

Call for tenders regarding measurement on commercial vehicles and trucks due to tampering with focus on possible increased emission in the cities – demonstrated by test with PEMS equipment

Task description:

1. Background

The Danish government introduced in late 2018 key initiatives to improve air quality and a stable climate. One of the initiatives focus on strengthening measures against tampering commercial vehicles and trucks causing non-functioning after treatment systems. The introduction followed the climate and air initiative "Together for a greener future"¹

Thus is this present part project an outcome from these initiatives.

2. Description of the task to be solved in general terms

The main objective of the project is to assess real driving emissions from light commercial vehicles and heavy duty vehicles when delivering goods in urban areas. The assessment shall simulate realistic test driving, delivering goods from a suburban transport hub to 5-6 addresses in the city center area while fitted with PEMS equipment monitoring the real driving emissions. Also simulation of a test drive delivering goods covering solely the city center – simulation a post delivery vehicle.

Earlier findings² suggest three main explanations for a non-functioning SCR-systems; tampering, cold operation, or lacked maintenance. When considering enforcement of tampering it would be helpful to distinguish the reasons for observed high emissions on a Euro 6/VI vehicle.

The goal is to establish under which conditions the SCR equipment are functioning and under which conditions the SCR system stops functioning efficiently due to the engines temperature, outdoor temperature, driving condition etc.

Therefore, the task is to perform test-drives fitted PEMS equipment to establish the duration of a functioning/non-functioning SCR system – especially with focus on city driving by Euro 6/VI commercial vehicles and trucks. The test shall include duration of time and distance of the functioning of SCR under different driving conditions (motorway, highway, city driving, queuing, idle, a drive with no load influence of outdoor temperature etc). The selection of vehicles shall reflect the latest Euro standard – preferable a test-drive by a Euro 6d temp or 6d commercial vehicle and two Euro VIe trucks with different engine size/effect.

The analysis shall carry out tests to investigate the effectiveness of after treatment systems when entering the city zone coming from motorways or country roads where the speed will be the maximum allowed and how a vehicles after treatment system function with solely driving in the city area. That way the motor will be warm when entering the city and presumably starts to cool off when engaging city driving mode. The test-drive could also cover a simulation of delivery of goods while in idle mode. After the vehicles enter the

¹ <https://en.kefm.dk/news/news-archive/2018/oct/together-for-a-greener-future>

² <https://dce.au.dk/udgivelse/vr/nr-351-400/abstracts/no-387-control-of-scr-systems-using-roadside-remote-sensing/> and <https://www2.mst.dk/Udgiv/publications/2018/06/978-87-93710-42-9.pdf>

city zone, the analysis shall cover when, why, and whether a threshold can be obtained when the SCR stops functioning. Also, an analysis of the particle emissions and blow-off due to accelerations or other driving conditions under the test drive are appreciated.

The test drives do not have to be fully in compliance with real driving emission regulations and the boundary conditions, trip specifications etc. set out in the EU Commission regulations thereof. However, the test drives should reflect emissions from normal condition of use, monitored by PEMS equipment, while simulation delivering of goods in city areas. Also the study is to uncover the distribution of how much time the vehicle will be driving in city zones and out city zones and to investigate if the engine while driving in the city zone will maintain or again reach a working temperature that enables the SCR system to work properly.

To get valid results in the project it is stressed that city zones should be the one of the largest cities in Denmark. It would be appreciated to perform the test-drive under low outdoor temperatures if the weather allow it.

3. The tasks

Below the parts in the project has been listed.

3.1 Equipment and data

- 3.1.1. Selections of test vehicles. Minimum: 1 commercial vehicles (van), 2 euro transporter trucks – 1 with no load and 1 that loaded. The trucks should be 2 axled.
- 3.1.2. The commercial vehicle is preferable Euro 6d temp or Euro 6d. The trucks are preferable Euro VIe
- 3.1.3. Monitor requirement: PEMS equipment and temperature measurement equipment. The PEMS shall obtain at least following parameters: CO₂, CO NO_x and PN. Following temperature parameters shall be obtained: Driving state (city, motorway ect), Engine load, vehicle speed, Engine- exhaust- and outdoor temperature. Further are queing, speed of the vechiles and geographical presentations of all emission measurement mandatory. All parameters are to be obtained under test drive.
- 3.1.4. PEMS measurements will be preferred.
- 3.1.5. The tender shall give suggestions how to handle the measurements statistically. Preferable using raw data as base.
- 3.1.6. The measurement/data should be able to be converted into spreadsheet for excel
- 3.1.7. All data (incl. raw data) and spreadsheet is to hand over to the Danish EPA for their sovereign use after the project is terminated
- 3.1.8. The readings from the project are temperature measurement from the engine, SCR logging (alerts from it and additional information about the cleaning), PEMS emission readings (alternative SEMS) and information about where the subject is driving (city zone or not), geographically data. More over information about when does the SCR-system/aftertreatment system function and set out functioning (e.g. due to low engine temperature or other reasons. The reason shall occur if possible in reporting). All data needs to be linked to each other.

3.2 Test-drive

- 3.2.1. Get results that uncover if the after treatment system and especially the SCR will keep working in the city zone or the engine will get warm enough again after been cooled off at a point while driving in the city so SCR is reactivated for cleaning the exhaust gas for NOx
- 3.2.2. A suggestion from the tender for the frame and arrangement of the test-drive concerning at least 3 vehicles is to be included in the offer. The suggestion needs to hold an approximate scatter between idle, queing, goods delivering, city drive and outside city drive. The precise planning of it will be settled with the provider after the chosen tender is found.
- 3.2.3. To make sure the engine has reached its working temperature and to simulate real driving it will has to arrive the city zone coming from outside a the city zone. The measurement is preferred to be done at chill conditions and idle motor in queuing and goods delivering is to be simulated as well.
- 3.2.4. The setup of one of the test-drive part has to be a mixture of driving in the city zones and out in the countryside (motorway, highway or country road). The other part of test-drive has to be conducted in the city area only.
- 3.2.5. The test-drive setup will be preferred so the vehicle engine is loaded for reaching maxium normal working temperature.
- 3.2.6. The location for the city drive mode is preferred to be in one of the largest Danish cities and after dialog with Danish EPA.

3.3 The analysis and general terms

- 3.3.1. The offer shall be accompanied by a timeframe for the project showing that the project is realistic to be performed with in the timeframe of the year 2020 including the writing the closing report and review time for the provider
- 3.3.2. The project shall end with a report answering the main goal and the rest of the raised matters in this paper.
- 3.3.3. Main questions to be answered by the project/report are:
 - Investigate the coherence between engine load and engine working temperature and SCR-system efficiency under different driving conditions.
 - The impact of outdoor temperature of the SCR-system efficiency under different driving conditions and loads.
 - The load of the engine while driving and the efficiency of the SCR-system
 - Observations of the after treatment system and the functioning under the different conditions (both NOx and PN).
- 3.3.4. Any uncertainties have to be described and evaluated in the offer.
- 3.3.5. The report shall be dealing with any uncertainties encountered during the project and be evaluated for the impact on the results.
- 3.3.6. The result shall be published and supplemented with an extended summery of the finding targeted non-technical receivers (politicians, government officials etc.).
- 3.3.7. The project has to be done and received by Danish EPA no later than 15th of December 2020.
- 3.3.8. The report needs to be written in English and if possible with an expanded Danish resume.

- 3.3.9. The tender will be asked for up to 2 public presentations of the project by web or conferences (the providers choice) with no extra fee.
- 3.3.10. The price of the project is a maximum of 732.000 DKK (excl. VAT) in total for the execution of the project and covers all related to the project incl. meetings, presentations, use of materials and man power also for any subcontractors usage. The payment will not be executed before Danish EPA has concluded that the report complies with the term listed in this present paper/call.
- 3.3.11. The offer needs to be in writing in English or Danish and shall handle all the above points in section 3.

4. The offer

Any offer has to be in writing and in English or Danish. The offer needs to answer all the terms in section 3.1 and 3.2 and describe the crew, which will conduct and join the project in term to be able to assess the quality of outcome. Moreover, it shall cover the task described in section 2.

The setup of the project including the choice of measurement equipment is to be described and any disadvantages with these has to be noted and concluded why the choice has been conducted this way.

5. Additional

Note that the project holder shall be willing to present the project on conferences without further payment. The payment will be executed when the project has been accepted by Danish EPA is fulfilled compared to the contract. *Any delay after the 15 th. of December 2020 will result in no payment.*

The project will include a starting meeting to establish the details of conducting it. Furthermore the aim with that meeting is to debate and find the optimal set up for the project frame i.e. the test-drive. This meeting activity is concluded in the generally fee, there is no extra payment for this activity.

6. Weighting

Note the weighting of offers compliance for the term will be as follow:

Criteria

<u>Weight</u>	<u>Topic</u>
30%	Quality in the description of the project offer and how to meet the main goal
10%	The numbers of data acquired from the project
40 %	Quality of the personnel conducting the measurements especially towards PEMS and setting up the project
10 %	The capacity to convey difficult technical matters to layman
10 %	The manning of the rest of the project

7. Contact persons

Project manager: Danish Environmental Protection Agency (EPA), Nils Nordholm ninor@mst.dk

Project worker: Ministry Of Environment and Food, Katja Asmussen kaasm@mfvm.dk

Projekt worker: Danish Road Traffic Authority, Rene Brandt Jensen rebj@fstyr.dk

Projekt worker: Danish National Police, Freddy Enøe Agerskov FPAoo1@politi.dk