
# RULES OF CONTEST

**6 DECEMBER 2017**

# 1. THEME: FUEL FROM THE SUN: ARTIFICIAL PHOTOSYNTHESIS

## 1.1 Objectives pursued

The Horizon Prize for Fuels from the Sun: Artificial Photosynthesis aims to promote new technologies that deliver fuels that can be used as a sustainable alternative to fossil energy and feedstocks for a range of industrial processes. Artificial photosynthesis is considered one of the most promising breakthrough technologies in the field due to its ability to use a combination of sunlight, water and carbon from the air to capture and store solar energy in an efficient and transportable form.

The focus of the prize is on proof-of-concept involving the building of a fully functional, bench-scale prototype device of an artificial photosynthesis synthetic fuel production system. The device to be built needs to integrate the whole artificial photosynthesis process from light capture to fuel production that generates a fuel capable of powering a small engine. Achieving the prize aim and objective will take current research out of the laboratory and into the realms of an engineering challenge, with a view to accelerating research and innovation in the field.

## 1.2 Expected results

Meeting the challenge will stimulate innovation and focus research and development towards energy applications in a new energy technology through increased public and commercial interest. Moreover, it will accelerate the development of new innovative energy conversion systems using solar light and natural elements to produce renewable fuels to be used in industry, housing and transport.

The challenge will also create a stimulus for industrial participation and creation of start-ups, pushing the artificial photosynthesis technology for fuel production to the next level of development.

Considering the innovative approach and the novelty of using artificial photosynthesis for fuel production, the prize will generate interest in the subject and foster interdisciplinary collaboration among potential participants, such as students, young researchers and engineers. The competition is expected to highlight the diversity of potential solutions.

The main expected outcome is a number of innovative devices and systems demonstrating the use of sunlight to produce a fuel ready to be used.

The prize winner will be the participant that will have developed a device that demonstrates the greatest level of efficacy, efficiency, novelty, durability, sustainability and scalability, with points being awarded for autonomous operation. The prize winner is required to verify the capacity of their device to perform these functions through a practical demonstration of its operation alongside other participants at an independent testing venue (a "Grand Final")...

## 2. PRIZE AMOUNT(S): 5.000.000 EUR[1]

## 3. DEADLINES & ADMISSIBILITY

| Deadlines | |
|---|---|
| **Opening of the submission** | 12 December 2017 |
| **Deadline for registration of interest** | 29 June 2020 at 17:00:00 CET |
| **Closing date for submission** | 3 February 2021 at 17:00:00 CET[2] |
| **Evaluation** | February – September 2021 |
| Solution demonstrations by the finalists at JRC Ispra ("Grand Final") | July – September 2021 (1 week therein) |
| **Award** | November – December 2021 |

Participants are invited to declare their intention to participate by registering their Interest via the prize mailbox **EC-FUELFROMSUN-EIC-PRIZE@ec.europa.eu** by the above mentioned deadline. The registration of Interest does not entail any obligation to participate.

Joint applications by a group of participants are admitted. In this case, the participants must appoint a 'lead participant' to represent them towards the Commission. The participants will be jointly responsible and must all fulfil and respect the conditions set out in these Rules of Contest.

Applications must be submitted by the (lead) participant via the Participant Portal Submission Service.

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 your prize application (Part B) is: **150** pages.

Sample application forms will be available on the Participant Portal Reference documents page.

Submissions shall consist of:

1. Part A and Part B application forms submitted through the Participant Portal

[1] In accordance with the budgetary procedure set in the Financial Regulation No 966/2012, the award of a prize must be preceded by the adoption of the respective budget and the adoption of the financing decision. Since the prize amounts are only to be foreseen in the 2020 budget, they are subject to the availability of the appropriations provided for in the draft budget for 2020 after the adoption of the budget by the budgetary authority or, if the budget is not adopted, as provided for in the system of provisional twelfths.

[2] Central European Time = Brussels local time.

2. Delivery, set up and operation of the artificial photosynthesis device at JRC Ispra in accordance with the procedures described herein.

## 4. ELIGIBILITY

### 4.1 Eligibility criteria

The contest is open to all legal entites (i.e. natural or legal persons, including international organisations) or groups of legal entities.

Please note however that special rules may apply for entities from certain countries (see General Annex C to the Main Work Programme).

Please note that the production of fuel in the form of hydrogen and the use of conventional photovoltaic cells for the light harvesting process or to collect light and electrolysers are not permitted

Please also be aware that participants that have already received an EU or Euratom prize cannot receive a second prize for the same activities.

### 4.2 Exclusion criteria

Participants will be excluded if they (or one of them):

- are subject to an administrative sanction (i.e. exclusion)[3]
- are in one of the following situations[4]:
    - bankrupt, being wound up, having their affairs administered by the courts, entered into an arrangement with creditors, suspended business activities or subject to any other similar proceedings or procedures under national law (including persons with unlimited liability for the participant's debts)
    - declared in breach of social security or tax obligations by a final judgment or decision (including persons with unlimited liability for the participant's debts)
    - found guilty of grave professional misconduct[5] by a final judgment or decision (including persons having powers of representation, decision-making or control)

[3] See Articles 131(4) and 106(1) Financial Regulation.

[4] See Articles 138(2) and 106(1), 107 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).

[5] Professional misconduct includes: violation of ethical standards of the profession, wrongful conduct with impact on professional credibility, false declarations/misrepresentation of information, participation in a cartel or other agreement distorting competition, violation of IPR, attempting to influence decision-making processes or obtain confidential information from public authorities to gain an advantage.

- convicted of fraud, corruption, involvement in a criminal organisation, money laundering, terrorism-related crimes (including terrorism financing), child labour or human trafficking (including persons having powers of representation, decision-making or control)

- shown significant deficiencies in complying with main obligations under a procurement contract, grant agreement or grant decision financed by the EU or Euratom budget (including persons having powers of representation, decision-making or control)

- found guilty of irregularities within the meaning of Article 1(2) of Regulation No 2988/95 (including persons having powers of representation, decision-making or control)

- have misrepresented information required for participating in the contest or fail to submit such information

- were involved in the preparation of the prize documents and this entails a distortion of competition.

## 5. AWARD CRITERIA

The prize will be awarded to the entry that best addresses the following cumulative criteria:

- Degree of system integration from light capture to fuel production;
- Device/system performance;
- Production of fuel that will be used in an engine;
- Widest market potential;
- Commercial potential of the device.

The award criteriashall be assessed in the following manner:

**Technical ability**

1. **Degree of system integration from light capture to fuel production (max. 30 points)**
   i. Integrity (max. 10 points)
   ii. Durability (max. 10 points)
   iii. Novelty (max. 10 points
2. **Device/system performance (max. 25 points)**
   iv. Efficacy (max. 13 points)
   v. Efficiency (max. 12 points)
3. **Production of fuel that will be used in an engine. (max. 25 points)**

**Scalability and Sustainability**

**4. Widest market potential (max. 10 points)**
**5 .Commercial potential of the device (max. 10 points)**

### 5.1 Technical Ability

#### 5.1.1 Degree of system integration from light capture to fuel production (max. 30 points)

The devices constructed in pursuit of the prize aim must show that they can perform against several key technical criteria in terms of conversion of sunlight into storable and transportable fuel. The criteria will assess

the degree of Integration of the device.

Integration performance shall be measured using the following parameters:

- Integrity (max. 10 points)
- Durability (max. 10 points)
- Novelty (max. 10 points)

The application shall provide detailed descriptions of the methods and measurement techniques employed in assessing technical ability, acknowledging internationally agreed standards and noting the measurement methods and equipment employed.

5.1.1.1 Integrity

Integrity is a measure of device's integration of the complete artificial synthesis cycle covering inter alia:

- Light capture
- Water splitting
- Carbon reduction ('dark reactions')

Participants shall provide details in their application regarding the level of process integration, including a description key integration challenges and how they were overcome through innovative design.

5.1.1.2 Durability

Durability is a measure of the device's capacity to perform under varying conditions, including variation in sunlight input during the operation cycle (light function), temperature fluctuations, and length of time of un-assisted operation.

Participants shall provide details in their application regarding the operational cycle and taking account of, inter alia, the following factors:

- light cycle(s)/light functions used during device testing;
- ambient temperature conditions and variability;
- duration of un-assisted operation (average, longest etc);
- the methods employed to make such measurements.

5.1.1.3 Novelty

Novelty is a measure of the innovations made in designing, constructing and improving the device's performance during its development. It is a qualitative measure.

Participants shall provide a description in their application regarding, inter alia, the following experiences gained during device development:

- Innovations in materials and genetic engineering involved in the biological and chemical processes applied in the device;
- Innovations on device design and construction materials
- Innovations made in respect of overcoming engineering challenges

Such innovations shall be described in the context of historical technical constraints

### 5.1.2. Device/system performance (max. 25 points)

The devices constructed in pursuit of the prize aim must show that they can perform against several key technical criteria in terms of conversion of sunlight into storable and transportable fuel. The criteria will assess the degree of Performance of the device.

Performance shall be measured using the following parameters:

- Efficacy (max. 13 points)
- Efficiency (max. 12 points)

The application shall provide detailed descriptions of the methods and measurement techniques employed in assessing technical ability, acknowledging internationally agreed standards and noting the measurement methods and equipment employed.

#### 5.1.2.1 Efficacy

Efficacy is a measure of a device's capacity to produce both useful volumes and quality of fuel.

Participants shall provide details in their application regarding:

- Total amount of fuel produced by the device;
- Amount of fuel produced per unit time;
- The fuel quality in terms of the type of fuel produced and its average calorific value per unit volume;
- The methods employed to make such measurements.

#### 5.1.2.2 Efficiency

Efficiency is a measure of the device's capacity to convert sunlight into fuel, also taking into account any energy utilised for ancillary services and materials consumed during operation.

Participants shall provide details in their application regarding:

- levels of solar energy input to the device;
- other energy inputs;
- material inputs;
- fuel output (consistent with Efficacy measurements);
- the calculated efficiency for each and all of these factors;
- the methods employed to make such measurements and calculations.

### 5.1.3 Production of fuel that will be used in an engine. (max. 25 points)

The devices constructed in pursuit of the prize aim must show that they can perform against several key technical criteria in terms of conversion of sunlight into storable and transportable fuel. The criteria will assess the fuel produced by the device and its operation. Participants shall receive maximum 20 points for autonomous operation in respect of energy use. Innovations in carbon dioxide capture and use are not considered within the scope of this prize, and therefore shall not count towards autonomous operation. The performance of the device will be verified and the final score awarded at a 'Grand Final' event.

## 5.2 **Scalability and Sustainability**

### 5.2.1 Widest market potential (max. 10 points)

The market potential will depend not only on the replicability potential of the device but more Importantly on its sustainability. Therefore the device should present no or minimal risk of damage to the environment throughout its lifecycle, including production, use and disposal.

Factors to consider are:

- Materials consumed, in particular toxic, hazardous or rare earth elements use
- Water consumption
- Emissions to air
- Waste production, including hazardous waste.

Participants shall prepare a life-cycle assessment (LCA) of their device using internationally recognised standards and methods, for example ISO 14000 series, taking account as a minimum the factors described. The LCA shall consider the potential effects of scaling-up the technology to a commercial size with possibly widespread deployment. Particular attention shall be given to the type and levels of material consumed including water.

### 5.2.2 Commercial potential of the device (max. 10 points)

The commercial potential of the device developed in pursuit of the prize aim Is linked to its scalability potential in terms of replicability, manufacturing value chain and cost competitivity. The criteria will be assessed on the following:

- Replicable in circumstances outside that of the prize competition conditions, in order to support wide market applicabiity
- Capable of being rolled-out and scaled-up within a tangible timeframe, without facing significant technical barriers (e.g. materials availability)
- Commercially viable or have good prospects to become commercially viable in the near future.
- Cost analysis of the device and Its cost prospect at commercial scale

Participants shall provide a description of these and other relevant factors affecting commercialisation of the technological innovations made and the capacity to further exploit the device developed in pursuit of the prize.

## 6. DOCUMENTS

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

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

## 7. PROCEDURE

All complete applications will pass to jury review. The jury evaluation is planned to take place between February 2021 and September 2021.

The jury will evaluate each application against the award criteria and score them as follows (half marks are possible, decimals are not):

| Criterion | Threshold | Maximum points |
|---|---|---|
| 1. Degree of system integration from light capture to fuel production | 25 | 30 |
| 2. Device/system performance | 15 | 25 |
| 3. Production of fuel that will be used in an engine | 15 | 25 |
| 4. Widest market potential | 5 | 10 |
| 5. Commercial potential of the device | 5 | 10 |
| **Total** | **65** | **100** |

The 10 best applications as scored by the jury in respect of criteria 1, 2, 4, and 5 will be invited as finalists to demonstrate their solutions during the Grand Final, which will take place at JRC Ispra during one week between July and September 2021. For applications with the same score, the jury will determine a priority order according to the following approach: the score for criterion 1 will be given a weight of 2 and the score for criterion 5 will be given a weight of 1.5. Criteria 3 will be scored after this Grand Final.

The Grand Final Verification will involve the following:

- Participants shall transport their device to JRC Ispra at a time to be specified, and set-up it on an outdoor pad not exceeding 5 metres by 5 metres and 3 metres in height. A maximum of 48 hours will be allowed for set-up and commissioning/initial testing;
- Inspection of the device by expert jurors to verify its design and materials use and inputs during set-up and commissioning;
- Simultaneous unassisted operation of all devices for a continuous period of 72 hours using natural sunlight. Pure carbon dioxide at a pressure of 1 atm, and mains eletricity and water will be supplied to all test pads;
- Evaluation of the fuel produced over the operating period through its combustion and powering a Stirling engine.

After the Grand Final the jury will finalise the evaluation and assign the final scores for all criteria.

If two or more applications tie for the first rank, the price will be equally divided and awarded to all.

On the basis of the evaluation by the jury, the Commission will decide on the award of the prize.
All participants will be informed by the end of 2021 on the outcome of their application..

A sample of produced fuel shall also be retained for laboratory analysis by the JRC.

Further information regarding the fuel testing conditions will be provided via the prize web site with respect to, inter alia:

1. The type and size of the Stirling engine testing device;
2. The fuel delivery specification for the Stirling engine testing device;
3. The logistical arrangements for travel to and set-up of devices at JRC Ispra.

## 8. OTHER CONDITIONS

## 8.1 Payment arrangements

The prize money (EUR 5.000.000) will be paid to the (lead) participant in one instalment after the award ceremony by bank transfer, provided all the requested documents have been submitted.

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

8.2.1 Publicity by the winner(s)
Both finalist(s) and the winner(s) must promote the prize 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/activity/person was finalist for/winner of the 'Fuel from the Sun: Artificial Photosynthesis' 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 their obligations, the finalist(s) and 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, they may not appropriate the EU emblem or any similar trademark or logo, either by registration or by any other means.

8.2.2 Publicity by the Commission
The Commission may use, for its communication and publicising activities, information relating to the action, documents notably summaries for publication as well as any other material, such as pictures or audio-visual material that it receives from the participants (including in electronic form).

The Commission will publish the name of both the finalist(s) and the winner(s), their origin, the amount of the prize and its nature and purpose — unless they have requested to waive this publication (because disclosure risks threatening its security and safety or harm its commercial interest).

Photos and videos taken by the Commission either in preparation of the award ceremony or during the award ceremony are the sole property of the Commission.

## 8.3 Dissemination and exploitation of results

The winner(s) must comply with the obligations set out in Title III of the Horizon 2020 Rules for Participation

Regulation No 1290/2013[6].

For more information and best practice, see Articles 23a-31 of the H2020 AGA — Annotated grant agreement.

## 8.4 Processing of personal data

8.4.1 Processing of personal data by the Commission
Any personal data will be processed by the Commission under Regulation No 45/2001[7] and in accordance with the Participant Portal privacy notice(s).

All finalist(s) and winner(s) consent that the Commission publishes the following information:

- name
- Member State of origin (address or NUTS 2 region)
- their activities in relation to the award of the prize (via the summary for publication they provided)
- prize amount

in whatever form and medium.

8.4.2. Processing of personal data by the participants
The participants must process personal data in compliance with applicable EU and national law on data protection (including authorisations or notification requirements, if any).

## 8.5 Ethics

The activities must be carried out in compliance with:

(a) ethical principles (including the highest standards of research integrity) 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 participants must ensure that the activities have an exclusive focus on civil applications.

The participants must ensure that the activities do not:

(a) aim at human cloning for reproductive purposes

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6 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).

7 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).

(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.

The participants must respect the highest standards of research integrity — as set out, for instance, in the European Code of Conduct for Research Integrity[8].

For more information and best practice, see the Participant Portal Online Manual, the Guidance — How to complete your ethics self assessment and the Guidance note — Research focusing exclusively on civil applications.

## 8.6 Security

The activities must be carried out in compliance with Commission Decision 2015/444, i.e. security-sensitive information must be **EU-classified**, if its unauthorised disclosure could adversely impact the interests of the EU or of one (or more) of its Member States. Applications that are too security-sensitive cannot be awarded a prize.

For more information and best practice, see the Guidance — Guidelines for the classification of information in research projects, the Guidance — Guidelines for the handling of classified information in EU research projects, the Guidance note — Potential misuse of research results and the Guidance note — Research involving dual use items.

## 8.7 Conflict of interests

The participants 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.

## 8.8 Liability for damages

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

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[8] European Code of Conduct for Research Integrity of ALLEA (All European Academies) and ESF (European Science Foundation) of March 2017 http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-ethics_code-of-conduct_en.pdf.

The Commission cannot be held liable for any damage caused by any of the participants in the context of the prize.

### 8.9 Checks, audits and investigations

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

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

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

(a) false information, fraud or corruption was used to obtain it

(b) a winner was not eligible or should have been excluded

(c) a winner is in serious breach of its obligations under these Rules of Contest.

### 8.11 Administrative sanctions

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

(a) exclude the participant from all future 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) impose a financial penalty between 2% and 10% of the value of the prize (or between 4% and 20% in case of repetition).

### 8.12 Cancellation of the contest

The Commission may cancel the contest or decide not to award the prize — without any obligation to compensate participants —, if:

(a) no applications are received

(b) the jury does not find a winner

(c) the winner is not eligible or must be excluded

### 8.13 Complaints

Complaints against decisions negatively affecting the rights of a participant or winner can be brought before the General Court — or, on appeal, the Court of Justice of the European Union — under Article 263 of the Treaty on the Functioning of the EU (TFEU).

## 9. CONTACT

For more information or in case of questions, please see the prize website.