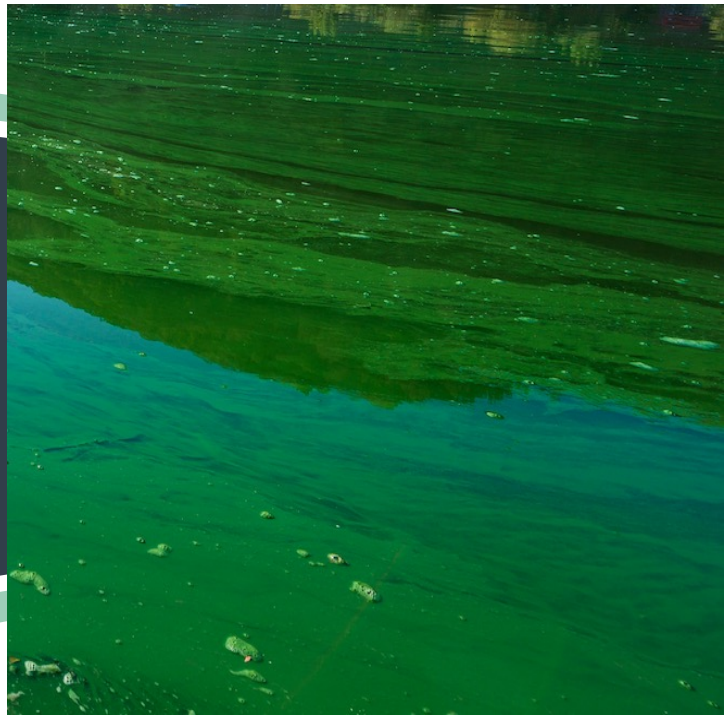
Series A Funding Round Pitch Deck

Competitive production of bioethanol in sun-rich regions, for profit and saving the environment

August 28, 2024



Executive Summary

Company & Management	▪ AXF Energy GmbH is headquartered in Düsseldorf, Germany ▪ Young biotechnology company run by experienced management ▪ Focus on large market with an important topic, potential to become a unicorn ▪ Three big assets (patent-pending technology, developed industrial process, genetically engineered organisms)
Climate Change	▪ Global temperature and CO_2 concentration are on highest levels and growing faster than ever ▪ The transportation sector's CO_2 emissions are still growing ▪ Electronic vehicles are part of the future, but not the sole solution, especially not internationally ▪ One renewable fuel competitive with gasoline already exists: bioethanol ▪ Typically produced from sugar cane or corn, with proof-of-concept of large scale use in Brazil ▪ Current bioethanol production however competes with agricultural land and production is not scalable further
Our Industrial Process	▪ AXF Energy developed a process to produce bioethanol from cyanobacteria ▪ Enough land exists to fully replace gasoline by bioethanol produced from cyanobacteria, e.g. part of the deserts of Australia ▪ Three process steps: Recycling of nutrients, efficient production of sugar-rich biomass using a patent-pending photobioreactor design utilizing heliostats (mirrors) and optical fiber, and utilizing our own genetically engineered optimized cyanobacteria, then classical bioethanol fermentation ▪ A future business option is rocket fuel: We can also produce biomethane as used in SpaceX's starship with our technology, and our process is more realistic to work on other planets than culturing sugar cane or corn ▪ AXF Energy is the first to join six USPs together, in total likely resulting into the first competitive process to produce bioethanol using cyanobacteria
The Future Plan	▪ We plan to build our first industrial plant in Southern Spain from 2025 - 2028, to be run at a profit, to prove our processes & technology beyond any doubt ▪ Current operations (2021 - 2024) cost 1.35 mio. € (forecasted). This amount was personally funded as seed funding by Thomas Rogg, CEO and currently the sole owner of AXF Energy GmbH ▪ End of 2027 the construction of a fully operational initial plant (1/8 of the final scale) is finished and tested. This requires a funding in this Series A round of a minimum of 20 mio. €. Enough to prove the plant design at 1/8 size in 2027 + buffer ▪ 2028 is dedicated to the expansion of the plant using established, scalable construction processes. This will require an additional 65 mio. €. To be also secured either in this funding round, or in a second one Q2 2027 ▪ Risks include having a too expensive process, regulatory risks and a low market price of bioethanol
Investor Value Proposition	▪ First plant's operation expected to achieve an EBITDA of 5 % of construction cost: ~ 4 mio. € per year ▪ With the success we will be in the position to secure contracts to build third-party plants ▪ This will generate substantial up-front revenue ▪ Our growth will be determined by our effectiveness in scaling. Billion dollar revenues possible till 2030 ▪ The importance of this business is easily comprehensible to the general public. Thus an IPO should be attainable, creating an exit opportunity with significant returns

Company & Management

Young biotechnology company run by **experienced management**

AXF Energy GmbH: Headquartered in Düsseldorf, Germany, with global way of working

Competitive edge due to own **genetically modified cyanobacteria**, developed in own lab

Large market, important topic, potential to become **a unicorn**

Patent-pending revolutionary photobioreactor design

Lab-tested technology and process to **competitively** produce bioethanol

Company & Management

CEO
Thomas Rogg, 38 years old

- Founder and currently sole owner of AXF Energy GmbH
- Expert in business management, biochemistry, computer science, and automation/robotics
- Co-founder and 50% owner of AllMediaDesk GmbH, a global company with approximately 30 employees, generating around € 5 million in annual revenue and around € 2 million in EBITDA
- Holds a German Diplom in Computer Science, equivalent to a Master of Science (M.Sc.)

VP of Research & Development
Dr. Michael Hinzmann, 34 years old

- Joined AXF Energy mid of 2023
- Doctorate in organic chemistry, solid history of innovate research projects prior to joining AXF Energy
- Responsible for developing and validating our technology
- Primary focus is to drive efforts in reducing the cost of producing green ethanol
- Expert in biochemistry and genetic engineering

VP of Engineering

To be recruited before completion of funding round

- Accountable for the development of the plant blueprint and operating protocols
- Oversees the construction of the first self-operated plant, scheduled for 2025 – 2028
- Leads the expansion of the plant construction team in anticipation of future plant construction contract sales

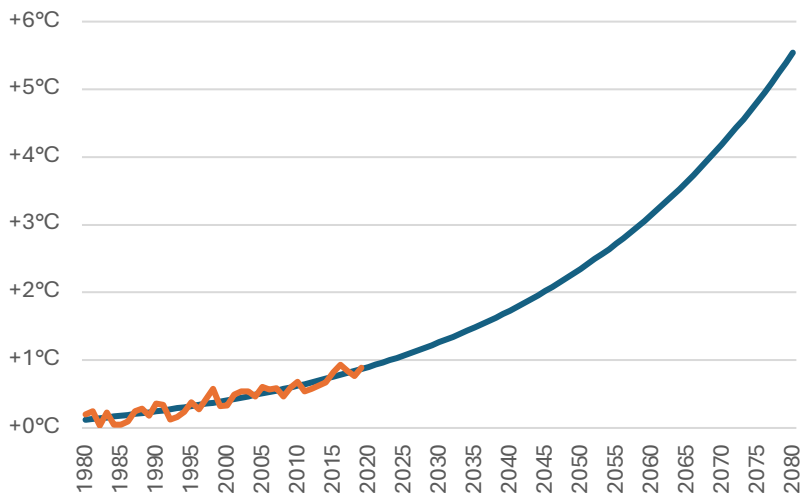
VP of Sales

To be recruited towards completion of construction of first self-operated plant (2027)

- Lead efforts to license our proprietary technology and secure large-scale plant construction contracts
- Drive strategic initiatives to influence policy and accelerate the transition from fossil fuels to green ethanol

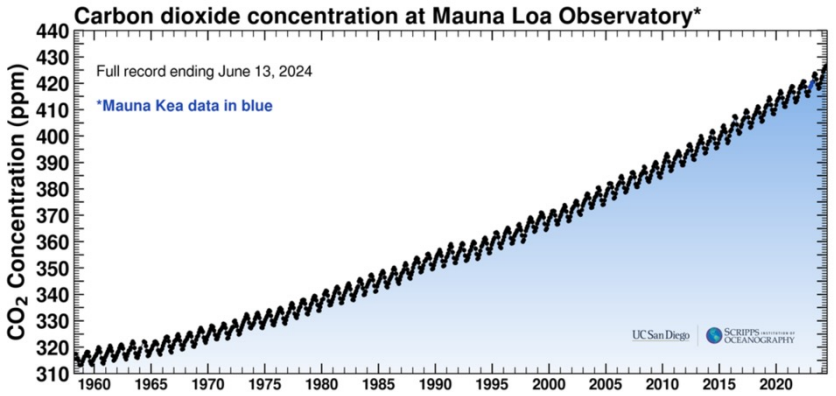
Climate Change

- Global temperature is increasing exponentially
- Temperature will increase by 0.1°C per year starting in only 40 years



Exponential curve fitted on Met Office Hadley Centre observations datasets https://www.metoffice.gov.uk/hadobs/hadcrut5/data/current/download.html

- CO_2 concentration continues to rise
- 2024 has seen the fastest increase in CO_2 concentration ever

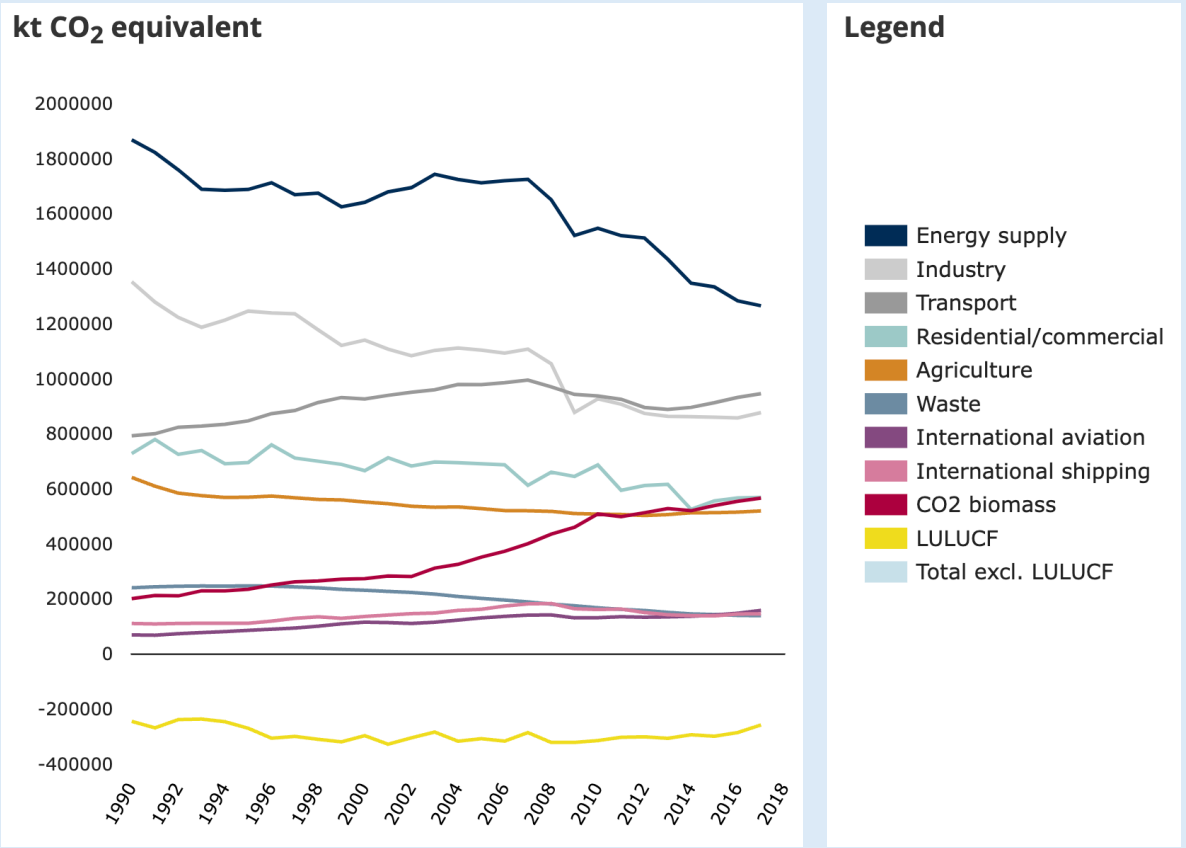


The „Keeling Curve“, https://keelingcurve.ucsd.edu/

Climate Change

- Transportation is one of the sectors in which the CO_2 emissions are still growing!
- Electric vehicles are part of the future, however not the full picture:
  - Familys and businesses appreciate the longer range and faster recharging of fuel vehicles
  - Infrastructure for EVs in lesser developed countries does not exist
  - Larger vehicles, such as 18-wheelers and ships, are yet to be electrified

➢ A demand for a renewable fuel exists



Greenhouse gas emissions by aggregated sector, EEA
https://www.eea.europa.eu/data-and-maps/daviz/ghg-emissions-by-aggregated-sector-5

Bioethanol: A potential solution with proof-of-concept in Brazil?

- An already produced biofuel
- From sugar cane or corn
- At ~ 80 % greenhouse emission savings compared to gasoline
- Already price competitive to gasoline

- Gasoline cars can be cheaply converted to run on E100
- Existing infrastructure of gas stations can be easily repurposed for E100
- 2013: 94 % market share of flexible fuel vehicles which run on E100 in Brazil
- Since 2008 more bioethanol is sold in Brazil than gasoline.

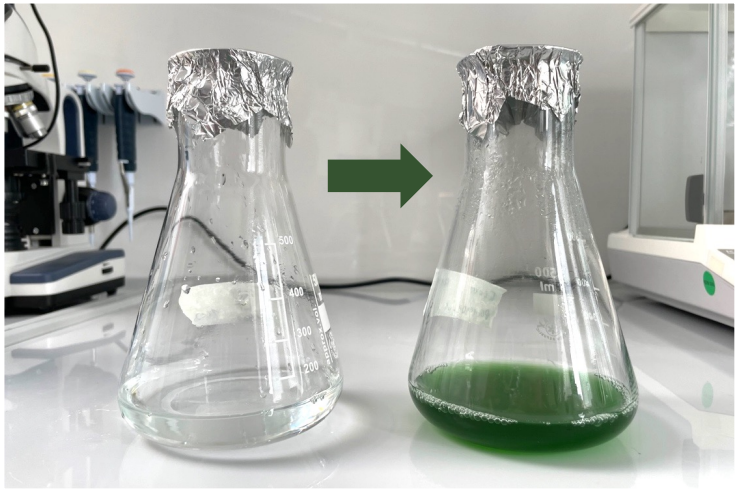
The production of bioethanol competes with agricultural land.

- Most developed countries only mix in small amounts of bioethanol in their gasoline (E5, E10, E20)
- This is enough to make over half of all crops in US and Europe flow into the production of bioethanol

Our Industrial Process

- We solved the problem of competing with agricultural land by cultivating cyanobacteria, the unicelluar photosynthetic microorganisms which plants evolved from, and fermenting their biomass.
- With this, only a fraction of the desert space of e.g. Australia is needed to produce enough bioethanol to replace the whole gasoline consumption world-wide.
- Others – of course – have already tried to use microorganisms like cyanobacteria or microalgae to produce bioethanol before.
- However, their processes are to costly.
- We spent the last three years to research and develop a potentially cheap enough process.

- Cyanobacteria thrive in tanks filled water and nutrients, instead of soil.



- Their growth turns water from transparent to dark green.

Our Industrial Process

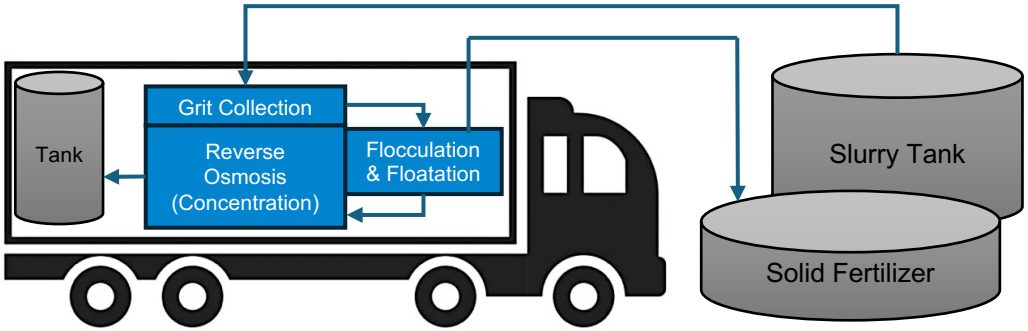
Step 1: Recycling of Nutrients

Liquid Fertilizer

- Agricultural slurry manure and anaerobic digestate from biogas plants are rich in all nutrients needed to grow cyanobacteria.
- Due to overfertilization, in many regions both are distributed for free or the owners even pay for their disposal.
- We help the farmers and biogas plants by separating their‘s into solid and liquid fertilizer using our trucks.
- They keep the solid fertilizer which they can sell more easily, we keep the liquid fertilizer.

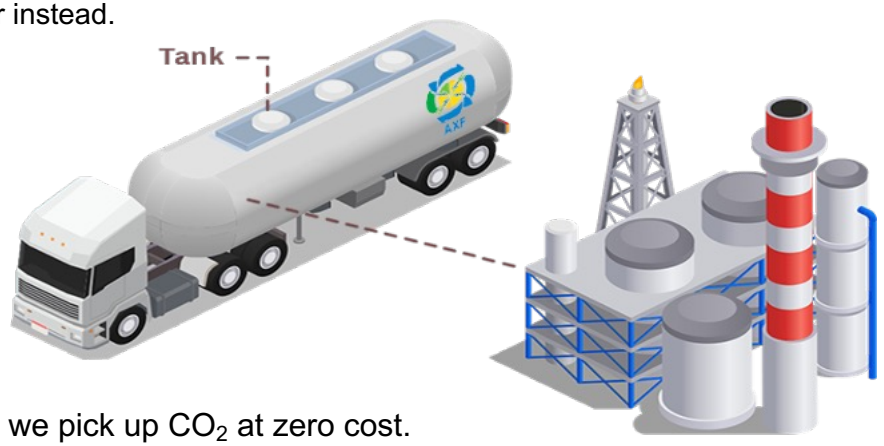
Flocculation of anaerboic digestate in AXF Energy lab and resulting liquid fertilizer.

- Our lab tests established that we can produce clear liquid fertilizer (for perfect photosynthesis) and that our cyanobacteria grow on these recycled nutrients.



CO_2

Biogas plants and cement producers, among others, produce CO_2 as side product. This gas is not pure, thus cannot be sold at a profit. It is blown into the air instead.

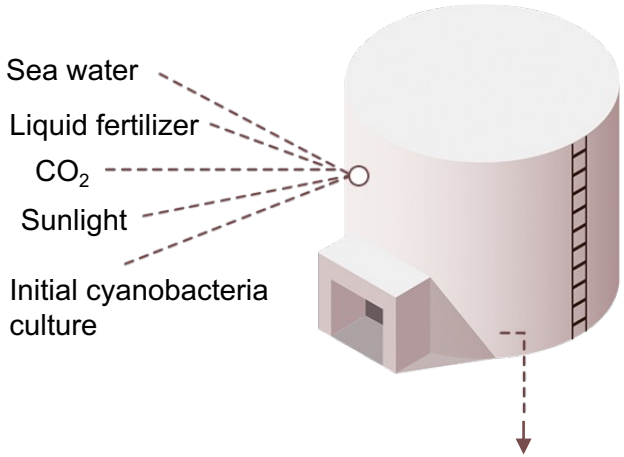


Here we pick up CO_2 at zero cost.

Our Industrial Process

Step 2: Sugar-rich Biomass Production

- We grow the cyanobacteria in closed vessels with controlled parameters, such as temperature range and CO_2 concentration (a so called „photobioreactor“ or „PBR“).
- The liquid fertilizer contains all the nutrients required by cyanobacteria to grow, except for carbohydrates. Cyanobacteria can utilize CO_2 as a source of carbon through photosynthesis.



Large amount of sugar-rich cyanobacterial biomass

Two innovations stand out:

Innovation 1: Our photobioreactor inspired by solar towers

Our patent-pending photobioreactor (PBR) solves the problem of delivering massive amounts of sunlight to the cyanobacteria while keeping an optimal temperature range at lowest operational costs.

The costs for building the PBR is < 5 % of the costs of existing PBRs.

The PBR is based on established designs which concentrate sunlight on dark buildings in deserts using a large array of mirrors, so called heliostats.

In our case the sunlight is transported into the culture medium using fiber optics.

Innovation 2: Our genetically engineered cyanobacteria

AXF001WT is our wild-type cyanobacteria strain, selected from many after an extensive series of in-house test culture runs.

Embedded in our process this strain achieves one of the highest absolute sugar contents of all wild-type strains and thus one of the highest yields of bioethanol per invest.

AXF001OPT is our genetically engineered strain, based on AXF001WT, which accumulates even more sugar: up to 80 % of the dry mass of the final biomass is glycogen (AXF001WT: up to 65 %).

This improvement allows for using up to 28 % less process inputs, reducing cost massively.

Our Industrial Process

Step 3: Bioethanol Fermentation and Destillation

- The harvested cyanobacterial biomass is dewatered, yielding a product with comparable key metrics (total solids, sugar content) to that of sugar cane or corn.
- In cyanobacterial biomass, sugar is stored as glycogen. We enzymatically convert this glycogen into glucose, similar to how sucrose in sugar cane and corn is converted into glucose before fermentation.
- After this, the ethanol distillation process remains identical to that used with sugar cane or corn.
- Modern ethanol distilleries optimize profitability by monetizing byproducts, such as CO_2 and biomethane, through the anaerobic digestion of fermented biomass.

➢ **Step 3 is a fully established process without further innovation. Can also be outsourced.**

- Doing this third step in-house however will allow to sell ethanol, an already fully tradable product with a great future as biofuel, instead of a product - cyanobacterial biomass - which others have no experience with.
    - Potentially, if the chain of production is controlled, a surplus on the market ethanol price may be achieved due to the more environmental friendly approach (no use of agricultural land, even higher GHG emission reduction).

Future business option:
Rocket fuel

- Our actual innovation is the production of cheap sugar-rich biomass.
- Our communication however concentrations on bioethanol due to the pursuasive topic of decarbonization of the transport industry.
- However, we can use the sugars to produce biomethane instead of bioethanol just as well, by directly anaerboic digestion of the biomass right away.
- With this, we have the cheapest option to produce biomethane, which is the rocket fuel of the future (used in SpaceX‘s Starship).
- In fact, producing cyanobacterial biomass in closed vessels like we do is much easier to implement on other planets than producing sugar cane or corn…

Our Industrial Process

We convert …

Abundant resources without value to owners → Nutrient recycling → Culture medium + CO_2 → Sugar-rich biomass production → Sugar-rich biomass → Bioethanol fermentation and destillation → … into **Bioethanol** A tradable product with large market

AXF Energy is the first to join all of these USPs together, in total resulting into a likely **competitive process to produce bioethanol:**

- Use of recycled nutrients instead of expensive minerals.
- There is no demand for these recycled nutrients, so we erase significant costs from our equation.

- Custom cheap PBR, both in construction and operation, allows for perfect thermal control and light harvesting at the same time.
- The light heats up the culture medium, and sea water is used to cool the culture medium down.
- With this approach we can keep the optimal temperature range at low cost.

- Efficiency of an entrepreneur-run startup instead of researcher spin-off or large group.
- Management has 18 years of experience of running start-ups.

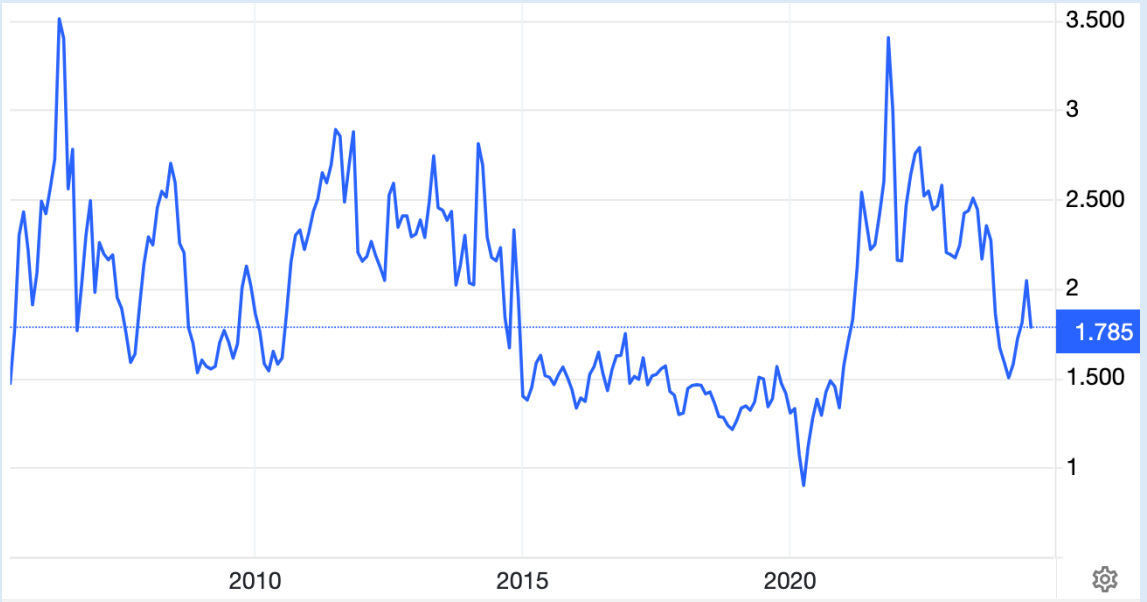
- Not a „4th generation“ ethanol production process: direct ethanol production using genetically engineered cyanobacteria.
- This is the path that the research community has been following for the last 15 years.
- However, our R&D shows this is a dead end: Storing the glycogen in bacteria‘s walls and fermenting later is the key to keep contamination in check.

- All optimization possibilities were exhausted to obtain the most sugar-containing biomass, including the task of genetically engineering cyanobacteria.

- We have extensive knowledge in biochemistry, automation, robotics and computer science.
- Supplemented with the knowledge of industrial processes and plant construction (VP of Engineering), we will be able to continue our R&D mostly in-house.
- This allows us to continue our operations efficiently and swiftly.

Bioethanol: A Commodity

- Current US market price of ethanol: $ 0.47 / liter. In the past 20 years, the price has been between $ 0.35 and $ 0.74 / liter (*July 18, 2024, Trading Economics).*
- The price for ethanol in Europe is typically $ 0.20 higher, thus currently ~ **$ 0.67 / liter**, and never lower than $ 0.52 / liter (S&P Global).
- Global ethanol market size: ~ 75 – 100 billion USD depending on market research institute asked.
- Thus, even the largest success of our business should not impact market prices.



July 18, 2024, Trading Economics (www.tradingeconomics.com), price of bioethanol, here in USD/gallon

The Future Plan

We plan to build our first industrial plant in Southern Spain from 2025-2028, to be run at a profit, proving our processes & technology beyond any doubt:

Construction cost

Phase 1:
1/8 of plant,
Fully functional

12.5 mio. €
~ 13.7 mio. $

Phase 2:

63.2 mio. €
~ 69.8 mio. $

Amount of bioethanol produced

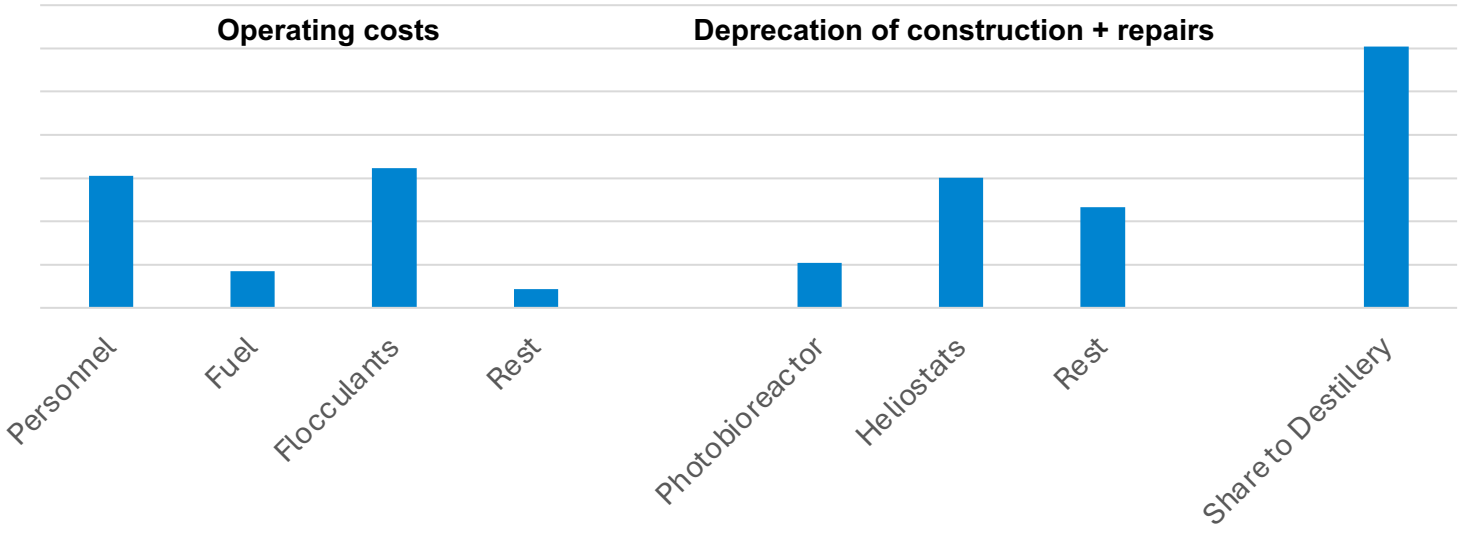
25 mio. liters

Cost of bioethanol produced

0.4 € / liter

Profit margin large enough for ROI of construction costs of 5 %

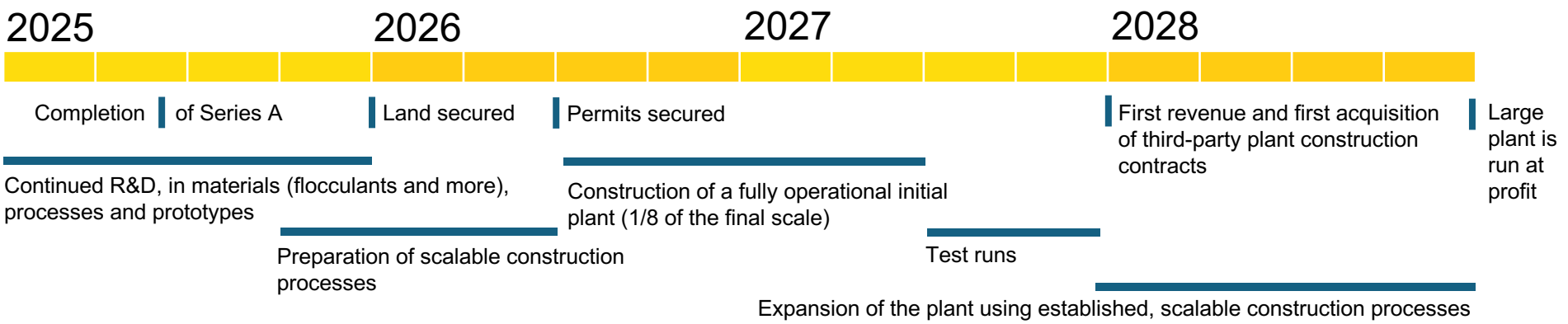
Split of cost of bioethanol produced



- Our first industrial plant only produces the sugar-rich biomass.
- To produce ethanol, a cooperation with an existing destillery will be established.

The Future Plan

Timeline

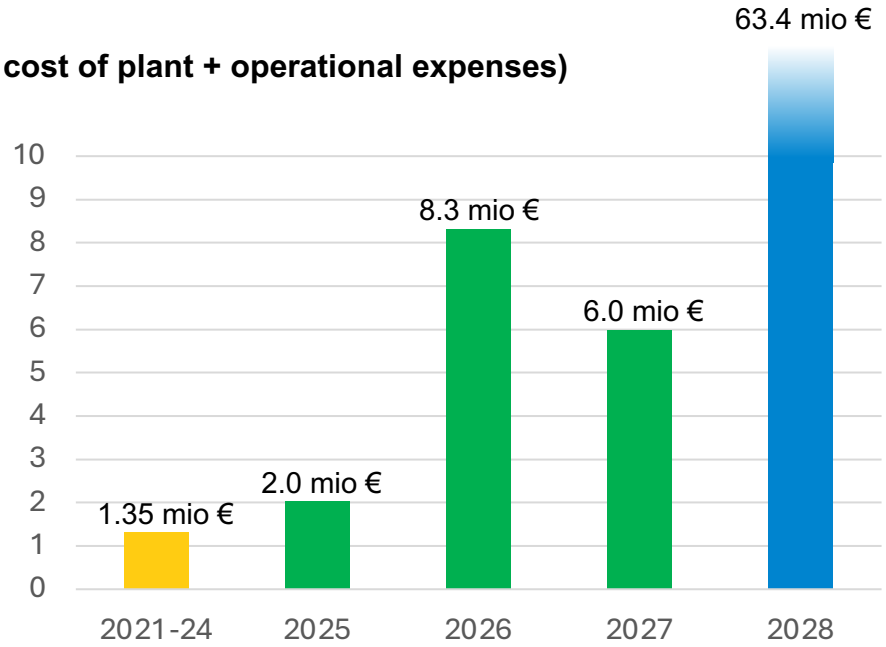


Investment (construction cost of plant + operational expenses)

Total invested 2021-24 (forecast):

1.35 mio. €

This amount was personally funded by Thomas Rogg as seed funding.



=> Funding Series A

Minimum of **20 mio. €**

Enough to prove the plant design at 1/8 size till end of 2027 + buffer

To be expanded to full size in 2028 using additional

65 mio. €

To be also secured either in this funding round, or in a second one Q2 2027

The Future Plan

The following problems may arise, derailing us from our plan.

Too expensive process

We have modeled the complete construction and operational costs of the plant based on laboratory tests and existing literature. However, unforeseen factors or overlooked aspects may result in the process not being as cost-effective as anticipated.

Possibile mitigation

- Additional research and development, funded through an extra investment round
- Explore the possibility of higher pricing for green bioethanol through strategic lobbying

Regulatory risks

The large-scale use of genetically engineered cyanobacteria, despite their environmental safety, along with the disposal of decontaminated material into the sea, may require extensive discussions to secure necessary permits. This could potentially delay the construction of our first plant.

Possible mitigation

- Early collaboration with the local government. The permit situation is taken into account when selecting the site to build the plant.

Market price of bioethanol

While unlikely, there is a risk that the market price of bioethanol could drop below the usual range. However, this is improbable since many traditional ethanol plants (sugarcane and corn-based) are already reporting losses at the lower end of the price spectrum. Prices are expected to stabilize as these traditional plants exit the market.

Factors which may limit scaling

Nutrients

The process relies on agricultural slurry, manure, or anaerobic digestate as nutrient sources. These resources are abundant and should not become limiting factors until a significant number of large plants are operational.

To get around this limitation on the long term, we will research on how to improve our process to fully recover all liquid fertilizer nutrients (none of these flow into the final product bioethanol), including phosphate and ammonia.

Locations for plants

Cyanobacteria require significantly less space for growth compared to sugar cane. Studies indicate that the Australian desert alone is sufficient to produce enough bioethanol to replace global gasoline usage.

However, other aspects also have to fit: Industry to gather nutrients reachable via trucks, connection to sea or lake, even if established via longer pipes.

Investor Value Proposition

- First revenue in 2027
- Break-even right after full expansion (planned for end of 2028)
- 5 % of construction cost expected as EBITDA: ~ 4 mio. € per year

Scaling opportunity

- With a validated business model, the significant bioethanol market valued at approximately $100 billion, and the growing relevance of the industry, we will have the capability to license our technology and construct numerous large-scale plants for other companies, beginning in 2028.
- By securing contracts to build these plants, we will generate substantial up-front revenues.
- The potential size of our growth will be determined by our effectiveness in scaling. If executed well, the growth trajectory could be significant:

	2028	2029	2030	2031
Revenue	10 mio. €	100 mio. €	1,000 mio. €	10,000 mio. €
EBITDA	1 mio. €	10 mio. €	150 mio. €	2,000 mio. €
Margin	10 %	10 %	15 %	20 %

- Margin growth is fueled by plant production efficiency growth over time.

Exit opportunity

- The importance of this business is easily comprehensible to the general public.
- Therefore, upon success, a public offering (IPO) should be attainable, creating an exit opportunity with significant returns.

Thank you for your attention!

Please indicate your interest in participating in our funding round to:

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