Call for quotation for paraffinic diesel engine testing

for an extensive engine and vehicle testing programme

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Background

Under the EU H2020 research and innovation programme a project has been developed for which the European Commission (EC) and CEN have signed a contract (SA/CEN/RESEARCH/EFTA/000/2014-13) under the Framework Partnership Agreement with CEN-CENELEC (FPA). The project is titled: "Engine tests with new types of biofuels and development of biofuel standards". One of its objectives being to check whether present or future engines might present issues regarding quality requirement for medium to high blends of paraffinic diesel and to confirm the potential emissions benefits for these types of fuels.

The work that this tender covers has the scope to procure a new (Euro 6c) diesel light-duty vehicle and test its emissions with a small set of paraffinic diesel test fuels.

Objectives

The overall objective of the project is to check if density in EN 590 diesel can be extended to a range of (for instance) 800 kg/m^3 to 845 kg/m^3, in order to improve the environmental performance as well as increase flexibility in diesel fuel production. A selected set of paraffinic blends will be used in Euro 6c light duty vehicle tests, including low temperature test, to get first ideas about emissions, driveability and adaptive performance of the engine management system.

Tender basics

This tender is part of an overall project funded by the European Commission and executed by the European Standardization Committee, CEN. Project execution is being seconded to NEN, the Dutch Standardization Institute. NEN has appointed a *programme manager* and has installed a group of experts to advice NEN on the effective testing and research required. This *TF4* has established the technical content of this call for quotation and assigned a *project manager* as their technical spokesperson. When indicated as part of the tender, the tenderer may be required to visit meetings of the *TF4* on invitation by NEN. The *programme manager* acts as the contact for the test organization (*tenderer*); he/she will receive the reports and deliverables.

Overall the tender consists of the following:

I. sufficient volumes of test fuel blends (diesel type) as delivered by the *project manager*, shall be stored, processed and used for the testing;

II. the necessary, prescribed vehicle, and other equipment to enable testing, are procured or leased, checked for correct functioning and stored, maintained and installed under the usual conditions;

III. the prescribed exhaust/emission test procedures are executed following a test plan suggested by the *tenderer*. Planning regarding randomized test order of the fuels shall be discussed with the *TF4;*

IV. a separate severe driving cycle test is executed following a procedure based on a proposal by the *tenderer* and further detailed by test plan and order proposed by the tenderer;

V. test results of individual tests are collected and shared with the *programme manager*;

VI. a consolidated report is written, and discussed with and presented to the *programme manager* and the *TF4*;

VII. where required assistance in the preparation of proposals for development of CEN deliverables to CEN/TC 19 is given to the *TF4*.

Tasks to be performed

The main tasks of the tenderer during the contracting period are:

- Discussion of the test programme with the *project manager* assigned by the *TF4* and with the *programme manager*;
- Reception of the necessary diesel type fuels in drums, store them to prevent degradation and contamination for the time of the contracting period until they will be used. Remaining fuels shall be returned to the *project manager* or be discarded on request;
- Procuring or leasing the vehicle in line with Annex A;
- Develop a detailed planning of each of the tests, fuels and vehicles for acceptance by the *TF4*;
- Preparation of the test programme and the vehicle test benches using an EU reference test diesel fuel following Regulation 2008/692/EC or by an updated version (as proposed by the *tenderer*);
- Execute for each fuel provided the emission tests as identified in Annex B;
- Execute a severe driving cycle test following a procedure as suggested by the tenderer that should fulfil the objectives as indicated in Annex C (option);
- Evaluation of test results per fuel and report them to the *project manager*;
- Advise *TF4* regarding the interpretation of the test results towards the driveability and emission effects regarding other engine and vehicle types;
- Report to the *programme manager* in writing on the exercise, the used methodologies, the results of the test and the conclusions thereof;
- Participate in the preparation of the final report to the EC and to CEN by the *TF4* in order to develop an eventual future test programme.

Execution of the work

The tenderer shall cooperate in evaluating the performance of representative vehicles of current and recent production (i.e. Euro 6c technologies) when operating on paraffinic diesel fuels containing increased amounts of HVO and GTL. The test programme has been developed by a taskforce led by NEN in order to assess the impact of these fuels on vehicle driveability and overall emissions.

Tests shall be executed on the unmodified vehicle, as complete fuel supply and after treatment systems have to be taken into consideration. Further detail on each test needs to be discussed with the *project manager* or the *TF4*. The indicated numbers and types of vehicles/engines are the foreseen maximum in terms of amount to be tested; they may change in accordance with decisions by *TF4*.

Tests shall be executed using the paraffinic diesel fuels as delivered by the *programme manager*. A number of 7 test fuels will be provided in 200 litre sample drums to the *tenderer* by the *project manager*. Where necessary the *tenderer* may request smaller container sizes. The *tenderer* will present a test planning to the *TF4*.

A test organization representative shall take part in the taskforce meetings (two meetings are foreseen during the contracting period and to take place in Europe) in order to exchange information and cooperate in the advice to the EC and CEN. The representative shall assist the *programme manager* in preparing the final report to the EC.

The *tenderer* shall report to the *programme manager* and *project manager* about the test progress and results providing a weekly progress report. The *programme manager* may visit the test organization facilities to check progress and discuss the testing. The *programme manager* may require an interim written status report for *TF4* information. The *tenderer* shall present a detailed report on the test execution, results and related advices regarding the impact of each of the fuels tested on emissions and driveability. The test results and reports shall become property of the contractor.

The tenderer shall use the fuels supplied by the programme manager ONLY for the purpose of the project described in this document. The *tenderer* shall, at the

end of the project and on request of the *programme manager*, destroy the remaining fuels in his possession.

General confidentiality around the fuels involved, vehicle brands participating and results, etc. shall apply and the *tenderer* shall not distribute any results other than to those involved in the tender.

The *tenderer* will present an overall planning with the tender proposal. This planning shall be confirmed at the first exchange with the *TF4* after the contract signature.

Award criteria for the tendering process

Offers for provision of the testing and reporting are treated individually although consortium offers will also be considered. Offers can also be from a single person, who should have a VAT number and a company registration.

Tenderers may chose not to bid for the specific test as indicated in Annex C. That shall be made clear in the offer presentation.

Selection of subcontractors will be based on the following criteria:
1) **Documented experience** (maximum 40 points):
- number of years working in relevant field
- demonstration of experience in leading and / or managing of similar projects
- demonstration of experience (in organization of and/or participation) in vehicle testing with different fuels
- demonstration of experience with the indicated test methods as described in Annex B
- if applicable, demonstration of experience with the severe test drive cycle as requested in Annex C and the proposal of the cycle as such
- technical experience and consulting activities in relevant field
- experience in European and/or international standardisation work
- experience in running European or/and international programs

2) **Organization** - demonstration of ability and understanding of the project (maximum 40 points):
- infrastructure and ideas regarding vehicles, emission testing and alternative fuels handling and testing
- facilities used for the vehicle preparation and testing
- organization of the vehicle preparation, measurements, testing, reporting
- established quality system

Possibility to complete the procurement of the vehicles and start the testing before mid-August will be considered an advantage.

Only offers that pass the selection criteria of scoring minimum 30 points under 1) and 20 points under 2) will be further evaluated. From those passing the minimum scoring a sensible pre-selection (based on the total of the short-list) will be made and the contractor(s) invited for further evaluation in a Q&A meeting session.

3) **Quotation price** (maximum 20 points). The quotation shall give insight in the costs for:
- fuel handling and storage,
- vehicle procurement;
- preparation of each vehicle,
- execution of each test as described in Annex B,
- execution of a severe driving cycle test in line with the objectives as described in Annex C (this test is considered as an option and can be excluded from the offer),
- total of the costs per vehicle if all tests and fuels as described would be executed, and
- overall organization and exchanges and meetings with the *TF4* and the *programme manager*.

NEN considers that proposals requesting a budget in the range of €150k for the testing described under Annex B would allow this study to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. For the optional severe driving cycle test a separate budget price shall be offered.

The offer with the highest points in total will be selected.

On the effective contract the "General Terms and Conditions for the Provision of Technical Services to NEN" shall apply. A copy of those can be delivered on request. The Contractor should also agree to the fact that the obligation of NEN to pay is subject to the normal functioning of the financing mechanisms of the Commission of the European Union and of the EFTA, through the order voucher(s) relative to the tasks under the Horizon2020 call under the Secure, clean and efficient energy programme: B.2.5. "Engine tests with new types of biofuels and development of biofuel standards" and/or through the Agreements between the Commission of the European Union and CEN on Action SA/CEN/RESEARCH/EFTA/000/2014-13.

Replies to tender

Tenders can be sent (by mail or e-mail) to the programme manager Mr Ortwin Costenoble (energy@nen.nl), as soon as possible, at the latest at 8 June 2018. The tender shall contain a specified breakdown of:

- tasks to be executed
- costs and expenses for work, travel, consumables and others where relevant
- if offered, a separate cost calculation and work description for the work concerning the severe driving cycle test (Annex C).
- first planning for the execution of the tasks, which will form the start of the discussion regarding the tender contract.
  Start of the work is expected to be not later than September 2018 and to be finished not later than February 2019

If necessary, additional information can be obtained via the programme manager, Mr O. Costenoble (T: +31 15 2690 330, e: ortwin.costenoble@nen.nl).

Annex A - Test vehicle requirements

This Annex presents the type of production vehicle that should be obtained (procured or leased) for the work. In general the requirements can be described as:

- Euro 6c, light-duty Diesel vehicle widely distributed on the market
- Middle-class car (see example below) or similar inertia from M (multi-purpose) or J (SUV) Segments equipped with DPF & SCR
- Less than one year old with a minimum mileage of 7 000 km to ensure a proper run-in of the engine and injectors. A maximum mileage of 30 000km is strongly recommended, to preserve the vehicle from usage drift.

As a concrete example, the vehicle could be a Volkswagen Passat B8 powered by the 2.0L TDI 190hp engine equipped with a U-shape DOC+SCRF after-treatment system.

Details	
Engine version	2.0L TDI 190 BLUEMOTION
Energy	Diesel
Power [ch]	190
Torque [Nm]	400
Cylinders	4
Displacement [cc] or [mL]	1968
Fuel capacity [L]	-
Weight [kg]	1474
Wheelbase [m]	2.79
SCx [m²] (Cx)	-
Urban consumption [L/100km]	5.4
Combined consumption [L/100km]	4.5
Extra-Urban consumption [L/100km]	4.0
CO2 [g/km]	118

Annex B - Vehicle and engine test requirements

1. Vehicle sensor equipment:

The following shall be monitored continuously during each driving cycle:

- Ambient air temperature
- Ambient pressure
- Hygrometry
- Vehicle Speed
- Vehicle Torque
- Engine speed
- Oil temperature (Oil sump)
- Coolant temperature (engine inlet)
- Fuel temperature (pump inlet)
- Exhaust temperatures
    - Temperature before DOC
    - Temperature after Aftertreatment
- As much as possible OBD channels (especially fuel system data and injection settings)

2. Vehicle fluids conditioning

Beginning of project

- Air filter replacement
- Engine oil needs to be renewed before the testing starts according to vehicle manufacturer's specifications if service is required in less than 2000 km
- Adblue top up [to avoid AdBlue adulteration]
- Engine oil and Fuel preparation:
    - Engine warm-up (Oil Temp = 90°C)
    - Engine oil (if needed, 30min) and fuel draining from the fuel system as close to the engine as possible (fuel filter or high pressure pump backflow)
    - Engine oil filter (if oil change needed) and fuel filter replacement
    - Engine oil (if needed), test fuel N°1 filling (approx. 10L)
    - Driving for 30 min for adequate rinsing and fuel system flush, initiating a manual DPF-regeneration (if possible)
    - Test engine oil (if needed, 30min) and fuel draining
    - Oil sampling (100 ml) and storing for later analysis
    - Test engine oil refilling to half between Min and Max of gauge
    - Test fuel N°1 filling (approx. 30L)
    - Ready for first test

Between each test (fuels):

- Engine oil gauge check (refill to half between Min and Max of gauge if needed – operation to be registered if occurs)
- Previous test fuel draining
- Next test fuel filling (approx. 10L)
- Driving for 30 min for adequate rinsing, initiating a manual DPF-regeneration (if possible)
- Next test fuel draining
- Next test fuel filling (approx. 30L)
- Ready for next test fuel evaluation

Between two different test cycles:

Temperatures must be checked and be within the given limits before start of test:

- Engine Oil temp = 23 ° C +/- 3 ° C
- Coolant temp = 23 ° C +/- 3° C
- Ambient air temp = 23 ° C +/- 3° C
- Fuel temp = 23 ° C +/- 3 ° C
- identical tires pressures for all cycles
- Ambient air temp must be kept à 23°C +/- 5°C throughout the entire test cycle duration.

End of project

- Air filter replacement, register severe dirt presence and store filters for eventual later assessment

- Engine oil filter replacement, register severe dirt presence and store filters for eventual later assessment
- Engine oil to be sampled and checked on total contamination

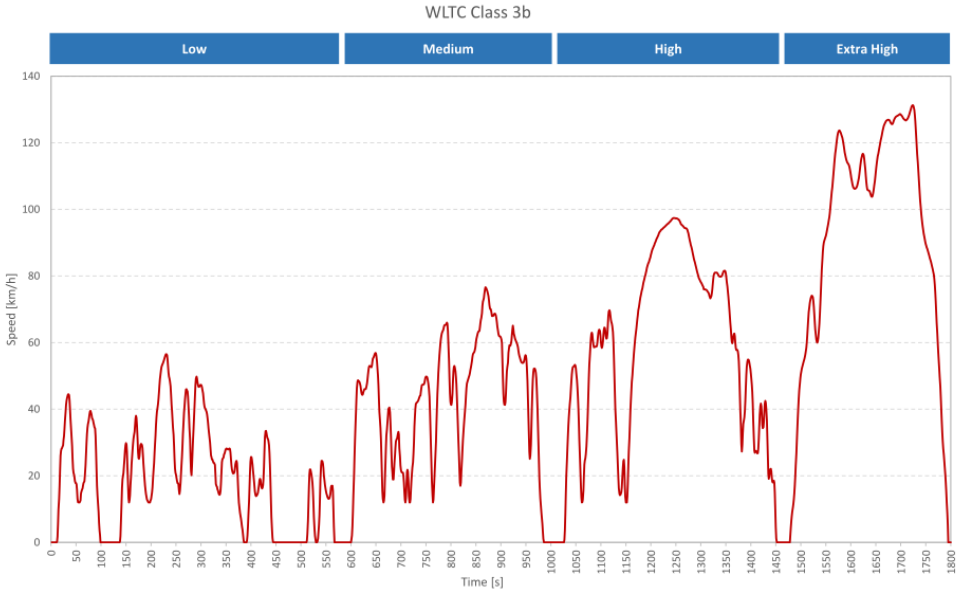
3. Vehicle emission testing required

3.1. WLTP

Three valid WLTC at 23°C, measuring HC, NMHC, NOx, CO, PM, PN, CO2, and fuel consumption at tailpipe. In addition measuring raw emissions (HC, CO, PM, NOx, PN distribution) after turbine and before aftertreatment will be needed. These data must be provided for entire cycle, per phase and continuously along the cycle.

Please indicate cost implications, in case the testing would have to be done at 14°C ambient temperature (option).

The test procedure to employ is the WLTP adapted to the test vehicle specifications.

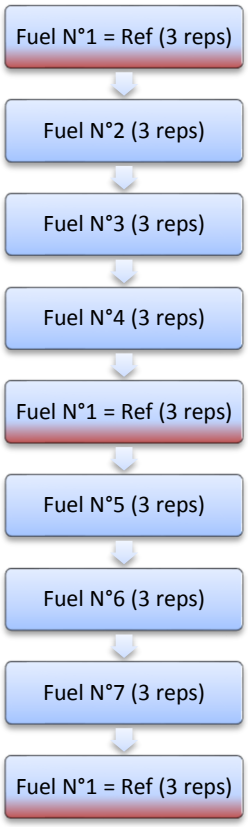


Test bench load setting will be done by coast down method on the bench with an iterative approach. The obtained road-load factors must be approved by TF4 and kept for the entire project. A coast down check will be done after each test cycle to ensure vehicle stability over the project.

The vehicle will be conditioned mainly according to the WLTP procedure.

- Preconditioning on WLTC
- Soaking of the vehicle with open engine hood between 6h and 36h in an atmosphere 23 ° C +/- 3 ° C

Proposed WLTC tests sequence:



3.2. RDE cycle

Tenderer must provide in the offer RDE evaluation for the 7 test fuels. The test could be considered with real road driving with PEMS or with simulation of REF testing on chassis dyno.

TF4 expects one valid RDE test on road for the 7 test fuels in the same route using PEMS and being compliant with all RDE exclusion criteria. If available tenderer can offer an own cycle (with proven relevance with RDE with PEMS road testing) to simulate RDE in a more accurate way on chassis dyno (with comparable ambient temperature between tests).

Annex C – Severe driving cycle test requirements (Option)

If possible, a proposition to suggest a severe driving cycle according to the following guidelines and the maximum capacities of the more suitable test bench available.

The basic need with this severe driving cycle is to verify that the engine settings and the fuel system (more specifically the injectors) are compatible with the test fuels in extreme conditions. The test needs to be short but severe and to be performed on a chassis dyno. The test to be proposed must be composed of high loads, transients and typical operating points that could generate cavitation in injectors (high fuel and ambient temperatures). This test should be within the remaining fuel after emission testing. As 200 litre is available per fuel for all tests, we estimate that the residual amount will be between 100 l and 120 l.

These specific tests must be considered at the end of all WLTP and RDE evaluations. As a consequence, fuel flushing procedure shall be repeated. Cavitation evidence is provided by abnormal pressure gradients in HP part of the fuel system and could also be seen in specific fuel system ECU labels to be determined according to tendered knowledge.

<u>The objectives</u>
Tenderer must provide the following details to demonstrate ability to propose such a driving test cycle:

- Chassis dyno maximum capacity (max power accepted / max ambient temperature / fuel temperature conditioning possibilities)
- Detailed test cycle proposal
- Test sequence proposal for 7 fuels assessment
- Ability to provide high pressure advanced measurements in fuel and fuel system ECU labels recorder

To conclude, this specific testing has to be considered as an option in the tender and corresponds to a short test development, 7 fuels evaluation, as well as injectors replacement and expertise (injectors will have to be provided by tenderer). It shall be offered as a separate element.