



## ***Answers to frequently asked questions (FAQ)***





## Table of Contents

<b>Answers to frequently asked questions (FAQ)</b> .....	<b>1</b>
<b>Theme 1: The LFree Project</b> .....	<b>5</b>
What needs and problems does the LFree project meet?.....	5
What is LFree Project? .....	5
What motivated us to come up with this Project? .....	5
What is the economic and ecological argument to be taken into account in solving the problem of access to clean and safe drinking water in isolated areas? .....	5
What is the meaning of LFree? .....	5
Tell us more about the inspirations behind the project. ....	6
What is needed to have a successful project? .....	6
How much does the micro-power plant cost to build? .....	6
What are the conditions for mass production? .....	6
Is the LFree project only focusing on Africa, or can other places around the World benefit from this technology? .....	6
What is the local response to the Project? .....	6
What is happening right now at Bio-S-TEAM? .....	6
What is the next step for the LFree Project implementation? .....	7
The advantage of this innovative technology .....	7
What are the prejudices that need to be rid of the LFree project? .....	7
What is the originality of the LFree project? .....	7
How is the LFree project organized from the logistical point of view? .....	7
How long does the LFree project take to develop before it is marketed?.....	8
How are the financial needs related to the LFree project budgeted? .....	8
<b>Theme 2: Functions of the appliance</b> .....	<b>9</b>
How does the micro-power plant work to co-generate drinking water and electric power? .....	9
How much electric power and water does it produce? .....	9
How is handled electric power generation and the production of different qualities of water? .....	9
Has the Product been tested?.....	9
How clean is the water produced with the appliance and how can it avoid contamination? .....	9



Should the daily drinking water produced be consumed every day? .....	9
When and how is working the energy storage?.....	10
<b>Theme 3: Material &amp; Design .....</b>	<b>11</b>
Can the product be made in different sizes and capacities? .....	11
Which technology did you use to design the smart grid? .....	11
How to describe the device?.....	11
<b>Theme 4: Installation of the product .....</b>	<b>12</b>
What tools are needed to construct the micro-power plant? .....	12
How is it constructed? .....	12
How much space does it need? .....	12
If you have more than one micro-power plant, how far apart do they have to be?.....	12
How much expertise does one need to install the micro-power plant? .....	12
Can inexperienced visitors interact with the micro-power plant directly? .....	12
Tell us more about the intellectual property and the social economy. ....	12
<b>Theme 5: Maintenance of the product.....</b>	<b>13</b>
What is the lifecycle of a micro-power plant?.....	13
Does it require maintenance?.....	13
How does it hold up to rain, wind, hail, heat, cold, dust, electrical and storms?....	13
Can elements of the micro power plant break during transport or installation? ....	13
<b>Theme 6: The Environment.....</b>	<b>14</b>
How do you identify the right site for the micro-power plant? .....	14
Does the micro-power plant require the presence of water and sun to function effectively, or can it produce electric power without sun or drinking water without water?.....	14
Is the system able to generate more than 26 gallons of drinking water per day? .	14
Are there any inhabited rural areas where the micro-power plant could not work well? .....	14
Is the water harvesting system is affected by pollution?.....	14
What environmental problem does the LFree project want to solve? .....	14
<b>Theme 7: The alternatives .....</b>	<b>15</b>
Are there any alternative to produce drinking water? .....	15
Why not simply use photo-voltaic panels / dig wells to get electric power and drinking water? .....	15
<b>Theme 8: the company Bio-S-Team .....</b>	<b>16</b>
The company Bio-S-TEAM: What is its legal form?.....	16
The company Bio-S-TEAM: What is its social object? .....	16



The company Bio-S-TEAM: What is its business model? .....	16
What is the company's activity? .....	16
Is it a committed company? .....	16
The company Bio-S-TEAM: Who are its founding members? .....	17
<b>Theme 9: Funding and support for the LFree project .....</b>	<b>18</b>
Do you receive assistance from other organizations? .....	18
Who is funding The LFree Project at this point? .....	18
How can I get more involved in the LFree Project? .....	18



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## The LFree Project

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### What needs and problems does the LFree project meet?

In the Face of population development in the countries of the South, a greater share of renewable energies and an optimization of the use of fossil energy is necessary. The technology provided by the LFree project makes it possible to optimise energy production to reduce the share of fossil fuels. It also allows the recycling of wastewater to combat water scarcity. The innovative technology provided by the LFree project allows to free itself from costly sewage treatment plants and to fight against the rural exodus. Finally, in order to combat pollution, global warming and reduce the impact of the emission of the most powerful greenhouse gases, the LFree project allows to optimise the complete combustion and to reduce the production of fine particles and gases to Greenhouse effects such as nitrogen oxide.

### What is LFree Project?

A breakthrough technology sized for individual dwelling located in remote tropical areas which enable cogeneration of electric power and drinking water using the sun energy. It offers alternative water source and Electric power to rural populations that face challenges in accessing them. Please report to the document named *"How can we help save the planet"* available on the website for more information.

### What motivated us to come up with this Project?

We travelled in several developing countries and we all witnessed this dramatic reality: the lack of potable water and the unreliable electric power network. It was imperative to act and create a simple and reliable solution to mitigate the water shortage issue and the electric power grid while reducing the carbon emission footprint due to the economic activity in accordance with the COP21 agreement.

### What is the economic and ecological argument to be taken into account in solving the problem of access to clean and safe drinking water in isolated areas?

Water re-cycling is necessary in the face of climate change: to combat water scarcity. The innovative technology provided by the LFree project allows to get free from costly sewage treatment plants. It fights against the rural exodus, and water scarcity by recycling waste water on site of use.

### What is the meaning of LFree?

LFree means "linear Fresnel reflection reflector" for Fresnel linear reflectors, a well-mastered technology that uses mirrors. The Fresnel linear refraction whose proposed English acronym is "LFr" for Fresnel linear refraction is an innovative technology. LFree therefore is a pun to mean: Linear Fresnel refraction to produce electrical energy and drinking water in isolated tropical areas. This technology can dramatically reduce the radiation capture area to allow for individual use.



## What are the inspirations behind the project?

The project drew inspiration from various sources. From nature, we observed how solar refraction in water droplets initiates severe burnings on plants under the sun and learned how we could use this effect to harvest solar power and efficiently use it to produce electric power and drinking water at the same time. From science, we reviewed technologies of the past that are well mastered and imagined how we could use them to design a breakthrough technology that does not necessitate very expensive tools and high skills to be implemented at a local level.

## What is needed to have a successful project?

To have a successful installation, the following elements must be present:

- social need for drinking water and electric power
- suitable meteorological conditions and topography
- community that will maintain and use it.

## How much does the micro-power plant cost to build?

Once the prototype development and testing phases are completed, we hope to manufacture the micro-power plant on a large scale at different local sites, which will bring the cost down. Please report to the document named “What is the appropriate financial contribution to the LFree Project” available on the website. The exact cost will depend on where it will be manufactured.

## What are the conditions for mass production?

First, we need to complete the research phase, test the prototypes on the pilot sites. In order to carry out the technology transfer, at the local level, with large-scale production, it is necessary, during the pilot development phase, to investigate the local environment: to assist in the creation or development of small and medium-sized enterprises. These companies should supply materials and, enable production according to the requirements.

## Is the LFree project only focusing on Africa, or can other places around the World benefit from this technology?

Our goal is to first pilot micro-power plant in Spain and studies the possibility of installing them in other geographical contexts such as sub-Saharan countries, islands and subtropical areas that present similar meteorological and topological characteristics as the pilot site.

## What is the local response to the Project?

The micro-power plant has not been installed in local communities yet. Nevertheless, a part of the micro-power plant concept is to reduce its size in order reduce its footprint and blend into the surroundings. People in Mali are very interested by the project.

## What is happening right now at Bio-S-TEAM?

We are trying to relocate the research activity in Spain to benefit from a sufficient solar power flux.

We need sufficient technical facilities to move the project forward.

A foundation in Spain is ready to welcome our activity providing all the facilities and personnel necessary.



## What is the next step for the LFree Project implementation?

We are currently developing a demonstration prototype and are looking for funding to support the completion of the project. We have a minimum requirement of 90 000 € to hire a mechanical engineer, a steam process engineer and finance the installation in Spain (for solar flux) for the final phase of tests.

For more information, please refer to the video entitled "FAQ" available on the website.

## What is the advantage of this innovative technology?

The price of the transport of electricity represents 50% of the invoice and represents 6% of the energy loss. It is now more profitable to produce ourselves provided we can do it permanently. The cost of drinking water distribution represents 45% of the price of water and responds to this same logic. The innovative technology for the permanent cogeneration of electricity and drinking water has a definite advantage for the consumer and the environment.

## What are the prejudices that need to be rid of the LFree project?

The project is not a humanitarian project and will not be financed by donations only. It is not a project of incremental innovations of existing solutions. This is an original combination of well controlled technologies and innovative processes.

It is not a free Source project: technological elements of the project will be protected by patents which the operating licence will be granted under conditions specific to SMEs and very small businesses.

On the other hand, it is an Open Source project. All operators having a license will be able to improve the technology. They may submit a change to Bio-S-TEAM who, after approval, will fund the new patent application and will donate the part of profits resulting from this technical improvement which belongs to the inventor.

## What is the originality of the LFree project?

It is a social science project that plans to produce commercial benefits to finance the project and generate job creation.

It is based on a breaking technology that allows:

- Hybridization of well-controlled technologies using fossil energy with optimized efficiency to reduce emissions of GHGs and fine particulates and produce electricity and drinking water at an affordable cost
- The combination of innovative technology captures and transforms solar energy into electricity to increase the production of electricity and drinking water even in the most remote locations to combat rural exodus

## How is the LFree project organized from the logistical point of view?

The objective is to miniaturize a solar power plant that spans several hectares and to concentrate the capture of solar energy over a few square meters and simplify the processes to allow a local manufacture

The project is divided into 4 independent modules that collaborate:

Module 1 deals with the innovative solar concentration technology (Fresnel linear refraction: FEDAA), which allows an important technological advance on the design of the device and on the tracking of the sun stroke on its two axes.



Module 2 deals with the production of electricity via an innovative micro turbine operating the boundary layer in terms of fluid mechanics and using different innovative energy storage systems.

Module 3 deals with the production and treatment of drinking water.

Module 4 deals with the synchronisation of the 3 modules, their automation and the development of an intelligent (or smart grid) power grid allowing the sharing of individual resources in water and electricity with the community.

### **How long does the LFree project take to develop before it is marketed?**

The expected development time of Module 1, which captures and concentrates the planned solar energy over 12 months.

The expected development time of Module 2, which transforms steam into electrical energy, is planned to be 13 months.

The expected development time of module 3 that separates and purifies drinking water qualities is expected to be 24 months.

The expected development time of Module 4 to manage supply and demand and manage communication between appliances is planned to be 22 months.

### **How are the financial needs related to the LFree project budgeted?**

The main focus of the expenditure is on the salaries of Engineers, the materials used and the location of the prototype testing site.

The development of Module 1 (solar concentrator and steam production) constitutes 30% of the budget and covers about 150 000 €.

The development of Module 2 (production and storage of electricity) constitutes 25% of the budget and covers about 125 000 €.

The development of Module 3 (potable water Production) constitutes 25% of the budget and covers about 125 000 €.

The development of Module 4 (Automation and Smart grid) constitutes 20% of the budget and carries about 100 000 €.



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## *Functions of the appliance*

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### **How does the micro-power plant work to co-generate drinking water and electric power?**

Module 1 captures and concentrates solar energy to produce steam from non-potable water. The steam produces electricity, thanks to an innovative micro-turbine. Module 2 is made of efficient storage systems converting the energy into the electric power when needed. The expanded steam is cooled and then, transformed into purified liquid water with several subsequent treatments made by the Module 3 generating safe drinking water. Module 4 handles the automation system and the smart micro grid.

### **How much electric power and water does it produce?**

The project is still in an exploratory phase, but the aim is to produce at least 6 to 12h of electric power a day using solar energy and 5 to 20 liters (1.32 to 5.28 US gallons) of drinking water a day, while producing much more potable water from a lower grade per day. Please report to the documents named *"How to ensure the energy transition by the implementation of a disruptive technology"* and *"How to solve the water crisis by setting up a disruptive technology"* for more information.

### **How is handled electric power generation and the production of different qualities of water?**

The alternative current is directly generated and transformed to appropriate standards of use. Excess electric power is stored under different forms (mechanical energy; chemical energy...). Please report to the document named *"How to ensure the energy transition by the implementation of a disruptive technology"* for more information. The different quality grade of potable water can be stored or shared within a network in the neighbourhood.

### **Has the Product been tested?**

Preliminary tests demonstrating the concept were carried out successfully. We are currently experimenting with different types of materials and technologies to finalize the prototype that must be tested in Spain.

### **How clean is the water produced with the appliance and how can it avoid contamination?**

The water produced from rain, runoff, dew, waste water, wells is purified after being processed through several potabilization techniques. It is not polluted and comply with WHO (World Health Organization) recommended guidelines for drinking water. Nevertheless, the storage of such drinking water may require additional precautions.

### **Should the daily drinking water produced be consumed every day?**

The long-term storage of drinking water may require additional precautions since it can be re-contaminated by parasites and bacteria. However, the volume of top grade drinking water is just sufficient to fuel a daily consumption of a dwelling.



## When and how is working the energy storage?

There are several types of energy storage that allows the micro-power plant to operate permanently even without solar energy. Please report to *“How to ensure the energy transition by the implementation of a disruptive technology”*.



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## *Materials & Design*

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### **Can the product be made in different sizes and capacities?**

We are developing different options to find the best design that is suitable for various environmental contexts (rural areas/ cities). The look and functionality of the micro-power plant have evolved over numerous iterations.

### **Which technology did you use to design the smart grid?**

For the emerging IEEE 1901.2 standard on Narrow-Band Power Line Communications there are two proposals regarding the Physical and Medium Access Control Layer—PLC G3 and PRIME. However, we did not decide yet about which specification between the PRIME and PLC G3 we are going to use.

### **How to describe the device?**

The device consists of several independent modules that work together.

The first module captures and concentrates solar energy to turn the water into steam.

The second module uses this steam to operate a simple design micro-turbine that converts mechanical energy into electricity through an alternator. It has different storage systems for thermal, mechanical, and electrical energy and extra systems when there is no sun.

The third module uses solar energy to purify water and separate it according to its quality for 3 types of use:

Drinking water.

disinfected water for shower, crockery and laundry.

Non-potable water for the garden and household.

A fourth module manages the communication between the 3 modules for their synchronisation and communication with other devices of the same type to enable the development of an intelligent network capable of providing water and electric power.



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## *Installation of the product*

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### **What tools are needed to construct the micro-power plant?**

Only the usual tools used in public works/ building construction are needed. The micro-power plant can be built with easily accessible material such as copper tubes, steel plates using simple tools such as a welding machine. However, a few parts must be imported (i.e. Fresnel lenses) while others can be recycled (i.e. thermal engine...).

### **How is it constructed?**

The micro-power plant is designed to be easily built by local workers. Technical specifications will be available and updated online and the material that cannot be manufactured on site will be distributed as a kit of elements prefabricated. The micro-power plant will be assembled in 3 days by a team of 4 people.

### **How much space does it need?**

A vacant area of approximately 5 sqm is required for the construction of one micro-power plant. An area of about 10 sqm is required for its installation as footprint.

### **If you have more than one micro-power plant, how far apart do they have to be?**

They can be close to one another if they are 2 meters apart from each other.

### **How much expertise does one need to install the micro-power plant?**

Special skills are required to install the micro-power plant. We will organize a training course to give the basic instructions and technical specifications on how to assemble and maintain the micro-power plant and distribute manuals on 'Construction' and 'Operation and Maintenance'.

### **Can inexperienced visitors interact with the micro-power plant directly?**

Visitors are welcome to engage with the micro-power plant from the outside through the API. However, the access to the core of the micro-power plant, where the solar concentrator is located, is limited and protected by a structure. The access will be limited to the manager and the people involved in maintenance.

### **Tell us more about the intellectual property and the social economy.**

The micro-power plant provides energy and drinking water autonomy without incurring huge investments. The company shares the industrial property protection through licensing, providing market protection for small and medium-sized enterprises compared to major groups. In exchange, SMEs and VSEs with an operating license must pay access to technical specifications and training in the construction of the micro-power plant. At least 6 patent requests are going to be filed concerning Fresnel referral system on 2 axes, Turbine / pump design, waste heat recovery system, hybridization with a conventional system, condenser system and automating system.



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## *Maintenance of the product*

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### **What is the lifecycle of a micro-power plant?**

There are pieces that wear out over time and should be replaced every year such as turbine discs (these pieces are not expensive to manufacture) but most parts of the micro-power plant last over 10 years.

### **Does it require maintenance?**

Yes, the micro-power plant operation must be checked every 6 months to keep it safe. The maintenance of the micro-power plant is very important to guarantee a long duration. It is important to check-up regularly the correct functioning and apply the maintenance needed to keep the micro-power plant operative and make sure that the Electrical systems material still complies with the European Directive 2006/95/EC and that the Equipment under steam pressure still complies with Directive 97/23/EC.

### **How does it hold up to rain, wind, hail, heat, cold, dust, electrical and storms?**

The device is designed to withstand various weather conditions. In case of severe weather events such as a sandstorm or an electrical storm, the solar concentrator has panels to protect optical systems. In the event of a hurricane, the appliance is firmly anchored on a concrete slab.

### **Can elements of the micro power plant break during transport or installation?**

All the elements are very sturdy and support the transport. The most fragile elements are the refractive systems of light that remain, far more robust than the mirrors used to achieve the Fresnel reflection. However, under the elements may partly require maintenance and replacements.



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## *Environment*

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### **How do you identify the right site for the micro-power plant?**

Studying the local climate and gathering data is fundamental to site selection. We analyse the weather conditions and assess the presence and frequency of sun, rain and underground water in the area. Once the site has been identified as suitable for the micro-power plant, the device may be installed. The micro power plant does not need a lot of space for its construction. Once the site identified as appropriate, the micro power plant can be installed and does not need a lot of space for its construction.

### **Does the LFree technology requires the presence of water and sun to function effectively, or can it produce electric power without sun or drinking water without water?**

The device can work better with the presence of the sun, but it can also function without it, thanks to auxiliary systems. However, the micro-power plant may not provide drinking water without a source of non-drinkable water (rain, runoff, wells, waste water...).

### **How much water Is the system able to generate every day?**

The system can provide different grade of potable water. Its volumetric capacity to provide potable water depends on the required grade. However, it provides sufficient drinking water: please report to the document “How to ensure the implementation of a breakthrough technology to solve the water crisis” available on the website for more details.

### **Are there any inhabited rural areas where the micro-power plant could not work well?**

Some areas may have more favourable conditions than others: inter tropical area providing both a sunny weather and a rainy season is better.

### **Is the water harvesting system is affected by pollution?**

The systems are designed to get rid of persistent substances dissolved in water. It is a clean technology.

### **What environmental problem does the LFree project want to solve?**

To combat pollution, global warming and reduce the impact of the emission of the most powerful greenhouse gases, the LFree project allows to optimise the complete combustion and to reduce the production of fine particles and gases with effects of Greenhouse like nitrogen oxide.



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## *Alternatives*

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### Are there any alternative to produce drinking water?

The warka tower is an ecological solution complementary to the LFree technology to provide drinking water without using consumables (filters) that are expensive.

Zeromasswater is a company providing a device able to extract water from air. This start-up financed by Bill Gates has neither social and solidarity economy values nor humanitarian purposes.

### Why not simply use photo-voltaic panels / dig wells to get electric power and drinking water?

Photovoltaic panels produce electric power and wells can provide water. However, a photovoltaic panel yield decrease when ambient temperature increases. It pollutes enormously at the end of its life if there are no recycling channels. The wells can provide water containing toxic persistent substances from a contaminated soil.



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## *The company Bio-S-TEAM*

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### **The company Bio-S-TEAM: What is its legal form?**

The company Bio-S-TEAM is a simplified company (SAS) of French law. However, its headquarters will have to migrate to Spain in the form of a medium-term limited liability company (SL) to test the prototype.

The company is not an association; a cooperative; a mutual; A Foundation or endowment fund

It is a simplified stock company with a specialized, scientific and technical activity.

### **The company Bio-S-TEAM: What is its social object?**

The company has as its object directly or indirectly, in France or abroad, within the framework of the development of research in relation to sustainable development and social and solidarity innovation, the creation, the protection, the developing and the promotion of the innovations of its principal partners and of its partner or other clients in the alternative.

### **The company Bio-S-TEAM: What is its business model?**

The company's business model is based on the transfer of technology through the social and solidarity economy allowing a local production of the product allowing a fair price for better access to drinking water and electricity.

The company's activity is the transfer of technology, i.e. the development of research in relation to the social and solidarity economy in developing countries, in accordance with the COP21 agreements.

### **What is the company's activity?**

The company is not a research laboratory.

The company is not a training center, a humanitarian organization or a solar panel installer.

The company's scientific activity is an applied research allowing to propose innovative and local solutions to sustainable development.

The Bio-S-TEAM develops the LFree project which involves the miniaturization of a thermodynamic micro power plant co-generating electricity and drinking water to supply a dwelling.

### **Is it a committed company?**

The company is not a militant or political organization.

The company supports citizen engagement for environmental protection, fair trade and sustainable development.

To sum up: Bio-S-TEAM is a commercial company with a scientific vocation operating in the social and solidarity economy.



## The company Bio-S-TEAM: Who are its founding members?

Ismael Aduayom, president of the company and director of research, specialist in water chemistry, he holds a PhD in biochemistry and has expertise in fluid mechanics and heat transfer. He's working on the development of the prototype.

Fred Elisma, director of the IT department, holds a master's degree in biochemistry and a master's degree in Bio-informatics. It works on the development of the Internet interface and the connectivity of the prototype.

Mélanie Grondin, Director of communication, Patent and technology transfer, she holds a PhD in biochemistry, has expertise in environmental toxicology and skills in patent filing. She's working on technology transfer.



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## *Funding and Support*

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### Why do we need 20 000 € from the crowdfunding?

We need to find people who are willing to invest time, energy and money to find sustainable solutions. We need to prove to financial investors that there really is a market for this disruptive technology that can stimulate local economies in tropical countries, reduce greenhouse gas emissions and combat water scarcity. We must demonstrate that a human society without large power plants and large sewage treatment plants that concentrate humans in overcrowded cities is possible without losing quality of life.

### How the 20 000 € will be used for?

The 20,000 euros will be used (1) to finance the move to Spain; (2) to obtain European grants for the development of the project; (3) to justify much-needed bank loans.

### Do you receive assistance from other organizations?

We worked independently with no specific assistance from other organizations. However, the International Office for water helped us to find infrastructures that can welcome the project in Spain (CENTA). The [Lafset](#) (CNAM) will provide expertise in thermic transfer.

### Who is funding The LFree Project at this point?

At this point, the partners have financed the whole research on the project to date. We have submitted several applications to the Horizon 2020 work program. We are looking for investors focused on the social and solidarity economy.

### How can I get more involved in the LFree Project?

To learn more about our project, you can visit our official [Facebook page](#):  
<https://www.facebook.com/LFree.Project/>

Connect with our [Facebook profile](#) : Lfree Bios-team

Follow us on [Twitter](#): [https://twitter.com/bio\\_s\\_team](https://twitter.com/bio_s_team)

Subscribe to our [Newsletter](#): <http://bio-s-team.com/>

If you would like to publish an article or a blog post on the LFree Project to help us spread the word, or have any other collaboration ideas, please drop us an email at [info@bio-s-team.com](mailto:info@bio-s-team.com). And lastly, help us make this project a success by donating! We would greatly appreciate your support for the LFree Project.