Bioenergy and Renewable Fuels from an European Union Research and Innovation Policy Perspective

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# Energy across Horizon 2020

Energy is also addressed in many Horizon 2020 parts

## Bottom-up activities
- European Research Council (ERC)
- European Innovation Council (SME instrument, FTI pilot, FET, Prizes)
- Marie-Sklodowska Curie Actions

## Industrial Leadership
- Materials
- PPPs on Energy-efficient Buildings and SPIRE
- Information and Communication Technologies
- Space (Galileo)

## Societal Challenges (SC)
- SC2: Bioeconomy, Blue Growth
- **SC3: Secure, clean and efficient energy**
- SC4: Electric vehicles, Batteries, Energy-efficient transport
- SC5: Cities, Earth observation, raw materials, climate change mitigation strategies
- SC7: Cybersecurity, Critical energy infrastructure

-> Please check also calls of other Horizon 2020 parts!
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**Societal Challenges (SC)**
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**BIOTEC-02-2019: Boosting the efficiency of photosynthesis (RIA)**

-> Please check also calls of other Horizon 2020 parts!
"Clean Energy for all Europeans"

- Putting energy efficiency first
- Demonstrating global leadership in renewables
- Delivering a fair deal for consumers

Paris Agreement

Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels

Accelerating, encouraging and enabling innovation is crucial...

Agreed headline targets

- 20% Greenhouse Gas Emissions
- 20% Renewable Energy
- 20% Energy Efficiency
- 10% Interconnection

2020

2030

≥ -40% Greenhouse Gas Emissions
≥ 27% Renewable Energy
≥ 27% Energy Efficiency
15% Interconnection

* To be reviewed by 2020, having in mind an EU level of 30%

Research and Innovation

New governance system + indicators

Other EU policy priorities

- Digital Single Market
- Jobs, Growth and Investments
- EU as a strong global actor
- ...

NOT LEGALLY BINDING
The Strategic Energy Technology Plan (SET Plan) - coordinating research and innovation across Europe

Overall objective: Accelerating the development and deployment of low-carbon technologies through cooperation among EU countries, companies, research institutions, and the EU itself, based on common priorities, targets and actions.

Priority Actions:
1&2. Improving performance and reducing cost of renewable energy
3. Smart solutions for consumers
4. Smart Resilience and Secure Energy System
5. Energy Efficiency in Buildings
6. Energy Efficiency in Industry
7. Batteries and e-Mobility
8. **Renewable Fuels and Bioenergy**
9. Carbon Capture Utilisation and Storage
10. Nuclear Safety

NOT LEGALLY BINDING
Mission Innovation

**Overall objective:**
To reinvigorate global efforts in clean energy innovation, Mission Innovation members share a common goal to **develop and scale** breakthrough technologies and substantial **cost reductions**. MI members aim to seek to **double public clean energy research & development investment** over 5 yrs.

EC/EU is proactively engaged:
- 150 Million € on MI-relevant calls by 2020 in Horizon 2020
- Engaged in all the 8 Innovation Challenge (IC)
  - smart grids, off-grid access to electricity, CCS, biofuels, solar fuels, clean energy materials, H&C buildings, hydrogen
- Co-leading IC5 on solar fuels
- Last ministerial meeting in Malmö, Sweden 23-24 May 2018
MI- Converting Sunlight Innovation Challenge – to discover affordable ways to convert sunlight into storable solar fuels

**guiding principle:**
- plausible technology scale-up to **terawatt scale (2050)**
- scalable, **non-toxic** materials and processes, recyclability, high-energy return
Approach
Few international organizations and initiatives in the area significant opportunity to enhance international collaboration.
→ enhancing scientific collaboration is the top priority. in certain areas, work has already progressed towards technology prototype experiments.

Progress
• Definition of scope (The Challenge has established an international experts group)
• Identified areas of particular interest: catalysts for water splitting and CO2 reduction, light harvesting, micro-algae, photoelectrochemical cells, concentrated solar light to energy rich chemicals and engineering of production devices.
• Identification of key knowledge and technology gaps and break-through opportunities
1) Continuous consultations with international experts

2) Focusing activities on possible implementation pathways

• Setting up a scholarship exchange programme for Post-Docs to enhance international collaboration and exchange of best practices;
• Designing and launching inducement prizes to stimulate development in this Challenge area;
• Developing joint tasks between IEA TCPs or setting up a separate dedicated TCP;
• Establishing an online platform to facilitate the sharing of data, materials or research infrastructure;
• Creating bi-/multi-lateral research programmes
Highlight of conclusions:

→ Impact R&I measures:

Up to +120% available feedstock – at lower price
Up to -40 to -60% capex for conversion

→ Role of Adv. Biofuel:

Up to 50% share of transport energy demand
Only limited competition with other green fuels
Reaching fossil fuel price levels in 2050

→ Macro-economic impact

€365 billion market (1.6% of EU’s GDP)
No negative GDP impact and +108k jobs
Net increase energy security

Authors: Paul Baker, Olivier Chartier, Robert Haffner, Laura Heidecke, Karel van Hussen, Lars Meindert, Barbara Pia Oberč, Karolina Ryszka (Ecorys), Pantelis Capros, Alessia De Vita, Kostas Fragkiadakis, Panagiotis Fragkos, Leonidas Paroussos, Apostolis Petropoulos, Georgios Zazias, (E3MLab), Ingo Ball, Ilze Dzene, Rainer Janssen, Johannes Michel, Dominik Rutz, (WIP Renewable Energies), Marcus Lindner, Alexander Moiseyev, Hans Verkerk (EFI), Peter Witzke (Eurocare), Magda Walker (IUNG)

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For every level of feedstock demand, R&I significantly decreases the cost of biomass.
R&I measures can significantly increase the availability of biomass by 2050 – by up to 120% as compared to the reference scenario in 2020.
Renewable Fuels/Bioenergy in H2020 – SC3 Energy WP; overall strategy

- **Technology and cost competitiveness**
  - Technology improvement, resource efficiency and diversification

- **Feedstock availability**
  - Feedstock diversification, energy intermediates

- **Commercialization**
  - Focus on particular transport sectorial needs
  - Aligned market up-take measures

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Forthcoming: Topics of WP2020 under preparation

**LC-SC3-RES-1-2020:** Developing the next generation of renewable energy technologies (up to TRL 3/4)

**Scope:** ... **Sustainable fuels other than hydrogen for energy and transport application through ground-breaking conversion technologies,** addressing for example development of novel microorganisms, enzymes, catalysts, photosensitizers and separation techniques, improvement of biomass and microalgae yields, and development of novel technologies of combined indirect and direct artificial photosynthesis with chemical/ biochemical/biological systems; ... 

**LC-SC3-RES-3-2020:** International Cooperation with USA on alternative renewable fuels for energy and transport

**LC-SC3-RES-25-2020:** International cooperation for Research and innovation on advanced biofuels and alternative renewable fuels

**LC-SC3-RES-26-2020:** Development of next generation biofuel and alternative renewable fuel technologies from CO2 and renewable energy (Power and Energy to Fuels)
Launched on 12th December 2017

The Challenge

Launched on 12th December 2017

SOLVE THE CHALLENGE

€5 million

Apply by 3 February 2021
What are inducement prizes?

- "Challenge" or "inducement" prizes, offering a cash reward to whoever can most effectively meet a defined challenge

- Incentive for innovation by prescribing the goal, but not how the goal should be achieved
Why is it important for Artificial Photosynthesis?

- Create **visibility** and **awareness** of this new « energy conversion » concept

- Get the science out of the “lab” in the “field”

- Get the engineers involved

- **Stimulate and accelerate** the R&D&I
What is the challenge?

• The focus of the prize is on proof-of-concept

• Building of a fully functional, bench-scale prototype device of an artificial photosynthesis synthetic fuel production system.

• Integrate the whole artificial photosynthesis process from light capture to fuel production that generates a fuel capable of powering a small engine.
Rules of the contest - Eligibility

• The contest is open to all legal entities (...) or groups of legal entities.

• 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.
# Deadlines

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<thead>
<tr>
<th>Event</th>
<th>Date/Time</th>
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<tbody>
<tr>
<td>Opening of the submission</td>
<td>12 December 2017</td>
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<td>Deadline for registration of interest</td>
<td>29 June 2020 at 17:00:00 CET</td>
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<tr>
<td>Closing date for submission</td>
<td>3 February 2021 at 17:00:00 CET</td>
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<td>Evaluation</td>
<td>February – September 2021</td>
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<td>Solution demonstrations by the finalists at JRC Ispra (“Grand Final”)</td>
<td>July – September 2021 (1 week therein)</td>
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<td>Award</td>
<td>November – December 2021</td>
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Commission proposal for
Horizon Europe

THE NEXT EU RESEARCH & INNOVATION PROGRAMME (2021 – 2027)

#HorizonEU

Thomas Schleker
First European Congress on Photosynthesis Research
27 June 2018
Horizon Europe

is the Commission proposal for a €100 billion research and innovation funding programme for seven years (2021-2027)

to strengthen the EU's scientific and technological bases

to boost Europe's innovation capacity, competitiveness and jobs

to deliver on citizens' priorities and sustain our socio-economic model and values

Additional €4.1 billion are proposed to be allocated for defence research, in a separate proposal for a European Defence Fund
Horizon Europe: investing in R&I to shape our future

- The vision:
  "a Europe that protects, a Europe that empowers, a Europe that defends"
  
  Jean-Claude Juncker

- Tackling **climate change** (35% budgetary target)

- Helping to achieve **Sustainable Development Goals**

- Boosting the Union's **competitiveness and growth**

Credits: https://www.un.org/sustainabledevelopment/sustainable-development-goals/
Horizon Europe: evolution not revolution

Specific objectives of the Programme

- Support the creation and diffusion of high-quality knowledge
- Strengthen the impact of R&I in supporting EU policies
- Foster all forms of innovation and strengthen market deployment

Optimise the Programme’s delivery for impact in a strengthened ERA

Pillar 1
Open Science
- European Research Council
- Marie Skłodowska-Curie Actions
- Research Infrastructures

Pillar 2
Global Challenges and Industrial Competitiveness
- Health
- Inclusive and Secure Society
- Digital and Industry
- Climate, Energy and Mobility
- Food and natural resources
- Joint Research Centre

Clusters

Pillar 3
Open Innovation
- European Innovation Council
- European innovation ecosystems
- European Institute of Innovation and Technology

Strengthening the European Research Area
- Sharing excellence
- Reforming and Enhancing the European R&I system
ARTIFICIAL PHOTOSYNTHESE: FUEL FROM THE SUN

EIC HORIZON

prize

Thank you

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#EICHorizonPrize

http://ec.europa.eu/programmes/horizon2020
Research Policy Framework

Energy in other parts of H2020

- Energy Challenge 55%
- Euratom 18%
- Other H2020 parts 27%

Additional energy-related spending in H2020 outside Energy Challenge: ~ 50% of the Energy Challenge budget

Total budget for energy in H2020: ~ EUR 8.5 billion (11.4% of the total H2020 budget)

Research and Innovation

NOT LEGALLY BINDING
Specific Challenge: The challenge is to take exceptionally promising and innovative energy solutions with high potential impact to real breakthrough and market application. ... 

Scope: Bionic leaf technology: advanced renewable fuel production through biological conversion of CO2 and renewable hydrogen in the presence of inorganic catalysts. ... 

Expected Impact: ...An economically viable bionic leaf technology with increased efficiency well beyond the state-of-the-art has significant market potential and environmental impact... 

Type of Action: Research and Innovation action
While benefiting from world-class research and strong industries…

Our knowledge and skills are our main resources.

→ 7% of the world's population
→ 20% of global R&D
→ 1/3 of all high-quality scientific publications

1.3% EU business R&D investment

…Europe fails to transform leadership in science into leadership in innovation and entrepreneurship