IGEM
MADRID _UCM
2021

4C_Fuels

Presentation Dossier
Project 4C_Fuels

4C_Fuels

CONTENIDOS

In this Dossier ...

We aim to briefly and concisely set out those main elements that make up 4 C_Fuels.

Our team considers it a priority to show a real, clear and objective image of the project, which we invite you to discover.

Project 4C_Fuels

4C_Fuels is an entrepreneurship initiative that aims to develop new **sustainable production technologies** based on **cyanobacteria**, coupling **carbon capture** with the **solar production** of different biotech products, with a biofuel as the first step. To do this, we are committed to combining **cutting-edge technologies** connecting biotechnology with other disciplines.

Our initiative is committed to the **application and transfer of knowledge**. Therefore, **communication, visibility, multidisciplinarity** and collaboration are also part of our fundamental pillars.

Our vision and objectives

4C_Fuels was born with a clear **vision**: we aspire to create **technological development** in our society to promote sustainability of our environment. That is why we believe in the need of developing a product with utility and impact, in line with **sustainable development goals**. Thus, we seek to create a real solution, not only theoretical, with an eminent potential for **industrial implementation.**

Our mission is the **integration, development, and transfer** of the current body of scientific knowledge in the field of **photosynthetic solar production** of biotechnological products. We seek to develop **solutions** that are adaptable to local context and needs, based on the principles of **circular bioeconomy and sustainability.**

The idea of the 4C_Fuels project was born at the end of 2019, Since then it has been developed until the consolidation of a team, the development of a design strategy, and the search for support.

The team of 4C_Fuels, in its core, consists of **university students**, advised by **expert researchers** in the different areas of the project. Today, we seek the **initial development of the idea** framed by our participation in **iGEM**; a competition convened by **MIT**, one of the world's greatest examples of biotechnological entrepreneurship.

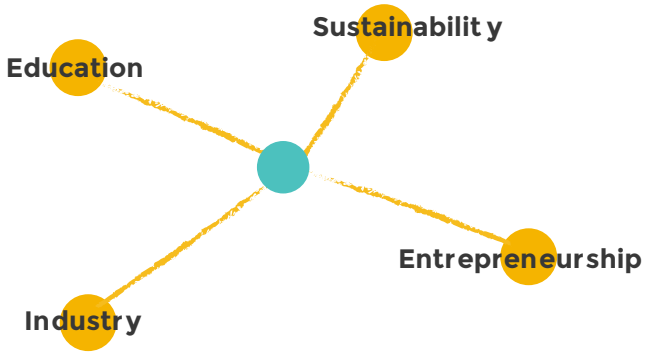
Our objectives today are to develop a minimal **technological prototype** for **direct solar production of biofuels**, as well as to **analyze the feasibility and techno-economic requirements** of its implementation in a real context. With this, we aim to increase the visibility of the biotech industry.

2. Value Proposal

Beyond R&D

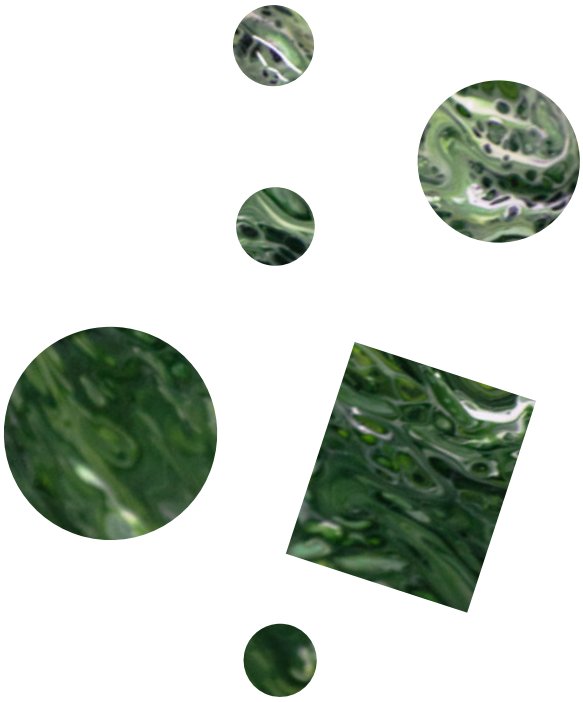
4C_Fuels is defined as a project of **innovation and biotechnological development.**

The project value proposal considers four main sectors, where the development of the project's contents generates a potential benefit: **Sustainability, Education, Entrepreneurship and Industry.**



Team commitment and recognition

This approach has enabled us to reap the support of the **faculties of Chemical and Biological Sciences** (UCM) as well as other institutions. To these awards is added the prize as finalists of the entrepreneurship contest **#StartupUCM**. All this, evidence of our commitment to society in order not only to be able to develop new sustainable production technologies, but also to work actively for its implementation and understanding by our society.



Value in society

4c_Fuels as an educational project

Our team consists mostly of **trained university students**, **who receive support from other more experienced members**, as well as expert **researchers** in different subjects. Currently, we have the main support of two research groups in the CSIC. This causes the project to acquire a **clear educational approach**, from which different training benefits are derived.

EDUCATIONAL VALUE

The **core** of the project consists of **students** (UCM, UAM URJC and alumni), who benefit directly from **both autonomous and expertly guided training**. In addition to acquiring specific scientific-technical training skills, they gain cross-cutting and business and industrial skills.

TRANSPARENCY TRANSFER

In the context of participation in iGEM, 4C_Fuels is committed to entating that **any content generated in the project may remain in public domain.** In addition, 4C_Fuels aspires to **integrate the knowledge** developed over years into a **practical and real application.**

VISIBILIZATION

We are committed to creating **didactic and informative content**, promoting values in **science, sustainability, and circular economy.**

An example of young entrepreneurship

We are a team of young entrepreneurs. We have the **capacity and ambition to develop innovative ideas** but **we need the means to make them real.**

Our team is made up of students from 3 Madrid universities. We **start from university,** but we also **communicate with** foundations, companies, research centers, and **other entities.**

Supporting the project is also **strengthening the relationship between university and business.**

We believe in the **potential of entrepreneurship** and therefore seek to be a **reference for other young people**, demonstrating entrepreneurship as a real and viable alternative.

Value in circular economy and sustainability

Sustainability is the cornerstone of 4C_Fuels. We are aware of the need for a transition in our energy and productive model.

Bioeconomy

We seek to draw inspiration from **natural biological processes** for the development of new biofuel technologies. We want to speed up the transition to a renewable, non-polluting energy model. Our proposal aims to **optimize the management of biological resources and energy** through solutions adaptable to the **local context** and its resources.

Speed & Implementability

Faced with the urgency of the current context, we design **technology based on proven principles** with almost **immediate implementation** potential after its initial development.

Environment

In addition to the production of **biofuels with neutral greenhouse emissions**, we are committed to a technology that **reduces energy and material consumption, thus minimizing the associated environmental impact** and facilitating the management of resources and waste derived from any production process.

Value in the biotech and energy sector

We aspire to **develop and validate technology** that obtains clean energy in the form of drop-in biofuels (direct use, without modification in existing facilities or vehicles).

To this end, we believe in the potential of biotechnology as a fundamental tool. Our design is based on **new fundamental principles**, the advantages of which will benefit both the energy sector and the biotech industry.

A new approach

Our design is based on the use of **photosynthetic microorganisms as biocatalysts**, rather than as resources (biomass).

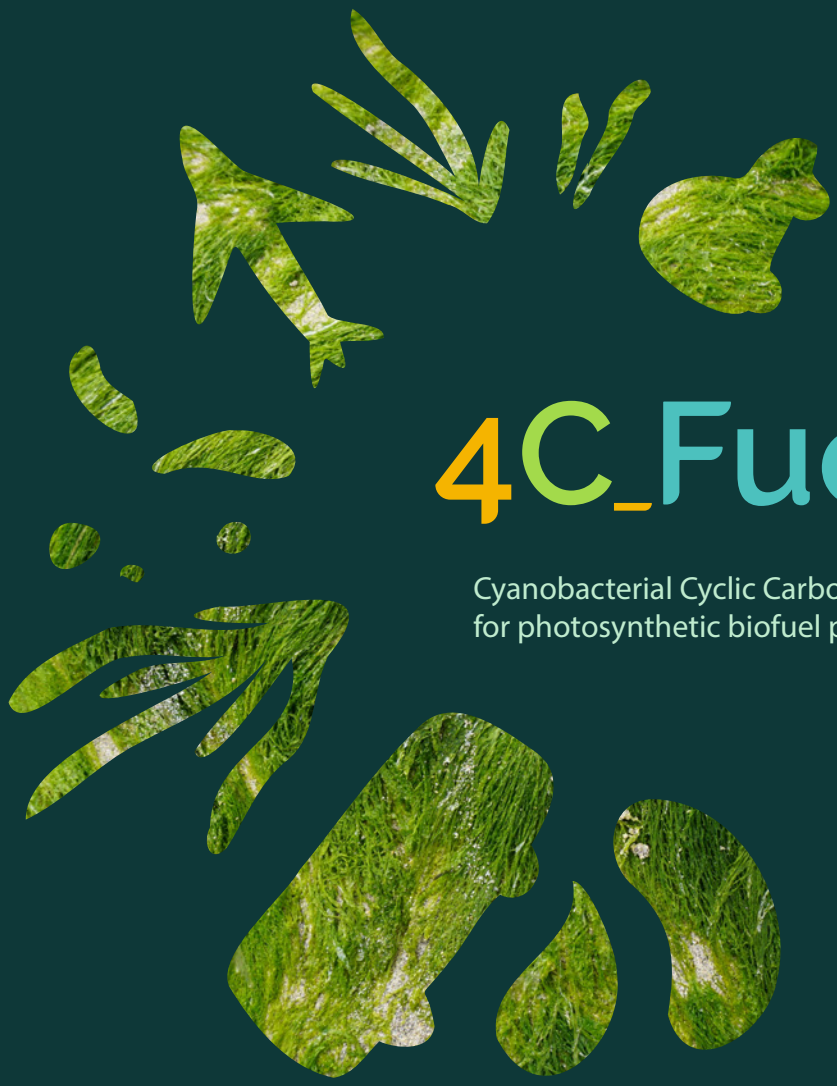
We seek the development of **continuous processes** where biofuel production occurs in **a single photosynthetic stage** from carbon dioxide and solar energy, requiring only the recovery of the product from the reaction medium.

This allows us to avoid the high costs associated with the processing stages commonly found in other microalgae-based industrial processes.

Synergy

We seek to offer a solution for the microalgae industry and the energy sector, where our technology is implementable in the infrastructure that is already available, with minimal modification. We aim to integrate it with other processes with high carbon dioxide emissions.

We also consider adapting the technology to different infrastructures and/or processes.



4C_Fuels

Cyanobacterial Cyclic Carbon Capture
for photosynthetic biofuel production

4C_FUELS IN DETAIL...

New problems. New solutions

The technology. How it works and its benefits

What is IGEM

Project planning and roadmap

Current problems, needs and opportunities

Current Problems and Needs

Emissions and pollution. Need for new sustainable processes

Increasing emissions of greenhouse gases and other pollutants, along with the growing demand for energy and products from our societies, has led to **the need to consolidate a new production model**. The transition is urgent.

New sustainable production technologies based on **circular economy** principles are required. Carbon capture and production coupled with energy sources and materials coupled with the development of energy-efficient processes are the cornerstone on which to build the new solutions.

Inconveniences of electrification and conventional renewable technologies

Current renewable technologies are mainly based on electrical or thermal production. However, despite their enormous potential, due to their characteristics there are gaps that remain properly uncovered. Generally, we could highlight the **difficulty of temporary storage** and the integration into the electrical grid of an **oscillating production**, as well as the environmental impact of its large-scale deployment or the difficulty of recycling some of its components.

Likewise, some **applications currently linked to fossil sources are not suited to electrification** such as heavy vehicles, long-distance transport or certain chemical processes.

Las oportunidades

The Sun as a source of energy

The Sun is the **main source of energy** on our planet. Solar energy set for millions of years in different fossil sources is currently the predominant engine of our world. However, annually the energy radiated on the Earth's surface is **7000 times the current demand of our society**.

This large source of clean energy opens up the possibility of combining different technologies for use and channeling towards **new sustainable processes**.

New advances in synthetic biology

Similar to the rise that Computer Science has experienced since the 1970s, synthetic biology is a recent field that has undergone **enormous development in recent decades.** Today there is a huge pool of knowledge and technology in constant improvement.

In the case of **cyanobacteria technology** there is a **broad theoretical body developed**, where its application to the development of new technologies has only begun over the last decade.

Process integration and flexibility

Process integration consists of the unification of different needs in the same technological system. This is a necessary condition for the **development of new, more efficient and sustainable processes**. In addition to **flexibility and adaptation** to the needs of the local context.

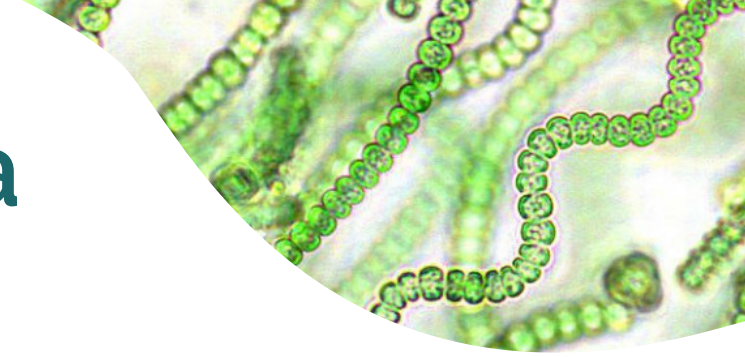
Biology and bio-inspired systems have repeatedly demonstrated their great flexibility and adaptability potential to very different applications.

National Industry and Infrastructure

In addition to its relevant development globally, Spain, due to our **mild and sunny climate**, has developed a **microalgae industry** with significant growth in recent years.

Although currently oriented to the almost exclusive production of biomass, there is an important industrial infrastructure that could benefit from the development and implementation of new technologies and the development of new products.

Cyanobacteria Technology



Metabolic engineering: Construction of a super productive strain

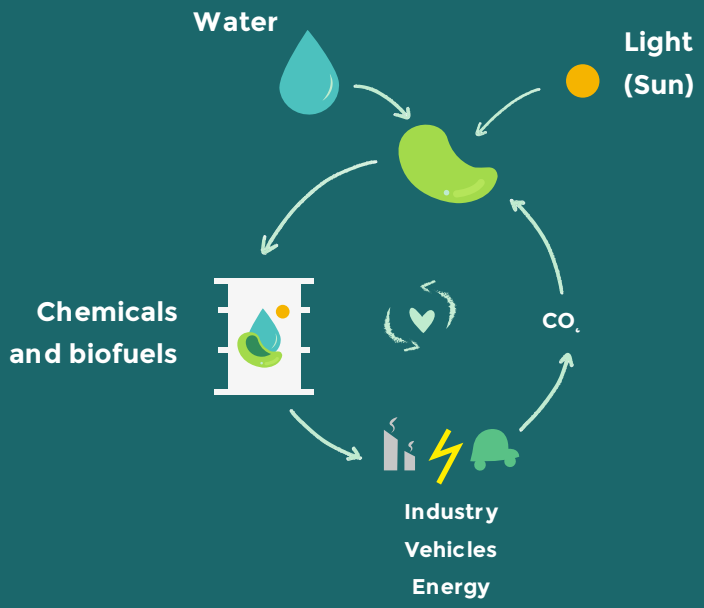
Cyanobacteria engineering is the main area of project development. The goal is the development of a **butanol-producing cyanobacteria strain**; an alcohol with the ability **to completely replace current gasoline mixtures** without the need for additional modifications to the engines, distribution or transport infrastructure. To this end, **metabolic engineering** technologies will be used to manipulate the photosynthetic metabolism of the microorganism.

Our goal is to **increase tolerance** to the product, **maximize its resulting amount** and **increase the fixation of carbon dioxide by cells.**

Bioprocess engineering: From bacteria to factory

From the perspective of bioprocesses, the needs of reaction and purification systems for the product are considered. Potential photobioreactor designs and purification systems that optimize production by **reducing economic and energy costs** will be evaluated.

Within this field, efficient product production and separation can be optimized by encapsulating cells into transparent inert materials. To this end, the **development of solid photo biocatalysts** based on new bionanomaterials capable of improving the performance of reaction and separation systems will be studied, facilitating the development of the production process



The basic principle of this technology is circular operation and a modular design that will make it a platform solution in the future

Objectives and scope

In the short term, the main objective is the development of a **biofuel super-producing strain** and strategies that allow a **recovery and purification of the product at a reduced cost.**

Once the technological base is established, there is the possibility of **expanding the range of products:** moving from a single biofuel to multiple base chemicals as well as other high added value biotech products.

The difference

Unlike most current microalgae-based processes, in 4C_Fuels we are committed to the **use of cyanobacteria as catalysts and not as an arable resource.** Most current processes consist of the production of biomass for further separation and refining to a final product. In our case we propose the generation of the final product directly, specifying only its separation.

Despite this differential approach, **our technology could be easily implementable in existing facilities** for the cultivation of microalgae, allowing it to integrate with other existing processes.

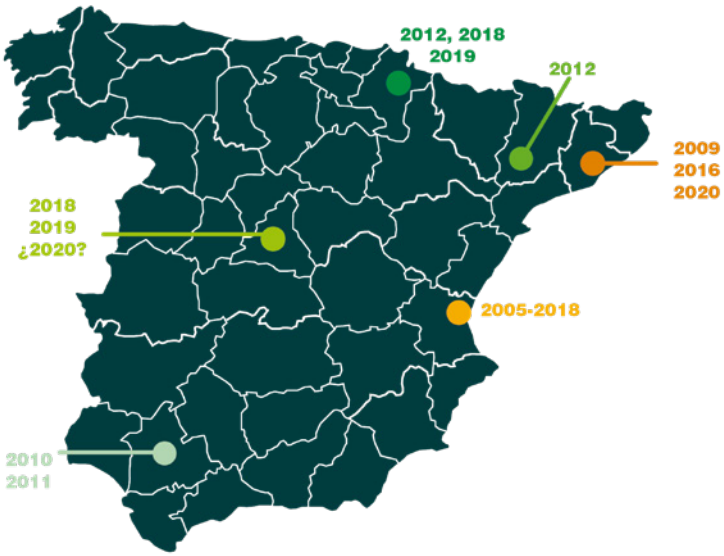
4.What is iGEM and why participating in it

iGEM stands for International Genetically Engineered Machine. Convened by **MIT**, it is the **world's largest synthetic biology competition.**

However, not only is it an innovation and entrepreneurship competition, but it has been the home of a large number of biotech startups due to the unique synergy that occurs between the **foundation, companies, researchers, and students** from all over the world in a single event.

DIFFERENT SPANISH TEAMS HAVE PARTICIPATED IN IGEM.

HOWEVER, THE REPRESENTATION IS LOW COMPARED TO THE REST OF EUROPE.



Conditions, requirements and benefits....

To be part of iGEM, **every team must pay a registration fee.** Every team then has to work not only on the **development of their project**, but also on the relationship of their contents with their close environment and society.

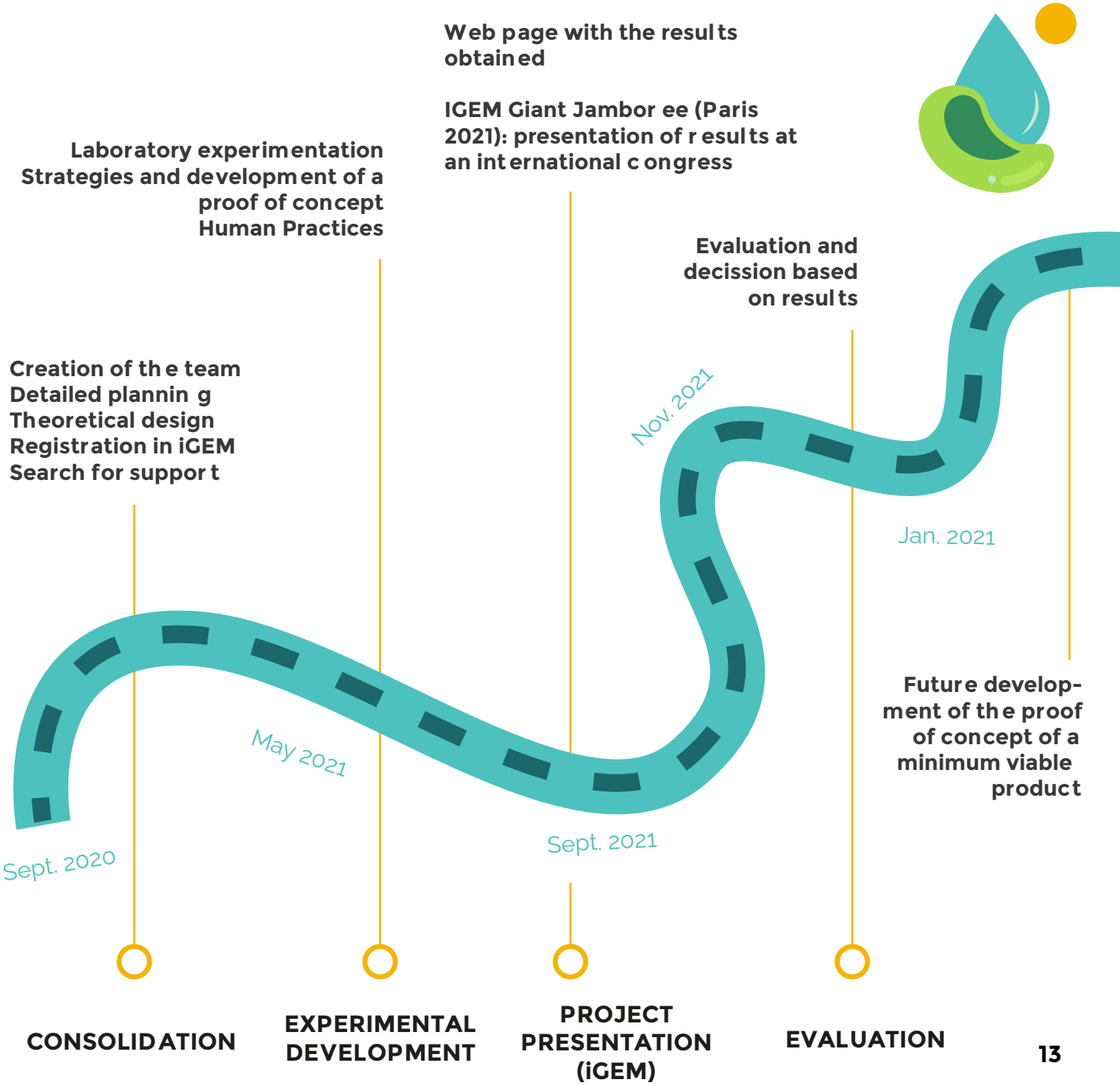
Despite being a competition, iGEM functions as a **great network for collaboration** between its different parties, from the teams, to a wide range of events, advice, seminars, sponsorships and support tools available to all participants, including some basic materials for the experimental development of the projects.

The structure of the projects presented in iGEM consists of the development and documentation of the project over the period of one year, collecting all the results in a **free access web domain (wiki)** hosted on MIT servers. At the end of the competition an exhibition and evaluation of the projects in each category is held by a jury, classifying them with different recognitions according to their development and achievements.

5. Roadmap

We consider iGEM a development opportunity. Thus, the objective of the 4C_Fuels project is the validation and recognition of the initiative through the development of its contents, in all areas of its value proposition.

This participation in iGEM defines both the basic needs and the initial deadlines of the project. To do this, our roadmap considers 4 main stages during the period 2020/2021.



6. Why supporting 4C_Fuels?

Supporting our team means **supporting entrepreneurial talent.** Taking a chance on our project will allow us to use our capabilities and ambition to develop innovative ideas and will **pave the way for other innovative projects in the future.**

Promoting initiatives like 4C_Fuels is to commit on **consolidating the economic structure** by leading it towards a greater focus on technology and innovation. We believe in entrepreneurship as a way to achieve a stronger and more resilient economy.

Collaborating 4C_fuels is also strengthening the **interaction** between the **university and company.**
We are committed not only to the **transfer of knowledge**, but also to channel talent to those places where it is most required, also seeking to offer the means to develop it.

EDUCATIONAL

YOUNG ENTREPRENEURSHIP

SUSTAINABILITY

We believe in the need for a shift towards sustainability. Taking a chance on 4C_Fuels is a commitment to a **circular economic model**, encouraging the consolidation of a strong local bioeconomy, adapted to the unique requirements and characteristics of our region.

COMPANIES & BIOTECHNOLOGY

Sponsoring 4C_Fuels is also an opportunity for **visibility and promotion** at national and international level, due to both the participation in iGEM and the intense visibility activity carried out by the project team.

Currently with the collaboration of:

We're looking for sponsors!

The initiative 4C_Fuels needs sponsors interested in financially supporting the project development. However, this support can take the form of a **monetary contribution, materials or equipm ent.**

The preliminary estimate of the required budget is based on the results of previous teams, considering a team of 8-10 members. Majority disbursement must be made during the team registration in iGEM and the acquisition of materials (March-April). 40% of the estimated budget is required at this time. We have documentation with detailed initial budget estimate.

From 4C_Fuels **we are committed** not only to the **development of the project**, but also to ensure the existence of **coordination and plannin g** that allows its development. We also extend our commitment to fully ensure **transparency** regarding the development of project activities, fund management, and team structure; generating relevant documentation for each of these aspects.

SPONSORSHIP LEVELS

	Sponsor level **FUEL**	Sponsor level **BIO**	Sponsor level **BIOFUEL**
Contribution	From 100 to 999€	From 1.000 to 4.999€	From 5.000€
Logo	Size S	Size M	Size L
Logo on our web	●	●	●
Logo on dossiers	●	●	●
Logo on presentations	●	●	●
Logo on equipement		●	●
Logo on covers			●
Mentions			
Mentions in social networks		●	●
Special mention in audiovisual content			●

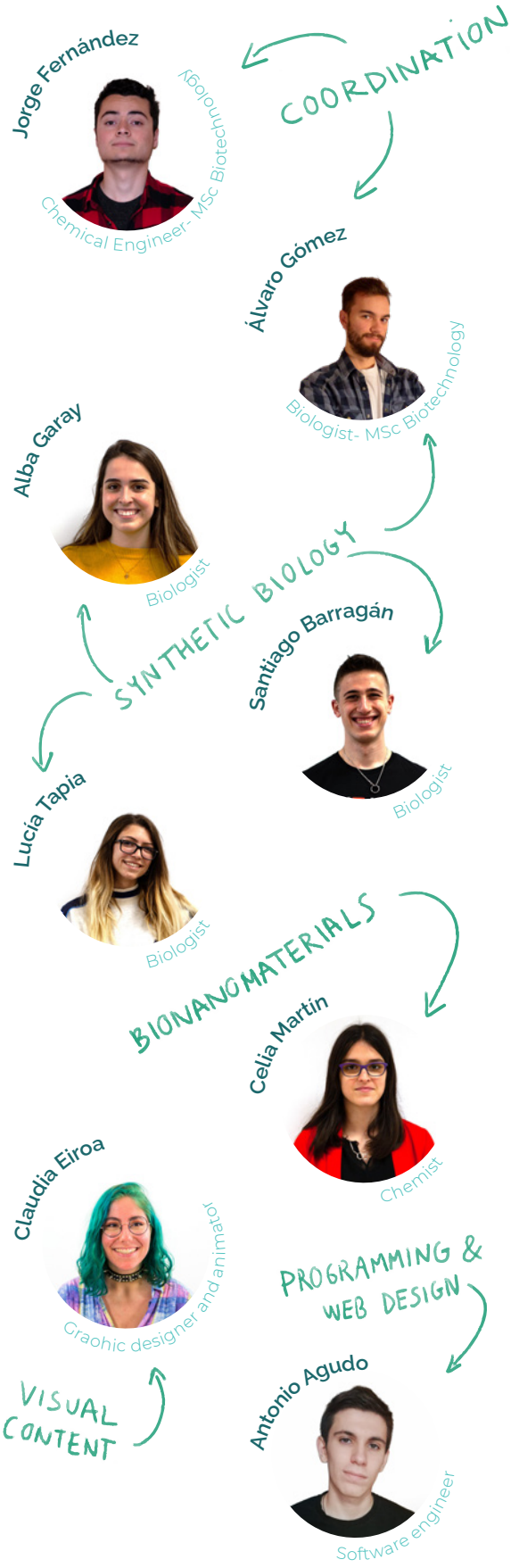
7. 4C_Fuels: the team

The main team of 4C_Fuels consists of **university students or recent graduates.** However, there are many more people behind 4C_Fuels.

Behind our team is an **extensive network of supports**, both **internationally renowned researchers and advisors** and institutions who support and ensure the quality of our work.

Due to the breadth and complexity of the project, we are strongly committed to **multidiscipline.** We not only seek to **integrate knowledge from different areas** into a solution, we believe in the synergy between the different profiles and experience of each team member.

In addition, 4C_Fuels considers the image and communication essential pillars to make society participate in its usefulness and relevance. Our team has web designers and developers, responsible for transmitting to society our vision and values.



CONTACT

igemmadrid2021@gmail.com

@4C_fuels

@4c_fuels

@4c-fuels

Thank you

@4C_fuels

@4c_fuels

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