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## TELL US ABOUT YOUR COMPANY AND YOUR BUSINESS MODEL

<b>Your "punch" line, in 140 characters</b>	Rivus Batteries pioneers cost-effective and eco-friendly grid-scale energy storage through <€100/kWh organic electrolytes for flow batteries
<b>Foundation Year</b>	2023
<b>Choose the cleantech segment that best reflects your core activities:</b>	Energy Storage
<b>Provide additional key words that describe the sub-segment / focus areas you operate in</b>	Grid scale energy storage, Long duration energy storage, Stationary battery energy storage, Electrolytes for flow batteries.
<b>Tell us about the problem you are solving and why it is important:</b>	Rivus tackles the urgent lack of cost-effective grid scale energy storage; with the energy sector reliant on fossil fuels, responsible for 40% of global CO2 emissions, and renewable energy growth impeded by grid-instability. Rivus aims to supply organic electrolytes to flow battery companies globally, targeting the growing \$4.2B market for >4-hour battery storage and increased demand for flow

battery electrolytes rising from 114 MWh to 907 MWh by 2025 (IHS Markit 2020).

**Describe your technology or solution in detail:**

Rivus offers cost-effective electrolytes for flow batteries, the 2nd most deployed technology in grid-scale energy storage.

Flow batteries is a simple system comprised of electrolyte tanks storing the energy and stacks for charging and discharging. Benefits include long lifespan and cycle life, minimal self-discharge, and non-flammability. However, its current reliance on vanadium for electrolytes—a heavy metal from China and Russia—poses security and cost barriers to widespread use.

**Is your solution:**

Hardware

**What is innovative about your idea?**

Rivus introduces cost-effective organic electrolytes, comprising only water, organic molecules, and salt. These offer 50% higher energy density (33 Wh/l) and stability over thousands of cycles. Employing a one-step reaction with cheap bulk chemicals, Rivus anticipates substantial cost reductions via optimized production. Forecasts indicate an electrolyte cost <€100/kWh shortly, a 60% cost reduction compared to vanadium electrolytes, positioning Rivus for grid-scale global energy storage.

**Describe your business model**

Rivus' business model is to contract chemical suppliers to produce the electrolytes in their existing facilities. The go-to-market strategy is to quickly pilot with Nordic end-customers, such as real estate, to demonstrate. Compatibility with existing hardware minimizes risks, enabling them to use European-supplied vanadium flow batteries for its pilots. Once demonstrated Rivus will sell its electrolytes to established flow battery companies to use in new flow battery installations.

**Application areas**

Rivus offers cost-effective, long duration energy storage for end-user applications such as real estate, industry, and utilities, slashing energy storage costs. The solution enables peak shaving, energy shifting, and independence, enhancing energy security and balancing renewable supply. Switching to Rivus' electrolytes empowers flow battery firms with cost advantages, reducing vulnerability to vanadium price fluctuations, dependence on critical imports, and environmental impact.

**Tell us about any intellectual property you have:**

Rivus has a European patent covering the use of its electrolyte and similar molecular structures in flow batteries, progressing internationally via the PCT process. They have received good search report for 18 of 19 patent claims, securing a robust protection for its upcoming deployment and scale-up.

**ENVIRONMENTAL IMPACT**

**What environmental benefits can be achieved with your solution?**

Rivus' mission is to utilize abundant materials to make batteries exceptionally cost-effective so that the combination of batteries with solar and wind power is cheaper than burning fossil fuels. Rivus' environmental benefits centres on providing significantly more cost-effective and eco-friendly electrolytes for flow batteries, targeting the 4–24-hour stationary energy storage market which currently lacks commercially viable battery technology.

**How can/will your innovation support, directly or indirectly, the reduction of carbon emissions?**

Rivus aims to supply its electrolytes to established flow battery firms, enabling them to offer the next generation green batteries at lower prices than today's batteries to their customers. This is critical to enable renewable energy expansion and reduce the dependence on fossil fuels. Rivus' strategy avoids gigafactory construction, ensuring rapid, low-risk growth. By 2035, the aim is to build 25 GWh of storage capacity, slashing CO2 emissions equivalent to 10% of Sweden's annual output.

**Have you calculated the environmental impact, actual or potential, of your solution?**

Yes

**Please provide the results of your impact assessment**

Rivus aims to install 25 GWh by 2035. If used once per day to store wind energy with a CO2 footprint of 12 kg/MWh\* with 70% energy efficiency, replacing gas power with a CO2 footprint of 500 kg/MWh\* (\*Vattenfall LCA) this results in a saving of 4.4Mt of CO2e per year, equal to reducing Sweden's annual CO2 emissions by 12%.  
Calculation:  $25,000 \times 365 \times 483$  (kg CO2e savings per MWh for wind power + energy storage compared to gas power) = 4.4M tCO2 / 35.85M tCO2 (Sweden's CO2 emissions 2021) = 12%

## MARKET, CUSTOMERS AND COMPETITORS

**What is your target market and how big of an opportunity is there?**

Rivus targets the \$4.2B >4-hour duration battery energy storage market. New technologies utilizing abundant materials are poised to grow, while lithium-ion batteries, featuring a higher energy density will play a pivotal role in electric mobility and short duration energy storage (1–4 hours). Rivus specifically targets the growing market of electrolytes for new flow battery installations, where demand is projected to surge from 114 MWh in 2019 to 907 MWh by 2025 (IHS Markit, 2020).

**In which geographical markets would you be most interested, in the short term?**

Rivus intends to carry out pilot installations in Sweden during 2024 with an aim of launching more widely in the market during 2025. The company intends to take the first steps internationally in 2025 and beyond, with Europe being the focus in the first phase and then North America.

**Describe your target customer**

End-users: LOIs have been secured with five pilot customers in real estate and industry for the 2024 pilots. Concurrently, discussions are ongoing with prominent utility and energy firms like Naturgy, E.ON, and Acciona, all

seeking cost-effective alternatives to lithium-ion batteries. Large electrolyte customers: Rivus has initiated discussions with established global flow battery manufacturers. Next step includes deepening the collaboration to prepare for pilot-installations next year.

**How many customers or users do you currently have?**

Five LOIs have been signed with pilot customers for 2024. Rivus has also initiated dialogues with several large vanadium flow battery companies, such as CellCube, Invinity Energy Systems, H2 Inc and Sumitomo Electric. They have spent the last decade reducing their hardware costs, now showing strong interest in new, alternative electrolytes to further drive down costs. Adopting more cost-effective electrolytes would enhance their competitiveness in the energy storage market.

**Who are your competitors?**

Rivus' advantage lies in its lower cost through independence from critical metals. Compared to other flow battery tech, Rivus stands out in its choice of redox-active molecules (energy carrier):

1. Vanadium, a costly heavy metal mainly mined in China and Russia.
2. Zinc-bromide, contains toxic and corrosive bromine, leading to increased system cost.
3. Iron-iron, produces hydrogen gas, leading to increased system cost
3. Other organic electrolytes: superior stability and cost-effectiveness.

**What is your unique selling point?**

Rivus utilizes abundant organic compounds - carbon, hydrogen, nitrogen, and oxygen - that can be easily synthesized from standard bulk chemicals that are available in nearly unlimited quantities. This reduces costs and mitigates the mounting pressure for scarce critical metals. Rivus' electrolytes provide clear benefits:

- Cost-effective and eco-friendly – made from organic materials.
- Exceptional safety – non-toxic, non-flammable and non-explosive.
- Secure supply chain – no critical metal

## TRACTION AND FINANCIALS

**How are you financing your activities?**

During the past year, Rivus has secured a total of €1M to expedite its development and deployment, comprising €0.5M in equity from new and existing shareholders, in addition to three grants worth €0.5M from the Swedish Energy Agency and Vinnova.

**Provide your most recent turnover (in EUROS)**

31721

**Select the option that best describes your company's development stage**

Prototype and Validation

**What have you accomplished so far and**

Rivus' technology is the result of six years' university research where Rivus built hundreds of lab-scale batteries,

**what are your next steps?**

demonstrating its electrochemical properties, long-term stability and cost-effectiveness. During 2023 the first demo battery was commenced, a compact 1 kWh organic flow battery with results indicating a life length of 20 years. During 2024 Rivus will deploy its first two full scale pilot-batteries (10 kWh + 100 kWh) expediting the path towards market launch in 2025.

**How much funding have you raised so far? (in EUROS)**

1000000

**Are you currently looking for funding?**

Yes. Alongside the planned pilot battery demonstrations during 2024, Rivus aims to secure its next funding round of €4-5M in late 2024 / early 2025 which will provide the resources needed to execute a successful market launch during 2025.

**Please specify the amount and type of preferred actor (e.g. strategic, passive, industrial, private) and what you are planning to use this funding for**

Rivus is currently at TRL 5 and €4-5M will help Rivus take rapid steps towards the market by:

- Scaling up and optimizing its electrolyte production
- Install a grid scale customer pilot, and prepare for the 2025 market launch
- Further build a team ready to rapidly scale

A grid scale pilot battery will be a game changer in attracting partners for further expansion. It is also the key to provide the data and confidence needed to pique global flow battery companies to buy Rivus' electrolytes

**TEAM**

**Describe the founders and key team members. Cite background and competences.**

Rivus' team shares a deep care for our planet:

- CEO and founder Dr. Cedrik Wiberg, an experienced electrochemist and idealist by heart;
- COO Andreas Kölling, a passionate intrapreneur with experience from several start-ups;
- CTO Dr. Lisa Åkerlund, a seasoned battery expert; and
- Lab Scientist Dr. Eduardo Maurina Morais, an experienced organic chemist.

The extended team consists of an electronics specialist, 3 board members and 5 advisors including experts from industry and academia.

**Why is your team the right team to bring this solution to the market?**

Rivus' core team consists of four driven people with in-depth knowledge within electrochemistry, organic chemistry, batteries, and business development which are needed to bring Rivus' solution to the market. In addition, Rivus' active board and advisors possess expert knowledge in both technology, business management and product development to meet specific challenges along the path ahead.

**What key additions to your team are needed in the short term?**

The only skill that is currently missing in the immediate team is a Chemical Industry Expert – with in-depth knowledge about various potential raw materials and deep knowledge in chemical scale-up.

## CONTACT DETAILS

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