable, with errors and biases in test results apparently increasing at an alarming rate. New approaches are needed. In the near term, the EU is on a course to adopt a new test procedure, the "World Light-duty Test Procedure", being developed by the UNECE. This new test procedure is intended to provide a closer approximation to real-world driving conditions and a better representation of the effects of certain technologies. However it was shown that the WLTP is unlikely to significantly improve the current gap, partly because it does not change some important aspects of how tests are conducted, e.g. the "golden vehicle" problem. However, since this is the primary focus of the EU over the next 5-7 years, it is not clear that other needed changes will occur in the near term.

Looking Forward, Next Steps

There was considerable discussion regarding how to integrate a role for in-use vehicle testing in such an environment. One proposal was to create an independent green vehicle rating system based on a separate test procedure that attempts to further reduce bias, possibly with assistance from sample

data on in-use vehicle performance. There is a "Global NCAP" system for rating car crash-worthiness and safety; a similar system could be developed for fuel economy, and GFEI partners working on this.

However, getting to such a system, and having this system be recognized and impactful around the world would be quite challenging and take considerable resources. Developing relatively low-cost in-use testing systems particularly for developing world applications would also be very useful. This is challenging given the need for robust, repeatable measurement systems, while maintaining manageable sample sizes and modest costs per vehicle. New pilot efforts of this type would be welcome.

What is the GFEI?

The Global Fuel Economy Initiative (GFEI) is a partnership of the International Energy Agency (IEA), United Nations Environment Programme (UNEP), International Transport Forum (ITF), International Council for Clean Transportation (ICCT), ITS Davis (Institute for Transportation Studies at UC), and the FIA Foundation, which works to secure real improvements in fuel economy, and the maximum deployment of existing fuel economy technologies in vehicles across the world.

The Initiative promotes these objectives through in-country policy support, analysis and advocacy.

The GFEI works with many countries to support their fuel economy policy development process. Central to this is the GFEI's Cleaner, More Efficient Vehicles Toolkit, which provides information and real-world examples of technology and policies used around the globe to improve auto fuel economy. It is aimed at policy makers seeking to understand and design effective policies to improve energy efficiency and lower greenhouse gas emissions in their countries. This innovative Tool is available online from **www.unep.org/transport/gfei/autotool**.

One of the GFEI's key roles is to improve understanding of global fuel economy trends. For example the Initiative has sponsored the first ever global study of duty vehicle characteristics, including fuel economy, covering close to 90% of global car sales in 22 major markets and the EU. The Initiative also works hard to raise awareness of the issue of fuel economy globally.

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