Testing the fuel economy gains with Eco-cars

Eco-cars enhances the fuel to have a more efficient combustion in the engine, and thus lowering the consumption. To be able to see measurable gains it is important to follow certain test procedures.

When measuring a vehicles fuel economy, many of us simply rely on the published data provided by the vehicle manufacturer. However this is not an accurate measure for most vehicles due to the many factors that affects the fuel consumption.

Another common way to determine the fuel consumption is by topping up the fuel tank, and drive until the tank is nearly empty, refilling the tank, and finally calculate the fuel-consumption average. This can also vary especially if the drive routes are different between the tests.

Nowadays also many vehicles are equipped with computerized trip meters that also display fuel-economy figures with varying accuracy.

There are several factors causing the fuel consumption to vary and fuel-economy testing will never produce the exact same result twice in a row. Differences in traffic volume on different days, different weather conditions (and even in the same weather on the same day but at different hours), make such tests unverifiable and unrepeatable.

The idea with this document is to support the way the tests are performed, how the statistics should be recorded and minimize having external factors affecting the fuel economy tests.

External factors affecting the fuel consumption

Driving patterns:

- ***Driving techniques***
  For example a driving style with more hard accelerations, unnecessary stops, and inefficient gear selections will increase the fuel consumption.
  Moreover road and traffic situations will of course also affect the consumption.

- *Nr of Starts and Stops, incl. Cold starts*

➔ **RECOMMENDATIONS:** ***USE THE SAME DRIVER AND THE SAME ROUTE WHERE POSSIBLE. USE THE CRUISE CONTROL WHERE AVAILABLE TO KEEP EVEN SPEEDS.***

Weather Conditions:

- ***Wind speed and direction***
  The wind speed/direction, in addition having large cargo creating more wind resistance, affects the fuel consumption considerably.
- ***Soil Humidity***
- ***Temperature***

➔ **RECOMMENDATIONS:** ***PERFORM THE TEST DURING THE SAME WEEK AND WEATHER CONDITIONS, IF POSSIBLE.***

Vehicle related:

- ***Setting of Engine***
- ***Fuel Used***
- ***Cargo weight/Load***
- ***Tire pressure***

➔ **RECOMMENDATIONS:*****COMPARE ALWAYS THE FUEL CONSUMPTIONS OF THE SAME VEHICLE AND CONDITIONS BEFORE/AFTER FITTING THE ECO-CARS. SAME QUALITY OF FUEL NEEDS TO BE USED, PREFERABLY FROM THE SAME FUEL PUMP. TRY ALSO TO COMPARE THE CONSUMPTION WHEN SIMILAR CARGO WEIGHT LOADED ON THE VEHICLE.***

Test execution

There are some aspects that should be taking into consideration before starting test for fuel consumption. Otherwise you run the risk of getting useless test results, mainly due to the lack of objective historical data. Main aspects are listed below.

Achieve appropriate historical/before fuel consumption data:

To compare the end results you need to have proper objective data of the current fuel consumption before the Eco-cars is fitted, to compare to and avoid jeopardizing the tests.

a) Record the historical data using the attached consumption table provided during minimum 2 weeks. The table not only gathers information on the distances and consumption, but also other factors and behaviors.
   Example: If the variations in the consumption are high, which usually happens with city busses , it can lead to confusing and improbable positive or even negative gains.
   If you for example observe 15% variations during the pre-test period it will not be possible to see a saving of 5%. And vice versa you might even see a 20% gain in a day.
   If the above occurs a more controlled test is then needed.

Handle factors affecting the consumption during the tests:

Record the factors that can affect the fuel consumption during the tests.
For example note things down like: Are you using different driver? What was the weather? How heavy was the cargo or the nr of passengers? Etc…

a) Create the list of factors as you understand it.
b) Agree with your Eco-carss representative on the best way to handle those factors in the test to make it more objective.

Create trip based statistics for comparison:

A trip is defined by a trajectory with a Start and Stop.
This requires to use the method B in the next chapter.

a) How many kilometers did I drive per trip, with a full tank before and after Eco-carss?
   i. Same or similar conditions?
   ii. How could variations affect the results?
b) In the same trip with the same conditions how many liters did I use?
   i. Same or similar conditions?
   ii. How could variations affect the results?

Using optional technical tools for more accurate comparison:

Do you have any technical device or solution that could help you to gather data from a GPS and/or Can-Bus? If not ask your Eco-carss representative if you could rent one for the tests. Many of the truck manufacturers might already have installed such solutions in the vehicle with reporting capabilities. It is recommended to use these reports for comparison.

In conclusion it is important to compare the right things in the same way before and after the installation of Eco-carss, make sure you know the consumption behavior, record a list of factors and agree in the way those should be handled and at last think of using technology aid when conducting the tests.

Test Methods

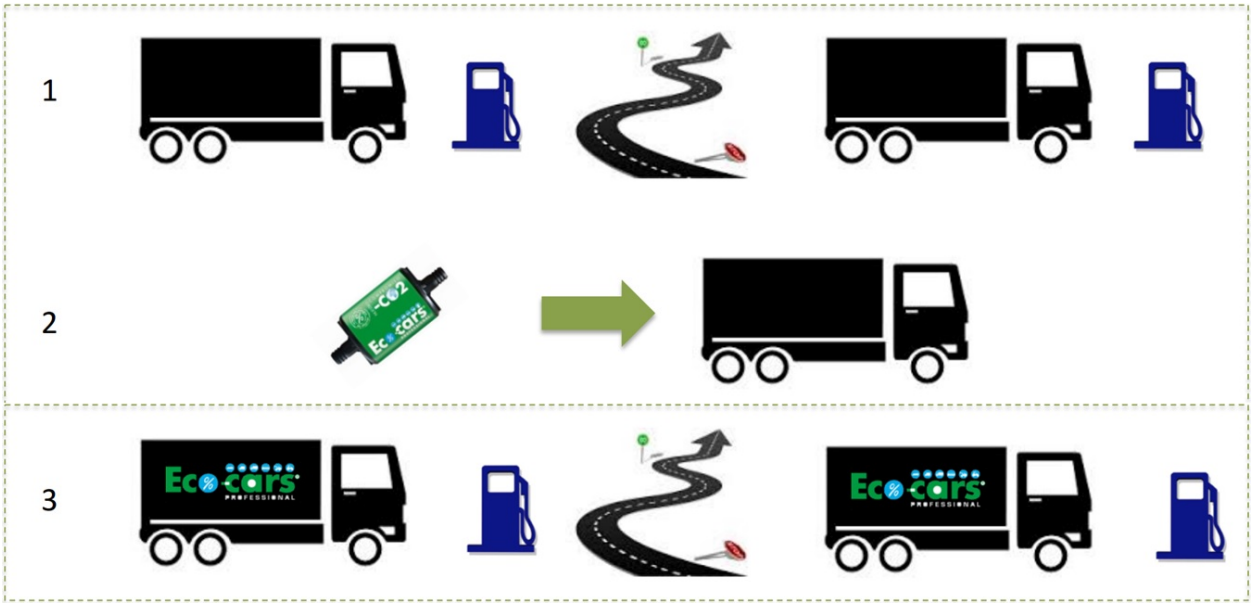
A. Topping up the fuel tank method and a predefined route

1. **Calculate the fuel consumption BEFORE installing Eco-cars:**
   a) Start by topping up the fuel tank.
   b) Drive a distance of minimum 100 km or more.
   c) Refill the entire fuel tank again. Use the same type of fuel/diesel and if possible from the same fuel pump. Calculate the average fuel consumption with the nr of liters and travelled distance in km.

2. **Install the Eco-cars device:**

3. **Calculate the fuel consumption AFTER installing Eco-cars:**
   a) Repeat the same steps as in step 1 above to calculate the fuel consumption under as identical conditions as possible.

Comments: In some cases it can be difficult to repeat the tests, under the same conditions before and after installing Eco-cars, to get a valid result of the differences in fuel consumption. The aim is to do the tests under as even conditions as possible to minimize the external factors listed in this document. If that is not possible, it is a good idea to repeat the above steps several times over the course of 2-3 weeks to get a good amount statistics for the consumption. Use the provided table to record the results.



B. Long Term test method by month and trips

1. **Measure the fuel consumption BEFORE installing Eco-cars:**

a. Track and measure the fuel consumption statistics on a monthly and trip basis.
   Keep track of the trip routes/destinations, driver, vehicle and cargo weight.
   Use the provided table.
   If historical data on the fuel consumption already exists this first step can be skipped.
b. Drive a distance of minimum 100 km or more on each trip.
c. Refill the entire fuel tank again. Use the same type of fuel/diesel and if possible from the same fuel pump. Calculate the average fuel consumption with the nr of liters and travelled distance in km.

2. **Install the Eco-cars device:**

3. **Calculate the fuel consumption AFTER installing Eco-cars:**
   a. Repeat the same steps as in step 1 above to calculate the fuel consumption under similar conditions. What is the difference?

Comments: This method is recommended where the method A is not possible to perform. This requires however historical data to be collected. Use the provided table to record the data.