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

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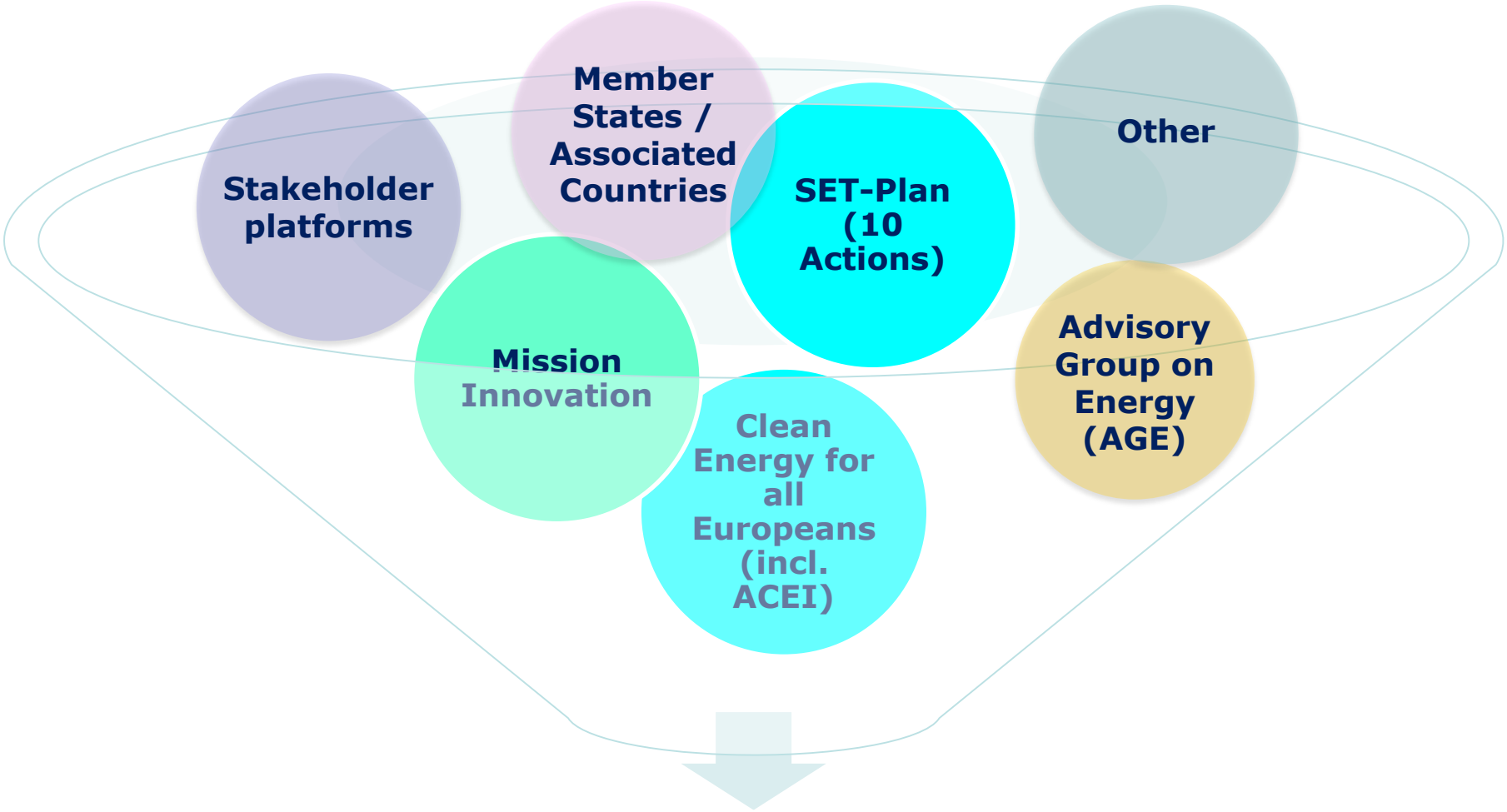
Renewable Energy Sources

Research and Innovation

Inputs to the Horizon 2020 SC 3 Energy Work Programme



Energy WP 2018-2020

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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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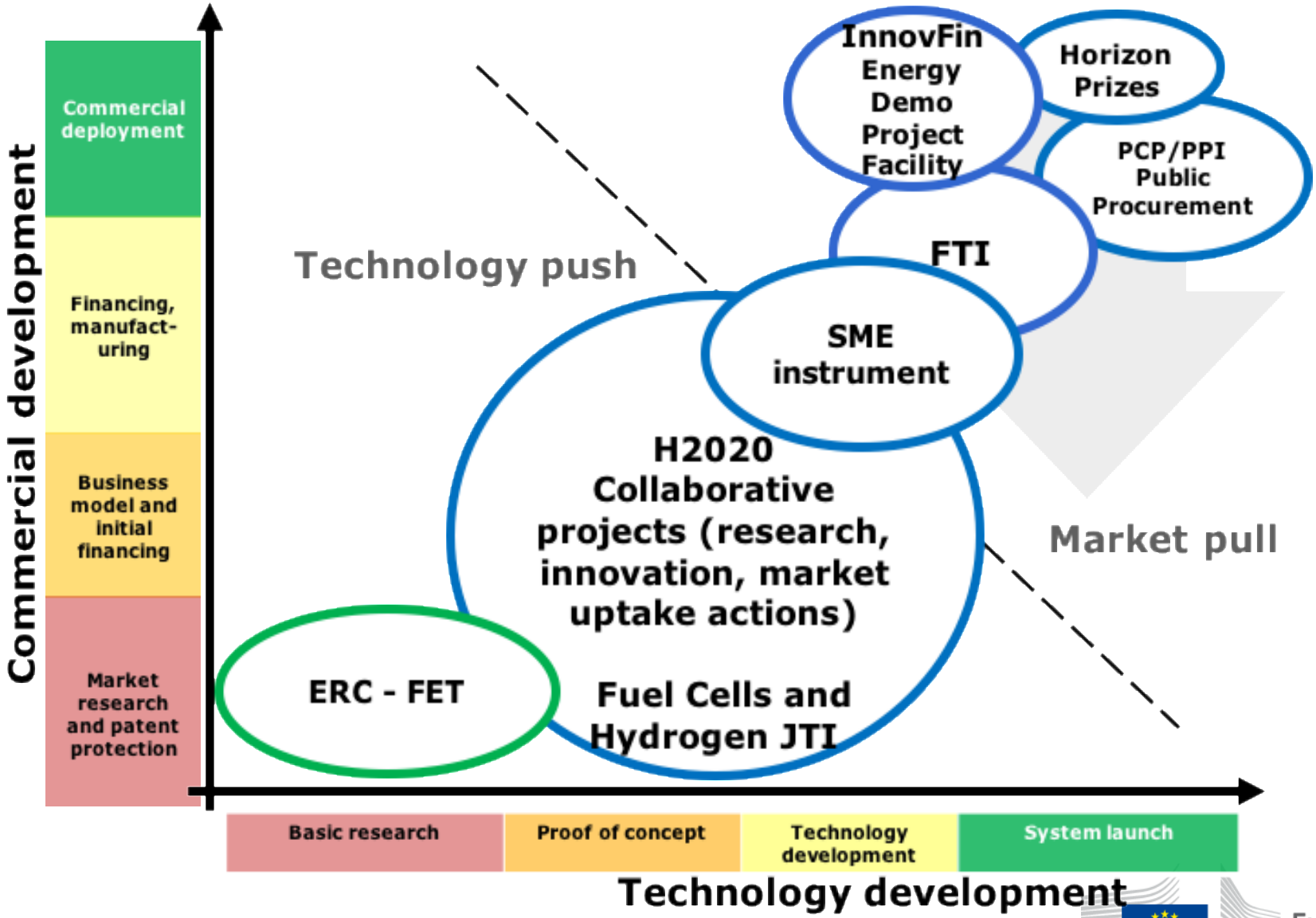
Societal Challenges (SC)

- SC2: Bioeconomy, Blue Growth
- SC3: Secure, clean and efficient energy

BIOTEC-02-2019: Boosting the efficiency of photosynthesis (RIA)

-> Please check also calls of other Horizon 2020 parts!

Research Financing Instruments

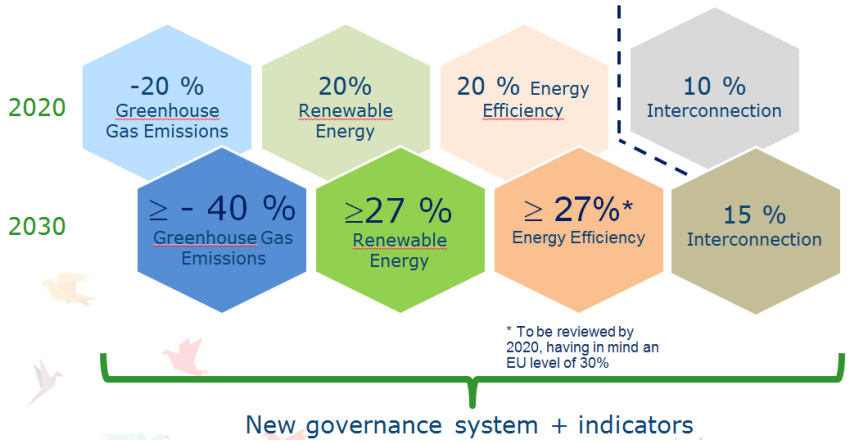


Policy Framework

"Clean Energy for all Europeans"

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

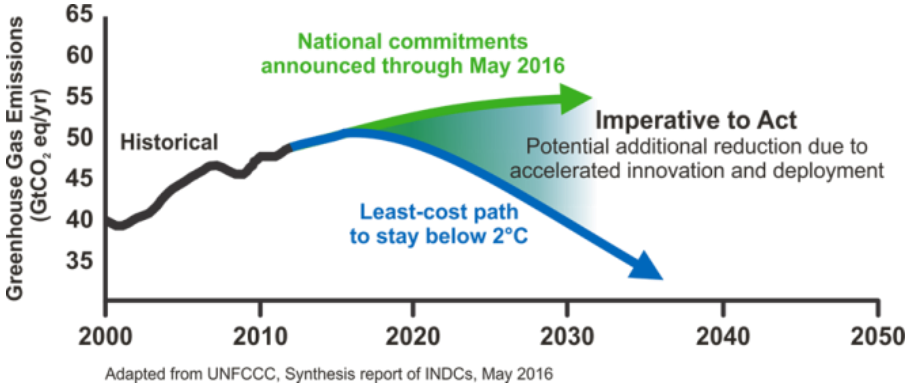
Agreed headline targets



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...*



Other EU policy priorities

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

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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**.

Defining priorities
- SET-Plan Communication 2015

Setting targets
- Declaration of Intents

Implementation Plans (IP)
- Temporary Working Groups

Execution of IPs

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

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Mission Innovation

www.mission-innovation.net

<u>Overall objective</u>:
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

		Australia	Brazil	Canada	Chile	China	Denmark	EC	Finland	France	Germany	India	Indonesia	Italy	Japan	Mexico	Norway	Republic of Korea	Saudi Arabia	Sweden	The Netherlands	UAE	UK	USA
1	Smart Grids Innovation Challenge	Participant	Participant	Participant		Lead	Participant	Participant	Participant	Participant	Participant	Lead	Participant	Lead		Participant	Participant	Participant	Participant	Participant	Participant		Participant	Participant
2	Off Grid Access to Electricity Innovation Challenge	Participant	Participant	Participant		Participant		Participant	Participant	Lead		Lead	Participant	Participant		Participant	Participant	Participant	Participant	Participant	Participant		Participant	Participant
3	Carbon Capture Innovation Challenge	Participant		Participant		Participant	Participant	Participant	Participant	Participant	Participant	Participant	Participant	Participant	Participant	Participant	Participant	Participant	Lead	Participant	Participant	Participant	Participant	Lead
4	Sustainable Biofuels Innovation Challenge	Participant	Lead	Lead		Lead		Participant	Participant	Participant		Lead	Participant	Participant		Participant	Participant			Participant	Participant		Participant	Participant
5	Converting Sunlight Innovation Challenge	Participant	Participant	Participant	Participant	Participant	Participant	Lead	Participant	Participant	Lead	Participant		Participant	Participant	Participant	Participant		Participant	Participant	Participant	Participant	Participant	Participant
6	Clean Energy Materials Innovation Challenge	Participant		Participant			Participant	Participant	Participant	Participant	Participant	Participant		Participant		Lead	Participant	Participant	Participant	Participant	Participant	Participant	Participant	Lead
7	Affordable Heating and Cooling of Buildings Innovation Challenge	Participant	Participant	Participant		Participant	Participant	Lead	Participant	Participant	Participant	Participant		Participant		Participant	Participant		Participant	Participant	Participant	Lead	Lead	Participant

Lead

Participant

guiding principle:

- plausible technology scale-up to **terawatt scale (2050)**
- scalable, **non-toxic** materials and processes, recyclability, **high-energy return**

MI - Converting Sunlight

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**

MI - Converting Sunlight - Next steps

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

www.publications.europa.eu

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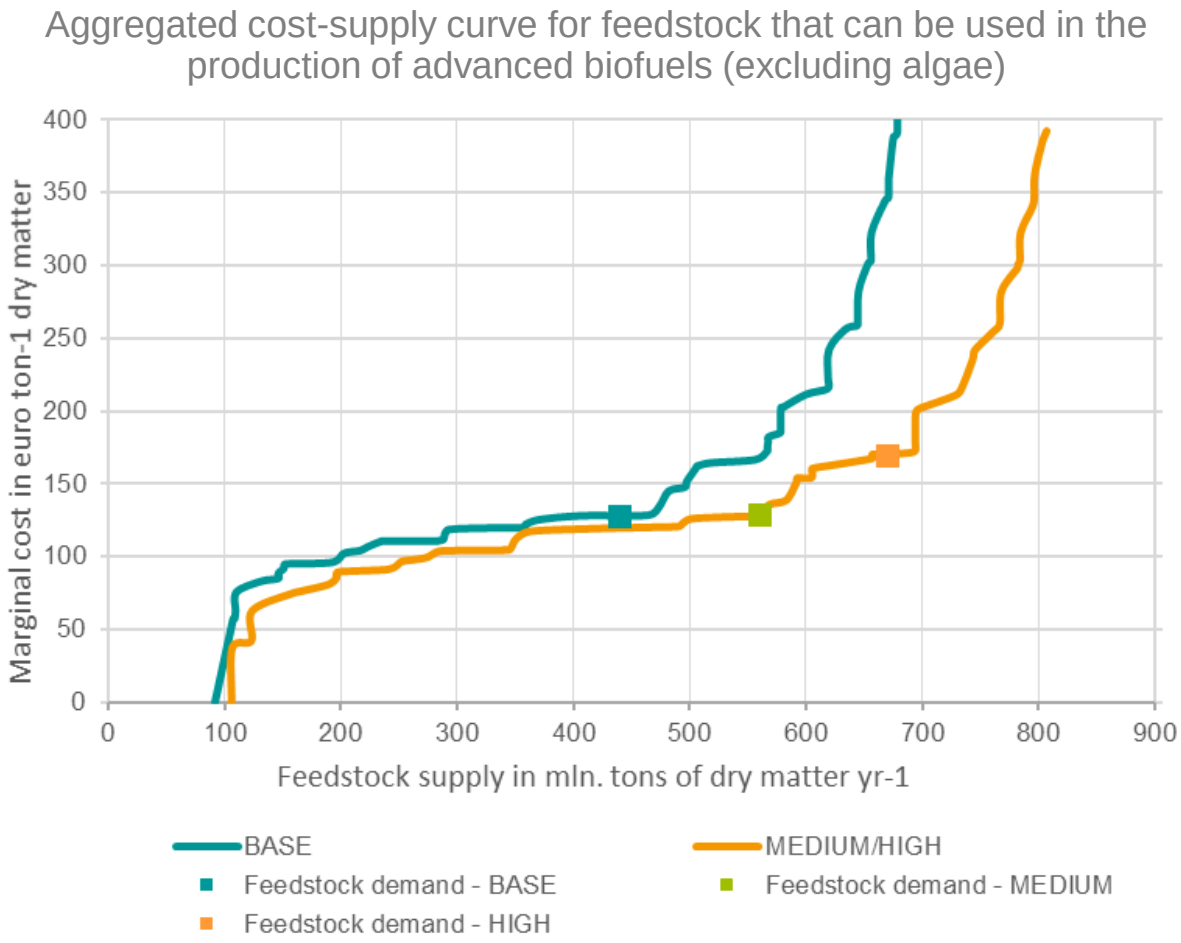
For every level of feedstock demand, R&I significantly decreases the cost of biomass



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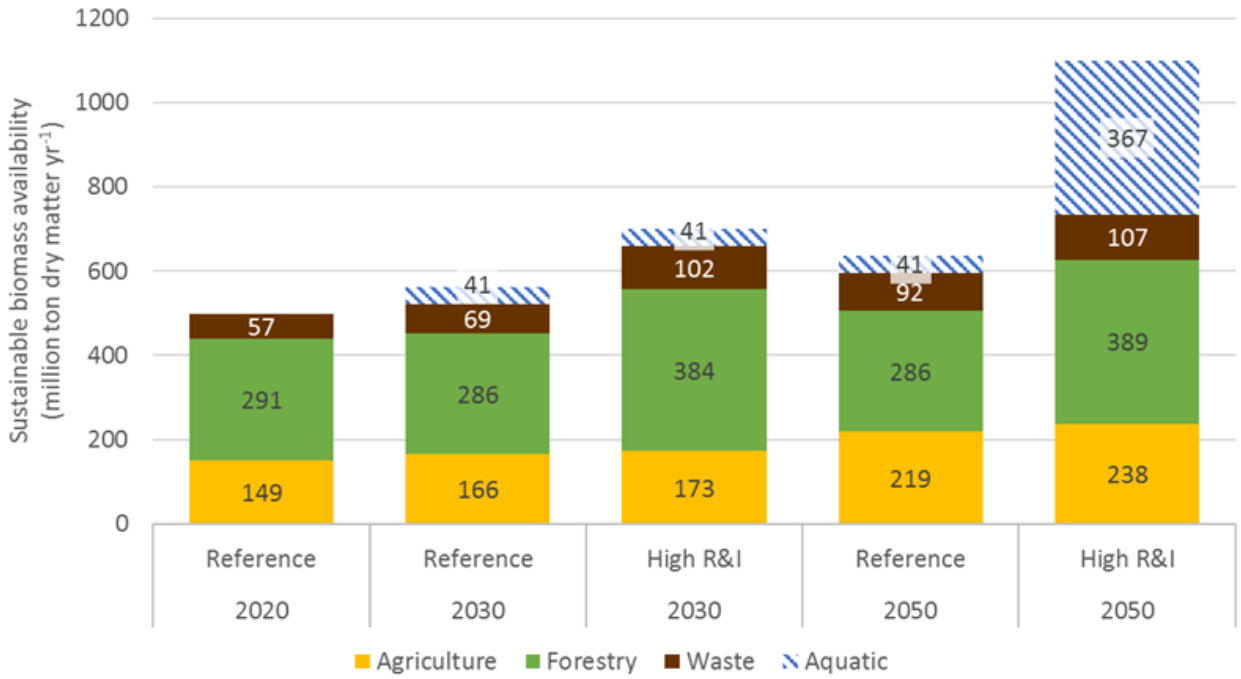
ECORYS

R&I measures can significantly increase the availability of biomass by 2050 – by up to 120% as compared to the reference scenario in 2020



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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

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, photosentisizers 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)

European Commission

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	
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
Evaluation	**February – September 2021**
Solution demonstrations by the finalists at JRC Ispra ("Grand Final")	**July – September 2021 (1 week therein)**
Award	**November – December 2021**

European Commission

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

Research and Innovation

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

European Commission

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/

European Commission

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

Clusters

- Health
- Inclusive and Secure Society
- Digital and Industry
- Climate, Energy and Mobility
- Food and natural resources

Joint Research Centre

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

European Commission

European Commission

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Thank you

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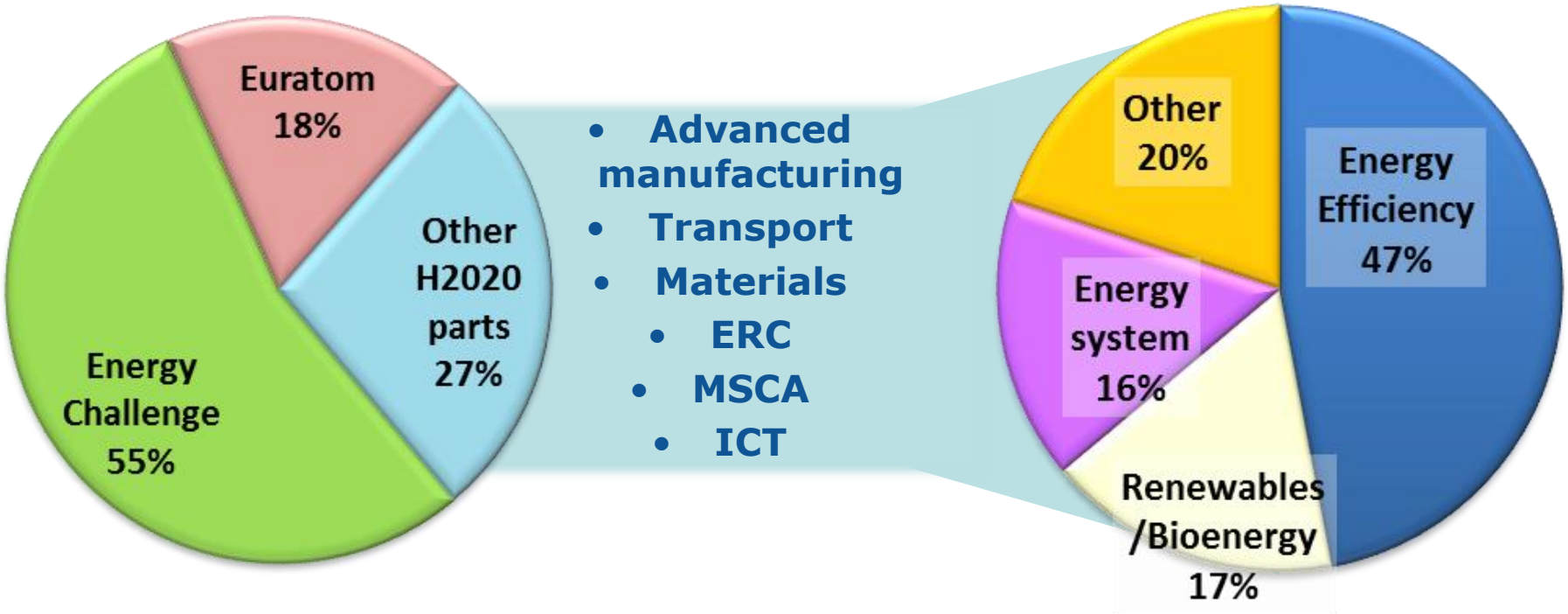
#EICHorizonPrize

http://ec.europa.eu/programmes/horizon2020

Research Policy Framework

Energy in other parts of H2020



✓ 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)

LC-SC3-RES-2-2018: Disruptive innovation in clean energy technologies

LC-SC3-RES-2-2018: Disruptive innovation in clean energy technologies

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. …

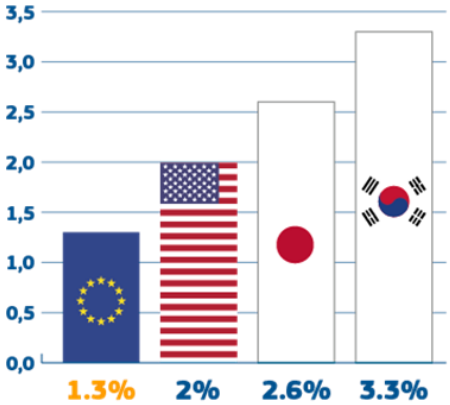
Expected Impact: …An economically viable bionic leaf technology with increased efficiency well beyond the state-of-the-art has significant market potential and environmental impact…

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

European Commission