
# RULES OF THE CONTEST

# 1. THE HORIZON PRIZE FOR THE ENGINE RETROFIT FOR CLEAN AIR

## 1.1 Objectives pursued

The Horizon Prize for the Engine retrofit for clean air aims at spurring the development of new technologies that can be applied to existing diesel engines and powertrains to reduce pollutant emissions in real driving conditions to a level comparable with that of new cars responding to the emissions legislation in force from 2017.

## 1.2 Expected results

European citizens in many urban areas suffer from serious health impacts due to air quality issues (around 500.000 premature deaths per year due to particles, $NO_X$ and ozone[1]). There are more than 250 million passenger cars on the road in European Union. 41% of these have diesel engines (up to 70% of the fleet in some countries), while only about 5% of the vehicles are using alternative powertrains and fuels.[2]

The Horizon Prize for the Clean Engine Retrofit aims at reducing the pollution produced by the existing fleet by retrofittable technology (i.e. additional devices and/or modification of existing diesel engines). The implementation of the technology should allow such retrofitted vehicles (a large part of which, being Euro 5 or early Euro 6 are relatively recent and therefore will be on the road for many years) to circulate without unduly affecting air quality.

More specifically, since such retrofitted vehicles could have less than half of the emissions of the unmodified vehicle in the case of $NO_X$, city authorities may consider measures to encourage their use to improve urban air quality. It is expected that a successful application of Clean Engine Retrofits will therefore improve health and life quality of European citizens.

The Horizon Prize for the Cleanest Engine Retrofit will be awarded to the applicant or team demonstrating the lowest emission of $NO_X$ (a generic term for the various nitrogen oxides), PN/PM (particulate matter in terms of number of particles and mass, respectively) and other pollutants under real urban driving conditions on the road as well as under standardized conditions in the laboratory.

# 2. PRIZE AMOUNT: 1.5 MILLION EUR[3]

# 3. DEADLINES & ADMISSIBILITY

| **DEADLINES**[4] | |
|---|---|
| **LAUNCH OF THE CONTEST**<br><br>Call for applications is published on the Participant Portal<br>All detailed information is available on the Horizon Prize website | 20 April 2016 |

1 http://www.eea.europa.eu/media/newsreleases/many-europeans-still-exposed-to-air-pollution-2015/premature-deaths-attributable-to-air-pollution

2 http://www.acea.be/statistics

3 In accordance with the budgetary procedure set in the Financial Regulation No 966/2012, award of a prize must be preceded by the adoption of the respective budget and the adoption of the financing Decision. Since the budget amounts are only to be foreseen in the 2017 budget they are subject to the availability of the appropriations provided for in the draft budget for 2017 after the adoption of the budget 2017 by the budgetary authority or, if the budget is not adopted, as provided for in the system of provisional twelfths.

4 This indicative timescale may be subject to review and update by the EC

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| **DEADLINE FOR REGISTRATION**<br><br>Contestants register by sending email to EC-ENGINE-RETROFIT-PRIZE@EC.EUROPA.EU | 12 June 2017<br>at 17:00:00 CET[5] |
| **CLOSING DATE FOR SUBMISSION**<br><br>Applicants submit the application form Part A and Part B thorough the Participant Portal and deliver the prototype to JRC in Ispra | 12 September 2017<br>at 17:00:00 CET[6] |
| **EVALUATION**<br><br>Applicant submissions are evaluated against the award criteria described in this document, and on the basis of verification tests performed by JRC | October 2017 - March 2018 |
| **AWARD**<br><br>Announcement of the Winner of the Horizon Prize of the Engine Retrofit for Clean Air | March - April 2018 |

Applications must be submitted by the (lead) contestant via the Participant Portal 'Submission Service', accessible via the call page.

Applications must be readable, accessible and printable. Incomplete applications may be considered inadmissible if essential elements are missing (see General Annex B to the Main Work Programme).

The page-limit for Part B is 600 pages. Drawings must be included in annex.

Participants are encouraged to declare their intention to participate by registering as 'contestants' as soon as possible by sending an email to the prize mailbox EC-ENGINE-RETROFIT-PRIZE@EC.EUROPA.EU by 12 June 2017. The registration does not entail any obligation to participate.

Sample application forms, guidance documents on submission procedure and other relevant information are available as reference documents on the Participant Portal. Stakeholders are advised to follow the information published on the Participant Portal and it should act as the primary source of information for both applicants and the public. General information about the prize is also available on the Horizon Prize website.

Other documents, such as the testing procedures that will be applied in verification testing, will also be available on the Participant Portal before the closing date of the prize.

Submission shall consist of:

1. Application Part A and Part B to be submitted through the Participant Portal;

2. Delivery of the prototype to the JRC in Ispra.

The prize will be awarded to the contestant demonstrating on a Euro 5b certified C class compact car the lowest emission of $NO_X$, PN/PM and other pollutants, combined with a minimal impact on fuel efficiency of the original vehicle and other performance as defined below to ensure that the proposed solution meets operational requirements.

[5] Central European Time = Brussels local time.
[6] Central European Time = Brussels local time.

Due to the specificity of the prize the following conditions shall be met:

In order for the application to be admissible, to achieve a real impact and be able to undergo real driving emissions testing by JRC, the solution should be able to demonstrate compliance with a series of operational aspects through the information provided in part B of the application and by inspection of the prototype.

Such aspects are:

- Safety: must be safe to operate
- Noise: must comply with applicable noise regulations
- Total costs of ownership: must not exceed a total of 2000€ over 100.000km
- Performance and Driveability: must be able to be driven on the prescribed test cycles and not have more than 10% worse acceleration performance than the unmodified donor vehicle (tested in initial testing) from 0-100 and from 80 to 120 km/h and no unacceptable driving behaviours (i.e. response lag and torque discontinuities should not be significantly worse than the donor vehicle).
- Fuel consumption: not worse than 10% with respect to the unmodified donor vehicle.

The innovation shall be installed for testing purposes on a mass production Euro 5b C class compact car (in the top C class sales[7], but limited to high-volume hatchback and three volumes family car bodies). Use of the most widely sold engine for the chosen model is also required to achieve maximum impact (use of very specific engines fitted on a small number of vehicles of the chosen model is not acceptable).

No modification to the body, the chassis and the auxiliaries (except for those directly related to the engine's functioning, such as pumps and generators, which are considered part of the powertrain) of the donor vehicle is accepted, except if the need to modify them to integrate the retrofit is fully demonstrated. The vehicle should retain most of its payload carrying capability (installation of devices in the trunk or in the passenger cabin should be avoided or kept to a minimum unless convincing demonstration that in a series production configuration it can be brought to an acceptable size of maximum 20l in the trunk and/or completely installed in the engine compartment and underbody.)

The standard gearbox of the donor vehicle should be left unmodified. If more than one engine, gearbox and/or aftertreatment strategy or user-selectable drive mode (i.e. eco, sport etc.) are available, tests can be performed in any of these modes. It is therefore advised not to use donor vehicles having multiple modes.

Engines/powertrains/cars in which the achievement of the emission reduction is due to using main propulsive energy coming from other forms of energy storage than the main fuel are not admissible: plug-in hybrids and in general systems using large energy storage capability beyond the main fuelwill not be admissible . A limited amount of hybridisation (peak power for 30 seconds up to 20% of the ICE's engine power, maximum continuous power up to 10% of ICE's engine power and up to 0.5 kWh of additional energy storage) is instead allowed.

The use of on-board generated chemicals is allowed, unless they affect the safety or the homologation potential of the innovation. The use of additives is allowed, unless they represent a significant quantity of energy (as mentioned above, and are used mainly to increase the energy efficiency of the engine) or affect the safety or the homologation potential of the innovation. For example, use of hydrogen or another gaseous fuel stored on board (used in small quantities to enhance combustion or to regenerate the catalysts) is acceptable, while injection in larger quantities that contribute significant energy is not allowed.

For the purpose of this prize, fuels are only diesel and its commercial low blends according to Annex II of Directive 2009/30/EC of the European Parliament and of the Council of 23 April 2009. Natural gas or other fuels are not allowed.

For the purpose of this prize, no access to OBD data should be needed or used in testing, nor should any other way of identifying that the vehicle is being tested be installed.

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[7] A list of acceptable models and engines will be provided on the Competition websites

# 4. ELIGIBILITY

## 4.1 Eligibility criteria

The contest is open to all legal entities (i.e. natural or legal persons) or groups of legal entities.

Please note however that special rules apply for Israeli entities[8] and for Crimean legal persons and that entities from non-EU Member States that are covered by Council sanctions are not eligible to participate[9] (see General Annex C to the Main Work Programme).

Moreover, applicants that have already received an EU or Euratom prize cannot receive a second prize for the same activities.

## 4.2 Exclusion criteria

Contestants will be excluded if they (or for points (a)(b) a natural or legal person that assumes unlimited liability for the debts of the contestant; or for points (c)(d)(e)(f) a natural person who is a member of the administrative, management or supervisory body of the contestant, or who has powers of representation, decision or control with regard to that contestant)[10]:

a) it is bankrupt, subject to insolvency or winding up procedures, its assets are being administered by a liquidator or by a court, it is in an arrangement with creditors, its business activities are suspended or it is in any analogous situation arising from a similar procedure provided for under national legislation or regulations;

b) it has been established by a final judgement or a final administrative decision that the applicant is in breach of its obligations relating to the payment of taxes or social security contributions in accordance with the law of the country in which it is established, with those of the country in which the authorising officer is located or those of the country of the performance of the contract;

c) it has been established by a final judgement or a final administrative decision that the applicant is guilty of grave professional misconduct by having violated applicable laws or regulations or ethical standards of the profession to which the applicant belongs, or by having engaged in any wrongful conduct which has an impact on its professional credibility where such conduct denotes wrongful intent or gross negligence, including, in particular, any of the following:

   (i) fraudulently or negligently misrepresenting information required for the verification of the absence of grounds for exclusion or the fulfilment of selection criteria or in the performance of a contract, a grant agreement or a grant decision;

   (ii) entering into agreement with other persons with the aim of distorting competition;

   (iii) violating intellectual property rights;

   (iv) attempting to influence the decision-making process of the Commission during the award procedure;

   (v) attempting to obtain confidential information that may confer upon it undue advantages in the award procedure;

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8 See Commission Guidelines on the eligibility of Israeli entities and their activities in the territories occupied by Israel since June 1967 for grants, prizes and financial instruments funded by the EU from 2014 onwards (OJ C 205 of 19.7.2013, pp. 9-11).

9 For the list of persons, groups and entities subject to EU financial sanctions, see http://eeas.europa.eu/cfsp/sanctions/consol-list_en.htm.

10 Article 105a, paragraphs 1 to 4, 6 and 7, except point (b) of the first subparagraph and the second subparagraph of that paragraph, paragraphs 8, 9, 11 and 13 to 17 of Article 106 and Article 108 of the Regulation (EU, Euratom) No 966/2012 of the European Parliament and of the Council of 25 October 2012 on the financial rules applicable to the general budget of the Union and repealing Council Regulation (EC, Euratom) No 1605/2002 (OJ L 218, 26.10.2012, p.1) shall apply to participants and winners. Article 107 shall apply to participants.

d) it has been established by a final judgement that the applicant is guilty of any of the following:

(i) fraud, within the meaning of Article 1 of the Convention on the protection of the European Communities' financial interests, drawn up by the Council Act of 26 July 1995;

(ii) corruption, as defined in Article 3 of the Convention on the fight against corruption involving officials of the European Communities or officials of EU Member States, drawn up by the Council Act of 26 May 1997, and in Article 2(1) of Council Framework Decision 2003/568/JHA, as well as corruption as defined in the legal provisions of the country where the authorising officer is located, the country in which the applicant is established or the country of the performance of the contract;

(iii) participation in a criminal organisation, as defined in Article 2 of Council Framework Decision 2008/841/JHA;

(iv) money laundering or terrorist financing, as defined in Article 1 of Directive 2005/60/EC of the European Parliament and of the Council;

(v) terrorist-related offences or offences linked to terrorist activities, as defined in Articles 1 and 3 of Council Framework Decision 2002/475/JHA, respectively, or inciting, aiding, abetting or attempting to commit such offences, as referred to in Article 4 of that Decision;

(vi) child labour or other forms of trafficking in human beings as defined in Article 2 of Directive 2011/36/EU of the European Parliament and of the Council;

e) it has shown significant deficiencies in complying with the main obligations in the performance of a contract, a grant agreement or a grant decision financed by the Union's budget, which has led to its early termination or to the application of liquidated damages or other contractual penalties, or which has been discovered following checks, audits or investigations by an Authorising Officer, OLAF or the Court of Auditors;

f) it has been established by a final judgment or final administrative decision that the applicant has committed an irregularity within the meaning of Article 1(2) of Council Regulation (EC, Euratom) No 2988/95;

g) for the situations of grave professional misconduct, fraud, corruption, other criminal offences, significant deficiencies in the performance of the contract or irregularity, the applicant is subject to:

(i) facts established in the context of audits or investigations carried out by the Court of Auditors, OLAF or internal audit, or any other check, audit or control performed under the responsibility of an authorising officer of an EU institution, of a European office or of an EU agency or body;

(ii) non-final administrative decisions which may include disciplinary measures taken by the competent supervisory body responsible for the verification of the application of standards of professional ethics;

(iii) decisions of the ECB, the EIB, the European Investment Fund or international organisations;

(iv) decisions of the Commission relating to the infringement of the Union's competition rules or of a national competent authority relating to the infringement of Union or national competition law.

(v) decisions of exclusion by an authorising officer of an EU institution, of a European office or of an EU agency or body.

Contestants will also be excluded if they misrepresent the information required as a condition for participating in the procedure or fail to supply that information or they were previously involved in the preparation of prize documents where this entails a distortion of competition that cannot be remedied otherwise.

However contestants will not be excluded where:

a) they have taken remedial measures[11], thus demonstrating their reliability. This point shall not apply in the case referred to in point (d) above;

b) such an exclusion would be disproportionate.[12]

### 4.3 Evidence upon request

Whenever requested by the contracting authority and where this is necessary to ensure the proper conduct of the procedure, the candidate or tenderer, as well as the entity on whose capacity the candidate or tenderer intends to rely, shall provide appropriate evidence that the contestant or a natural or legal person that assumes unlimited liability for the debts of the contestant; a natural person who is a member of the administrative, management or supervisory body of the contestant, or who has powers of representation, decision or control with regard to that contestant is not in one of the exclusion situations referred to in paragraph 4.2.

## 5. AWARD CRITERIA

The prize will be awarded to the entry that according to JRC verification measurements and in the opinion of the jury demonstrates a solution that best addresses the following criteria:

a) Levels of $NO_x/NO_2$

b) Levels of PN/PM emissions

c) Levels of Hybrocarbon (HC) emissions

d) Emissions of other pollutants

The following sections outline in more details the test specifications and criteria that need to be met by applicants when submitting the application, the quantified metrics, the scoring method and the weighting process.

### THRESHOLDS

The following table outlines the thresholds which must be met in initial testing and reported in the application submitted in the Participant Portal.

None of the flexibilities mentioned in the "Supporting Analysis regarding Test Procedure Flexibilities and Technology Deployment for Review of the Light Duty Vehicle $CO_2$ regulations" report[13] should be applied in initial testing, and in general no setting or modification that would not be commonly used by a normal customer for normal operation should be adopted in any testing or driving condition: for instance, the vehicle should have installed commercially available certified tyres (inflated with air at the pressure suggested by the manufacturer) providing good driveability, normal wheel angles, standard lubricants, etc.

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[11] The measures which remedy the exclusion situation may include, in particular: measures to identify the origin of the situations giving rise to exclusion and concrete technical, organisational and personnel measures within the relevant business area of the economic operator, appropriate to correct the conduct and prevent its further occurrence; proof that the economic operator has undertaken measures to compensate or redress the damage or harm caused to the Union's financial interests by the underlying facts giving rise to the exclusion situation; proof that the economic operator has paid or secured the payment of any fine imposed by the competent authority or of any taxes or social security contributions.

[12] In particular taking into account the seriousness of the situation, including the impact on the Union's financial interests and image, the time which has elapsed since the relevant conduct, its duration and its recurrence, the intention or degree of negligence, the limited amount at stake for point (b) above or any other mitigating circumstances, such as the degree of collaboration of the economic operator with the relevant competent authority and its contribution to the investigation as recognised by the contracting authority, or the disclosure of the exclusion situation by means of the declaration

[13] http://ec.europa.eu/clima/policies/transport/vehicles/cars/docs/report_2012_en.pdf

In initial testing prior to submission contestants are allowed to use any commercially available type of diesel fuel and any standard lubricant indicated in the user manual by European automotive OEMS.

These results may be verified by JRC. The same criteria will be used for pollutants as Not-To-Exceed values for real urban driving tests (including under specific conditions, such as cold start and regenerations, with a conformity factor = 1.2).

Should any unjustified modification be applied to enhance energy efficiency the jury at its discretion can attribute a score of zero to the submission in all criteria or, if easily measurable or assessable, deduct the energy efficiency improvement thus obtained from the achieved emissions performance

Verification testing at JRC will be performed using the fuel in the car tank, and/or a standard market fuel available there.

Lubricants for verification testing shall be the ones provided in the submitted engine by the applicant, and should be clearly identified in the submission papers in case a need for replenishing emerges during testing.

The polluting emissions and fuel consumption criteria of Table 1 shall be met on all the three test cycles mentioned in part B of the application template. A combination of these results will be used for scoring.

| CRITERIA | THRESHOLDS |
|---|---|
| a) Maximum $NO_X$ emissions | 180 mg/km |
| b) Maximum PN/PM emissions | $6 \times 10^{11}$ mg/km, 4.5 mg/km mass |
| c) Maximum HC emissions | 230 mg/km for HC+$NO_X$ |
| d) Emissions of other pollutants | 500 mg for CO |

**Table 1: Threshold table for initial testing**

## ASSESSMENT GRID FOR THE AWARD CRITERIA

The key metrics that will be used for the assessment to determine the winner are set out below. All applications shall meet a threshold score of 1 on all criteria.

### Award criteria

These criteria define the scoring of measured levels of $NO_X$, $NO_2$, PN/PM, and other pollutants.

These criteria will be evaluated based on the Information provided in the application and on JRC verification results where applicable. Measurable performance will be assessed according to the grid provided below, using a scale from 0 to 5, where 0 means that the results are not sufficient, and 5 is attributed to the best preferable performance. All applications shall meet a threshold score of 1 on all criteria.

The chassis dynamometer parameters shall be selected based on the UNECE Regulation 83 coefficients using the empty weight of the donor vehicle minus any replaced or removed components plus 100 kg plus the retrofit weight (for the post retrofit tests).

### a) Levels of $NO_X$ and $NO_2$

$NO_X$ emission level refers to the levels of $NO_X$ measured on chassis dyno and verified using portable emission measurement systems in real urban driving conditions where applicable. Intermediate values are listed to incentivize advancements towards low-cost systems that can meet the ultimate target of 60 mg $NO_X$/km.

| $NO_x$ EMISSIONS | SCORE |
|---|---|
| > 180mg km | 0 |
| > 150mg ≤ 180mg km | 1 |
| > 120mg ≤ 150mg km | 2 |
| > 90mg ≤ 120mg km | 3 |
| > 60mg ≤ 90mg km | 4 |
| ≤ 60mg km | 5 |

**Table 2: $NO_X$ Emissions levels criteria**

| ABSOLUTE $NO_X$ REDUCTION | SCORE |
|---|---|
| < 100mg km | 0 |
| < 250 ≥ 100mg km | 1 |
| < 350mg ≥ 250 km | 2 |
| < 450mg ≥ 350mg km | 3 |
| < 550mg ≥ 450mg km | 4 |
| ≥ 550mg km | 5 |

**Table 3: Absolute $NO_X$ reduction criteria**

A mark will also be attributed to the absolute reduction in $NO_X$ emissions, and the average of the two marks used for scoring.

$NO_2$ emission levels refer to the amount of $NO_2$ measured on chassis dyno and verified using portable emission measurement systems in real urban driving conditions. Since this is the pollutant regulated in air quality laws, and since some catalysts combinations can generate artificially high $NO_X/NO_2$ ratios, it is given specific targets. For this reason, a multiplier of 1.5 would be applied to the $NO_X$ score if the $NO_2/NO_X$ ratio is lower than 30% and/or $NO_2$ is lower than 60 mg/km (whichever is higher in absolute value). A weight of 0.5 will be applied instead if the $NO_2/NO_X$ ratio is higher than 60% and $NO_2$ is higher than 120 mg/km. This allows taking into account the different behaviours of some after treatment systems.

The proposed technology should also have a strong potential to be successfully incorporated into other diesel vehicles beyond the demonstrated one. Should it be deemed feasible by the contestants, applicability of the proposed innovation to additional Euro classes of vehicles would be an important additional benefit.

Applicability of the technology to early Euro 6 vehicles demonstrating RDE compliance with legal Euro 6 RDE limits and conformity factors entering into force in 2017 would be rewarded by multiplying the score in the NOx criteria for the Euro 5b submission by 1.5 if all required data and the retrofitted Euro 6 vehicle are presented.

### b) Levels of PN/PM emissions

Emissions will be measured in terms of particle mass collected on a filter which shall be below 4.5 mg/km. If this condition is satisfied, the PN value will be used for scoring otherwise the score for this criteria will be zero. The proposed limit values are normally achievable by a wall flow filter, currently the best available technology, normally applied to Euro 5b vehicles, and could be challenging only if another technology is proposed.

The particles taken into account will be any solid particles (carbonaceous and metal or other chemical species resulting from additives or other installed devices) larger than 23 nm.

| NUMBER OF PARTICLES (>23 NM) PER KM | SCORE |
|---|---|
| > $6x10^{11}$ per km | 0 |
| $6x10^{11}$ per km or lower | 1 |
| $1X10^{11}$ per km or lower | 2 |
| $5X10^{10}$ per km or lower | 3 |
| $1X10^{10}$ per km or lower | 4 |
| $5X10^{9}$ per km or lower | 5 |

**Table 4: Number of Particles per km criteria**

The proposed technology should also have a strong potential to be successfully incorporated into other diesel vehicles beyond the demonstrated one. Should it be deemed feasible by the contestants, applicability of the proposed innovation to additional Euro classes of vehicles would be an important additional benefit.

The capability to apply the technology to C class vehicles without a particle trap (Euro 4 or Euro 5a diesel vehicles or any Gasoline Direct Injection vehicles) is a benefit for the environment that will be rewarded by double points in the PN criteria for the Euro 5b submission if all required data and the retrofitted vehicle are presented.

### c) Levels of Hydrocarbons (HC) emissions

HC emission levels refer to the levels of total unburned hydrocarbons also measured on chassis dyno and verified using portable emission measurement systems in real urban driving conditions where applicable. Since the Euro 5-6 diesel legislation mandates only a value for HC + NOx, limits are expressed in the same way to ensure that the vehicle can at least maintain the Euro 5 certification. These pollutants are important because they include known carcinogens and contribute to ozone and secondary particles.

| HC + $NO_X$ EMISSIONS | SCORE |
|---|---|
| > 230mg/km | 0 |
| > 210mg ≤ 230mg/km | 1 |
| > 190mg ≤ 210mg/km | 2 |
| > 170mg ≤ 190mg/km | 3 |
| > 150mg ≤ 170mg/km | 4 |
| ≤ 150mg km | 5 |

**Table 5: HC + $NO_X$ Emissions Levels criteria**

### d) Levels of emission of other pollutants (CO, $NH_3$, $N_2O$)

Carbon monoxide (CO) is a pollutant regulated in the Euro 5 legislation, and its level is verified to ensure that the vehicle can at least maintain the Euro 5 certification. It is normally emitted during combustion and is poisonous as it inhibits oxygen exchange in the lungs.

Other pollutants, currently unregulated by European Legislation ($NH_3$, $N_2O$), will be measured in final testing (they do not need to be measured in initial testing since many test laboratories don't have the needed instruments).

$NH_3$ (commonly known as ammonia) can be emitted both during combustion and as an effect of improperly-controlled reactions in ammonia-based catalysts. The maximum accepted emission level is 60 mg/km.

$N_2O$ (commonly known as laughing gas) can be emitted both during combustion and as an effect of secondary reactions in catalysts, particularly in cold conditions. It is assessed for its high global warming potential (300) and the chosen maximum accepted emission level is 40 mg/km, equivalent to 12g/km $CO_2$.

Other unforeseen chemical species not included in this criteria, which might derive from additives, catalysts etc. will be also assessed and the score for this criteria might be zero if there are indications of severe potential health risks (applying if needed the precautionary principle) and insufficient measures are taken to deal with such emissions.

| CO EMISSIONS | SCORE |
|---|---|
| > 500 mg / km | 0 |
| > 400 ≤ 500 mg / km | 1 |
| > 300 ≤ 400 mg / km | 2 |
| > 200 ≤ 300 mg / km | 3 |
| > 200 ≤ 100 mg / km | 4 |
| ≤ 100 mg / km | 5 |

**Table 6: Emissions of CO criteria**

**Scoring and weighting**

Each of the criteria is assigned a number of points connected to different ranges. Entries must receive at least the minimum score of 1 for each category as set out in Table 1 and pass the RDE test with the prescribed conformity factor for all pollutants. A score weighting will be used to weight the different criteria to be used in ranking the submissions, thus highlighting the importance of each criteria

| CRITERIA CATEGORY | SCORE WEIGHTING |
|---|---|
| a) $NO_X$ Emissions | 3 |
| b) Particles emissions (mass and number > 23nm) | 2 |
| c) HC emissions | 1 |
| d) Emissions of other pollutants | 1 |

**Table 7: Scoring and weighting**

If the results for any of the technical criteria for different entries differ by less than the measurement error range[14], then those systems will be considered tied for that category and given the higher of the two scores.

If two entries' total scores are tied, the entry with the highest score for $NO_X$ will be ranked higher, should this not be sufficient to break the tie, the same approach will be applied in turn for PN, HC and CO and other pollutants.

The EC reserves the right to modify these criteria and modify these Rules of Contest in response to emerging market or technology developments.

## 6. DOCUMENTS

The mandatory supporting documents are set out in the application form.

Contestants may be asked at a later stage for further documents (at hearings or for legal entity validation, bank account validation, ethics review, declaration of honour on exclusion grounds, etc.).

## 7. PROCEDURE

Any individual or team (consortia among several participants) willing to participate should register for the contest as soon as possible but at latest by 12 June 2017.

In case of consortia among several participants, one lead applicant has to be selected to act as the main contact legal entity. Only the lead applicant will be able to submit the application in the system.

The submission in the Participant Portal must be performed by completing Part A and Part B of the submission forms, and these shall report all required information on the proposed technology as well as test results indicated in Part B for both the unmodified donor vehicle and the prototype, including emissions on the three prescribed test cycles performed at an external independent laboratory, prior to submission.

The technology has therefore to be developed and installed on the donor vehicle already well in advance of the submission deadline to allow for mandatory initial testing according to the conditions specified in Part B of the submission forms.

Since testing will take place in winter, the vehicles should be provided with both summer and winter tyres, as local regulation impose the latter for driving on public roads. In order to check for possible cycle beating, chassis dyno tests in JRC will be conducted at a different temperature between 15 and 30 degrees and with the vehicle on 4-wheel-drive bench.

In case the proposed solution uses any consumable other than lubricants and fuel, the contestants should deliver with the vehicle a quantity sufficient for 1000 km of driving. Any instructions on the use and any warning on the handling the consumables should be also provided.

If multiple vehicles of different Euro standards are modified with the retrofit technology, all the required documentation in the Part B of the application template shall be provided separately and fully for each vehicle under the same prize submission.

By 12 September 2017 17:00:00 CET participants have to submit the application through the Participant Portal and deliver the prototype (i.e. the donor vehicle with the installed innovation which has already been tested by the applicants, with no modifications) to the JRC in Ispra.

Since RDE testing might take place in autumn/winter, the vehicles should be provided with both summer and winter tyres, as local regulation impose the latter for driving on public roads from November.

[14] To be defined for each pollutant in the measurement methodology annex, to be published on the Competition websites

Joint Research Centre's labs address:

Attn: Alois Krasenbrink
European Commission
Joint Research Centre
Institute for Energy and Transport
Via E. Fermi 2749,
I-21027 Ispra (VA)
Italy
Email: Alois.Krasenbrink@ec.europa.eu

Contestants are allowed to submit more than one solution/concept if they wish so but each one must be registered under a separate application.

Applications will be evaluated by an independent expert jury between October 2017 and March 2018.

The jury will evaluate all eligible applications against the award criteria as described in part 5 of this document. The role of the expert jury will be to evaluate the accuracy and robustness of the provided data and assessments, and mark them accordingly.

In order to be able to better evaluate and compare applications, applicants may be invited to hearings to provide explanations to any consequential questions by the jury. The Commission may decide to submit the applicant prototype for verification testing at JRC, which can include chassis dynamometer and Real Driving Emissions tests.

In order to check for possible cycle beating, chassis dyno tests in JRC can be conducted at a different temperature between 15 and 30 degrees and with the vehicle on 4-wheel-drive bench.

The Commission and the JRC will not take any responsibility in case of any problems deriving from incomplete or missing instructions on the operation of the vehicle and its systems.

On the basis of the evaluation, the Commission will decide on the award of the prize.

## 8. OTHER CONDITIONS

### 8.1 Liability

The Commission shall not be held liable for any damage caused or sustained by any of the participants, including any damage caused to third parties as a consequence of or during the implementation of the activities related to the contest.

### 8.2 Applicable law and competent jurisdiction

The contest is governed by the applicable Union law complemented, where necessary, by the law of Belgium. The General Court or, on appeal, the Court of Justice of the European Union, shall have sole jurisdiction to hear any dispute between the Union and any participant concerning the interpretation, application or validity of the rules of this contest, if such dispute cannot be settled amicably. For participants that are International organisations such disputes with the Commission relating to the Contest must - if they cannot be settled amicably - be referred to arbitration.

The Permanent Court of Arbitration Optional Rules for Arbitration Involving International Organisations and States in force at the date of entry into force of the Contest will apply.

## 8.3 Payment arrangements

The prize money will be paid in one instalment after the award ceremony by bank transfer, provided all the requested documents have been submitted.

The EC reserves the right not to award the prize fund should the jury deem that no applicant has met all the criteria for the prize.

The EC will only award the prize if the jury consider an entry or entries to have met or exceeded the challenge. Should no submission reach the minimum targets and therefore the prize cannot be awarded, however, the Commission reserves the right to select up to three top ranking entries (if they are particularly promising or sufficiently close to the targets) for the attribution of an Acknowledgment of quality of the application to encourage further development.

Winners of the Competition are encouraged to use the prize money to implement their ideas and make it benefit their project and its target group, but no strict condition is set as regards the use of the funds. Winners are responsible for payment of taxes and charges applicable when using the prize money.

## 8.4 Publicity — Promoting the prize — Visibility of EU funding

### 8.4.1 Publicity by the winner(s)

The winner(s) must promote the action and its results, by providing targeted information to multiple audiences (including the media and the public) in a strategic and effective manner.

Unless the Commission requests or agrees otherwise or unless it is impossible, any communication activity related to the action (including in electronic form, via social media, etc.) must:

a) display the EU emblem and

b) include the following text:

"This action has been awarded the [insert prize name] from the European Union's Horizon 2020 research and innovation programme".

When displayed together with another logo, the EU emblem must have appropriate prominence.

For the purposes of its obligations, the winner(s) may use the EU emblem without first obtaining approval from the Commission.

This does not, however, give it the right to exclusive use. Moreover, the winner(s) may not appropriate the EU emblem or any similar trademark or logo, either by registration or by any other means.

### 8.4.2 Publicity by the Commission

The Commission may use, for its communication and publicising activities, information relating to the action, documents notably summaries for publication and deliverables as well as any other material, such as pictures or audio-visual material that it receives from the contestants including in electronic form). If the right of use is subject to rights of a third party (including personnel of a contestant), the contestant must ensure that it has obtained any necessary approval from the third party concerned.

The Commission will publish the name of the winner(s), their origin, the amount of the prize and its nature and purpose— unless the winner has requested to waive this publication (because disclosure risks threatening its security and safety or harm its commercial interest). The Commission may publish similar information about the other contestants under the same conditions.

Photos and videos taken by the Commission either in preparation of the award ceremony or during the award ceremony or other events related to the Prize (such as testing, brokering and communication events, etc.) are the sole property of the Commission and might be used for its communication and publicising activities, while respecting Intellectual Property rights.

## 8.5 Dissemination and exploitation of results

The winner(s) must comply with the obligations set out in Title III of the Rules for Participation Regulation No 1290/2013[15] and the following additional exploitation obligations:

Intellectual Property Rights relating to the results will remain with the winner and the winner must exploit the results.. If a winner fails to commercially exploit the results within 3 years after the award of the prize, it must – upon request – grant a royalty-free licence s to any third party established in the EU Member States or Associated Countries to commercially exploit the results

The winner must provide any information requested by the Commission regarding the dissemination and exploitation of the results.

## 8.6 Processing of personal data

### 8.6.1 Processing of personal data by the Commission

Any personal data will be processed by the Commission under Regulation No 45/2001[16] and according to the 'notifications of the processing operations' to the Data Protection Officer (DPO) of the Commission (publicly accessible in the DPO register).

Such data will be processed by the 'data controller' of the Commission for the purposes of the award, implementation and follow-up of the prize or protecting the financial interests of the EU or Euratom (including checks, audits and investigations; see below).

The persons whose personal data are processed have the right to access and correct their own personal data. For this purpose, they must send any queries about the processing of their personal data to the data controller, via the contact point indicated in the 'service specific privacy statement(s) (SSPS)' that are published on the Participant Portal.

They also have the right to have recourse at any time to the European Data Protection Supervisor (EDPS). The winner(s) consent that the Commission publishes (in whatever form and medium) the following information:

a) name

b) Member State of origin (address or NUTS 2 region)

c) their activities in relation to the award of the prize (via the summary for publication they provided)

d) prize amount.

### 8.6.2. Processing of personal data by the contestants

The contestants must process personal data in compliance with applicable EU and national law on data protection (including authorisations or notification requirements).

The contestants may grant their personnel access only to data that is strictly necessary for the award, implementation or follow-up of the prize.

The contestants must inform the personnel whose personal data are collected and processed by the Commission. For this purpose, they must provide them with the service specific privacy statement(s) (SSPS) (see above), before transmitting their data to the Commission.

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[15] Regulation (EU) No 1290/2013 of the European Parliament and of the Council of 11 December 2013 laying down the rules for participation and dissemination in "Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)" (OJ L 347, 20.12.2013 p.81).

[16] Regulation (EC) No 45/2001 of the European Parliament and of the Council of 18 December 2000 on the protection of individuals with regard to the processing of personal data by the Community institutions and bodies and on the free movement of such data (OJ L 8, 12.01.2001, p. 1).

## 8.7 Ethics

The activities must be carried out in compliance with:

a) ethical principles (including the highest standards of research integrity — as set out, for instance, in the European Code of Conduct for Research Integrity[17] — and including, in particular, avoiding fabrication, falsification, plagiarism or other research misconduct) and

b) applicable international, EU and national law.

No prize will be awarded for activities carried out outside the EU, if they are prohibited in all Member States.

The contestants must ensure that the activities have an exclusive focus on civil applications.

The contestants must ensure that the activities do not:

a) aim at human cloning for reproductive purposes

b) intend to modify the genetic heritage of human beings which could make such changes heritable (with the exception of research relating to cancer treatment of the gonads) or

c) intend to create human embryos solely for the purpose of research or for the purpose of stem cell procurement, including by means of somatic cell nuclear transfer.

Research activities involving human embryonic stem cells (hESC) are moreover subject to the conditions set out in the Statement of the Commission related to research activities involving human embryonic stem cells.

For more information and best practice, see the Online Manual, the sample 'proposal template' for prizes and the guidance 'How to complete your ethics self assessment'.

## 8.8 Conflict of interests

The contestants must take all measures to prevent any situation where the impartial and objective award of the prize is compromised for reasons involving economic interest, political or national affinity, family or emotional ties or any other shared interest ('conflict of interests').

They must inform the Commission without delay of any situation constituting or likely to lead to a conflict of interests and immediately take all the necessary steps to rectify this situation.

The Commission may verify that the measures taken are appropriate and may require additional measures to be taken by a specified deadline.

## 8.9 Liability for damages

The Commission cannot be held liable for any damage caused to the contestants or to third parties as a consequence of the award or implementation of the prize, including for gross negligence.

The Commission cannot be held liable for any damage caused by any of the contestants, as a consequence of activities linked to the prize.

Applicants participate in the contest at their own risk and costs. The applicants should obtain liability insurance, or satisfactorily demonstrate financial responsibility, during the period of the competition, including during transport to and from JRC at Ispra, accidents during testing due to faulty instructions, design or manufacturing of the prototype.

[17] The European Code of Conduct for Research Integrity of ALLEA (All European Academies) and ESF (European Science Foundation) of March 2011.http://www.esf.org/fileadmin/Public_documents/Publications/Code_Conduct_ResearchIntegrity.pdf

## 8.10 Checks, audits and investigations

The Commission, the European Anti-Fraud Office (OLAF) and the Court of Auditors may carry out checks, audits and investigations in relation to the prize.

## 8.11 Withdrawal of the prize — Recovery of undue amounts

The Commission may withdraw the prize and recover all payments made, if it finds out that:

a) false information or fraud or corruption was used to obtain the prize or

b) the winner was not eligible or should have been excluded.

## 8.12 Administrative and financial penalties

If a contestant has committed irregularities or fraud or has made false declarations, the Commission may also impose:

an administrative penalty excluding the contestants from all contracts, grants and contests financed from the EU or Euratom budget for a maximum of five years (or 10 years in case of repetition) and/or

a financial penalty between 2% and 10% of the value of the prize (or between 4% and 20% in case of repetition).

## 8.13 Cancellation of the contest

The Commission may cancel the contest or decide not to award a prize — without any obligation to indemnify contestants —, if:

a) the objective of the contest has already been achieved

b) no applications are received

c) the jury does not find a winner or

d) the winner is not eligible or must be excluded.

# 9. CONTACT

For more information, please see the prize website.

In case of questions, please contact EC-ENGINE-RETROFIT-PRIZE@EC.EUROPA.EU

## 10. DEFINITIONS

In the context of the Horizon prize for the Engine retrofit for clean air the following specifications and definitions shall apply:

| TERMS | SPECIFICATIONS AND DEFINITONS |
|---|---|
| **C-class vehicle** | A compact car similar in size to a Volkswagen Golf, Renault Megane, Peugeot 308, Fiat Tipo, Opel Astra or Ford Focus covering a large part of the European market and therefore providing a large impact, since their engines are normally also applied to vehicles in lower and higher categories. |
| **Chassis dyno** | A chassis dynamometer consists of a platform with a pair of rollers, a braking or power absorption system, and software. The dynamometer simulates the vehicle resistance as function of the vehicle speed using as inputs the vehicle mass and 2 (or 3) constants of a parabolic equation (road load coefficients). |
| **Common Artemis Driving Cycles (CADC)** | A suite of chassis dynamometer test cycles developed in the ARTEMIS EU Project and deemed to be a realistic representation of driving behaviour in different conditions (urban, extra-urban, motorway). In the motorway cycle, the high speed variant going up to 150 km/h shall be used. |
| **Conformity factor (CF)** | A multiplier, applied to the chassis dyno-based limits in Euro regulations that takes into account measurement errors of the portable instruments with respect to those installed on the chassis dyno. For the purpose of this prize CR equals 1.2 |
| **Diesel engine** | An engine where the combustion of a fuel, (normally a fossil fuel or a blend with biofuels in low percentages) occurs by compression with an oxidiser (usually air) in a combustion chamber that is an integral part of the working fluid flow circuit. In a diesel engine the expansion of the high temperature and high pressure gasses produced by combustion, apply direct force to some component of the engine. |
| **Donor vehicle** | A C-class compact vehicle on which the innovation shall be installed to demonstrate its performance under real driving conditions on the road as well as under standardized conditions in the laboratory. Modifications to the donor vehicle other than for installing the innovation are not allowed, but a maximum volume of 20l of trunk space can be taken in the donor vehicle for the purpose of installing the device. |
| **Euro 5/Euro 6** | Limits for pollutant emissions of new vehicles sold in the EU member states after 2009 and 2014 respectively according to REGULATION (EC) No 715/2007 of the European Parliament and of the Council and Commission Regulation (EU) No 459/2012. |
| **Fuel and lubricants** | Fluids which are used in a conventional engine to provide energy and reduce friction respectively. For the purpose of this prize only diesel and its commercial low blends according to Annex II of Directive 2009/30/EC of the European Parliament and of the Council of 23 April 2009 can be used.<br><br>In initial testing participants are allowed to use any commercially available type of diesel fuel and any standard lubricant indicated in the user manual by European automotive OEMS. Final testing at JRC will be performed using the fuel in the car tank, and/or a standard market fuel available there.<br><br>Lubricants for final testing shall be the ones provided in the submitted engine by the applicant, and should be clearly identified in the submission papers in case a need for replenishing emerges during testing. |

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| **Fuel efficiency** | Fuel efficiency is the volume of fuel consumed per 100 km of driving distance [l/100 km], measured on the road or chassis dynamometer. |
| **Initial testing** | The testing which is required to accompany a submission. For the purpose of this prize, this applies both to the modified donor vehicle, to establish a baseline, and to the retrofitted prototype. It has to be performed prior to submission on a chassis dyno by a certified laboratory on behalf of applicants and according to the requirements defined hereafter. All costs should be covered by the applicants. |
| **NEDC** | The New European Driving Cycle (NEDC) is the chassis dynamometer test cycle used to determination of polluting and $CO_2$ emissions and fuel consumption from light-duty vehicles for type approval purposes. For the purpose of this prize, however, it will be performed at a lower temperature than in the standard certification test. |
| **Not-to-exceed (NTE)** | NTE is the limit that should not be exceeded by the pollutant emissions of a vehicle measured according to a Real Driving Emissions procedure. |
| **$NO_X$** | A generic term for a mixture of nitrogen monoxides NO and $NO_2$ (nitrogen dioxide). They are produced from the reaction of atmospheric nitrogen and oxygen during combustion at high temperatures. |
| **On Board diagnostic (OBD)** | A vehicle's self-diagnostic and reporting capability. Early versions of OBD would simply illuminate a malfunction indicator light or "idiot light" if a problem was detected but would not provide any information as to the nature of the problem. Modern OBD implementations use a standardized digital communications port to provide real-time data which allow one to rapidly identify and remedy malfunctions within the vehicle. For the purpose of this prize, no access to OBD data should be needed or used in testing. |
| **PN/PM** | Particulate matter refers to very small pieces of solid or liquid matter emitted by a combustion engine. At present, vehicle emission regulations are based on gravimetric filter measurements for particulate matter mass (PM), and optical counting of particles >23 nm diameter for particle number (PN). Additional particles are formed in the air by $NO_X$ and VOC emissions (including those emitted by combustion engines). Together they are suspended in the atmosphere and contribute to atmospheric aerosol, a term which refers to the particulate/air mixture. To ensure that particle targets are achieved by reducing the number of particles and not by shifting them to a smaller size, below the detection threshold of the counting methodology, for the purpose of this prize the reference technology is the wall flow particle filter which is assumed to be installed unless an innovative device or combustion system is proposed. In this case its efficiency shall be demonstrated by the applicant to be the same or better than the reference technology. |
| **Portable emission measurement systems (PEMS)** | Essentially a lightweight and transportable 'laboratory' that measures tailpipe emissions of vehicles during real-world operation on the road. |
| **Powertrain** | The complex of components capable of providing motive power to a car, including the engine, its auxiliary components (pumps, starter etc.) an aftertreatment system and a mechanical transmission system. Hybridisation (i.e. the coupling with other forms of energy to provide propulsive power) is allowed only for systems that do not require modifications to the gearbox and with a limit of 20% on the peak power and 10% on maximum continuous power of the electric machine with respect to the maximum power of the ICE and with a storage based either on a normal lead-acid 12V battery or an additional one not having more than 0.5kWh of energy storage capacity. |

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|---|---|
| **Prototype vehicle** | The donor vehicle after installing the working prototype of the innovative technology. |
| **Real driving emissions** | Test procedure reflecting emissions measured on the road through the use of portable emission measurement systems (PEMS). For information purposes, a definition of these procedures under this prize will be provided shortly on the Prize website. |
| **Retrofit** | Measures taken in the manufacturing industry to allow new or updated parts to be fitted to old or outdated assemblies in order to improve performance and durability and/or decrease costs. In the case of this prize, such parts will aim at reducing the emissions of the existing car engine to which it's applied. |
| **Total Cost of Ownership** | It is defined as buying price plus installation cost, plus cost of operation over 100.000 km, plus or minus any fuel consumption and maintenance cost increase/reduction induced by the innovation over the same duration |
| **Verification testing** | The testing performed at JRC in Ispra (Italy), that will include both chassis dyno and real driving tests. Costs for transport to and from JRC shall be borne by the contestants, while testing costs will be taken up by JRC. |
| **WLTP** | The worldwide harmonized light vehicles test procedure (abbreviated WLTP) includes a new chassis dynamometer test cycle (WLTC) for the determination of emissions and fuel consumption from light-duty vehicles. In 2017 it will replace the European NEDC procedure for type approval testing of light-duty vehicles. For the purpose of this prize, however, it will be performed at a lower temperature than in the standard certification test. |
| **Working prototype** | Presents the final design, aesthetics, materials and functionality of the intended submission. The construction of a fully working full-scale prototype is the ultimate proof of concept demonstrating its functionality. |