



European  
Commission

# Horizon Prize

CLEANEST ENGINE  
OF THE FUTURE



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## RULES OF THE CONTEST



## 1. THE HORIZON PRIZE FOR THE CLEANEST ENGINE OF THE FUTURE

### 1.1 Objectives pursued

The Horizon Prize for the Cleanest Engine of the future aims at improving air quality by reducing excessive polluting emissions by cars and light commercial vehicles. Since engines are the main contributors to vehicular emissions, the prize aims at spurring the development of advanced lean burn engine and powertrain technologies using conventional fuels that reduce emissions of pollutants, in real driving conditions on the road.

The focus will be on reducing the most dangerous pollutants, NO<sub>x</sub> and particulate matter (PN/PM), to the lowest possible level, while limiting other emissions. At the same time, such future engines will also have to contribute to the Greenhouse Gas emissions reduction targets agreed at COP21, therefore increased energy efficiency and a reduction of climate-forcing pollutants are also an objective of the prize.

While the parallel development of electrified propulsion, that delivers even better results, is currently underway, it is likely that for some applications conventional combustion engines will remain important for some time to come. Reducing their emissions is therefore of paramount importance to improve air quality in urban areas.

### 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<sub>x</sub> and ozone alone<sup>1</sup>). 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 them are using alternative powertrains and fuels.<sup>2</sup>

The prize aims at stimulating innovation to reduce to sustainable levels the excessive polluting emissions currently produced in real driving conditions by internal combustion engines used on cars (and often the same engines are applied to light commercial vehicles). The solution will improve air quality in EU cities, thus improving health and quality of life of their citizens.

The Horizon Prize for the Cleanest Engine of the Future will be awarded to the applicant or team demonstrating the lowest emission of NO<sub>x</sub> (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-driving conditions on the road as well as under standardized conditions in the laboratory combined with improved fuel efficiency while complying with operational requirements such as good driving performance, safety, noise and an acceptable costs.

## 2. PRIZE AMOUNT: 3.5 MILLION EUR<sup>3</sup>

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

<sup>2</sup> <http://www.acea.be/statistics>

<sup>3</sup> 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 2019 budget they are subject to the availability of the appropriations provided for in the draft budget for 2019 after the adoption of the budget 2019 by the budgetary authority or, if the budget is not adopted, as provided for in the system of provisional twelfths.

### 3. DEADLINES & ADMISSIBILITY

<b>DEADLINES<sup>4</sup></b>	
<b>LAUNCH OF THE CONTEST</b>  Call for applications is published on the Participant Portal All detailed information is available on the Horizon Prize website	20 April 2016
<b>DEADLINE FOR REGISTRATION</b>  Contestants register by sending email to <a href="mailto:RTD_FUTURE_ENGINE_PRIZE@EC.EUROPA.EU">RTD_FUTURE_ENGINE_PRIZE@EC.EUROPA.EU</a>	20 May 2019 at 17:00:00 CET <sup>5</sup>
<b>CLOSING DATE FOR SUBMISSION</b>  Applicants submit the application form Part A and Part B through the Participant Portal and deliver the prototype vehicle to JRC	20 August 2019 at 17:00:00 CET <sup>6</sup>
<b>EVALUATION</b>  Applicant submissions are evaluated against the award criteria described in this document, and on the basis of verification testing performed by JRC	September 2019 - March 2020
<b>AWARD</b>  Announcement of the Winner of the Horizon Prize for the Cleanest Engine of the Future	April-June 2020

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 [RTD\\_FUTURE\\_ENGINE\\_PRIZE@EC.EUROPA.EU](mailto:RTD_FUTURE_ENGINE_PRIZE@EC.EUROPA.EU) by 20 May 2019. 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.

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<sup>4</sup> This indicative timescale may be subject to review and update by the EC

<sup>5</sup> Central European Time = Brussels local time.

<sup>6</sup> Central European Time = Brussels local time.

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 the lowest emission of NO<sub>x</sub>, PN/PM and other pollutants on the test bench, which can be verified by the JRC on the roller bench and in real driving conditions while at the same time being capable of delivering good performance in the other domains defined below to ensure conformity with operational requirements and therefore applicability.

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
- Maintenance requirements and durability: must be compatible with applicable legislation and not imposing more than 10€ additional maintenance/consumables costs per 1000km with respect to vehicles currently on the market in the same category.
- Performance and driveability: must be able to be driven on the prescribed test cycles and have acceleration similar to that of vehicles on the market in the same category at the time of closure of the prize (not worse than 12 seconds from 0-100 and not more than 30 seconds from 80 to 120 km/h) and response lag and torque discontinuities must not be worse than any vehicle on the market in the same category at the time of closure of the prize.

The innovation shall be installed for testing purposes on a C-class compact vehicle - prototype vehicle. (in the top of C class EU sales,<sup>7</sup> average over the last three years, but limited to hatchback and three volumes family car bodies).

No modification to the body, the chassis and the auxiliaries of the donor vehicle is accepted (in particular to enhance the energy efficiency of the vehicle), except if the need to integrate the technology is fully demonstrated. A maximum volume of 50 litres of trunk space can be taken in the donor vehicle for the purpose of installing the device (in a serial production vehicle such space might be recovered by appropriate design).

Any gearbox can be used be it the one originally installed in the donor vehicle, its modification or a completely new one. Gearbox, engine and aftertreatment management shall not have alternative strategies or user-selectable drive modes.

Since the objective of the prize is to promote the improvement of engine technology, engines/powertrains/cars which use main propulsive energy, even partially, coming from other forms of energy storage than the main fuel are excluded: hybrids (electric, compressed gases, hydraulic etc.), plug-in hybrids and in general systems using large energy storage capability beyond the main fuel will not be admissible. It is understood that, in the future phase of commercialization and deployment of the technology, such an engine will most likely be combined with some form of hybrid system, and therefore will achieve even higher energy efficiency and lower emissions. The aim of the prize is however to achieve low emissions and higher efficiency from the base engine.

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<sup>7</sup> A list of acceptable models and engines will be provided on the Competition websites

For the purpose of this prize, fuels are only diesel or gasoline and their 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.

## 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<sup>8</sup> and for Crimean legal persons and that entities from non-EU Member States that are covered by Council sanctions are not eligible to participate<sup>9</sup> ([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)<sup>10</sup>:

- 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;

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<sup>8</sup> 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).

<sup>9</sup> For the list of persons, groups and entities subject to EU financial sanctions, see [http://eeas.europa.eu/cfsp/sanctions/consolidated-list\\_en.htm](http://eeas.europa.eu/cfsp/sanctions/consolidated-list_en.htm).

<sup>10</sup> 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.

- (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;
- d) it has been established by a final judgement that the applicant is guilty of any of the following
- (vi) 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;
  - (vii) 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;
  - (viii) participation in a criminal organisation, as defined in Article 2 of Council Framework Decision 2008/841/JHA;
  - (ix) money laundering or terrorist financing, as defined in Article 1 of Directive 2005/60/EC of the European Parliament and of the Council;
  - (x) 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;
  - (xi) 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,<sup>11</sup> 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<sup>12</sup>

### 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<sub>x</sub>/NO<sub>2</sub>
- b) Levels of PN/PM emissions
- c) Levels of Hydrocarbon (HC) emissions
- d) Emission of other pollutants (NH<sub>3</sub>, N<sub>2</sub>O, CO, CH<sub>2</sub>O)
- e) Fuel Efficiency

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 during the initial testing prior to submitting the application 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<sub>2</sub> regulations" report<sup>13</sup> should be applied in

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<sup>11</sup> 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.

<sup>12</sup> 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

<sup>13</sup> [http://ec.europa.eu/clima/policies/transport/vehicles/cars/docs/report\\_2012\\_en.pdf](http://ec.europa.eu/clima/policies/transport/vehicles/cars/docs/report_2012_en.pdf)

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.

In initial testing participants are allowed to use any commercially available type of gasoline and 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 driving tests (including under specific conditions such as altitude, use of auxiliaries, cold start and regenerations, with a conformity factor = 1.2). All limits are technology neutral and therefore there is no difference depending on the type of fuel used by the innovation.

In case of large weight differences between the different vehicles submitted by contestants, since the aim of the prize is to assess engine performance and not vehicle design, the total weight of the vehicles tested in real driving conditions could be made equal by ballasting, while performance on chassis dyno tests would be equalised by using the same road loads coefficients for all applicants defined in the Part B of the submission forms.

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.

CRITERIA	THRESHOLDS
Maximum NO <sub>x</sub> emissions	60mg/km
Maximum PN/PM emissions	6 x 10 <sup>11</sup> , measured with a 10nm threshold, 1 mg/km mass
Maximum HC emissions	60 mg/km
Maximum emissions of other pollutants (NH <sub>3</sub> , N <sub>2</sub> O, CH <sub>2</sub> O, CO)	30 mg/km for NH <sub>3</sub> , 15 mg/km for N <sub>2</sub> O, 10 mg/km for CH <sub>2</sub> O and 400 mg/km for CO
Minimum Fuel Efficiency	5 l/100 km

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

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

## ASSESSMENT GRID FOR THE AWARD CRITERIA

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

### Award criteria

These criteria define the scoring of measured levels of NO<sub>x</sub>, NO<sub>2</sub>, PN/PM, and other pollutants, as well as fuel efficiency.

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 3 or 5, where 0 means that the results are not sufficient, and 3 or 5 is attributed to the best preferable performance. All applications shall meet a threshold score of 1 on all criteria.



### a) Levels of NO<sub>x</sub> and NO<sub>2</sub>

NO<sub>x</sub> emission levels refer to the amount of NO<sub>x</sub> measured on chassis dyno and verified using portable emission measurement systems in real driving conditions where applicable. Intermediate values are listed to incentivize advancements towards low-cost systems that can meet the ultimate target of 20 mg NO<sub>x</sub>/km.

NO <sub>x</sub> EMISSIONS	SCORE
> 60mg km	0
> 50mg ≤ 60mg km	1
> 40mg ≤ 50mg km	2
> 30mg ≤ 40mg km	3
> 20mg ≤ 30mg km	4
≤ 20mg km	5

**Table 2: NO<sub>x</sub> Emissions Levels criteria**

NO<sub>2</sub> emission levels refer to the amount of NO<sub>2</sub> measured on chassis dyno and verified using portable emission measurement systems in real driving conditions where applicable. Since this is the pollutant regulated in air quality laws, and since some catalysts combinations can generate artificially high NO<sub>x</sub>/ NO<sub>2</sub> ratios, it is given specific targets. For this reason, a multiplier of 1.5 would be applied to the NO<sub>x</sub> score if the NO<sub>2</sub>/NO<sub>x</sub> ratio is lower than 30% and/or NO<sub>2</sub> is lower than 20 mg/km (whichever is higher in absolute value). A weight of 0.5 will be applied instead if the NO<sub>2</sub>/NO<sub>x</sub> ratio is higher than 60% and/or NO<sub>2</sub> is higher than 40 mg/km (whichever is lower in absolute value).

### b) Levels of PN/PM emissions

Emissions will be measured in terms of particle mass collected on a filter which shall be below 1mg/km. If this condition is satisfied, the PN value will be used for scoring, otherwise the score for this criteria will be zero.

The highest allowed value is that mandated in the Euro 6 legislation, which however counts only particles above 23nm. The particles taken into account for the purpose of this prize will instead be any solid particles (carbonaceous and metal or other chemical species resulting from additives or other installed devices) larger than 10 nm. 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 particle-removing device or engine measure is proposed. In this case its efficiency shall be demonstrated by the applicant to be the same or better than the reference technology.

NUMBER OF PARTICLES (>10 NM) PER KM	SCORE
> 6x10 <sup>11</sup> per km	0
6x10 <sup>11</sup> per km or lower	1
1x10 <sup>11</sup> per km or lower	2
5X10 <sup>10</sup> per km or lower	3
1X10 <sup>10</sup> per km or lower	4
5X10 <sup>9</sup> per km or lower	5

**Table 3: Number of Particles per km criteria**

### 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 driving conditions where applicable. These pollutants are important because they include known carcinogens and contribute to ozone and particles formation and might be higher than with current technologies when using advanced combustion systems or not sufficiently effective catalysts.

HC EMISSIONS	SCORE
> 60 mg km	0
> 50 mg ≤ 60 mg km	1
> 40 mg ≤ 50 mg km	2
> 30 mg ≤ 40 mg km	3
> 20 mg ≤ 30 mg km	4
≤ 20 mg km	5

**Table 4: HC emissions level criteria**

### d) Levels of emission of other pollutants (NH<sub>3</sub>, N<sub>2</sub>O, CO, CH<sub>2</sub>O)

Other pollutants, some currently unregulated by European Legislation (NH<sub>3</sub>, N<sub>2</sub>O, CH<sub>2</sub>O), will be measured and the resulting scores averaged to give a final score for 'emissions of other pollutants'. They are assessed in order to verify that the new technologies will not create new environmental problems.

NH<sub>3</sub> (commonly known as ammonia) can be emitted both during combustion and as an effect of improperly-controlled reactions in ammonia-based catalysts.

N<sub>2</sub>O (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 limits are equivalent to 4.5g/km CO<sub>2</sub> or less.

CO (commonly known as carbon monoxide) is normally emitted during combustion and is toxic as it inhibits oxygen exchange in the lungs.

CH<sub>2</sub>O (commonly known as formaldehyde) can be emitted during combustion, particularly when some biofuels are used.

Other unforeseen chemical species not included in these criteria, which might derive from additives, catalysts etc. will be also assessed and the entry might be scored with zero in the overall criteria if these are deemed to represent a potential health issue and insufficient measures are taken to deal with such emissions.

For example, if a vehicle emitted 15 mg/km NH<sub>3</sub>, 4 mg/km of N<sub>2</sub>O, 130 mg/km CO and 9 mg/km of CH<sub>2</sub>O the number of points will be as follows: (2+ 3 +3+ 1)/4=2.25 points.

EMISSIONS OF OTHER POLLUTANTS	
NH <sub>3</sub> EMISSIONS	SCORE
> 30 mg / km	0
> 20 ≤ 30 mg / km	1
> 10 ≤ 20 mg / km	2
≤ 10 mg / km	3

<b>N<sub>2</sub>O EMISSIONS</b>	<b>SCORE</b>
> 15 mg / km	0
> 10 ≤ 15 mg / km	1
> 5 ≤ 10 mg / km	2
≤ 5 mg / km	3
<b>CO EMISSIONS</b>	<b>SCORE</b>
> 400 mg / km	0
> 300 ≤ 400 mg / km	1
> 200 ≤ 300 mg / km	2
≤ 200 mg / km	3
<b>CH<sub>2</sub>O EMISSIONS</b>	<b>SCORE</b>
> 10 mg / km	0
> 6 ≤ 10 mg / km	1
> 3 ≤ 6 mg / km	2
≤ 3 mg / km	3

**Table 5: Emissions of other pollutants criteria**

### e) Fuel efficiency

Fuel efficiency is a proxy for CO<sub>2</sub> emissions, and it has been selected instead of CO<sub>2</sub> since both gasoline and diesel fuels are allowed. Moreover, this is what end users can easily relate to. It will be assessed on a mix of standard cycles (tested on the bench and reproduced for verification on the road to exclude any defeat device and the use of any flexibility) and will be expressed as litres per 100 kilometre (l/100km).

Since the effect of vehicle mass is neutralised in the tests by choosing standard chassis dyno load coefficient values, the total powertrain mass, and its effect on fuel consumption will be evaluated by the jury and factored in in the fuel efficiency mark.

<b>FUEL EFFICIENCY (L/KM)</b>	<b>SCORE</b>
> 5.5l/100km	0
> 4.5l/100km ≤ 5.5l/100km	1
> 4.0l/100km ≤ 4.5l/100km	2
> 3.5l/100km ≤ 4.0l/100km	3
> 3l/100km ≤ 3.5l/100km	4
≤ 3l/100km	5

**Table 6: Fuel efficiency criteria**

## f) 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 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 <sub>x</sub> emissions	3
b) Particles emissions (mass and number > 10nm)	3
c) HC emissions	2
d) Emissions of other pollutants (NH <sub>3</sub> , N <sub>2</sub> O, CH <sub>2</sub> O, CO)	1
e) Fuel efficiency (l/km)	2

**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<sup>14</sup>, 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<sub>x</sub> will be ranked higher, should this not be sufficient to break the tie, the same approach will be applied in turn for PN, Fuel efficiency, 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 and in part 3 of this document.

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 the latest by 20 May 2019. 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, including emissions and fuel consumption on the three prescribed test cycles performed at an external independent laboratory.

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.

The responsibility and costs of completing the necessary assessments of the solution, and all costs regarding transportation to/from the JRC in Ispra must be covered by the applicants, while JRC testing costs will be borne by JRC.

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<sup>14</sup> To be defined for each pollutant in the measurement methodology annex, to be published on the Competition websites before the closing date of the prize.

By 20 August 2019 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. 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.

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.

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](mailto: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 of more than eight experts between September 2019 and March 2020).

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.

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 Future Engine Prize 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<sup>15</sup> 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 5 years after the award of the prize, it must – upon request – grant a licence under fair and reasonable conditions 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<sup>16</sup> 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.

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<sup>15</sup> 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).

<sup>16</sup> 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).

### 8.6.2. 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.

## 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](#)<sup>17</sup> — 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.

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<sup>17</sup> 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](http://www.esf.org/fileadmin/Public_documents/Publications/Code_Conduct_ResearchIntegrity.pdf)



## 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.

## 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:

- a) 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
- b) 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 [RTD\\_FUTURE\\_ENGINE\\_PRIZE@EC.EUROPA.EU](mailto:RTD_FUTURE_ENGINE_PRIZE@EC.EUROPA.EU)

## 10. DEFINITIONS

In the context of the Horizon prize for the Cleanest engine of the Future the following specifications and definitions shall apply:

TERM	SPECIFICATIONS AND DEFINITIONS
<b>C class vehicle</b>	A compact car similar in size to a Volkswagen Golf, Renault Megane, Peugeot 308, Fiat Tipo, Opel Astra or Ford Focus. This category covers a large part of the European market and therefore provides a large impact, also because their engines are normally applied to vehicles in lower and higher categories too.
<b>CH<sub>2</sub>O</b>	CH <sub>2</sub> O (commonly known as formaldehyde) can be emitted during combustion, particularly when some biofuels are used.
<b>Chassis dynamometer</b>	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).
<b>CO</b>	CO (commonly known as carbon monoxide) is normally emitted during combustion and is poisonous as it inhibits oxygen exchange in the lungs.
<b>Common Artemis Driving Cycles (CADC)</b>	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.
<b>Conformity factor (CF)</b>	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.
<b>Conventional internal combustion engine</b>	An engine where the combustion of a fuel, (normally a fossil fuel or a blend with biofuels in low percentages) occurs with an oxidant (usually air) in a combustion chamber that is an integral part of the working fluid flow circuit. In an internal combustion engine the expansion of the high temperature and high pressure gasses produced by combustion, apply direct force to some component of the engine. For the purpose of this prize, use of the working fluid is allowed, included for heat recuperation and short term storage of energy, but not to generate and store other forms of energy, for instance by hybridizing exhaust-gas-driven compressors to generate and store electricity.
<b>Donor vehicle</b>	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.
<b>Euro 6</b>	Limits for pollutant emissions of new vehicles sold in the EU member states after 2014 according to Regulations (EC) No 715/2007 of the European Parliament and of the Council, and Commission Regulation (EU) No 459/2012.
<b>Fuel and lubricants</b>	Fluids which are used in a conventional engine to provide energy and reduce friction respectively.

<b>Fuel efficiency</b>	Fuel efficiency is the volume of fuel consumed per 100 km of driving distance [l/100 km], measured on the road or chassis dynamometer.
<b>Initial testing</b>	The testing of the prototype which is required to accompany a submission. 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.
<b>Lean burn engine</b>	Refers to an internal combustion engine that burns fuel with an excess of air. In lean burn engines, the air-to-fuel ratio can be 65:1. The air-fuel ratio needed to stoichiometrically combust petrol, by contrast is 14:1. The excess of air in a lean burn engine leads to higher fuel efficiency, fewer hydrocarbon emissions, but can increase the emissions of NO <sub>x</sub> .
<b>NEDC</b>	The New European Driving Cycle (NEDC) is the chassis dynamometer test cycle used to determination of polluting and CO <sub>2</sub> 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.
<b>Not-to-exceed (NTE)</b>	NTE is the limit that should not be exceeded by the pollutant emissions of a vehicle measured according to a Real Driving Emissions procedure.
<b>NO<sub>x</sub></b>	A generic term for a mixture of nitrogen monoxides NO and NO <sub>2</sub> (nitrogen dioxide). They are produced from the reaction of atmospheric nitrogen and oxygen during combustion at high temperatures.
<b>On Board diagnostic (OBD)</b>	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.
<b>PN/PM</b>	<p>Particulate matter refers to very small pieces of solid or liquid matter emitted by a combustion engine. Additional particles are formed in the air by NO<sub>x</sub> 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.</p> <p>At present, vehicle emission regulations are based on gravimetric filter measurements for particulate matter mass (PM), and optical counting of particles &gt;23 nm diameter for particle number (PN). For the purpose of this prize, however, optical counting will instead be performed with a 10nm threshold.</p>
<b>Portable emission measurement systems (PEMS)</b>	Essentially a lightweight and transportable 'laboratory' that measures tailpipe emissions of vehicles during real-world operation on the road.
<b>Powertrain</b>	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. For the purpose of this prize, hybridisation (i.e. the coupling with other forms of energy to provide propulsive power) is not allowed.
<b>Prototype vehicle</b>	The donor vehicle after installing the working prototype of the innovative technology.

<b>Real driving emissions</b>	Test procedure reflecting emissions measured on the road through the use of portable emission measurement systems (PEMS). For information purposes, an exact definition of these procedures under this prize will be provided shortly on the Prize web site.
<b>Verification testing</b>	The testing performed at JRC in Ispra, Italy, that will include both chassis dyno and real driving tests.
<b>WLTP</b>	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.
<b>Working prototype</b>	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.

