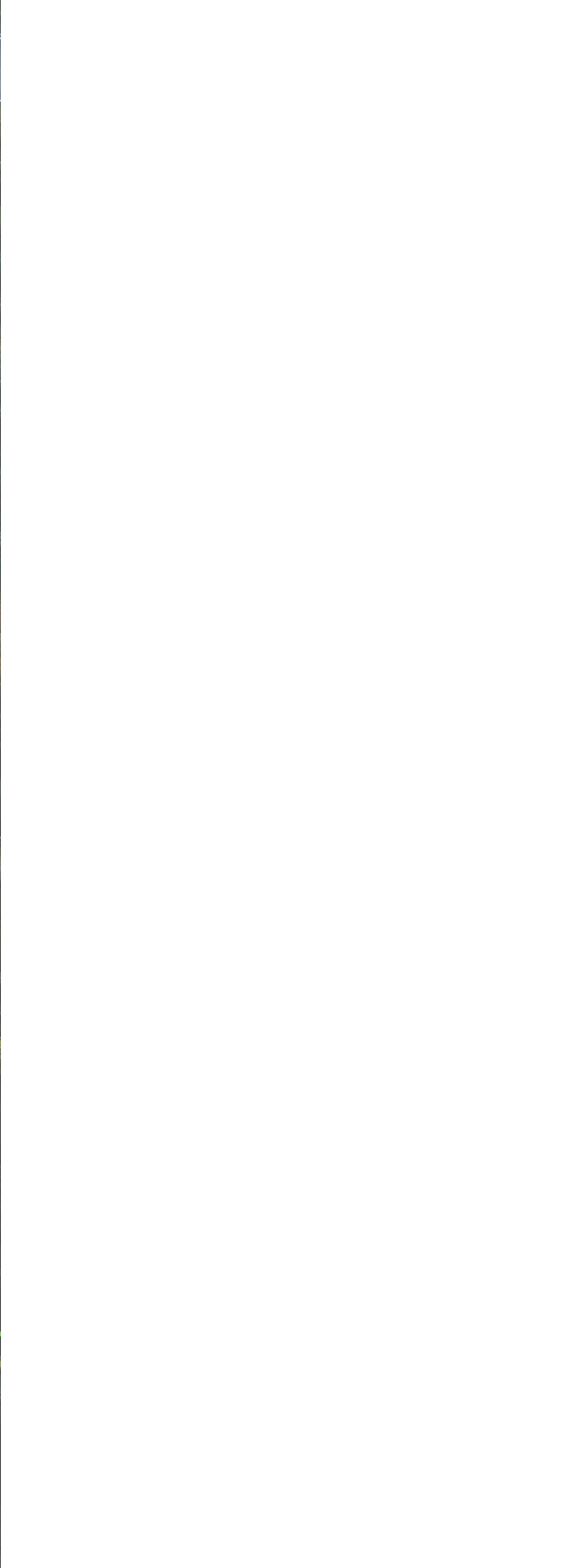


An overview of cleantech start-ups



With the support of



Start-ups : a reliable gauge of the development of cleantech in Switzerland

In 2010 the «cleantech wave» was widely dismissed as a fad. Fifteen years on, the sector has proved its mettle.



Eric Plan – Secretary General of CleantechAlps

Of course, the situation has changed radically since those days. First with the international consensus on global warming reached with the signing of the Paris Agreement, which came out of COP 21 in 2015. Then with the advent of an international framework for sustainability following the adoption of the Sustainable Development Goals (SDGs) by the United Nations. Since then, more than 70 countries have announced their strategy for achieving Net Zero by 2050.

Start-ups are a good way of measuring the pulse of the innovative sectors of an economy and the vitality of an innovation ecosystem. They also reveal which technologies are emerging and point the way of future trends. No surprise then that we should choose to use our start-ups to illustrate the growth of the Swiss cleantech sector and the promises it holds.

To this end we have completed an exhaustive audit of this ecosystem and are delighted to share it with you in this report on the state of play in the sector. The report takes a close look at the change in the number of companies established year on year, their geographical spread and specialism (technology segmentation), their characteristics (importance or otherwise of their IP, origins, nationality of their founders, SDGs supported, and more), and also their target markets and the investment secured since the sector's emergence in 2010.

We also present a portfolio of profiles of our start-ups and scale-ups to illustrate the solutions that are contributing to our transition to a more sustainable society. This report complements the Swiss Cleantech Report, the fourth edition of which was published in spring 2024 and is distributed at all the cleantech sector's major international forums and trade fairs and to Switzerland's embassies and consulates all over the world.

We also share with you our vision for 2030 for the cleantech sector, a vision that incorporates the concept of sustainability in our society. Since sustainability is nothing other than « the ability to maintain an activity in the long term », incorporating it into our business strategies in a world in recurrent crisis is surely a no-brainer ? The doubters among you can check back in with us in 15 years' time!

On behalf of CleantechAlps, I would again like to express my heartfelt thanks to our partners, the Swiss Federal Office of Energy (SFOE), Switzerland Global Enterprise (S-GE), the Federal Office for the Environment (FOEN), and the Office for Economic Affairs and Innovation of the Canton of Vaud (SPEI) and its innovation agency Innovaud, without whom this study would never have been possible.

Happy reading !

The Swiss cleantech start-up ecosystem : key facts and figures

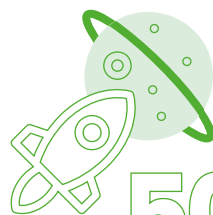


More than

560

cleantech start-ups

founded since 2010 and still in business in 2024



50

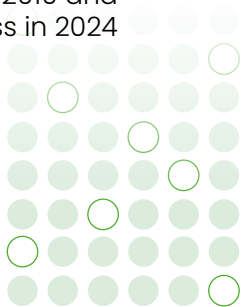
new cleantech start-ups

founded every year in Switzerland

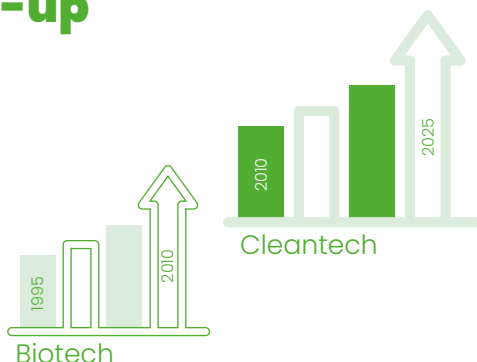
Of all the start-ups created in Switzerland in the last 5 years,

1 in 6 is a

cleantech start-up



59% of start-ups cite **funding** as their main challenge



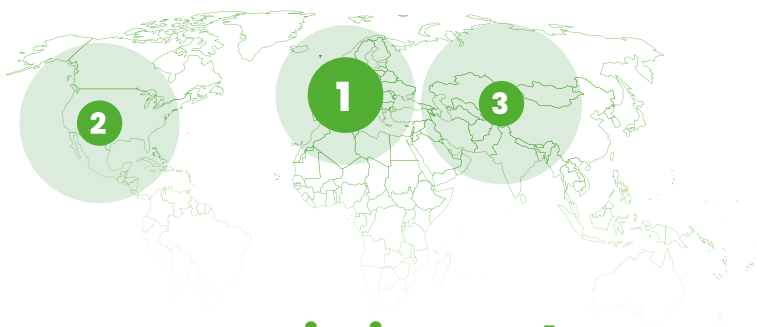
Investment

in cleantech start-ups is similar to the investment seen in biotech 10 to 15 years ago

48%

of cleantech start-ups are the result of

initiatives of private individuals



Europe remains the **priority market** (84%), ahead of North America (37%) and Asia (27%)

The **number of female employees** is constantly increasing, accounting for 30% of the workforce at the end of 2023



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01

Audit of the Swiss start-up ecosystem

Introduction

This panorama provides an inventory and overview of the entire cleantech sector in Switzerland. It showcases the innovative and technology businesses of Switzerland with strong growth potential, also known as deep tech companies. We have included all companies entered in the commercial register from 2000 onwards that are active in the cleantech sector. This study does not include projects (which have not yet established a company), self-employed activity, services companies, consulting and engineering firms, or foundations, NGOs or other not-for-profit entities. Companies that have ceased trading by the date of publication or that have been acquired by other companies in the meantime have been included in our analysis.

The overall objectives of this panorama are to :

- raise the profile of the cleantech sector;
- reassure and attract investors;
- illustrate the density and dynamism of the Swiss cleantech sector;
- demonstrate its importance and its contribution to the country's economic fabric;
- identify emerging fields;
- discuss ways of cementing Switzerland's leading role in cleantech;
- show the potential for the development of future instruments to support the sector;
- provide a portfolio of solutions for the media, local authorities and industry.

MUCH MORE THAN A MERE TECHNOLOGY...

Cleantech is not simply about using innovative technology to exploit our energy resources more sparingly. It is also about adopting an attitude, habits and a way of life that result in individuals and businesses from every sector of industry acting in a way that preserves nature's resources globally. We must therefore rethink human activity and economic processes to incorporate the principle of the efficient and respectful use of raw materials, energy, water and soil. By its nature, the cleantech sector encompasses a wide range of activities and is constantly evolving. In this panorama we have divided it into seven main categories, subdivided into 22 subcategories closely inspired by the segmentations proposed by the Cleantech Group and the strategy consultants Roland Berger. The next page shows the typology we have adopted.

« With the accelerating climate crisis, social and technological innovation has never been more necessary and urgent. As the most innovative country in the world, Switzerland must lead by example. »

— Jean-Christophe Zufferey, Founder of SenseFly, Co-founder and Board member of newatts



AGRITECH



SUSTAINABLE
FOOD
PRODUCTION



AGRONOMY AND
COMMERCIAL
FORESTRY

RENEWABLE ENERGY
PRODUCTION AND
DISTRIBUTION



OTHER RENEWABLE
ENERGIES



ENERGY STORAGE



SMART GRIDS



SOLAR
PHOTOVOLTAICS



HYDROPOWER

ENERGY
EFFICIENCY

WHAT IS CLEANTECH?

Cleantech (or clean technologies) refers to technologies, products and services developed to further the sustainable use of natural resources and the production of renewable energy. Its main purpose is to reduce our consumption of resources and manage our natural systems more carefully. The new technologies have a key role to play in this. The role of the user and understanding user behaviour are also becoming increasingly important.

SERVICES



INDUSTRIAL ECOLOGY
AND CONSULTANCY



ENERGY
EFFICIENCY

TRANSPORTATION



FINANCE



ECO-MOBILITY

RESOURCES



WASTE, RESOURCE
EFFICIENCY,
RECYCLING



ENVIRONMENTAL
TECHNOLOGIES



WATER



CIRCULAR
ECONOMY



ADVANCED
MATERIALS

OTHER



HYDROGEN



MISCELLANEOUS



HYBRID
TECHNOLOGIES



ARTIFICIAL
INTELLIGENCE



SUSTAINABLE
CONSTRUCTION/
PROPOTECH



PREVENTION OF
NATURAL DISASTERS

FAVOURABLE FRAMEWORK CONDITIONS

Like start-ups in every other sector of the economy, new cleantech businesses need to grow. Today these businesses benefit from a favourable context in terms of the framework conditions inherited from the internet revolution and the emergence of biotech that marked the beginning of the start-up era. Since the turn of the century, and more specifically since 2010, Switzerland has built up an environment that provides professional support for fledgling companies. All over the country, incubators – physical or virtual structures dedicated to helping businesses grow – have been set up. Examples include the Energypolis Campus in Sion and The Ark Foundation and its start-up incubator for businesses throughout Valais, the EPFL Innovation Park (EIP) and its future Ecotope building in Ecublens, the Blue Factory in the centre of Fribourg, the various Swiss Innovation Park sites around Switzerland, or the Technoparks in German-speaking Switzerland in cities such as Zurich, Winterthur and Lucerne. A wide range of specific support services, including coaching for start-ups, has been developed. Over time, acceleration and training programmes aimed at entrepreneurs have come into being, as have all kinds of ideas competitions, business plans, awards and investor forums.

The global environment has thus become structured and specialised. The underlying principles of entrepreneurship may remain the same but the management and development of innovation have to adapt to the demands of each business sector. It is therefore no surprise to see that specific programmes have sprung up which are now available to cleantech businesses. One example is the Venture Leaders Cleantech programme organised by Venturelab.

Co-funding instruments have been adapted and expanded, such as the Pilot and Demonstration fund and the SWEET and SWEETER funding programmes run by SFOE, FOEN's Environmental Technology Promotion fund, and the Technology Fund providing bank loan guarantees to businesses operating in the sector.

IN A DISRUPTED GEO-STRATEGIC CONTEXT

With the exception of the Fukushima nuclear accident in March 2011 which helped to kick-start the sector, the period from 2010 to 2015 was a very positive time. It was characterised by a context of economic growth, with a highlight being COP 21 in Paris and the subsequent signing of the climate agreement and launch of the Sustainable Development Goals (SDGs) by the United Nations, following on from its Millennium Development Goals. The SDGs call for common action to combat poverty, promote economic growth and protect the climate. This impetus continued with the approval by the Swiss populace of the Energy Strategy Act in 2017, forming the high point of the previous decade.

What happened next is familiar to us all: the disruption of supply chains following the incident involving the container ship Evergreen, which blocked the Suez Canal. Some commentators claim that this episode was a harbinger of things to come, marking the beginning of a period of uncertainty. The resulting instability has persisted to today, with the global Covid-19 pandemic, the war in Ukraine, the explosion in energy prices caused by the geopolitical situation; we could go on...

This critical situation was exacerbated in 2022 by a combination of circumstances caused in part by climate change, including France's maintenance shutdown of its nuclear power stations, insufficient gas stocks and reduced rainfall resulting in low water reserves. This situation of general instability now appears to have become the norm. In addition, the hike in interest rates in the last two years has wooed away some investors, lured back to the once-again profitable financial market which is deemed less risky than putting their money in start-ups. This has resulted in tension in the investment market.

The vision in 2010...

To a somewhat sceptical audience, in 2010 CleantechAlps publicised its vision of the three stages of cleantech development in Switzerland:

- The launch period of 2010 to 2015, characterised by the emergence of the sector with a reasonable number of – in some cases opportunistic – initiatives, which between them would get the sector up and running.
- Between 2015 and 2020, a consolidation of the sector was expected in a generally favourable context.
- From 2020, this vision predicted a large-scale rollout in the decade up to 2030.



FIGURE 1: Development phases and key events in the history of cleantech in Switzerland

This vision from CleantechAlps, inspired by the Conference on Innovation held by the Swiss Federal Councillor and Energy Minister Doris Leuthard, proposed a simple logic based on the assumption that the Swiss market was quite simply too small to give rise to a significant development of Swiss cleantech players by itself. The view was that the domestic market had to be considered to be only the first step in the development of the sector, serving as a pilot market and a springboard to pave the way to internationalisation.

Contrary to the Minister's perception, which considered Switzerland's strength in cleantech to lie in product manufacture, at that time we were already arguing that Switzerland had the capacity to produce turnkey solutions suited to the various application contexts. Switzerland's ability to adapt a solution to the environment and context in which it is to be applied transpired to be one of the keys to success in this sector.

In the meantime this vision has by and large been confirmed by the facts, as illustrated in Figure 1, and is today still very much valid going forward. Figure 1 presents a deliberately pared-down summary of the significant events during this period, shown in five-year stages. During the first period (2010 to 2015), public initiatives relevant to cleantech flourished, at both cantonal and federal level. Private companies, including the Big 4, chanced their arm right from the word go. Between 2015 and 2020, with the exception of CleantechAlps, almost all of the initiatives in cleantech, both institutional and private, disappeared, at a time when the number of start-ups being created was accelerating.

The big challenge for the period 2020 to 2025 and beyond is now evident. The way ahead clearly lies in Swiss expertise forging a path into the relevant international markets. Switzerland does have much going for it to succeed in this final stage and ensure long-term growth, but to do so it is essential that it steps up a gear and is better coordinated.

On the whole, the current framework conditions are favourable, but we must use our current momentum to strengthen them. For the immediate future, here are two suggestions on how to do this:

- Introduce some degree of flexibility in the interpretation of the selection criteria for the current co-funding instruments. The main way of achieving this is by tweaking the rules of application, without making any changes to the legal bases.
- Introduce pooling of the resources allocated to financial support, in particular for a programme such as REPIC. This would involve re-allocating during the year those budgets that look like they are set to remain in surplus and are unlikely to be used by an instrument to other programmes experiencing higher demand over the period in question.

AND THE OUTLOOK FOR 2030...

«Cleantech 2030+» is our current vision for the next decade, which foresees a boom in the sector subject to our ability to exploit two key elements: the international markets and the paradigm shift accompanying the energy transition. Or, more accurately, the energy revolution that is under way – a paradigm shift, the outcome of which we cannot yet predict with any certainty. Since we have already discussed the first of these two points at length above, let us consider the second here.

In energy terms, the current period represents far more than a revolution. We are living through the transition from the old (carbon-based) world to a new more sustainable and more responsible (lower-carbon) one. And it is precisely this rapid adoption of sustainable practices that informs our vision of what is to come.

The political and economic background to this move towards zero-carbon strategies (as of mid-2024, more than 70 countries have set a net-zero carbon emissions goal) and the new limitations imposed by environmental, social and governance (ESG) criteria combined with the European directive on corporate sustainability reporting (CSRD) are set to fundamentally change the face of the economy in the coming years.

We are convinced that sustainability, **in other words, our capacity to maintain an activity over the long term**, will profoundly impact the society of tomorrow and play a significant part in the growth of cleantech businesses.

Check back in with us in five years' time for our next assessment. In the meantime there is plenty to be done!

MAINTAINING MOMENTUM

And the cleantech bandwagon is indeed on the move – but with international competition gathering apace we must not forget that the race is not yet won. Our absolute priority must be to ensure that at every level (and in particular among our leaders) everyone is aware of the position and the potential of Switzerland's cleantech sector today.

The Swiss Cleantech Report provides a useful appraisal of Switzerland's position in the sector. This official publication, distributed to embassies and at major industry events, complements this report on the subject. We invite you to read it: [swisscleantechreport.ch](https://www.swisscleantechreport.ch)

Ensuring that this sector, one that augers well for Switzerland's future, becomes properly established calls for a significant and targeted increase in financial resources. It is essential that we endow ourselves with the means to remain at

the leading edge of innovation in those sectors identified as strategic for the future and which are part of Switzerland's DNA, such as (seasonal) energy storage, sustainable chemistry and bioprocess technology, and reducing CO₂ emissions.

The rocket is off the ground, let's give it enough fuel to keep it in the air for the long term. Close collaboration with Deep Tech Nation Switzerland in the matter should also cement Switzerland's place in the race to win these niche markets.

The state of play: progress made since the advent of the sector in Switzerland

A quick look 15 years on tells just how far we have come since 2010. The sceptics of the day have since dropped their sardonic smiles, many of them even jumping on the cleantech bandwagon. Because the figures don't lie.

EVOLUTION OF THE NUMBER OF START-UPS

Given the number of cleantech start-ups springing up year on year – a figure that has almost doubled every five years (Figure 2) –, the progress made by the sector is clear to see. Currently, the number of new companies founded every year is hovering around the fifty mark.

EVOLUTION OF FINANCE RAISED

Investment in cleantech start-ups was stagnant until 2015, when around CHF 13 million of funding was raised. Since then investment has shot up, almost tripling every two to three years to reach the CHF 1 billion mark in the record year of 2022, as shown in Figure 3.

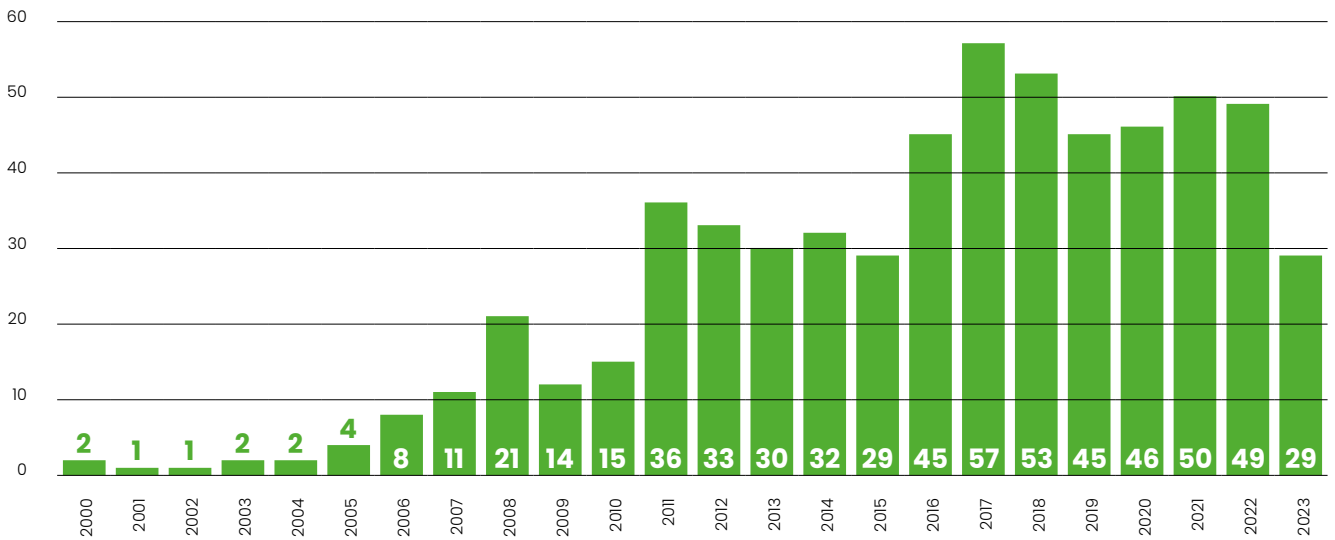


FIGURE 2 : The number of cleantech start-ups established each year

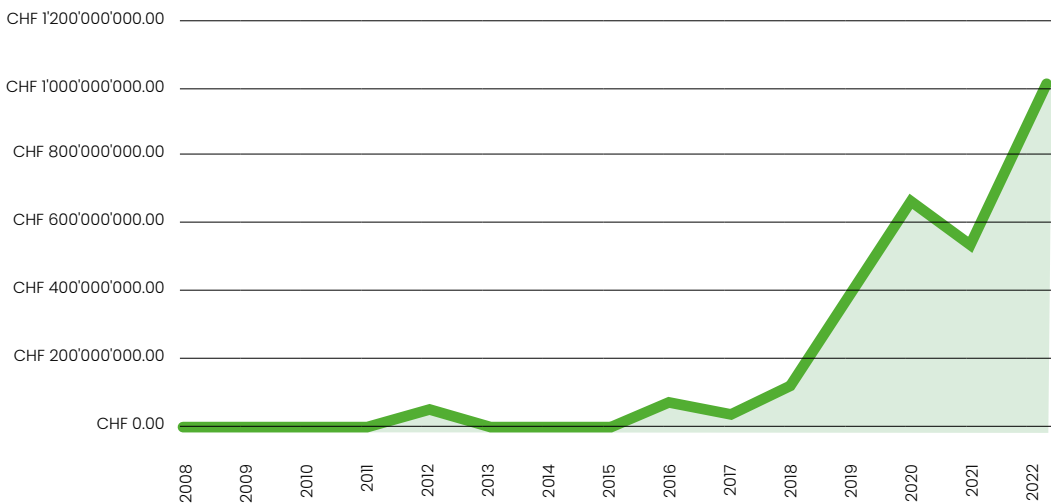


FIGURE 3 : Funds raised each year by cleantech start-ups in Switzerland from 2008 to 2023

2000–2005, THE PRELUDE TO THE EMERGENCE OF CLEANTECH START-UPS IN SWITZERLAND

The audit presented in this report covers the period 2000 to 2023. It may appear surprising that this analysis should start as early as 2000 when cleantech in Switzerland and in Europe generally did not really emerge until a decade later. At a time when picking up on weak signals to anticipate the future is becoming the norm, it was simply curiosity that led us to begin the analysis on that date. Our aim in doing so was to try to gain a better understanding of the sector’s history to provide a greater insight into its development, for example learning more about the new cleantech fields or emerging areas such as sustainability.

Therefore, even though the figures prior to 2006 are marginal (we have identified 12 cleantech companies founded between 2000 and 2005, justifying the description of these years as the prelude to the emergence of cleantech), this period and

the profiles of these businesses have provided us with an interesting insight into the genesis of cleantech start-ups in Switzerland. Although we did not detect the emergence of a specific sector during this period, it is fair to say that most of the current industries such as photovoltaic technology, waste and water were already present. We also discovered that these were clearly private initiatives launched by a small number of visionaries at the forefront of their respective fields who cleared a path for others with varying degrees of success. It is interesting to note that two-thirds of these companies are still on the market today, some having travelled a bumpy road along the way. These businesses make very interesting use cases for analysis. Given the limited time available for this audit, we have not been able to investigate this matter further, but will return to it should we have the opportunity to do so.

THE FUTURE STEP 2026–2030+ : THE SUSTAINABILITY EFFECT?

We expect the last development stage of the Swiss cleantech ecosystem to begin in 2026, using «2025+» to describe its large-scale international rollout in specific niches.

More specifically, we predict a significant step up in 2026–2027 as a direct consequence of the increasing importance and generalisation of legal requirements promoting sustainability (ESG reporting, the CSRD, etc.). Currently, it is the multinationals and European SMEs that are directly concerned by this, but in the future (and the future is already here for some players such as subcontractors of large groups), it will be up to our SMEs to follow suit. As yet, very few (too few) Swiss SMEs have come to terms with the coming paradigm shift and the impact that this will have on the functioning of the economy and their business.

This evolution offers tremendous business opportunities for start-ups, which are agile by nature, to develop and offer businesses solutions and services that respond to their growing needs in this area, smoothing the way for them and enabling them quite simply to remain in the game. A fair amount of thought and activity has already been dedicated to this subject with the integration of AI in particular, as we shall also see in the way that the numbers of business break down into the different portfolio segments.

Current corporate communication on the subject of sustainability may be focused very much on the Sustainable Development Goals (SDGs), but it is apparent that (Swiss) start-ups are communicating very little in these terms. With a view to gauging this aspect of business, in a later section of this report we show you how the cleantech start-ups are positioning their portfolios in terms of the SDGs.

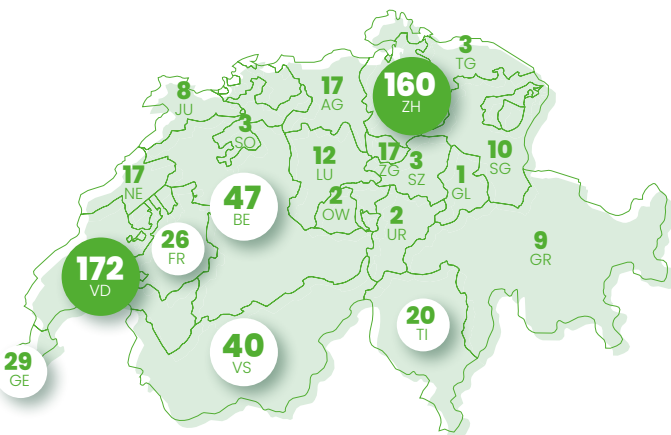


FIGURE 4 : Number of start-ups by canton

GROWTH IN A SERIES OF STAGES

The growth in the number of cleantech start-ups over the period of our analysis is not constant; it occurs in stages, with each step lasting roughly five years: 2006–2010, 2011–2015, 2016–2020 and 2021–2025 (the current period). We have found a correlation between these steps and the occurrence of major events such as the Fukushima disaster, the Paris Agreement and the adoption of the Energy Strategy Act in Switzerland (see Figure 2).

It is interesting to note that the number of start-ups created in 2023 (29) is significantly below the average for the period concerned (around 50). We had previously observed this phenomenon in the first edition of this report (published in 2017), when the figures for 2016 showed a fall in the number of start-ups created that year. Figure 2 shows that five years later, more companies founded in that year (but not visible at the time) have since come to light, clearly resulting in an incremental jump in 2016, the start of the third step. Furthermore, we had predicted this jump, expecting the highest figure to be in 2017, in view of the forthcoming Energy Transition Act. And that is exactly what we are expecting for the fourth step in 2021–2025 with the adoption of the federal Climate and Innovation Act (LCI).

KIWI, A NEW TOOL TO SPREAD THE WORD ABOUT SUSTAINABILITY

To encourage this shift as part of its mission to raise sustainability awareness, CleantechAlps has developed jointly with The Ark Foundation a self-evaluation tool designed to educate start-ups on the subject. The tool will be rolled out nationwide through organisations such as Venturelab.

Designed to align with businesses' day-to-day needs, this tool has the potential to evolve into an application for use by scale-ups and SMEs. Its primary objective is to enable start-ups to get to grips with sustainability from the start, helping fledgling companies to get into the habit of systematically incorporating the sustainability dimension into their relationships with their future customers. The aim is to ensure that new businesses instil right from the word go sustainability-driven concepts in their workforce for the design of their products, services and business models.

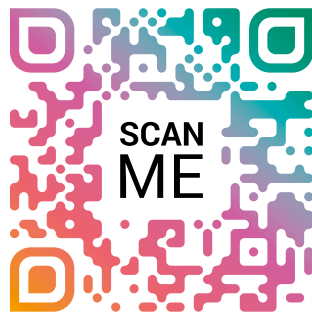
The purpose of this initiative is also to speed up the transition to a more sustainable society while strengthening the economic fabric as a whole.

The swiss contribution to achieving the Sustainable Development Goals


4th edition

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enabling new business

Cleantech
Western Switzerland
Sustainability Cluster **Alps**


energypolis

:: csem

ONE CREATION
Think Sustainable

CimArk >

gaz
nat



02

Analysis of the Swiss start-up ecosystem

Number of start-ups by canton

In this study, using the public data available, we identified and analysed 615 businesses that were founded over the period 2000 to 2023. More than 90% of these start-ups are still in business. In addition, 208 of them (34%) responded to a detailed questionnaire which provided us with some very valuable first-hand information. The figures and statistics marked with an asterisk are taken from this sample.

Comparing the characteristics of this sample with the full data set (615 businesses) revealed that they were very similar in their composition. Cross-checking several analysis parameters confirmed this similarity, which means that the figures obtained from this sample can be considered, at first glance, to be representative of the Switzerland's entire entrepreneurial cleantech ecosystem. More in-depth analyses, for example through a series of systematic interviews with the people concerned, could be helpful if we felt the need to refine our understanding of any one or more of the individual analysis criteria. We are not, however, anticipating any surprises that would require us to resort to this option in our analysis.

The cantons of Vaud (172) and Zurich (160) lead the way in terms of the number of cleantech start-ups (Figure 4). On the surface, this result would appear to be explained by the presence of the country's two Federal Institutes of Technology EPFL and ETHZ in these cantons and their contribution to generating deep tech spin-offs.

However, an analysis of the origin of these start-ups (Figure 5) shows that the actual situation is more complex. Slightly more than half of these fledgling companies are the result of private initiatives (55%), with the remainder having their origins in the various academic institutes. Between them, the two Federal Institutes of Technology account for 28% of these young companies, with the country's other academic establishments completing the picture with 17%.

This reveals an ecosystem with a healthy balance between the private and public sectors when it comes to generating cleantech start-ups, and this is no doubt one of its strengths. We found a similar situation in terms of the geographical spread and origins of these start-ups in our 2017 analysis. As we have seen, it would therefore be simplistic and false to explain the boom in cleantech start-ups in a region solely by the presence of one of the two Federal Institutes of Technology. The vitality of an ecosystem arises from a combination of factors, as revealed in our analysis below.

Nevertheless, since it is clear that internationally recognised academic institutions do contribute to the pulling power of a region, we should seek to understand how this happens. It would appear that their reputation attracts private individuals who are keen to set up their (future) company in the vicinity, essentially to facilitate collaboration and to benefit from both the image and the momentum generated by the nearby ecosystem. It is interesting to note that while ETHZ acts as a

magnet attracting talent to the Zurich area, EPFL's regional hub strategy has a broader impact on Western Switzerland as a whole, as we shall see later. This strategy, instigated by EPFL President Patrick Aebischer and stepped up by his successor Martin Vetterli, is bearing fruit in this respect.

A more careful look behind the scenes of these two leading regions does however suggest that it is more likely to be a combination of factors and framework conditions, developed over the long term, that ultimately results in a momentum becoming established. This then translates, as it does here for example, to the systematic generation of start-ups in one area of industry rather than another. But we should not forget that SMEs make up more than 99% of Switzerland's economic fabric. And therefore that success and prosperity also lie in a region's ability to connect its fledgling companies with its SMEs and vice versa. This can be achieved, for example, by introducing programmes in specific fields and providing physical sites and dedicated resources to facilitate in-situ testing, industrial pilots and the large-scale rollout of solutions. Examples of this are numerous.

The other story told by the findings shown in Figure 5 is that innovation is not generated solely in academic circles. It is its association with the private sector that stimulates this kind of impetus. This is a very good illustration of a circular chain of innovation, with innovation capable of emerging from any link in the chain and not solely from research institutes, which tends to remain the received wisdom even if it is not always the case. It is this combination of public/private rivalry that feeds the momentum of innovation at regional and national level.

Returning to the figures, the group of runner-up cantons includes almost all of the cantons of Western Switzerland, in decreasing order: Bern (47), Valais (40), Geneva (29), Fribourg (26) and Neuchâtel (17), along with Ticino (20), Aargau (17) and Zug (17). The other cantons and regions are (for now) home to relatively few cleantech start-ups.

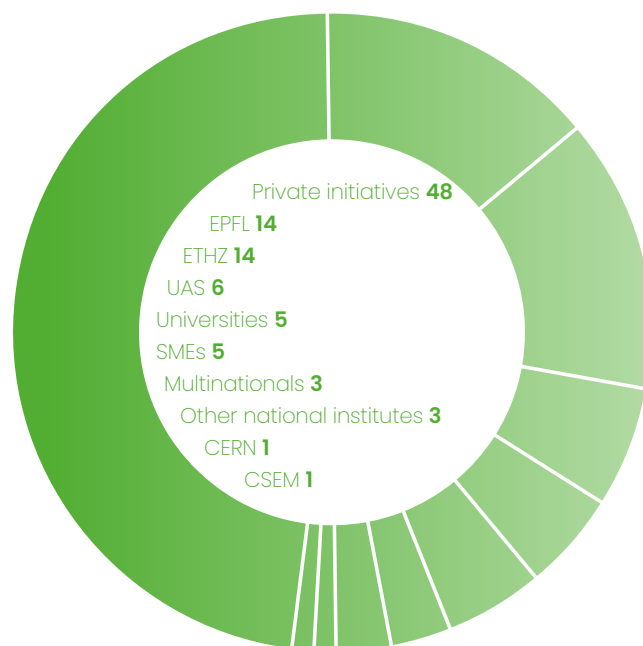


FIGURE 5: Distribution of start-ups by origin (*)

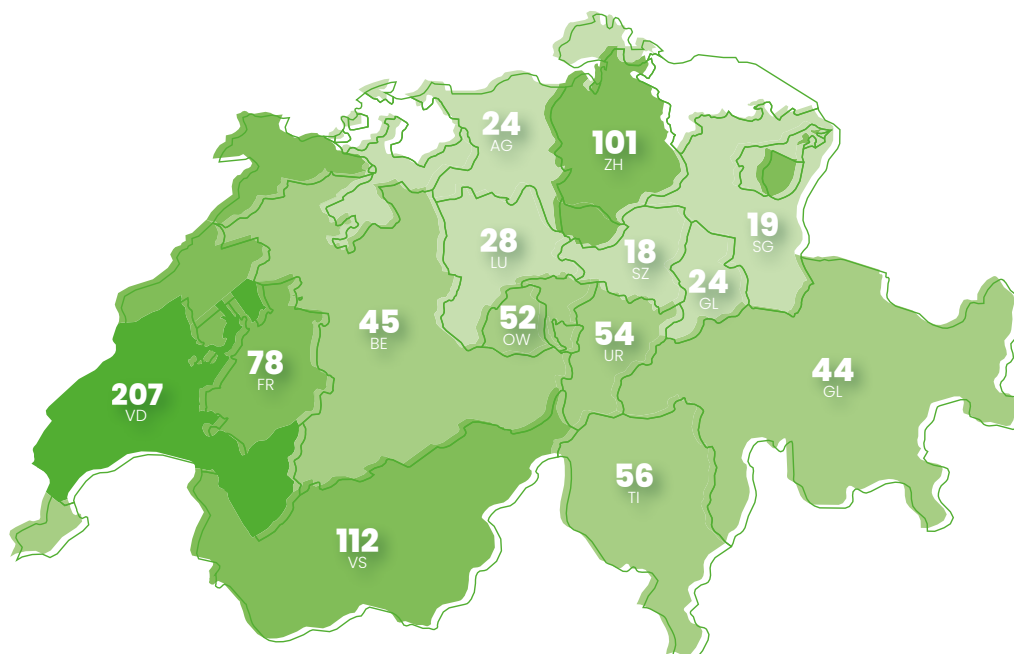


FIGURE 6 : Relative number of start-ups created per head of population

VALAIS, AN INTERESTING USE CASE

It is interesting to note Valais' fourth place just behind Bern, with a quarter of the number of cleantech start-ups of the two leaders despite there being no universities in the canton. This is a good illustration of the observation discussed earlier. The vitality of Valais' ecosystem can be explained by the fact that very nearly 20 years ago The Ark Foundation was established by the canton to introduce a long-term strategy of supporting innovation. The Foundation, whose mission is to "construct the technological and industrial Valais of tomorrow", is an innovation-generation project. It provides practical support for innovation in three main areas, one of which is engineering, with a particular focus on energy and the environment. It is these aspects that are of particular interest to us here.

The Foundation ensures that a consistent approach is applied canton-wide in the chosen domains (ITC, the life sciences and energy), through various sites around the canton and in particular in the main towns situated along the Rhône valley. Each site features a minimum of three innovation-boosting elements (industry, training and entrepreneurship). The groundbreaking concept implemented in Valais with regard to innovation strategy and deployment on the ground is in fact regularly cited as an example by the

Swiss State Secretariat for Economic Affairs in its New Regional Policy. Note also that in 2015 the Swiss federal institute of technology in Lausanne (EPFL) opened a satellite site in Valais on the Energypolis Campus in Sion. This was a logical next step in The Ark's development strategy begun with the opening of a satellite site on the EPFL site (EIP) in Ecublens in 2000 by its operational arm CimArk.

THE CLEANTECHALPS MODEL INTRODUCED BY WESTERN SWITZERLAND IS BEARING FRUIT

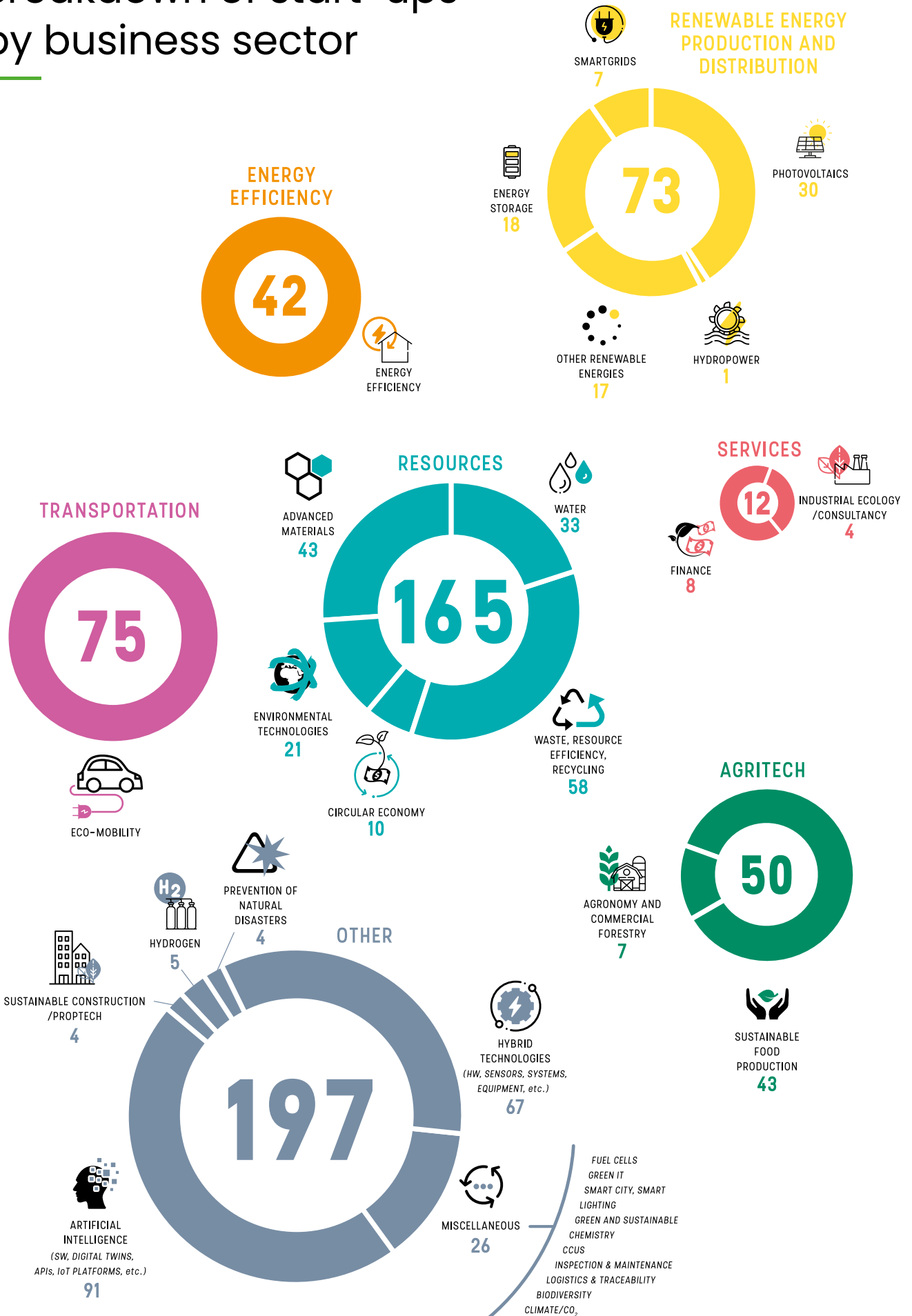
Cross-referencing the above figures with the sources of these start-ups reveals another explanation for the momentum that cleantech has established in Switzerland, and in particular Western Switzerland. This region is punching above its weight when it comes to the number of start-ups created in relation to population and GDP.

This can largely be explained by the winning combination of three factors at play behind the scenes: excellence in research, industrial expertise (precision, quality and reliability) and unconditional support from the public sector. This strong support from the public sector is delivered through CleantechAlps, Western Switzerland's sustainability cluster, which is now a well-established organisation with a nationwide reputation. CleantechAlps

is a neutral player which coordinates the whole process. More importantly, it has earned the trust of every player in the ecosystem, from start-up founders to CEOs of multinationals and including representatives of research institutes, leaders of cantonal and federal authorities and politicians. Its main strength lies in its expertise in the ecosystem and its close connections with businesses. That, along with its intrinsic knowledge of how things work behind the scenes and how each of the stakeholders operates, gives CleantechAlps the ability to bring them together around opportunities that benefit everyone. Set up by the cantons of Western Switzerland in 2010, CleantechAlps operates from its base on the Energypolis Campus in Sion. This campus, whose main focus is on renewable energy development and the decarbonisation of industry, is a prime location for CleantechAlps.

Figure 6 shows the number of start-ups created in the Swiss cantons per head of population. The canton of Vaud has maintained its leading place, with twice the number of new businesses of the runners-up (Zug, Appenzell IR, Valais, Jura, Zurich and Neuchâtel), which in turn post double the scores of the third group, made up of Ticino, Geneva, Uri and Obwalden. Fribourg is positioned between the second- and third-placed groups but has what it takes to catch up with the second-placed cantons.

Breakdown of start-ups by business sector



This section provides a more in-depth analysis of the portfolio of start-ups making up the Swiss ecosystem (previous page), based on the segmentation discussed in the introductory section. Our first detailed analysis of the ecosystem, published in 2017, serves as an interesting benchmark by which to gauge the evolution of the sector and its subsectors since.

By way of introduction, it is helpful to mention that the reason why the number of companies in each subcategory is relatively low in absolute terms is because there is such a wide range of cleantech applications. As a result, the figures have no real scientific value in statistical terms. On the other hand, they do provide a reliable indication of the vitality intrinsic to each sector and subsector. This is especially true since in this report we have categorised each start-up under its main category only, to prevent duplication and ensure clarity in the resulting figures. In real terms there are many more start-ups doing business in the different categories, which adds to the credibility of the observations we make in this section.

The sectors that come under the categories «Other» (artificial intelligence, hybrid technologies, hydrogen, prevention of natural disasters, sustainable construction and miscellaneous) and «Resources» (waste recycling, advanced materials, water, environmental technologies and circular economy) feature by far the largest number of start-ups, ahead of the sectors that come under Transportation. Almost a third of start-ups (197) come under the «Other» category, which we analyse in more detail later in this report. A good quarter of start-ups (165) are categorised in the «Resources» sector, which is the second-biggest sector in every canton.

Overall, as was the case in 2011, the years 2017 and 2021 can be considered pivotal in the growth of the cleantech start-up ecosystem in Switzerland given the large numbers of fledgling companies founded in those years. A closer analysis of the subcategories reveals the following trends emerging:

- Artificial intelligence (software, apps) and hybrid technologies (sensors, IoT)
- Eco-mobility
- Waste recovery and circular economy
- Agritech (sustainable food production)
- Advanced materials
- Energy efficiency

WATER AND PHOTOVOLTAICS MAINTAIN THEIR GROWTH

Since our last analysis in 2017, the water and photovoltaics sectors have continued to grow, each hitting the 30+ mark, with 33 and 30 start-ups respectively. Photovoltaics has experienced two peaks, in 2007 and 2015. Water has seen steady growth with a relatively constant number of new businesses each year, an indication of the difficulty of introducing a disruptive innovation with industrial applications in a sector subject to such fierce competition.

A DOUBLING (AND MORE) OF THE NUMBERS IN ECOMOBILITY, ENERGY EFFICIENCY, OTHER RENEWABLE ENERGIES AND ENVIRONMENTAL TECHNOLOGIES

The number of start-ups in these four sectors has more than doubled since 2017, a year which saw a significant step up in growth in the sector. In mobility, since 2008 at least three start-ups have been established on average each year, reaching a peak of eight in 2014. It is no surprise that the period with the greatest number of new energy-efficiency start-ups is 2017 to 2022. This sector, given a boost by the adoption of the Energy Act, has now come very much to fore.

The growth of the «other» renewable energies (biomass, geothermal energy, etc.) and of environmental technologies (air and soil) has been much more modest. In absolute terms there is little potential in these areas for new innovative solutions with scope for quickly adoptable industrial applications. These subsectors remain the poor relatives of cleantech, despite very interesting companies such as Distran, Plair, NanoCleanAir and Sparrow Analytics leading the way. These companies are nevertheless disadvantaged by the fact that air and soil for example do not (yet) have a commercial value. Their deterioration is an economic externality that is not taken into account. This will change when air quality, for example, starts to have a more significant effect on public health, as we are already seeing in China for example.

The same applies to soil quality. Companies like Medusoil (see profile), which markets a sort of natural cement containing microorganisms to stabilise soil and foundations, may well open up potential for development in this sector. This is quite simply because this technology provides a way of reducing pollution by the construction industry, a sector subject to increasing pressure because of its environmental impact and which is consequently eager to find solutions. This example leads us on nicely to our commentary on the other segments, which include new materials.

« The Swiss cleantech industry needs a functioning ecosystem and the right regulatory framework conditions to make a contribution to Net Zero. »

— Marcel Winter, Co-President of swisscleantech & CEO of AFRY Switzerland



SUSTAINABLE FOOD PRODUCTION, ADVANCED MATERIALS, WASTE RECOVERY AND ENERGY STORAGE ALL GROWING STRONGLY

The number of start-ups in these four categories has exploded since 2017, increasing from 3 to 43, 8 to 43, 21 to 58 and 4 to 18 respectively. In the case of the sustainable food production sector, this is not surprising. There has been a growing appetite to work on production, distribution and consumption methods in the food industry, with these aspects even becoming a necessity for producers coming under increasing consumer pressure.

Growth in advanced materials has been driven mainly by the building industry's energy-efficiency goals and by the circular economy. Meanwhile, over this period the number of waste management start-ups has more than doubled to 58 companies. This reveals a picture of a sector undergoing strong growth, in particular due to the rollout of the circular economy. Up to now, waste recovery has often been considered only in terms of the conventional aspect of materials recycling, with the circular economy and recycling being lumped together as the same thing. This is not altogether incorrect but it is nevertheless extremely simplistic.

The **circular economy** is an approach that aims to transform the – traditionally linear – economy (extraction, production, use and disposal) into a circular process in which raw materials are reused at every stage. It is above all a change in paradigm that encompasses the product from creation to disposal, hence the expression "from cradle to grave". The true circular economy is based on the five Rs: refuse, reduce, reuse, repurpose, recycle. **Understanding the full extent of this movement is a sine qua non of any move towards a more sustainable society.**

Rather insignificant in 2017, the energy storage sector has, as expected, become a hot topic with the boom in renewable energy technologies and the quest for solutions enabling deferred use of the energy they produce. The biggest challenges in this sector lie in battery management systems, increasing battery capacity and improving recycling, and also seasonal energy storage.

However, the energy storage and battery industry is a special case. We are seeing the emergence of new companies such as Librec, Libattion and Evolium, complementing the existing set-up of older companies that are reinventing or renewing themselves. While these companies (an example being Leclanché) do not count as start-ups because they have been operating for quite some time, their business models, management and growth strategies and funding methods are very similar.

This situation again illustrates how complex cleantech is and the need to exercise caution when analysing a particular sector or category and discussing trends. It is therefore often a good idea to take a step back, adopt a healthy distance and identify the reference points, avoiding lazy analyses which may be unrepresentative or even misleading. We fully intend to return to this sector in a separate publication.

HYBRID TECHNOLOGIES ARE EXPLODING

The contribution of digital technologies is covered by the category previously described as enabling technologies. This segment has skyrocketed since 2017, increasing from 30 to more than 150 companies by the end of 2023 and evolving into two main categories: hybrid technologies (67) and artificial intelligence (91).

The picture is completed by various emerging subcategories that have not yet reached critical level. Examples of these include sustainable construction and proptech, green and sustainable chemistry, logistics and traceability, fuel cells, green IT, smart cities and smart lighting, carbon capture, utilisation and storage (CCUS), hydrogen, biodiversity, and building and equipment maintenance and inspection. These applications all come under the «miscellaneous» category and will remain there until they reach a critical mass enabling them to be regarded as a separate subsector.

Hybrid technologies mainly feature hardware solutions such as sensors, systems and equipment. Artificial intelligence consists of software solutions such as applications based on the Internet of Things (IoT), digital twinning, application programming interfaces (APIs), data analysis and visualisation or trading (e.g. certificates) platforms and other similar technologies.

Lastly, there is prevention of natural disasters, a category which has doubled from two to four start-ups. This very weak growth in absolute terms is explained by the fact that SMEs already have this business more or less tied up. In this sector, with the exception of simulation software (often the product of private software developers and managed by engineering firms, and therefore not covered by our study), innovations often come in the form of infrastructures, which demand a lot of time and investment before they reach the market (full-scale testing). This is a prerequisite that is rarely compatible with start-ups.

SMART GRIDS, AGRONOMY AND COMMERCIAL FORESTRY, SERVICES : ALL SHRINKING

The first two of these sectors, which were emerging in 2017, still do not make up a significant part of the panorama, even losing ground since 2017 (with seven start-ups in each category compared to 13 and 10 in 2017). In services, the number of start-ups has increased from five to 12 since 2017. Again, it would be wrong to suggest a lack of dynamism in these sectors. With the possible exception of smart grids, the young companies operating in these segments simply do not (yet) fulfil the eligibility criteria that we have chosen and so are not regarded as deep tech start-ups. Services businesses make little use of new technology and have a lower growth potential and as such do not come under the categories we are targeting.

That said, there is a good chance that AI will soon shake up the current state of the services sector, transforming its business models. Companies providing conventional consultancy services might in future be able to offer services such as impact measurements for reforestation, mining and other projects through a web platform drawing on satellite data for example. If this happens, these companies will quickly join the ranks of the artificial intelligence category referred to above by offering applications for the subsegments discussed here.

Again, cleantech is a complex area. It is not restricted to one industrial sector, often finding its way into others. In any analysis of a sector, particular category or trend, a cautious approach is called for.

Agritech



Advanced materials



Energy storage



Other

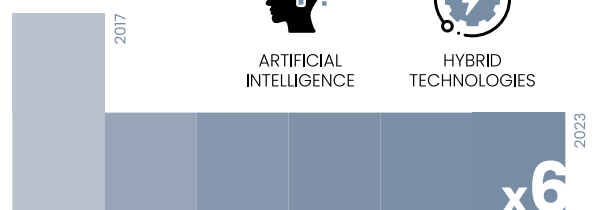


FIGURE 7 : Emerging sectors

« The use of biomass is a major economic, societal and environmental issue. Fribourg's cleantech sector is proud to contribute to research and implementing innovative solutions. »

— Jerry Krattiger, Director of the Development Agency FDA (Fribourg)



MARKETS TARGETED

Of the 208 start-ups that responded to our survey, 181 (84%, compared to 72% in 2017) said they had ambitions to grow internationally and therefore had target markets abroad.

Switzerland remains the priority market, with 87% of start-ups using the domestic market as a demonstrator with a view to developing business abroad.

Three countries constitute the main markets for Switzerland's cleantech start-ups: two neighbouring countries (Germany and France) and one overseas (USA).

Internationally, Europe remains by far the biggest market (84%), ahead of North America (37%) and Asia (27%).

In Europe, the countries bordering Switzerland are the priority targets, with Germany (64%) in the lead with a more than 40% increase in interest since 2017, followed by France (49%), Austria and Italy (both 31%). The United Kingdom (30%) is the fifth European country in terms of interest.

The export market of Switzerland's cleantech start-ups encompasses 41 countries, six regions (Europe, North America, Asia, the Middle East, Africa, Latin America and Australia) and two sub-regions (Eastern Europe and Northern Europe).

Africa (9%), Latin America (9%) and Australia (8%) are all of similar interest to Swiss cleantech exporters.

« The future of the climate change transition depends on our ability to leverage technology to reinvent our relationship with energy. »

— Assia Garbinato, Head of Digital & Innovation Romande Energie SA

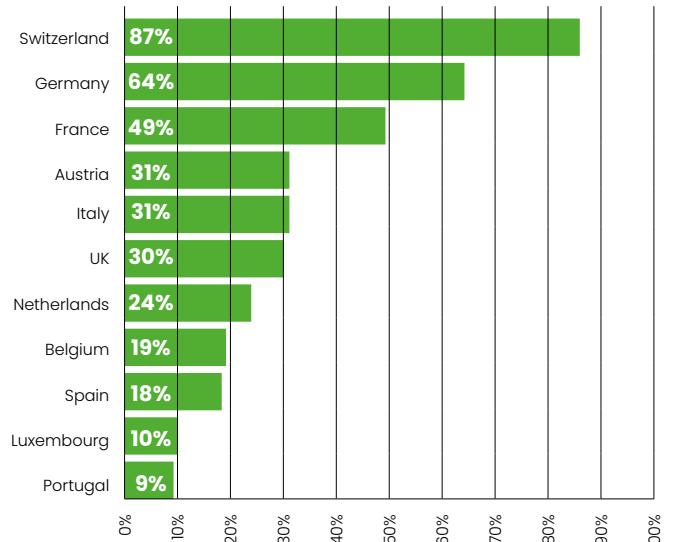


FIGURE 8 : Interest in Europe (*)

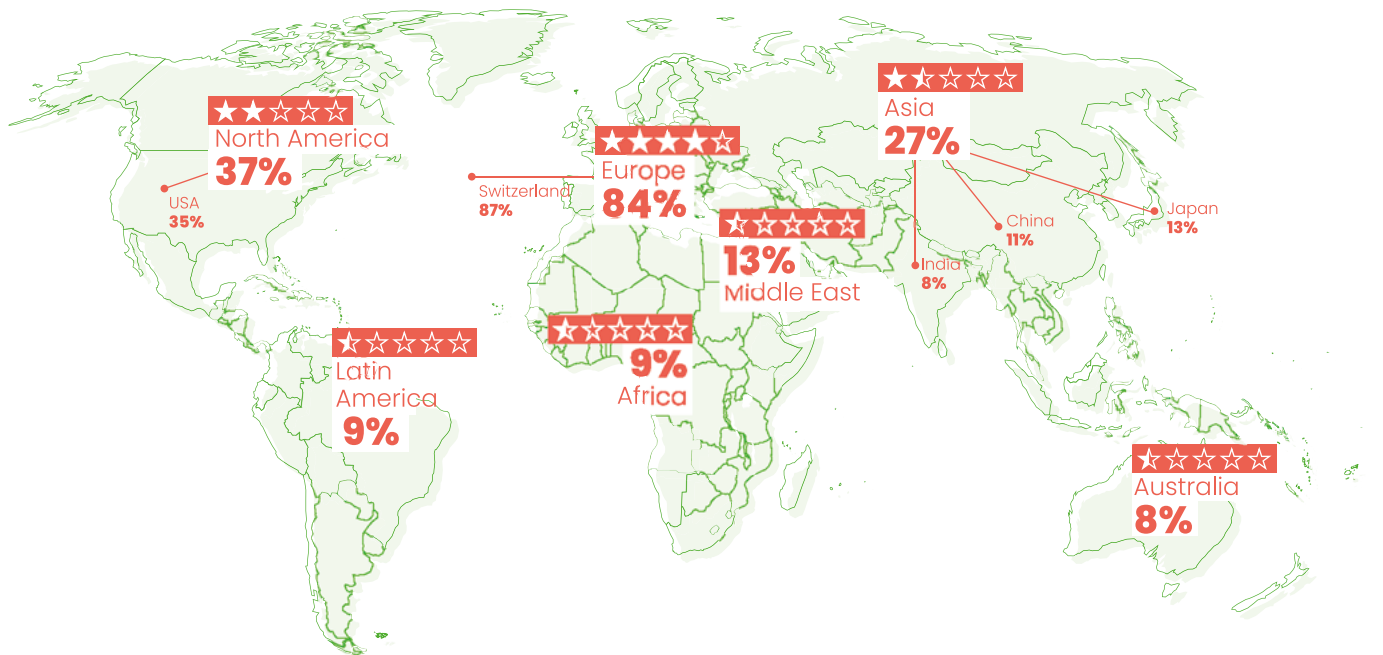


FIGURE 9 : Markets targeted by Swiss cleantech start-ups (*)



Supported by



The transformation of the Swiss energy industry is gathering pace, driven also by young Swiss Energy companies with their innovative services, products and business models.

Over 200 of these companies founded in the last 20 years are shown on the «Swiss Energy Startup Map 2023» subdivided into 8 areas. The analysis data is extracted from the Innovation Monitor which is a continuously updated database providing information on innovative Swiss startups, projects and companies in the environment and energy business sectors.

Maintained by the Zurich University of Applied Science (ZHAW) the focus of the monitor is on active start-ups and project ideas that might become start-ups and helps fostering collaboration between start-ups, established companies, authorities and research. On the public available website the companies can be filtered by area, technology and canton.

For more information contact info@innovation-monitor.ch or check the website www.innovation-monitor.ch/energy/news/article/energy-startup-map-2023/

TURNOVER

With the aim of providing a comprehensive assessment of the ecosystem's state of health, we took the pulse of these businesses by asking them how they saw the future in terms of the change in their turnover.

One-third of CEOs answered this question by predicting an increase in 2023 compared to the previous financial year, with the others saying their turnover was likely to remain stable. No respondent predicted a fall in turnover. This is the opposite result compared to the situation in 2015 and 2017, when CEOs were more optimistic: slightly more than half (53% and 56% respectively) predicted an increase and around one-third (37% and 38%) a stable turnover. The remainder (10% and 6% respectively) expected a fall in turnover in the coming year.

In 2017, turnover broke down into 28% locally and 45% and 27% respectively for nationally and internationally, whereas by 2023 international turnover had come to the fore, with 55% of turnover generated internationally, 29% nationally and 16% locally.

The breakdown of the 2022 turnover of Swiss cleantech start-ups is shown in Figure 10. Points of interest:

- Around two-thirds (63%) of start-ups posted a turnover of less than CHF 500k. This is also the category that predicted a stable turnover for the next financial year.
- One-third of the portfolio breaks down into three lots, each of around 10% of start-ups, with turnovers of between CHF 500k and CHF 1M, between CHF 1M and 2M, and between CHF 2M and CHF 5M.
- The remainder (4%) achieved a turnover of between CHF 5M and CHF 10M and CHF 20M and 50M respectively.

The evolution of these figures tells the same story as above, with business growing more strongly internationally than at the other two levels. This analysis also suggests that the portfolio is reaching maturity, with the emergence of a cohort of scale-ups targeting international markets and banking on an increase in turnover.

This observation is reassuring. It reveals that these start-ups have matured in terms of both their governance and their technologies (see also our TRL analysis below). It also shows that they have a better grasp of the dynamics of foreign markets than they did in the previous period.

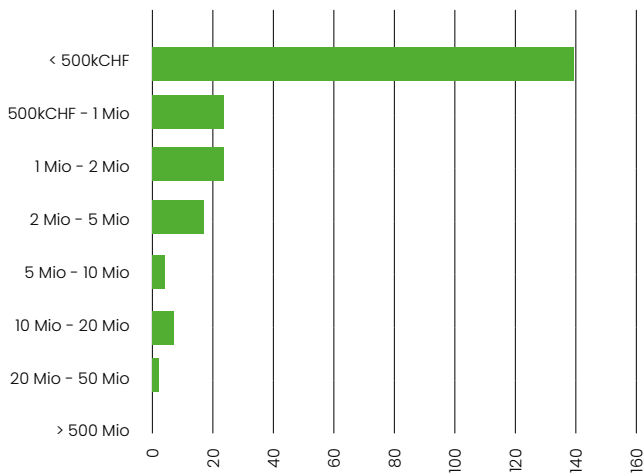


FIGURE 10 : Breakdown of 2022 turnover of Swiss cleantech start-ups (*)

« Cleantech has become essential to the Energy Transition. Every initiative large and small helps us improve more quickly and in a more controlled way how we consume. »

— Patrick Houlmann, Independent Expert, Member of CleantechAlps' Expert Committee



MATURITY OF THE TECHNOLOGIES IN THE PORTFOLIO

To assess the maturity of the cleantech start-ups portfolio, we asked these businesses to state the level of maturity of their main product on the TRL scale and to provide the same information for any other products in their offer.

The TRL (technology readiness level) scale is a measurement system used to assess the level of maturity of a technology (hardware, components, etc.). It was invented by NASA as a way of managing the risk levels of the technologies developed for NASA programmes.

This concept has since been widely adopted around the world and is used as a benchmark to assess the maturity of projects, technologies and solutions in the innovative industries. The bottom end of the scale (level 1) is the observation and description of basic principles and the top end (level 9) is the actual application of a technology.

- TRL 1 – basic principles observed
- TRL 2 – technology concept formulated
- TRL 3 – experimental proof of concept
- TRL 4 – technology validated in lab
- TRL 5 – technology validated in relevant environment
- TRL 6 – technology demonstrated in relevant environment
- TRL 7 – system prototype demonstration in operational environment
- TRL 8 – system complete and qualified
- TRL 9 – actual system proven in operational environment

An analysis of the cleantech start-ups portfolio using the TRL scale shows that half of these businesses report having a system proven in an operational environment (TRL 9), the highest level of maturity.

Three-quarters of start-ups (74%) have technologies or products that are in the top third of the TRL scale (TRLs 7 to 9), which means that they have achieved at least a system prototype demonstration in an operational environment.

The TRL breakdown of the portfolio is shown in Figure 11. The following points are of interest:

- Most of the technologies used in the photovoltaics, water and AI sectors have reached the highest level of maturity, TRL 9.
- Ecomobility is the technology sector with the widest range of maturity levels, varying from TRL 3 to TRL 9.
- Sustainable food production and AI are in second place in terms of the range of technological development, with 6 different TRLs.
- On average, the recently emerged hydrogen sector shows the lowest level of technological development (TRL 4). This is not surprising.

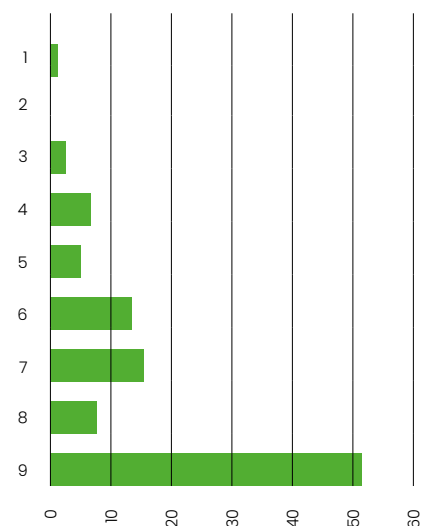


FIGURE 11: Degree of maturity of the Swiss cleantech start-up portfolio (TRL scale) (*)

CHARACTERISTICS OF THE BUSINESS FOUNDERS

The founders of these start-ups are of 40 different nationalities. The dominant nationality is Swiss (44%), followed by nationals of the neighbouring countries France (11%), Germany (9%) and Italy (7%), with 22% being nationals of other European countries. Founders from other continents make up less than one-sixth of the total.

One-third of the start-ups reported having an academic involved in their business. In 44% of responses, academics are represented on the advisory or scientific board and in a quarter of cases they own shares in the business.

The number of female employees is growing steadily, accounting for 30% of the workforce at the end of 2023.

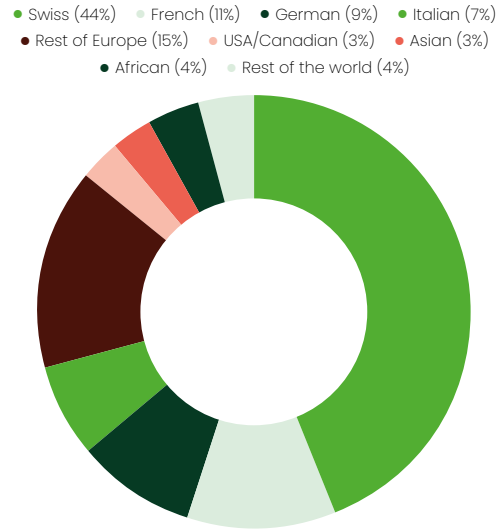


FIGURE 12: Nationality of business founders (*)

INTELLECTUAL PROPERTY

In a quarter of start-ups the intellectual property belongs to a research institute. Two-thirds of these start-ups are satisfied with the terms negotiated with the institute's technology transfer office (TTO). The majority of them (92%) consider this intellectual property to be relevant to their business.

Two out of three companies have developed their own IP or have registered patents in addition to those registered by their partner institute and for which they have a licence.

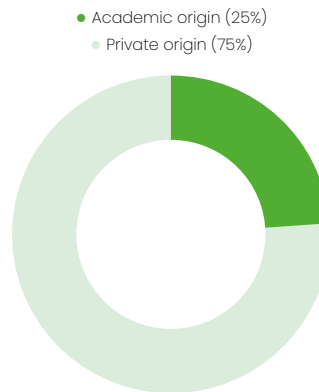


FIGURE 13: IP owned by a research institute (*)

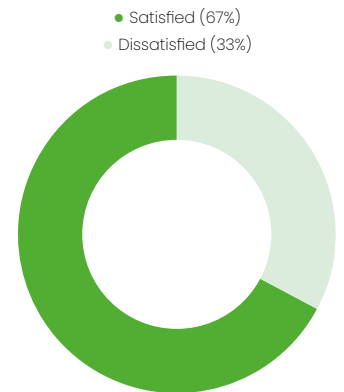


FIGURE 14: Satisfaction with the technology transfer office (*)

It is no surprise that IP ownership is higher in spin-offs of academic institutes (59%) than in privately founded start-ups (41%). This is largely explained by the culture, strategy and any reporting measures required of institutes, which apply for patents for their developments as a matter of course. They then negotiate the use of these rights with the start-up or with other interested parties as and when required. Because of the cost of this repeated process, private companies are less likely to adopt this approach.

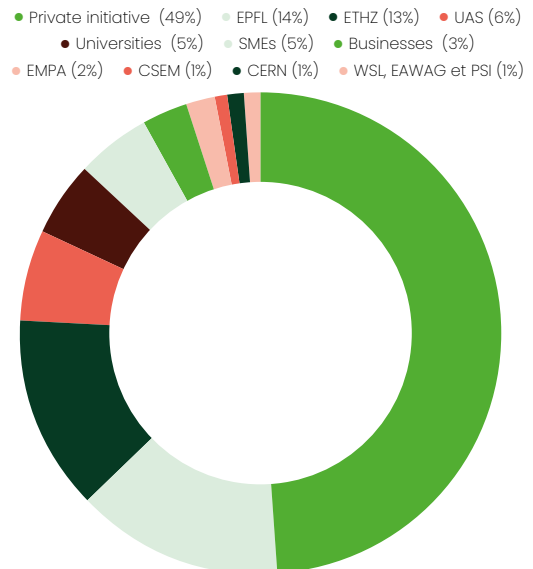


FIGURE 15: Breakdown of IP ownership by start-up origin (*)

● <10 FTEs (63%) ● 10-50 FTEs (29%) ● 50-250 FTEs (7%) ● >250 FTEs (1%)



FIGURE 16: Percentages of start-ups by FTE count (*)

EVOLUTION AND BREAKDOWN OF THE NUMBER OF EMPLOYEES

With Switzerland being the land of the SME, it is no surprise that two-thirds of these start-ups have fewer than 10 full-time-equivalent (FTE) employees. The proportion of businesses with between 10 and 50 FTEs is 29%, while 7% of businesses have between 50 and 250 FTEs. Only 1% are companies with more than 250 employees.

The change in the number of FTEs by company founding date is shown in the figure below. This shows an increase in the number of medium-sized companies (10 to 50 FTEs) after three to five years, indicating the emergence of a cohort of scale-ups of increasing size, but it is difficult to draw more precise conclusions regarding the factors impacting the growth of these businesses using the ranges of figures available. A study based on the actual number of employees would provide a clearer picture of company growth.

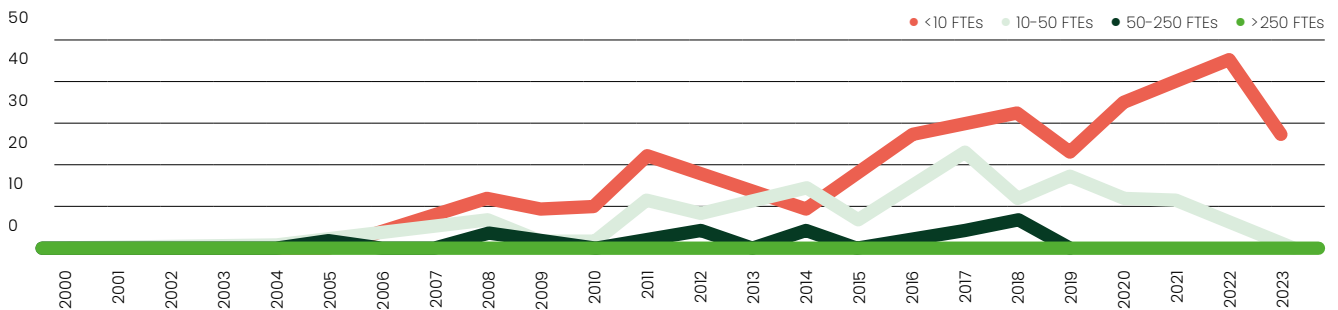


FIGURE 17: Numbers of FTEs by year of start-up creation (*)

WHAT NEEDS ARE START-UPS REPORTING?

The survey we carried out identified five needs currently expressed by cleantech start-ups. These are illustrated in Figure 18.

The biggest needs are the same as those identified in 2017, but with the exception of investment, which unsurprisingly remains at number one, priorities have changed. A need for investment is reported by nearly two out of three companies (59%), compared to one out of three (35%) previously.

In second place is the need for a strategic partner, reported by 45% of businesses compared to 13% in 2017. The third-biggest need is to identify and secure an introduction to key partners or clients, reported by 43% of business (compared to 22% in 2017). In fourth place is a partnership with the public authorities, up from 3% and last place in 2017 to more than 20%.

The last three needs are a clear indication of the level of maturity reached by the players in the ecosystem. They are now actively looking for partners to conduct pilots, demonstrate the reliability of their technologies and begin industrial production. This is the stage that immediately precedes rolling out their solutions on a larger scale.

Almost no other need was cited by several respondents in the survey cohort, unlike in 2017 when start-ups reported a need for more centralised support and clearer support options. They also asked for help with determining where they belonged in the ecosystem and more administrative support from incubators and the public authorities to reduce business start-up costs.

This change in the needs of businesses confirms that the ecosystem has now become consolidated and is gaining momentum. This is the result of the work put in by both public and private players throughout the development of the ecosystem. It would seem, then, that everything is under control, but there are signs that the market is evolving rapidly. We must not rest on our laurels but anticipate future needs.

There is a clear clue that this assumption is correct in the fifth need, which is for more networking opportunities. This need has tripled since 2017, underlining the speed with which the market is evolving and creating new demands. One response to this challenge is to continue to develop appropriate networking opportunities.

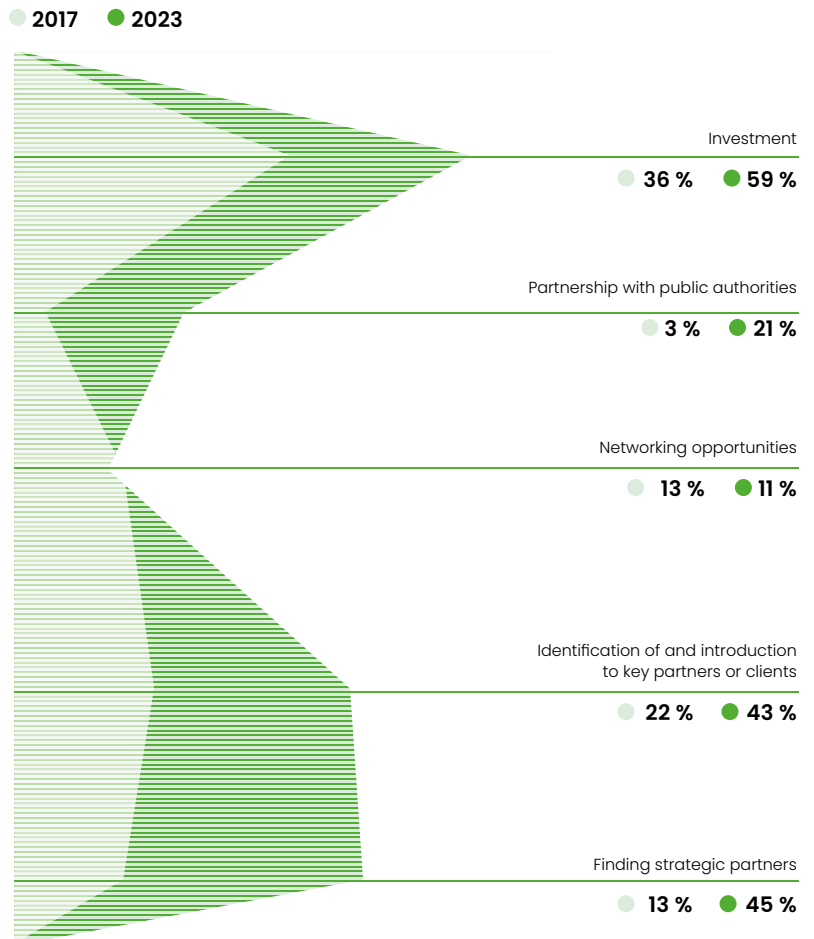


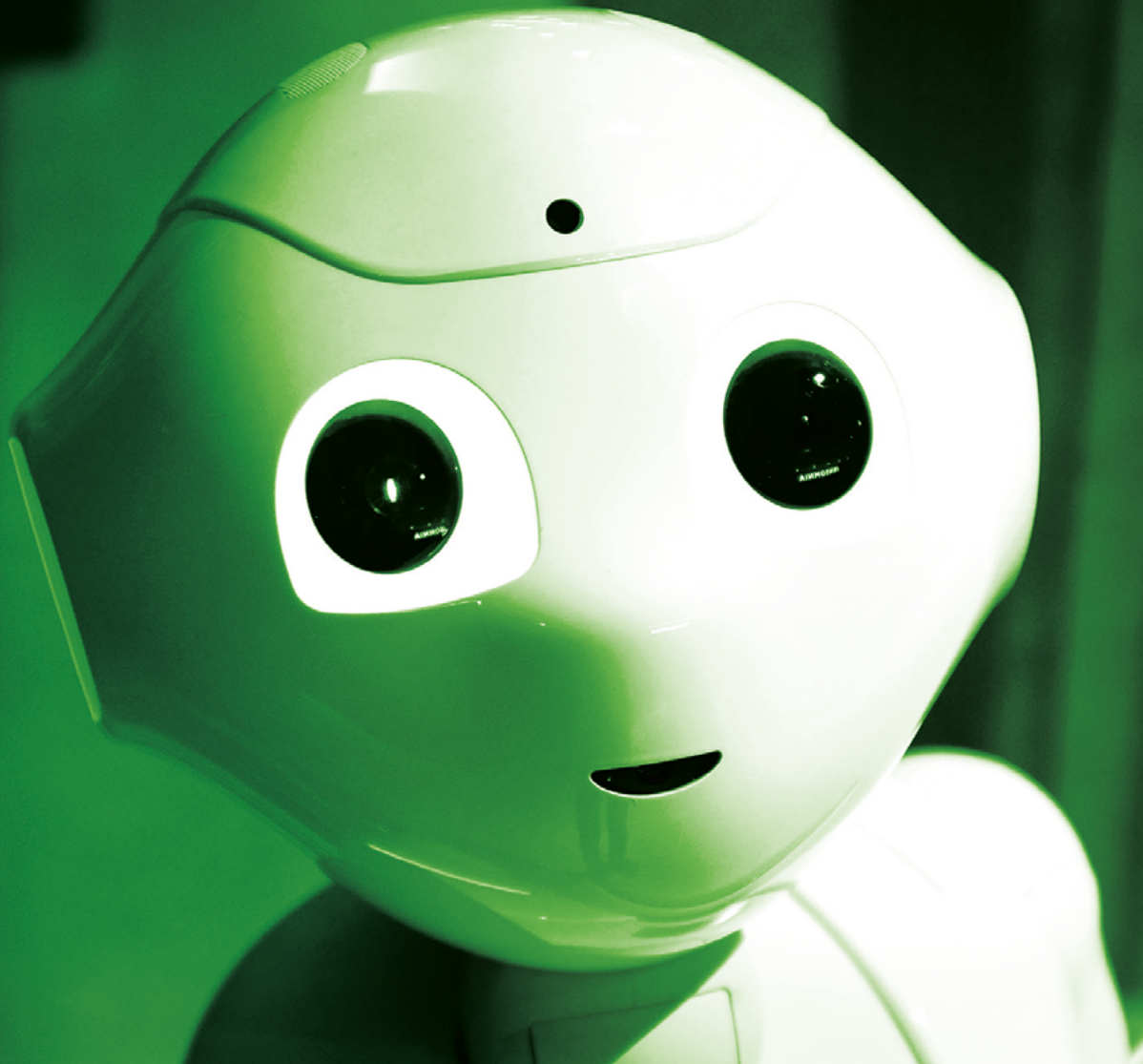
FIGURE 18 : Comparison of the needs of cleantech start-ups in 2017 and 2023 (*)

« Innovation is our greatest asset in building a future where energy transition, environmental protection and job creation go hand in hand. »

— Sylvia Marra,
Head of Transformation
and Innovation, OIKEN



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Fostering
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growth

155
deals done

45
companies
funded

4
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jobs created

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The Sustainable Development Goals

As we have already said, incorporating every aspect of sustainability will completely transform the economy of the future. The Sustainable Development Goals (SDGs) are a set of reference points essential to ensuring that we transition in a consistent and concerted way to a more sustainable society. Before analysing the Swiss cleantech start-up ecosystem from this point of view, let us provide a brief reminder of what the SDGs are. We should not forget that the SDGs are already a reality in Switzerland, as the Swiss Cleantech Report makes clear.

The SDGs are a set of 17 objectives established by the member states of the United Nations. They constitute the reference framework for sustainable development on a global scale, following on from the Millennium Goals established in the previous period. These goals come under the 2030 Agenda, an action plan adopted by the UN in September 2015 following two years of negotiations involving governments and civil society. The 2030 Agenda defines the targets set by the SDGs that must be reached by 2030.

The SDGs and their 169 targets (sub-goals) form the cornerstone of the 2030 Agenda. They apply to everyone (governments, civil society, business, science and every individual citizen) and take into account in equal measure the economic, social and environmental dimensions of sustainable development.

Switzerland and Swiss business are of course formally committed to achieving these goals. The country's cleantech start-ups are helping to meet some of these goals more quickly, more effectively and more cheaply.

The contribution that young Swiss companies are making to achieving the SDGs is illustrated in Figure 19.

Overall, the goals most widely supported, as cited by a third of the cohort responding to our survey, are SDG 7 (affordable and clean energy), SDG 9 (industry, innovation and infrastructure), SDG 12 (responsible consumption and production) and SDG 13 (climate action).

Our observation is that there is not yet a single set of rules governing how companies should interpret the impact of their business on any one of the SDGs. It is worth mentioning at this point that although the SDGs are used systematically by international and governmental agencies, the private sector (with the exception of multinationals) have not yet fully integrated them into their communication.

Their interpretation will become more consistent over time and our observation will no doubt change with respect to some of the SDGs. It will be interesting to revisit this subject in two to three years' time to see how this has situation has changed.

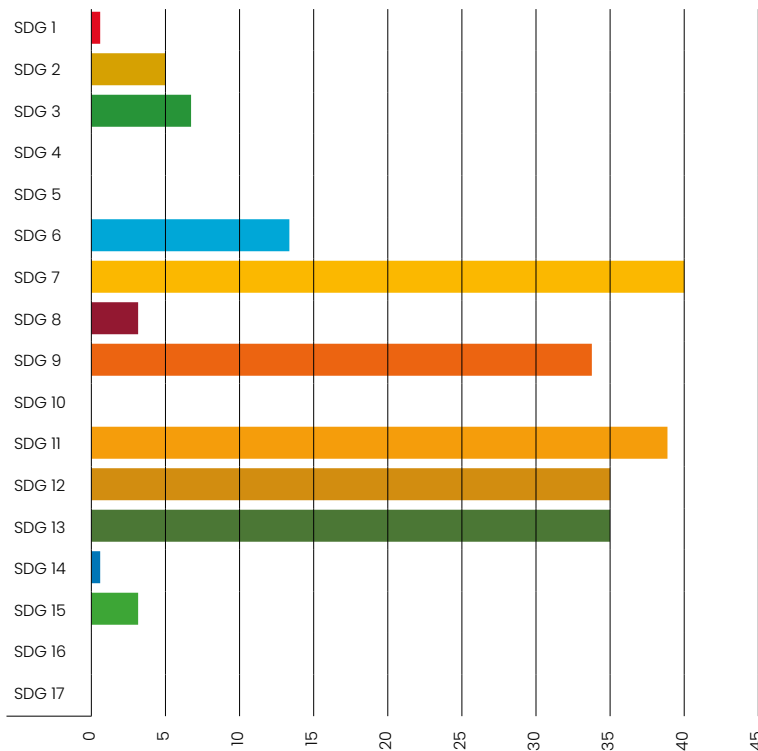


FIGURE 19 : SDGs to which the products of Swiss cleantech start-ups are contributing (%) (*)

« In the context of the energy transition, having a sustainable, personalised supply chain enables companies to focus on their core business. »

— Christophe Pot, Director of Spontis Ltd



Throughout this publication, and in particular in the start-up profiles section, you will find references to these 17 goals, indicated by the relevant icon.

SUSTAINABLE DEVELOPMENT GOALS



RELATIONSHIP BETWEEN PATENTS (IP) AND THE SDGS

We have seen above the importance to start-ups of intellectual property (chiefly in the form of patents). This is mainly because patents enable start-ups to protect their technology and they make them more attractive to potential investors.

Start-ups provide an indication of the level of innovation in the economic fabric and of the emerging trends stemming from this innovation. At the same time, patents provide some clues regarding the direction of travel of this innovation, of industry and of some of the industry players in particular.

The Swiss Federal Institute of Intellectual Property (IPI) conducted an analysis of the evolution of Swiss and worldwide patents in the cleantech sector, which is featured in the Swiss Cleantech Report. This analysis included an examination of the portfolio of Swiss cleantech patents from the point of view of their contribution to achieving the SDGs.

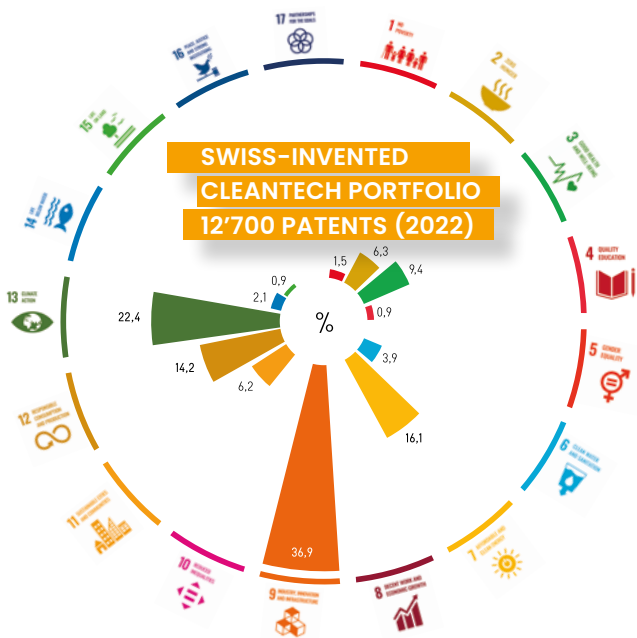


FIGURE 20: Exploded diagram illustrating the contribution of « Swiss-invented » cleantech to the SDGs and to the underlying technology sectors, based on the patent database.

We are including here an extract from this targeted analysis of the SDGs by the IPI and invite you to read the full analysis, which includes an international comparison, in the fourth edition of the Swiss Cleantech Report.

Cleantech is making a significant contribution to the United Nations' Sustainable Development Goals. To establish a logical and transparent protocol for assessing the extent to which the patents registered by entities contribute to sustainability, 100 technology sectors were defined on the basis of the objectives and indicators cited in the 17 SDGs.

We cross-referenced our collections of "Swiss-invented" cleantech patents with the 17 SDGs and the 100 underlying technology sectors.

In our appraisal of the underlying technology sectors, greenhouse gas emissions reduction is the biggest technology sector of the cleantech sectors relevant to the SDGs.

The technology sectors Sustainable products and production methods, Advanced manufacturing, Resilient building and Solar energy are well represented in the «Swiss-invented» portfolio.

This analysis confirms the trend outlined above, in other words the dominance of SDGs 7, 9, 12 and 13. It is interesting to note that SDG 11 is less prominent. One possible explanation for this is that this is perhaps a sector less in need of the innovation-protecting function of patents.

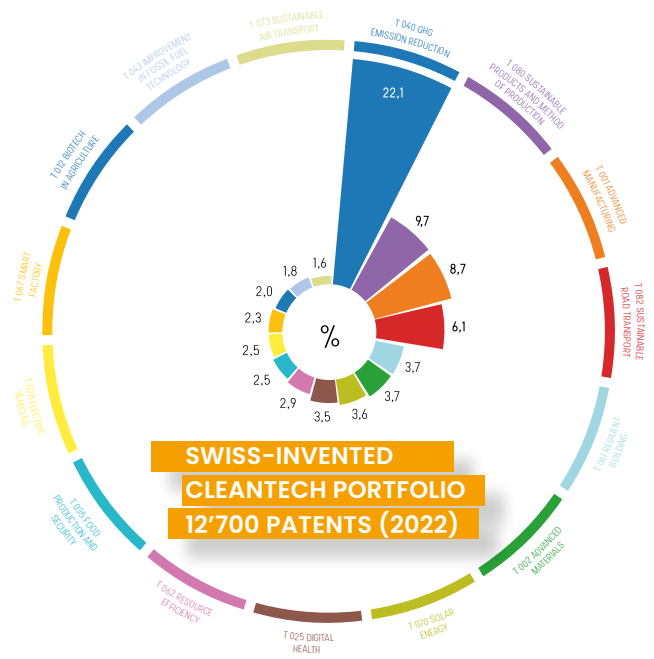


FIGURE 21: Exploded diagram illustrating the contribution of « Swiss-invented » cleantech patents to the underlying technology sectors.

Below are two additional free sources of information for anyone interested in learning more about the evolution of cleantech patents and their impact on the SDGs.

- Clean energy technologies platform on the European Patent Office website: www.epo.org/en/searching-for-patents/technology-platforms/clean-energy
- Climate Change and Intellectual Property page of the World Intellectual Property Organization (WIPO) website www.wipo.int/policy/en/climate_change/

Investment in Swiss cleantech

Despite a sluggish investment climate in 2023, Swiss cleantech start-ups raised more than CHF 400 million that year, following a record year of more than CHF 1 billion in 2022, buoyed by the CHF 600 million invested in Climeworks. These dizzying figures belie the fact that in 2010 total investment struggled to reach CHF 2 million for all start-ups over the whole year and totalled CHF 5 million in 2013. And yet, the cumulative total invested over 15 years is more than CHF 3 billion!

IN THE FOOTSTEPS OF THE BIOTECH SECTOR

The vision we published in 2010 predicted growth in the cleantech sector along the same lines as the development of biotech some 15 years earlier. Our prediction met with scepticism at the time but turned out to be spot on, and today the debate is closed. With around CHF 40 million raised in 2016 and almost CHF 400 million in 2019, a ten-fold increase in just three years, the investment machine is not only up and running but is now firing on all cylinders at every level of the ecosystem. Cleantech is clearly following in the footsteps of the biotech sector in terms of growth, partly thanks to the vast sums raised by companies like Climeworks and Energy Vault, driving forces that have brought along the entire sector in their wake.

Figure 22 shows the funds raised by Swiss cleantech start-ups between 2008 and 2023 by sector (agritech, renewable energy production, etc.). The total amounts raised in each year are also shown.

Until 2015 we see relatively little movement in all categories. The scale used in the diagram does hide the detail in the curves here, but there is no denying that before this date private investment in the cleantech sector in Switzerland was marginal.

For greater clarity, Figure 23 zooms in on this period. Here, we can clearly see that during the cleantech sector's emergence phase between 2010 and 2015, private financial activity in the sector all but flatlined. Stirrings can be seen between 2015 and 2017 as the ecosystem was becoming consolidated, followed by a gradual increase in funds raised and then a significant take-off from 2019 onwards.

The pivotal period is 2018–2019, when investment in Swiss cleantech really took off. The breakdown by sector shows investment growth in every case, each with its own characteristic growth curve. Agritech and Transportation follow a flatter and more gradual progression than Resources, Renewable energy and Other, which show peaks in investment every year from 2019 onwards.

This difference between the sectors can partly be explained by the sums required to turn solutions into commercial realities, since each sector has different demands in terms of resources, depending on the equipment, certifications and infrastructures involved. According to our discussions with the relevant players, the peaks correspond to key fundraising drives required to

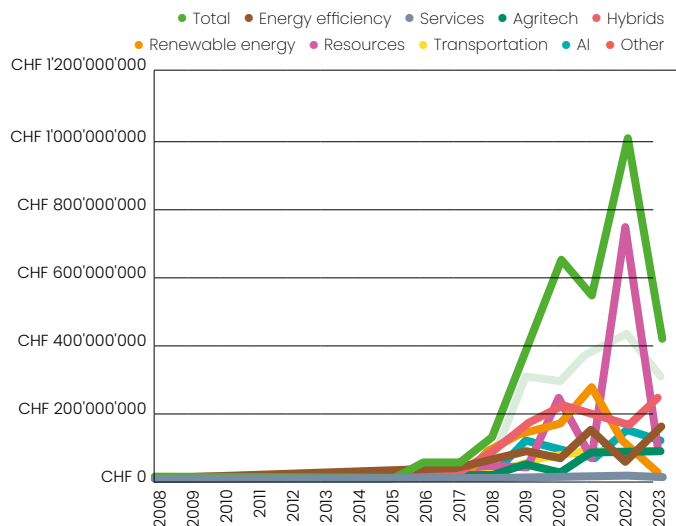


FIGURE 22: Funds raised by Swiss cleantech start-ups.

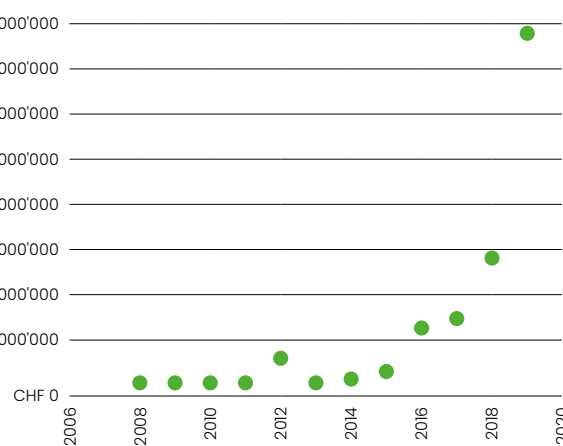


FIGURE 23: Funds raised by Swiss cleantech start-ups. Illustration of the ecosystem's transition from emergence to consolidation.

reach milestones in the start-up's roadmap. The frequency of the investment rounds observed is every 18 to 24 months, which explains the peaks in the chart every two years. This is logical and as expected, given that a less established ecosystem is less likely to secure annual funding deals. Consequently, no smoothing effect is yet at play in the start-up portfolio.

Since the data we have is not exhaustive (we discuss ways of improving this situation below), it is difficult to draw more conclusions about individual dynamics or the particular challenges of the different segments. If we try to do so at this stage, there is danger that we will end up drawing general conclusions from specific cases that are not statistically representative and above all not necessarily indicative of the evolution of the sector. To provide a more in-depth analysis, it would be very useful to have data on the number of fundraising rounds for example, in addition to the amounts raised each year. Since we do not have exhaustive data at our disposal, in our analysis we have adopted a qualitative approach.

There is quite a lot of movement in investment in the Other sector, in particular with regard to the hybrid technologies subsector. It is not surprising that this curve outdoes the Artificial intelligence (AI) curve, which on the face of it demands fewer financial resources than hybrid technologies. This is essentially because, similar to the two other categories discussed above,

the hybrid technologies include an element of equipment manufacturing. However, because here too we have information about the total sums raised but not about the number of funding rounds, we are not able to go into the detail of the sector's fundraising dynamics. Analysing just the data without being able to put it in context would be counter-productive.

In conclusion, a detailed analysis of investment in the start-up ecosystem requires significantly more information that we have been able to gather from the innovation players coupled with the data obtained directly from the companies. We do now have a clear view of the dynamics and overall development of investment in cleantech, but we had hoped to gain a better understanding of the dynamics specific to each sector to enable us to introduce more targeted strategic actions for each of them. There is therefore more to be done here, and work is already under way, in particular on the relationship between the SDGs and the different aspects analysed in this report, and on the importance of the SDGs in the ecosystem.

A CENTRALISED DATABASE FOR RECORDING INVESTMENT

To date, there is still no systematic and centralised record of investment by Swiss cleantech start-ups, or start-ups in any other sector in Switzerland for that matter. There is even less available data consolidated from the entire life cycle of businesses, from the development of products and services to company creation to sales growth. Furthermore, there is also no roadmap to market reference point providing data on the process leading from applied research to prototyping to market launch.

This failure to systematically collect quality data is detrimental. It is always harder to collect data retroactively than to organise data gathering at source. Without reliable figures to go on, it is also difficult to then gauge the impact of a particular measure or to time correctly any leg up given to the ecosystem. Data protection is (too) often used as an excuse for not consolidating and processing data. As the saying goes, where there's a will there's a way... In the meantime the consequences are clear: we are not making progress as rapidly as we could be because we do

not know enough about the situation on the ground – and Switzerland's global competitiveness is suffering as a result!

WHY THIS IS IMPORTANT

Collecting, consolidating and making available high-quality official investment data would for example create an easily available source of information on the amount of funding raised in a particular deep tech sector, and not just in cleantech (which could be used in a pilot if appropriate), thereby attracting talent and investors to Switzerland.

This would also enable decision-makers to assess quickly whether a support programme or specific measure is delivering the expected impact and then to decide, for example, whether to step up resource provision or redirect resources elsewhere (if the criteria are not properly aligned with the needs of target customers). And the range of benefits does not stop there.

In the same vein, it would be beneficial for the entire Swiss start-up industry to have at its disposal an exhaustive database of high-quality fundraising data. We sincerely hope that with the launch of the Deep Tech Nation Switzerland initiative, this idea will be actively supported and the appropriate steps taken as a priority.

A second death valley

A few years ago, working with the EPFL Energy Center and Energypolis, we conducted an analysis of investment in cleantech to gain an insight into the investment mechanisms at play and how the investment market worked and share this with the community, which was in its consolidation phase at the time (see the publication *Investissement dans les cleantech : analyse des mécanismes de financement et perspectives*). In that analysis we highlighted a peculiarity of the cleantech sector, **the double death valley**.

The sheer amount of investment required to bring a cleantech technology to market is staggering. The effort involved in nurturing a cleantech technology to maturity, and in particular scaling it up ready for industrial production so that it can be mass-produced, is enormous. This is especially true of environmental technologies and sustainable chemistry, and to a lesser extent energy. While conducting a pilot rollout on the ground can cost between CHF 2 million and CHF 10 million, taking the step to industrial production can easily cost ten times that – before any significant turnover is generated.

The notorious «death valley», familiar to many investors in innovative start-ups, simply refers to the period when a company's earnings do not yet cover the investment required to get the business on a commercial footing and generate enough profit to reward investors.

This makes the company reliant on investors with deep pockets, bucket-loads of patience and extensive experience of industrialisation. In cleantech, a heavy infrastructure is often required to roll out a product. This aspect plays a crucial role in the roadmap to market, and this is why we talk about there being two successive death valleys in cleantech finance (see Figure 24).

The first death valley occurs during the period leading to the demonstration of the technology on the ground in an initial pilot, when it is tested under conditions relevant to the target customer. The

second occurs when the industrial demonstrator is in preparation. This is the pre-production phase before the start of either serial production or mass production depending on the product. These two stages are also referred to respectively as the field demonstration of the technology PoC and the pre-industrial demonstrator. They correspond to the two successive death valleys that fledgling companies have to cope with.

This double dip constitutes the major challenge facing any cleantech company developing a technology that involves at least a component of heavy equipment such as a reactor, processing infrastructure or a vehicle. A company developing an innovation in the energy, construction or chemicals industries has an extremely hard time of it, usually much harder than an IT company, for example. In the digital tech industry, it takes relatively little money and time to produce a mock-up or MVP (minimum viable product). Conversely, building a reactor to show how it performs and then prove that it is reliable demands massive resources in terms of time, infrastructure and expertise. And despite a well-oiled innovation-support ecosystem and an increasingly warm reception from manufacturers, this challenge is not always met with a satisfactory response in real life. There are two aspects to this requirement, which furthermore are partly connected: the amount of money that needs to be raised and the time it takes to get the money together to fund a demonstrator.

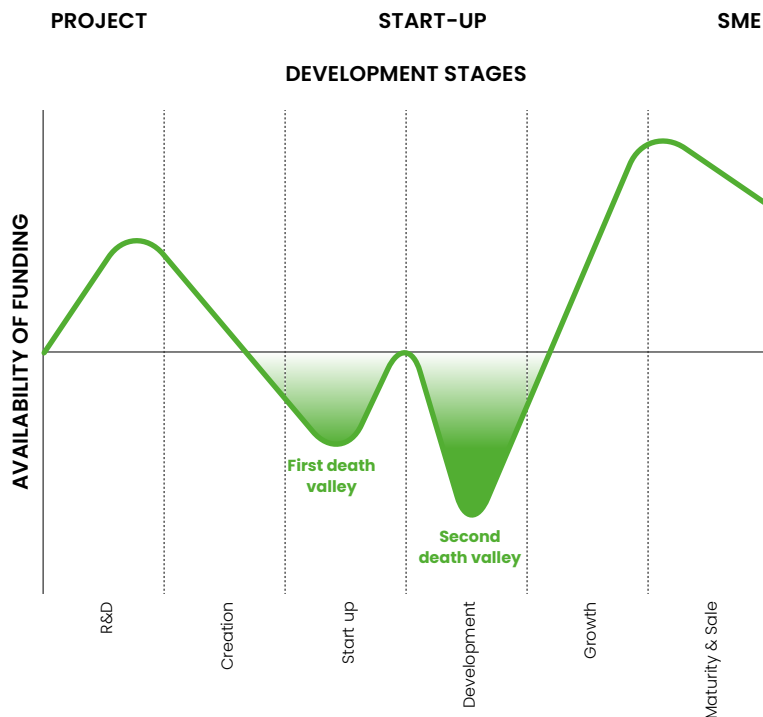


FIGURE 24 : Life cycle of a cleantech start-up showing funding requirements.

The response from the public sector

PILOT AND DEMONSTRATION (P+D) PROGRAMME

The public sector's offer has evolved to meet these needs. The Swiss Federal Office of Energy (SFOE) provides a wide range of support programmes. On its website, SFOE publishes an overview of the support available for innovation, referring budding entrepreneurs to different organisations offering financial support and advice to innovative research and development projects in the energy sector.

SFOE's Pilot and Demonstration programme goes some way to helping businesses deal with the issues discussed above. Through this programme, SFOE encourages the development and testing of new technologies, solutions and concepts relating to the economical and ecological use of energy, the transmission and storage of energy and the use of renewable forms of energy. Its P+D programme acts as an interface between research and the market. Its aim is to help new technologies reach maturity so that they can ultimately access the market.

This programme is well designed and has proved its worth in various pilot projects. It features everything needed to help businesses cope with the double-death-valley problem, more specifically getting through the second valley. One way in which this programme could be improved so that it provides a comprehensive counter to this challenge and supports pre-industrial installations more effectively would be to make the task of businesses easier in some respects by providing more money, providing support for projects closer to market than it does currently, and taking more risks when allocating support to projects. We shall come back to these points later.

« To meet the climate goals, we all have to act together to innovate. CleantechAlps is making a direct and useful contribution to this. »

— Laurent Wehrli,
Member of the Swiss
National Council



SWISS ACCELERATOR

Switzerland's national innovation agency Innosuisse has developed two instruments to meet these needs. The first of these is the Swiss Accelerator, set up as one of the transitional measures introduced in association with the Horizon Europe European research programme. The Swiss Accelerator enables SMEs and start-ups to pursue projects with strong innovation potential. The aim is to get these companies' innovative products and services to the commercial stage quickly and efficiently, the idea being to accelerate the growth of Swiss businesses already established on the market. The programme was run in 2022 and 2023, but no call for projects is planned for 2024 and its future is uncertain.

This instrument is relevant and popular and we are calling for it to be revived to run over the next few years with a bigger overall budget and shorter project acceptance decision times.

We need faster decision-making because any delay in the development of a project reduces its chances of getting to market on time. We are aware that this needs to be accompanied by a change in culture that will have to be effectively communicated. Faster decision-making clearly brings with it a greater risk of mistakes and of allocating funds to one project that is perhaps less mature and has less potential than another. But this is the risk we need to take, chancing our arm on the fact that the overall benefit of the programme's results and impact outweigh any losses made by projects that turn out to be «poor» choices.

Innovation is not an exact science. Without a crystal ball, it is impossible to tell in advance which technology is really going to break through – all the more so in the extremely volatile world we live in today.

START-UP INNOVATION PROJECTS

Innosuisse's other instrument helping companies to negotiate death valley is its programme supporting competitive start-up projects at the pre-market stage. These innovation projects must be based on applied research and must be the start-up's first attempt at entering the market. The start-up must not yet have any already-developed products or services on the market. Only the start-up is supported. Research partners are not supported. Support is available for projects in all subject areas (www.innosuisse.admin.ch/en/start-up-innovation-projects).

This instrument is of great interest since it addresses the second-death-valley problem. It also has the potential to become more effective if improved along the same lines as the Swiss Accelerator.

A comparison of this tool with the Swiss Accelerator is available here: www.innosuisse.admin.ch/en/swiss-accelerator-innovation-projects.

THE INNOVATION LANDSCAPE

The Federal Office for the Environment (FOEN) provides an excellent summary of the situation on its website. The Innovation Landscape provides an interactive view of the different Swiss and European programmes funding innovation. Filters can be used to provide views of funding tailored more specifically to energy or environmental projects.

The page shows the roadmap to market, starting with basic research and followed by applied research, laboratory prototypes, pilots and demonstration, market authorisation and introduction, and lastly market rollout and export. This interactive Innovation Landscape page provides the user with information about the various instruments available (with funding details) to support businesses on their journey through the two death valleys.

The user can clearly see the large number of instruments available in the different areas of application, and it very quickly becomes apparent that the poor relative of funding is the transition from laboratory pilot to entry to the market, which incidentally is where the P+D and start-up innovation programmes discussed above come into play.

AN UNDER-RESOURCED LINK IN THE INNOVATION CHAIN

The budgets of these two instruments are around CHF 20 million each. Comparing these budgets with the sums of money shown in Figure 22 and the amounts needed to build pre-industrial facilities illustrates the problem and the size of the challenge facing us. The public funding available for this link in the chain is far too limited, especially given that the Innosuisse instrument is for all sectors of industry and not just energy and the environment.

The argument wheeled out in response is that it is up to the private sector to fund this support. Without wanting to be drawn into a philosophical debate here, the reality is that investors will always try to minimise their risk, and if we do not find a way to solve this problem, it is going to be very hard for industrially based Swiss technologies to compete in the future. The solution must be a joint one. We know what the rules of investors are, and the public sector can provide more support at this stage in the process. With this in mind, it is questionable whether it is worth continuing to invest the sums currently being spent on academic research if we do not solve this pressing problem.

THE TECHNOLOGY FUND

The Technology Fund acts as a guarantee for loans to Swiss businesses developing innovative products designed to make a sustainable reduction to greenhouse gas emissions. This instrument of the Confederation's climate policy is run by Emerald Technology Ventures on behalf of FOEN, which is responsible for the strategic implementation of the Fund.

To date, the Fund portfolio comprises 132 businesses that between them reduced carbon emissions by 1.9 million tCO_{2e} in 2023, with an estimated total reduction of 8.7 million tCO_{2e} since it was introduced in 2015. The results obtained by the Technology Fund are very encouraging. Carbon emissions reductions are increasing exactly in synch with the growth

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of the ecosystem and the number of start-ups. The Fund was initially directed very much towards SMEs but quickly shifted its focus to fledgling technology companies, as the current portfolio illustrates.

This instrument is undeniably having a big impact, but it could be even more effective simply by revising the fund allocation conditions. Given that the role of public funding should be to give the sector a leg up and plug a gap in the current financial landscape, the Fund's strategy is still too closely aligned with the investment criteria of venture capital. It is clearly not evolving fast enough to keep up with the changes in the ecosystem. Some companies languishing in the second death valley are still not eligible, despite having secured orders or investments worth more than ten million Swiss francs in some cases. For example, a criterion demanding a minimum turnover, no matter how small (the figure being touted is CHF 100,000) currently excludes companies with confirmed orders in hand and/or investors on board.

The practical consequence of this in reality is that these companies do

not have access to this instrument at a crucial point in their existence (lever effect, reduction of share dilution, etc.), and by the time they are in a position to fulfil the criteria it may well be too late. By then, they will be a sufficiently attractive proposition to complete future funding rounds without parapublic support. Some commentators will say that this is logical and just as it should be, arguing that it shows they don't need this help. But this is misguided, because this argument doesn't take into account the speed with which the economy is evolving. This poor timing creates a difficult situation for everyone involved.

This is because these companies will not have benefited from a helping hand at the right moment to accelerate their growth. Their shares will be more diluted and if their investors are based abroad (as in the majority of cases), they will potentially generate lower direct returns for the Swiss economy. There is also a much greater risk that the company will relocate once it has reached a certain size, and as a result the Technology Fund will also lose those contributions to its carbon emissions reduction total. If more generous funding placed too

much demand on budgets it would be understandable, but this is the wrong way to look at the issue. We shouldn't shy away from increasing the budgets for those instruments that are working and having an impact.

In answer to the question «where do we find the extra money?», we refer you to the Innovation Landscape web page mentioned above. On the left we can see the lofty peaks of the budgets allocated to academic research and on the right the lowly foothills of the sums set aside for supporting the end of the chain before the product reaches the market. Can we be any clearer?

We have already discussed a second solution at the beginning of this report, in the section setting out our vision, where we mention the option of syphoning off the leftovers of budgets not committed to support programmes. There is surely some room for manoeuvre here that is way below the pain threshold. If we want to ensure that Switzerland has a place at the table in the future, we must act now. We're holding all the cards – now it's decision time...

With respect to what is discussed above, this instrument does not completely fulfil the role it should in reinforcing Switzerland's competitiveness. This raises another fundamental aspect of the federalist approach. Each co-funding instrument or programme is designed to meet an objective described in a special federal act. On the other hand, these instruments almost never take into account the economic impact that they could also have (or ought to have). If this were the case, all these support programmes would have a far greater impact. We could increase Switzerland's global competitiveness simply by strategically aligning these instruments with a common goal alongside their main objective.

A POTENTIAL SOLUTION: A CAPEX/OPEX FUNDING PACKAGE

When we talk about the private sector, we are referring to all the financial players and not just to venture capitalists. Banks and pension funds are part of the solution. Switzerland has a reputation for precision, safety, reliability and quality, and our cleantech solutions are built on these values. It is true that due to factors such as labour costs their purchase price is often higher than in our competitor countries, but their lifetime cost, if not the cheapest, remains very attractive.

One potential way of boosting the sector and at least partially solving the problem discussed above would be to set up funding offers over the lifetime of a technology, combining help with both CAPEX (capital expenditure) and OPEX (operational expenditure). Similar financial instruments for co-funding projects already exist. Here, it would be a question of applying this solution in a programme designed to support the rollout of cleantech.

This represents not only a paradigm shift for the financial sector, it is also capable of changing the stakes and transforming the future of a sector which is here to stay. The solution is not down to any one individual organisation or authority, it is the responsibility of everyone – the financial sector, politicians, industry, the economy and academia – to put together an attractive package that will bring about the society of tomorrow.

The response from the private sector

Staying on the subject of finance, it is worth highlighting our observation that the involvement of financial players converges on the early stage of a company's development or the first round of investment. We have also recently seen the appearance of new players, including philanthropic foundations and other impact investors, who are making noises about investing in projects at this stage of development. The intention is there; only time will tell whether they will actually commit. In practice, the period corresponding to this double death valley, and in particular the second dip, is very demanding in terms of the volume of funding required and is often then regarded as too risky by newcomers unfamiliar with the start-up scene.

Once an entrepreneur has completed a pilot and has therefore successfully negotiated the first death valley, they think they have made it to the other side, but they have only reached an island half way across. And this moment is critical, because they are in fact not even in the middle of their journey: they still have to clear a path along the winding, thorny road to industrialisation that lies ahead, as we explain above.

It is extremely worrying to see that, in general, the funding instruments available to cleantech companies are still not suitable for their needs at this decisive stage. This is despite the convergence of players mentioned just above and which is illustrated in Figure 25.

This table provides an overview of the players involved in funding innovation projects. It shows the investment stages they target in terms of the development stages of a start-up. This is a generic view only. It must be borne in mind not only that every start-up is different, with its own particular context applicable to the sector or industry vertical in which it operates, but also that each investor follows its own rules in line with the objective adopted by its fund. Thus, while a conventional impact investor is more likely to be interested in businesses that have reached a certain level of maturity and will tend to use a loan facility (more in line with its expertise and core business), other investors are more inclined to offer capital to start-ups at the beginning of their journey.

« Switzerland is a leading source of innovations and clean technologies that can support the transition to a more sustainable future. »

– David Avery, Sustainability and Cleantech Expert



FUNDING PLAYERS	FUNDING STAGES					
	PRE-SEED	SEED	EARLY STAGE	ROUND A	ROUND B	ROUND C
Accelerators (acceleration programmes)		●				
Banks					●	●
Business angels		(●)	●	(●)		
Venture capitalists			(●)	●	●	●
Cooperatives			●	(●)		
Corporate ventures			(●)	●	●	●
Family offices				(●)	●	
FF&F (fools, family & friends)		●				
Founders	●	●				
Foundations		●	●	(●)		
Impact investors		(●)	(●)	●	●	●
Incubators		●	●			
European public institutions (H2020, etc.)	●					
National public institutions (Innosuisse, SFOE, FOEN, etc.)	●	●	●	(●)		
Cantonal public institutions		●	(●)			
Industrial partners (R&D)		(●)	(●)	●	●	
Crowdfunding platforms		(●)	●			

FIGURE 25: Involvement of funding players at the different funding stages of start-ups.

● core target
 (●) possible involvement in investment

OUTCOME

To round off this section on funding, it is fair to say that the challenge of securing co-funding for the last stage before market rollout is a familiar one to which solutions have been proposed in the past. The most recent attempt is the federal Climate and Innovation Act (LCI), a bill that was rejected by the Swiss people in 2021 and then passed by referendum in a heavily watered-down version in 2023.

The proposal in the original LCI was well thought out and perfectly aligned with a long-term strategy for prosperity in Switzerland, incorporating both sustainability and the economy. There is a host of possible reasons why this bill did not make it through: the political and economic downturn at the time, an unfavourable geostrategic situation, an approach that was too radical, bad political timing, cultural sensitivity, dogmatism and more. We shall probably never know why it failed, but that is not the point.

The point is that this was the right vision for Switzerland. We would like to see the bill updated and put back on the table for another national referendum, taking into account today's context. Because perceptions change over time. Given recent dramatic weather events, with tornados in the Jura, repeated record flooding and mudslides in the Alps, and nationwide drought just a year earlier, the effects of climate change are increasingly plain to see. These consequences are being felt not just in the melting glaciers at the end of remote valleys but on our doorstep and in our very homes (if they have not been swept away) !

« Encouraging innovation and supporting start-ups is critical to developing the technologies we need to overcome the climate challenges and achieve net zero. »

— Aliénor von Roten, Senior Project Manager at the Sustainability in Business Lab (ETHZ)



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03

Conclusion

We would like to conclude with an example taken from the environmental technologies category, and more specifically sustainable chemistry.

In terms of its development, the ecosystem discussed in this analysis is best described as a slow burner, and this is essentially due to how the sector is made up. Things are looking good for the sector, with a community of cleantech scale-ups in place – vigorous companies that grow faster than most – and expanding year on year. Newly founded companies have been reaching this fast-growth stage significantly more quickly in recent years. The pipeline of promising technologies is full and the supply is assured. Since success breeds success, the originators of environmental technology projects based abroad are now seriously interested in becoming part of the Swiss ecosystem. R&D institutions are making regular announcements about launches of new training and education programmes (in hydrogen, energy systems, logistics, sustainability and more) and openings of new research units and labs, and new academic chairs of energy and environment are springing up. All this is helping the community and the ecosystem to grow and feeding the continuing increase in the number of cleantech start-ups being created each year.

The regulatory framework is also supporting this impetus. The framework conditions are now better established, providing reassuring medium- and long-term visibility to entrepreneurs and investors alike. Specific support measures and programmes are keeping pace with the new requirements and restrictions emerging all over the world, opening up a whole range of commercial opportunities that start-ups clearly have in their sights. As far as global warming is concerned, the pressure on the economy, society and our politicians is set to ramp up further in the coming years. Meanwhile, the cleantech sector and the players that are part of it are generating practical, economically promising solutions.

« Start-ups are the pioneers of today, driving the innovation and transformation crucial to a sustainable future. »

– Paul-André Vogel,
Director of CimArk



THE PRELUDE TO INDUSTRIALISATION

Today, a whole series of technologies such as those used in decarbonising industrial processes are entering the last stage of industrial development before being rolled out on the market in force. Many of these are alternative manufacturing process solutions that use biosourced or recycled raw materials, for example.

What springs to mind here is of course Climeworks' third-generation direct air capture technology, released last June. But in a country famed for its pharma industry, we are inevitably going to be thinking above all about the future of this sector, one in which sustainable chemistry scale-ups will undoubtedly play a part. With companies like DePoly, Bloom Biorenewables, Plastogaz, Deasyl, Treattech, GRZ and Qaptis, Switzerland has some real contenders to continue leading the industry into the future.

These companies are all helping to decarbonise industry, but they have something else in common too: they are all developing industrial equipment and facilities and entering the pre-industrialisation phase, the prelude to large-scale industrial rollout. It's a stage that demands a lot of resources and investment. The road ahead is still a rocky one littered with pitfalls, and it is crucial that these players have the support of industry experts. Let us not forget that in our survey, start-ups cited this requirement as their second-most important.

Switzerland's sustainable chemistry cohort is a shining example of the level of maturity that the country's cleantech sector has now reached, despite the complicated environment. We should not count our chickens, but with respect to the points made above, we are pretty confident that these companies will secure the funding they need. These funding rounds will ensure not only their own growth but also that of the entire ecosystem in their wake, as the two driving forces cited in our introduction are already doing. The pump is primed and their future is assured.

If we have used this example, it is because of the iconic significance of the sector to which it belongs. But it is worth noting that the situation is similar in the other cleantech sectors making up the Swiss ecosystem. This observation made from behind the scenes of the innovation coming out of the sector reinforces the vision we have shared above.

SUMMARY AND NEXT STEPS

To summarise this study in a few points :

- In 15 years, the Swiss cleantech ecosystem has become consolidated and developed a strong impetus, with more than 615 start-ups, 50 new companies each year and more than CHF 3 billion of funding raised (CHF 1 billion of that in 2022 alone)
- Our vision for the sector for 2030 and beyond predicts that this impetus will continue, with a focus on foreign markets, supporting the growth of sustainability
- Sustainability is the capacity of a player to maintain its activity over the long term
- Switzerland's cleantech start-up portfolio is coming up with practical solutions supporting the transition to a more sustainable society
- Cleantech companies have to negotiate a double death valley, the first when creating pilots and the second when building industrial demonstrators
- The challenges of industrialisation remain a critical pinch point to which there is as yet no satisfactory response
- We have come up with various potential solutions for ensuring the sector's future :
 - Developing a CAPEX/OPEX package for funding solutions
 - Adapting existing support programmes (extending their scope more towards the market stage)
 - Aligning eligibility for technology funds with market dynamics
 - Increasing the budgets of (pre-)industrialisation support programmes
 - Bringing about a change in project-selection culture that allows room for «poor» decisions (communicating this mindset to the players and encouraging them to adopt it)
 - Creating a high-quality centralised database of funds raised and associated data to improve the impact measures of support instruments
 - The solution lies in collective action by everyone involved and sharing the same vision and values (under the impetus of SECO, DETEC and SERI/Innosuisse)

The impact of climate change is not for the future on the other side of the world, it is here and now! We can act, we must act, we will act... the question is simply how much longer are we going to wait ?

This second edition of the report, featuring some 70 profiles of start-ups, shows that we already have countless solutions enabling us to respond to these challenges now. And to respond to the challenges facing the industry, all we need is a programme of decisive support in place to accelerate pre-industrialisation and rollout on an industrial scale.



« Impact startups are crucial to speeding up the transition towards a sustainable future. With innovation-monitor.ch we are supporting the startup ecosystem. »

– Christina Marchand, Head of the Innovation Monitor and Researcher at ZHAW

The swiss cleantech innovation ecosystem

INTERNATIONAL ORGANIZATIONS

- World Intellectual Property Organization (WIPO)
- UN Environment Programme (UNEP)
- United Nations Industrial Development Organization (UNIDO)
- United Nations Framework Convention on Climate Change (UNFCCC)
- World Alliance for Efficient Solutions

SWISS CONFEDERATION

- Swiss Federal Office of Energy (SFOE)
- Swiss Federal Office for the Environment (FOEN)
- Swiss Agency for Development and Cooperation (SDC)
- State Secretariat for Economic Affairs (SECO)
- Innosuisse - Swiss Innovation Agency
- State Secretariat for Education, Research and Innovation (SERI)
- Federal Office of Transport (FOT)
- Swiss Federal Institute of Intellectual Property

ACADEMIC INSTITUTIONS

- École polytechnique fédérale de Lausanne (EPFL)
- Eidgenössische Technische Hochschule Zürich (ETHZ)
- Adolphe Merkle Institute
- Swiss Federal Laboratories for Materials Science and Technology (EMPA)
- Paul Scherrer Institute (PSI)
- Swiss Federal Institute of Aquatic Science and Technology (EAWAG)
- Centre Suisse d'Electronique et de Microtechnique (CSEM)
- Swiss Federal Institute for Forest, Snow and Landscape Research (WSL)
- European Organization for Nuclear Research (CERN)
- Centre de Recherches sur l'Environnement Alpin (CREALP)

INCUBATOR, HUBS AND TECHNOLOGY PARKS

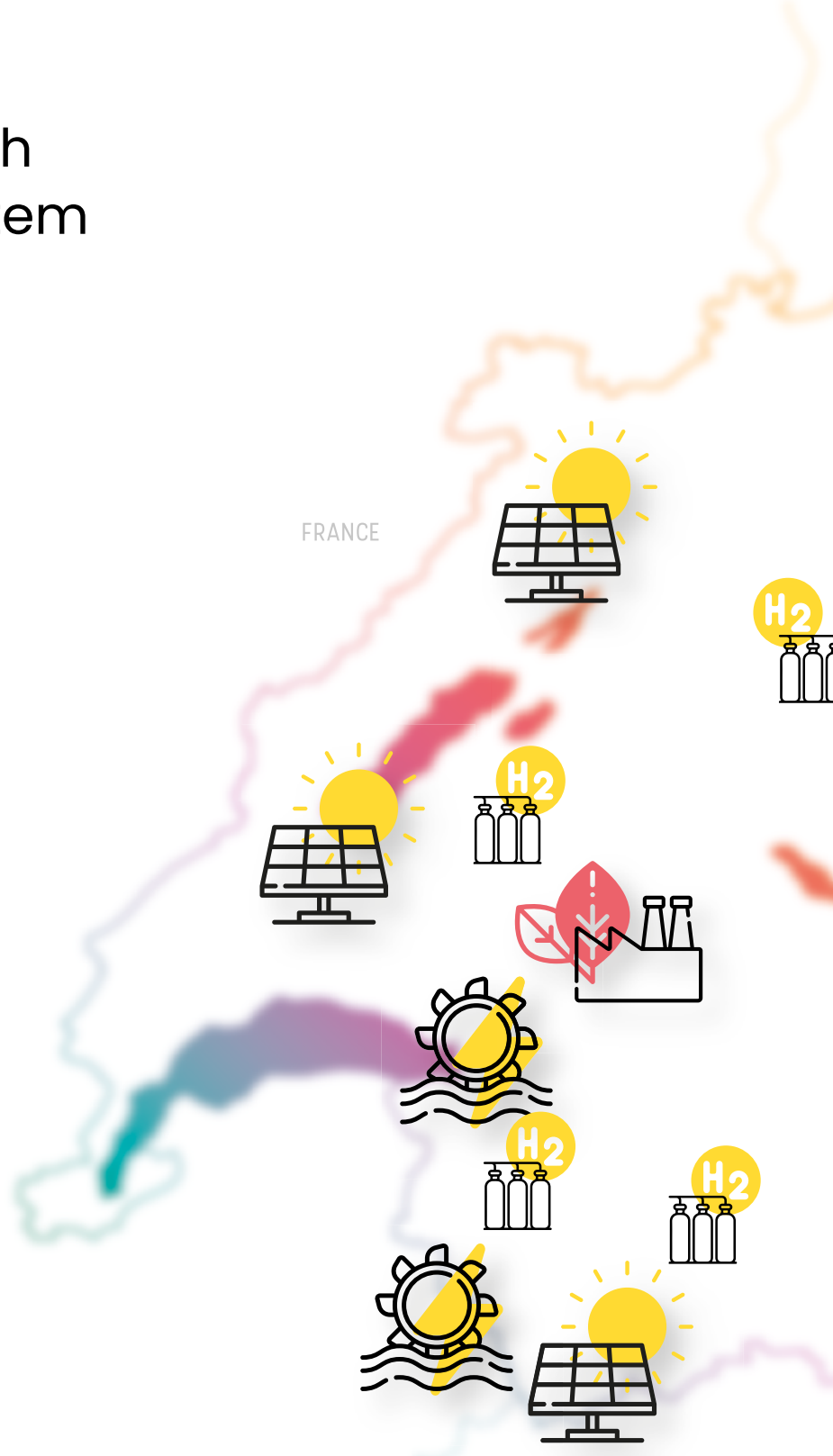
- TecOrbe
- BlueFactory
- BlueArk Innovation Hub
- Microcity
- Bluebox
- Energypolis & Alpole
- Impact Hubs (ZH, BE, GE, VD, NE, ...)
- Technopark (ZH, LU, AG, ...)
- Creapole
- Ecoparc Daval
- Ecopole FLASA
- Spontis Supply Chain Optimization Platform

INDUSTRY

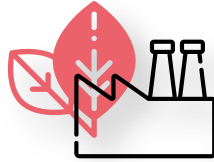
- SMEs
- Start-ups
- Corporates
- Engineering practices
- Utilities

EXTERNAL OFFICIAL NETWORK

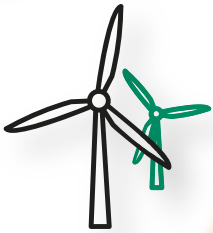
- Swissnex
- Swiss Business Hubs
- Switzerland Global Enterprise
- Embassies & Consulates
- GGBa
- Basel Area



GERMANY



AUSTRIA



ITALY

REAL SCALE TEST FACILITIES

- Gridlab
- SmartLab
- iHomeLab
- Mobility Lab
- Swiss Future Farm
- Smart Living Lab
- Bosch IoT Lab
- Net Zero Lab
- EnovArk
- Plastic Upcycling Industrial Innovation Platform
- Fuel Cell Pre-Industrial Technology Platform
- Gaznat Green gas Innovation Lab
- Destinus H2 Park
- Spontis Logistic & Assembly Hub

INNOVATION BOOSTER

- Carbon Removal
- Future Food Farming
- New Mobility
- Applied Circular Sustainability
- Circular Building Industry
- Energy Lab
- Living Labs for Decarbonisation
- Plastics for Zero Emission
- Swiss Food Ecosystems
- Swiss Smart Cities

ASSOCIATIONS

- Swissolar
- Swisseole
- energie-cluster
- Reffnet
- swisscleantech
- Organisation faitière de l'économie des énergies renouvelables et de l'efficacité énergétique (AEE Suisse)
- Schweizerischer Verband für Umwelttechnik (SVUT)
- Swissmem
- Swiss Water Partnership
- Swiss Business Council for Sustainable Development (ÖBU)
- Circular economy Switzerland
- CleantechAlps
- Swiss Solar Connect
- Agence de l'Énergie pour l'Économie (AEnEC)
- Swisspower



Navigating the waters of entrepreneurship.

Venturelab set sail in 2004, and has been designing and operating flagship startup programs to support the best entrepreneurial talents in Switzerland, including Venture Kick, Venture Leaders, the TOP 100 Swiss Startup Award, and Innosuisse Start-up Trainings.

Together with successful founders, top academic collaborators, and leading industry partners, we support the best startups on their journey of winning the race in global markets.

Our partners in growing world-class startups. Swiss made.

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Since its launch in 2007, Venture Kick has provided 1,024 Swiss university spin-offs with CHF 51.98 million in seed capital. To date, 796 of them have been incorporated, creating 13,305 jobs. These startups have attracted CHF 8 billion in extra investment.

The philanthropic initiative Venture Kick is financed by a private consortium:

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André Hoffmann

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Martin Haefner

Fondation
ProTechno

esa business incubation centre
Switzerland

swisscom



www.venturekick.ch

04 What the experts say

Start-ups, a crucial mainstay of Switzerland's energy and climate ecosystem

Start-ups, a crucial mainstay of Switzerland's energy and climate ecosystem?

Switzerland is pursuing ambitious energy and climate policies, and the two are closely linked. In order to ensure a sustainable and efficient energy supply, we need innovative and affordable technologies that enable the energy supply system to be restructured. Research is well advanced in many areas. The challenge is to move innovations from the lab to the market. Mature companies are more risk averse, which slows down the necessary restructuring. Start-ups play an important role as they are agile and flexible and often move directly from research to market maturity.

What are the major challenges for the energy and decarbonisation sector over the next few years?

It is the role of government to provide a secure regulatory framework for the energy sector. The right incentives, and a clear and stable regulatory framework, provide investment security. Another critical issue is the timing of regulation. Early regulation often slows down innovation, while regulation that comes too late delays important investments. International cooperation, which is crucial to the success of Switzerland's energy system, is also a political task. Many solutions for the energy supply system, such as an H₂ network or CO₂ storage, will require international cooperation.



Benoît Revaz

Director of the Swiss Federal Office of Energy (SFOE)

What specific support are you offering cleantech companies?

To promote affordable and sustainable technologies, the SFOE supports promising projects with subsidies. Our aim is to assist the entire value chain. We support the early stages of applied research in the fields of renewable energies and energy efficiency. Our Pilot and Demonstration programme supports projects with significant potential for multiplication. When a technology is ready for the market, start-ups and SMEs can obtain loan guarantees through the Technology Fund. From 2025, when the Climate and Innovation Act comes into force, innovative technologies that make a significant contribution to the net-zero goal will also be eligible for funding.

Optimise your operations and commit to sustainable practice with Spontis!

What are the new challenges facing start-ups and SMEs and why have you come up with an offer specifically to support them?

Corporate social responsibility (CSR) is clearly a new challenge facing businesses. Many companies are introducing procedures and other initiatives to respond to the issues around sustainability, such as calculating their greenhouse gas emissions. But they soon come to realise how difficult it is to calculate and optimise their scope 3 emissions (indirect emissions generated by the company's supply chain).

At Spontis, we offer businesses the opportunity to reduce their carbon footprint by consolidating their procurement, optimising their logistics flow and maximising their waste recovery. They can then focus fully on their core business in the knowledge that they are helping the environment.

How does Spontis respond to the supply chain needs of these new companies?

Spontis enables fledgling companies to delegate certain operational activities and all their supply-chain-related tasks (strategic purchasing, procurement, logistics and waste recovery). Few growing companies consider supply chain proficiency to be a key skill. They feel it is more important to acquire competences in line with their core business. That's why Spontis offers a technology platform that interacts with its customers, along with automatic resupply solutions, procurement pooling and technical standardisation advice.

What kind of support do you offer at your logistics and assembly hub? What added value does this offer start-ups and SMEs?

Spontis offers personalised logistics support to companies that want to focus on their core business. We provide added value by taking on pre-delivery storage or assembly tasks. We put together tailor-made kits, assemble products with parts from different suppliers, and extract products, test them and put them back into the circuit to encourage the circular economy. Spontis keeps abreast of its customers' needs and changes it offer to match their expectations.



David Humbert

Executive Assistant and Business Development Manager of Spontis Ltd

Innovaud, the Canton of Vaud and cleantech

Innovaud is one of the organisations involved in promoting the economy of the Canton of Vaud. Its main mission is to support technology companies in their innovation process, which it does in close collaboration with SPEI, the Office for Economic Affairs and Innovation of the Canton of Vaud. For more than 10 years, Innovaud's advisers have been working closely with businesses on the ground. As a result, they have an unrivalled insight into the canton's entrepreneurial ecosystem.

Having been involved since the beginnings of Innovaud, I have seen how cleantech has become and remains a highly productive and dynamic facet of the canton. In recent years, the field of clean technology, as it is described on the CleantechAlps website (www.cleantech-alps.com), has been complemented by the concept of sustainability through the Viva initiative (www.viva-vaud.ch).

How this concentration of cleantech and sustainability players in Vaud has come about

There is a vibrant community of cleantech businesses here which, along with the canton's universities, are sustaining a dynamic ecosystem. This can be partly explained by the following three factors.

The first of these is the thriving business community, which has created a snowball effect. The success of scale-ups such as Ecorobotix and Cleangreens, to name but two of several dozen, stimulated by the multinational Nestlé, which is very active in the canton, demonstrates that businesses have specific needs and that these can be met with locally developed innovations.

The flourishing academic environment, with EPFL, HEIG-VD and the Changins UAS site all based here, feeds a steady stream of extremely varied projects working on ways to protect our natural resources and use them more sparingly.

And lastly, the businesses of Vaud have a very well-established ecosystem at their disposal. Vaud's many and varied innovation drivers, including SPEI, Viva or Innovaud, CleantechAlps, Platinn and FIT to name but a few, are catalysts for success which go some way to explaining the proliferation of projects and concentration of players in the canton.



Jean-Michel Stauffer

*Microtech and Cleantech
Innovation Adviser at Innovaud*

The importance of complementarity in business

One of the challenges in promoting economic activity is facilitating the creation of communities to encourage collaborative projects. Inspired by the old saying "faster alone, further together", our canton has introduced two main programmes designed to promote and support inter-company collaborations in any aspect of cleantech or sustainability.

SyNNergy (www.synnergy.ch) is a digital success accelerator for SMEs in Vaud. Where several companies face a shared problem with a digital solution, they can submit a request to receive a financial contribution to help them develop their solution, which will then be shared between them.

Viva is a sustainable-economy platform and support fund that provides dependable support for collaborative sustainability projects. Starting from the principle that an innovative project requires a lot of resources for a business on its own, Viva is able to support business consortiums that pool their resources to achieve a shared sustainability objective.

Drawing on the potential complementarity of both technologies and businesses, we are convinced that working together is a route to success.

In conclusion, the Canton of Vaud boasts a well-established business ecosystem which is able to balance the day-to-day needs of businesses with the development of innovative solutions. This makes it the ideal region in which to establish and grow cleantech companies. The result? Vaud is home to a significant concentration of businesses active in a variety of sectors, including environmental protection (air, water, soil), energy (hydrogen, smart grids, solar, hydro, wind power), the circular economy and agritech.

If you are interested in joining one of these communities, please get in touch.

Accelerate the transition with the Swiss Climate Foundation

What does the Swiss Climate Foundation do, and what practical support do you offer cleantech businesses?

The Swiss Climate Foundation supports product development projects put forward by SMEs that have a potentially beneficial impact on the climate. We receive applications from different sectors, such as agriculture, IT, construction and energy. The Foundation has supported a third of the projects described in this report, such as the ones from dhp in Graubünden, which is developing photovoltaic installations, the SME Voltiris in Lausanne, which speeds up crop growth while producing electricity, and the Zurich-based start-up Oxara, which is developing cement-free building materials.

How is the Foundation contributing to the Confederation's net-zero strategy?

To reach net zero, Swiss industry and society have to change considerably. In addition to changing the way we manage non-renewable resources, we also need new products and technologies. The Swiss Climate Foundation is supporting nearly 200 innovative climate projects and solutions. Since we were founded, we have invested nearly CHF 40 million in climate protection projects developed by SMEs in Switzerland and Liechtenstein. This sparks two to three times as much additional investment, which can only be good for the climate and the innovation sites in Switzerland and Liechtenstein.

In your view, what are the climate change challenges in which innovation will play a crucial role?

Every industry faces its own challenges when it comes to decarbonising its products. We need to manage our resources differently and find innovative solutions. Fortunately, Switzerland is an innovative country, with 966 patent applications per million inhabitants in 2020, compared with 146 in the EU. But a good idea has a long way to go before it can become a successful product on the market that can have a real impact on the climate. It is important that entrepreneurs have ambitions to grow and that scaling-up capital is made available.



Vincent Eckert

Director of the Swiss Climate Foundation

CAMPUS ENERGYPOLIS Innovation in the heart of the Alps.



energypolis
CAMPUS

The Energypolis Campus brings together EPFL Valais Wallis, HES-SO Valais-Wallis and The Ark Foundation to put new technologies into the hands of innovative companies.

EPFL Valais Wallis

Hes-SO VALLIS WALLIS

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54	—	Bloom Biorenewables	77	—	Sparrow Analytics	100	—	FAIRTIQ
55	—	Cortexia	78	—	GRZ Technologies	101	—	Bcomp
56	—	Seprify	79	—	Celectis	102	—	ID Genève Watches
57	—	Viridhys Technologies	80	—	Solaxess	103	—	xFarm
58	—	Separatic	81	—	Carvolution	104	—	Synhelion
59	—	AgroSustain	82	—	ennos	105	—	V-Locker
60	—	Ecorobotix	83	—	Yord	106	—	Distran
61	—	SOLARSPLIT	84	—	Urbio	107	—	OPTIML
62	—	Deasyl	85	—	Divea	108	—	Eaternity
63	—	Climeworks	86	—	Emissium	109	—	Fluidsolid
64	—	Pelt8	87	—	WattAnyWhere	110	—	Batronics
65	—	Panatere	88	—	Evolium	111	—	dhp technology
66	—	DePoly	89	—	AELER	112	—	H55
67	—	MobyFly	90	—	Daphne Technology	113	—	Dufour Aerospace
68	—	Oxara	91	—	Planted Foods	114	—	HOOC
69	—	NanoCleanAir	92	—	FenX	115	—	DigitalRoots
70	—	TreaTech	93	—	MeduSoil	116	—	GreenGT
71	—	Neustark	94	—	bNovate	117	—	Softcar
72	—	Qaptis	95	—	BeyondScroll	118	—	ProSeed
73	—	CompPair	96	—	SmartHelio	119	—	UHCS
74	—	YASAI	97	—	KITRO	120	—	Yuon Control
75	—	Librec	98	—	Arboloom Cup	121	—	Joulia
76	—	Libattion	99	—	Tide Ocean	122	—	Voltiris

05 Company profiles

Although the title of this report is « Panorama of cleantech start-ups », the sample we present here reflects the diversity of the ecosystem, which includes emerging start-ups, fast-growing scale-ups and innovation-pioneering SMEs. This section illustrates the **dynamism and vitality** of the cleantech community through these representative examples.

CONTEXT

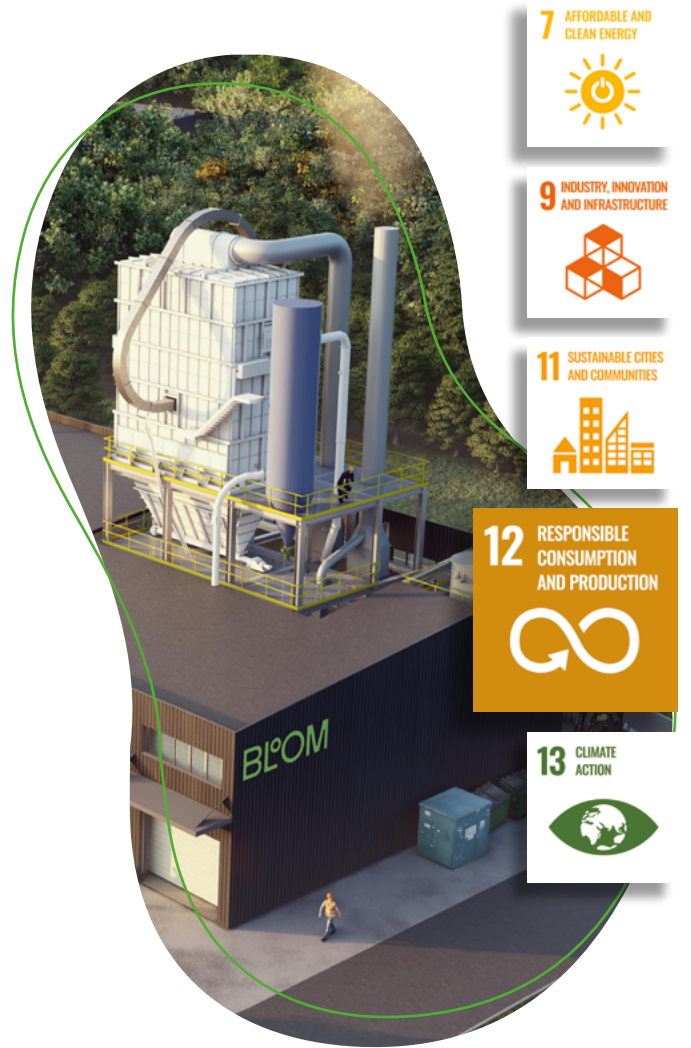
Petrochemicals are used not only in fuels but also in the manufacture of plastics, perfumes, flavourings and antioxidants, among many others. All these petroleum derivatives contribute to increasing CO₂ emissions. Thanks to its advanced knowledge of biomass chemistry, Bloom Biorenewables is able to offer industry a sustainable alternative with the same, or similar, properties as fossil carbon.

TECHNOLOGY

The company has developed a unique biorefinery process that can efficiently separate all the biomass components: cellulose, lignin and hemicellulose. Until now, it was only possible to isolate cellulose – mainly used in papermaking – which accounts for less than half the total weight of the biomass processed. The « magic brew » developed by Bloom Biorenewables can be summed up in three letters : AAF, standing for aldehyde-assisted fractionation – a process that is at the forefront of its field and protected by several patent families. It is what enables these hitherto underused polymers to be extracted unaltered and to be stabilised. Depending on the petroleum derivatives replaced, the use of biomass components can reduce the CO₂ footprint of the manufacturing processes concerned by 60 to 90%.

MATURITY

Bloom Biorenewables has already validated the process's potential in some markets, with several customers having committed to purchasing compounds on a commercial scale – dsm-firmenich for fragrances and fine chemicals, Soprema for polyurethane foams, and Amcor for new types of plastics for packaging. Bloom aims to start building a demonstration plant in 2025, with an annual processing capacity of 1000 tonnes, and to start production in 2026. In the meantime, it can count on its partnership with Valais-based chemical producer Valsynthèse to turn out smaller quantities to meet the growing demand from its customers. Once it has secured its initial markets, the company's long-term aim is to also market renewable fuels for aviation and maritime transport, in order to contribute to fuel defossilisation on an international scale.



Replacing oil with biomass

Bloom Biorenewables specialises in refining biomass components and markets its compounds to industry, where they are used to replace petroleum derivatives in the manufacture of polymers and solvents.

« The biomass available today is under-utilised, yet it represents an abundant and accessible source of renewable carbon to replace fossil carbon. »

— Remy Buser, Co-founder and Co-CEO





Cleaning cities in real time

Clean, sustainable cities delivered to us by intelligent street cleaning vehicles ? This is reality, not science fiction, thanks to the urban waste mapping tool developed by Cortexia. Its AI-based solution enables resources to be better allocated, with less environmental impact.

« We are extending our platform to enable a standardised assessment of the quality of organic waste by measuring the foreign substances present in the waste stream. »

— *Andréas von Kaenel, CEO*

CONTEXT

European towns and cities use an average of 35 diesel vehicles per 100,000 inhabitants to clean their streets, including 16 for sweeping and washing. This represents a total of more than two million tonnes of CO₂ emitted by street services every year. Cortexia offers an objective measure of the effectiveness of cleaning campaigns through automatic urban waste mapping, using on-board cameras coupled with artificial intelligence. The technology enables cities to control the use of their resources, improve the wellbeing of their residents and reduce their impact on the environment.

TECHNOLOGY

The AI developed by Cortexia recognises several types of waste and uses this to calculate the cleanliness level of streets, assigning a score of 0 (dirty) to 5 (clean). The Clean City Index reflects the perception of local residents and makes it possible to identify both the causes of dirt and the means to clean it. This solution has enabled the city of Geneva to reduce by 20% the operating time of its maintenance vehicles. The company's unique technology can be installed on different types of vehicle, depending on the geographical coverage required. By optimising the use of resources, it also saves water – cities that opt for sweeping alone consume up to 30 times less. Lastly, quantitative waste measurement enables cities to step up the effectiveness of their campaigns to raise residents' awareness, particularly of littering.

MATURITY

Cortexia's waste management solution is mature and already in use in around fifty European cities. The company is now extending its platform to include improving the quality of organic waste collected in the sorting process, in order to increase the quantities recycled. Following tests in Switzerland, Cortexia is looking for European pilots to further develop its Clean Biowaste Index. This new index, graded from 0 to 4, can be used to detect non-target items in a skip's load. Cortexia raised funds at the end of 2023 to finance the extension of this technology and the roll-out of its activities in other European markets.

6 CLEAN WATER AND SANITATION



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



10 REDUCED INEQUALITIES



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



3 GOOD HEALTH AND WELL-BEING



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



A natural white

Colour pigments are used in the production of wall paints and varnishes, as well as in food and many other consumer goods. The Fribourg-based start-up Seprify AG is the first company in the world to produce white pigment from a plant-based material, cellulose.

« We are initially focusing on products that people put on or in their bodies, such as food, cosmetics and pharmaceuticals. »

— Lukas Schertel, CEO & Co-founder



CONTEXT

White walls, white sweets, white sun cream and headache tablets – we are surrounded by the colour white throughout our lives. What gives these and many other things their white colour are white pigments. Until now, the latter were mainly produced from titanium dioxide ; however, this metallic compound is now suspected of damaging the human genome. As a consequence, its use in food has recently been banned in Switzerland and many other European countries. Another drawback is that the synthetic production of titanium dioxide generates climate-damaging carbon emissions.

TECHNOLOGY

Seprify, a start-up founded in 2022, has developed an alternative. Instead of using titanium dioxide, the company produces white pigment from cellulose – this is a natural substance that occurs in all plants and has long been used for paper production, among other things. Seprify founder Lukas Schertel, a trained physicist with specialised knowledge of optical materials, has used his expertise to extract the required substances from cellulose and process them into white pigment. The innovation here is not a new process but a new combination of process steps, and their control. Seprify intends to primarily supply the safe and non-hazardous white pigment they've developed for applications in direct contact with people.

MATURITY

The pigments are currently being prepared for different applications as part of development projects carried out in close cooperation with customers – the first products containing Seprify white are due to be launched on the market in 2025. In January of that year, a pilot plant with a production capacity of one tonne of white pigment a year will go into operation at the Marly site in Fribourg. No specialised machinery is required, so the construction of larger plants can follow quickly : a commercial demonstration plant with a capacity of 1000 tonnes is planned for just over a year later. The cellulose components that are not processed into white pigment will be used to strengthen the circular economy – for example as a texturing agent for toothpastes.

Turning plastic directly into electricity

Viridhys offers industries with a lot of plastic waste the means to recycle it on site to meet part of their energy needs. Called Pyroplas, the technology can convert up to 80% of the plastics processed in this way.



« Our process makes it possible to recover plastics that cannot be recycled mechanically, with minimal environmental impact. »
 – Frédéric Haase, CEO

CONTEXT

Hundreds of millions of tonnes of plastics are produced around the world every year. While they are linked to more than half the world's CO₂ emissions, barely 10% of plastics are currently recycled. And some, although theoretically recyclable, are entirely excluded from mechanical recovery processes. To remedy this lost opportunity, Viridhys Technologies has developed a thermal process for producing electricity directly from plastic waste. A specialist in using plasma to sterilise seedlings for agriculture, the Fribourg-based company has added this latest process to its portfolio of innovative solutions.

TECHNOLOGY

Viridhys Technologies has improved its plasma pyrolysis technology and developed a continuous process for converting plastics into pyrolysis oil. The addition of a catalyst used in petrochemicals transforms this crude product into refined oil that can be used on site to produce electricity, using a generator equipped with a CO₂ filtration system. The food-grade CO₂ is then liquefied and can be sold and used in a wide range of applications. The entire system fits into four standard containers and is sold as a turnkey solution that can process up to 2000 tonnes of plastic a year, to produce 5 GWh of electricity. The company's winning combination enables industrial firms to not only cover part of their energy needs but also sell the CO₂ emitted during the process, all while eliminating their plastic waste.

MATURITY

While no Pyroplas unit is yet operational in Switzerland, ten or so have already been sold and installed around the world, in Germany, the Netherlands, Indonesia and Japan. Viridhys Technologies' customers are chemical companies and industrial firms that produce a lot of packaging waste. The company currently has a production capacity of five units a year, working with a network of partners to manufacture the various components then assembling and commissioning them on site. A funding round in 2024 enabled Viridhys to raise CHF 7 million to develop the technology and manufacture the units. Numerous orders have already been placed for delivery in 2025 and 2026.

Simplifying CO₂ capture

Separatic, a start-up incubated at the University of Fribourg, is developing and producing innovative gas separation systems for direct CO₂ capture and hydrogen recovery. Its goal is to help industries move towards carbon neutrality with a simple, effective and low-cost solution.

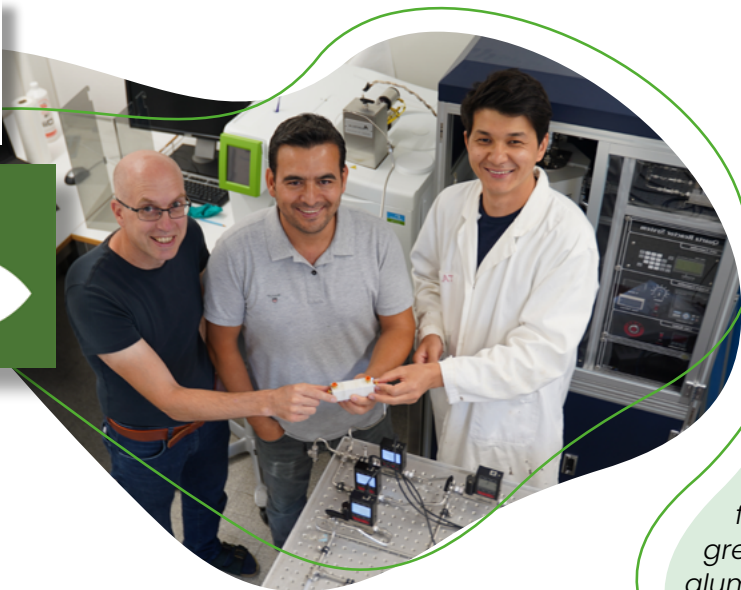
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«One of our aims is to set up a direct CO₂ capture facility in Tajikistan: I grew up there, close to an aluminium factory, and it's my desire to guarantee clean air for my community.»

– Timur Ashirov,
CEO



CONTEXT

The global carbon footprint reduction targets are very ambitious, and limiting CO₂ emissions will not be enough. Consequently, negative emission technologies are being used to eliminate some of the greenhouse gases resulting from human activities. This is where Separatic comes in: the start-up is developing gas separation solutions based on innovative, low-cost and easy-to-implement membranes, focusing on the capture and separation of carbon from industrial waste gases. It has also made hydrogen recovery an essential part of its strategy.

TECHNOLOGY

The main innovation is the use of tubular graphene membranes to separate CO₂ from flue gases. They also enable hydrogen to be recovered for fuel cell applications. These membranes were developed during the doctoral research of Separatic founder Timur Ashirov and are covered by several patents. Coated in an adsorbent material, the membranes considerably improve the efficiency of gas separation, reducing energy consumption by five to nine times compared with traditional methods. The high permeation rate also reduces the membrane surface area required by a factor of 100, significantly lowering costs, while the modular design means that this solution can be integrated into any existing installation.

MATURITY

Following successful laboratory tests in Denmark, Separatic is developing industrial pilot projects with Swiss partners such as Plastic Omnium and Groupe E Celsius. If these are also successful, market entry is planned for the end of 2025. The start-up is initially targeting the European Union, where CO₂ emission reduction targets are very strict, after which it plans to extend its activities to Asian markets. The technology is particularly well suited to the energy production sector but could also be applied to biogas treatment. Separatic is supported financially by the BRIDGE Proof of Concept programme and the University of Fribourg's research department, and is looking to raise further non-dilutive funds before approaching private investors.

« Our vision is to use natural and biological solutions to extend crop freshness, which means less waste generated along the entire value chain. »

— Olga Dubey, Founder & CEO



Natural « packaging » that preserves fresh produce

AgroSustain has developed a 100% edible coating that extends the shelf life of fruit, vegetables and flowers. The company is also developing other organic solutions in a bid to make farming more sustainable.

CONTEXT

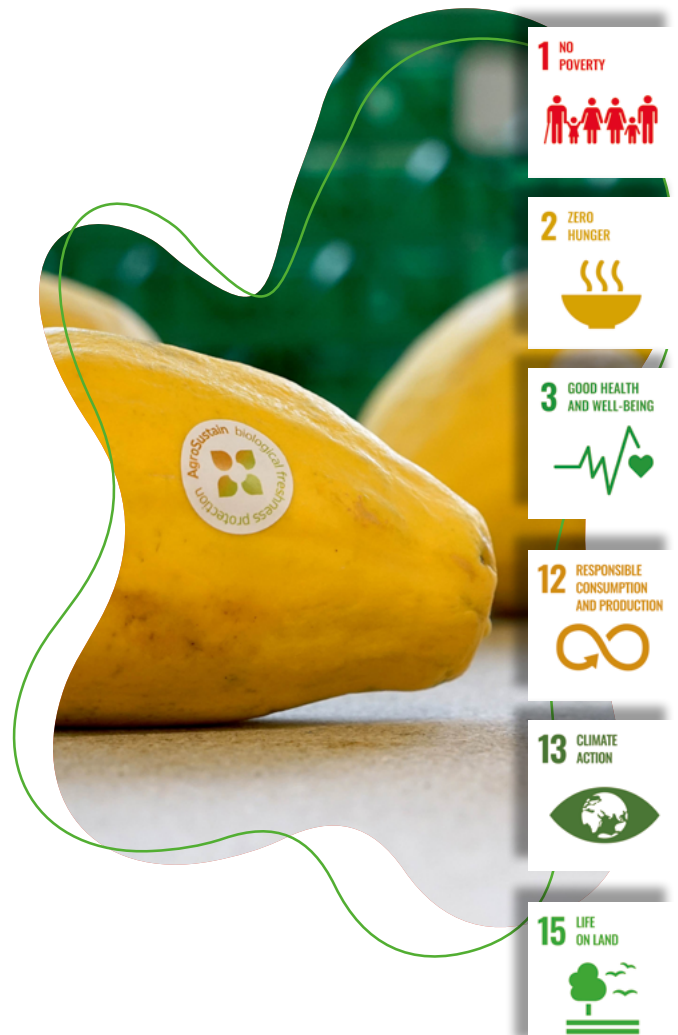
From field to fork, each year Switzerland generates 2.8 million tonnes of food waste. Because it is easily damaged and perishable, a substantial proportion of the fruit and vegetable harvest never makes it to the table. To prevent this waste and supply the consumer with high-quality produce, AgroSustain markets a natural conservation solution that keeps these foodstuffs (and flowers) fresher for longer. The University of Lausanne spin-off also makes two other products free of chemical additives developed to improve crop yields.

TECHNOLOGY

To provide effective protection for fruit, vegetables and flowers, AgroSustain has developed and patented a range of natural edible coatings. Made up of vegetable oils and edible emulsifiers, these coatings can be applied as a spray, in a bath or by waterfall application immediately after harvest or at any other stage of the supply chain. The coating forms a protective layer on the surface of the produce. Invisible, odourless and flavourless, it can extend the product's shelf life for up to one month – without affecting the natural ripening process. This reduces the product's environmental impact since plastic packaging becomes unnecessary, air freighting can be avoided and there are no harmful chemicals to contaminate the environment when the produce is washed before consumption.

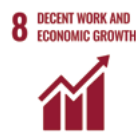
MATURITY

The coatings are made in Switzerland and marketed all over Europe, Latin America and the Middle East. At the same time, AgroSustain is working on other solutions, starting with a plant biostimulant set to improve yields in parts of the world vulnerable to climate risks. Trials have been carried out in partnership with Agroscope in Changins and the product is currently in the approval phase. The fledgling company is also developing biofungicides for pre- and post-harvest applications. Their efficacy has been demonstrated in field trials and validation of the toxicological analysis results is pending. After securing CHF 12 million of funding, in 2024 AgroSustain completed a funding campaign worth CHF 3 million to continue its development work.



Using AI to optimise crop protection treatments

Ecorobotix is working to develop artificial intelligence technologies and precision farming equipment. Its goal is to help shape a future in which farming practices better respect the environment.



CONTEXT

The agricultural sector's intensive spraying of crop protection products has a negative impact on our environment. As regulations in this area become increasingly strict, Ecorobotix has developed a solution that minimises the use of chemicals in the fields. Based on artificial intelligence and machine learning, Plant-by-Plant AI software differentiates between useful and harmful plants, allowing treatments to be applied with great precision and only where necessary.

TECHNOLOGY

The product currently available on the market is the ARA ultra-high-precision smart sprayer. This cutting-edge technology is capable of scanning the field to recognise and classify plants in real time, then spraying only the ones selected, with a precision of 6 x 6 cm. The result is an average 88% reduction in the quantity of chemicals used compared with full-field spraying. Ecorobotix estimates that, in 2023, its fleet of machines saved around 250 tonnes of CO₂ equivalent. Unlike traditional methods, ARA virtually eliminates the risk of crop protection products being dispersed by the wind, while also reducing the manual labour required for spraying. By massively curtailing the use of chemical products, this solution also helps to protect biodiversity and preserve soil quality, leading to an increase in agricultural yields in the long term, as well as encouraging nature to thrive.

«Ecorobotix target is to help farmers reduce the use of crop protection products by more than 90% and to regenerate biodiversity using AI.»

— Dominique Mégret, CEO



MATURITY

The ARA sprayer has been available since 2021. The product of lengthy development work, it is more versatile than its predecessor, which was an autonomous robot; it can also be attached to and towed by any tractor. While Ecorobotix initially concentrated on the European markets, it shipped its first batch of sprayers to the Americas at the end of 2023 and now intends to expand its presence in North America. Since its foundation, the company has already raised more than CHF 70 million to help develop its activities, particularly at international level and, more specifically, in North America.



A smart app to speed up the rollout of solar energy

SOLARSPLIT is developing an all-in-one digital solar investment platform to simplify the adoption of solar energy. Its community-based approach connects property owners with installers and investors.



«By streamlining administrative processes and facilitating funding for installations, SOLARSPLIT acts as a real catalyst for solar energy.»

— Wilfried Josset, CEO & Co-founder

CONTEXT

It is estimated that the lack of decision-making support for property owners is leading to the postponement or cancellation of more than half of all solar installation projects in western Switzerland, which is holding back the energy transition in the building sector. SOLARSPLIT's solution to this problem is to offer an all-in-one platform for investing in solar energy. By simplifying the various processes involved and directly connecting owners, installers and investors, SOLARSPLIT aims to democratise access to solar installations.

TECHNOLOGY

The company, which is incubated in the start-up programme run by Microcity, has developed an application to connect its community via three integrated services within a single platform. These are SOLARSPLIT Install (to help landowners plan their project, find the best installer and facilitate contact), SOLARSPLIT Invest (to facilitate financing and offer innovative remuneration models based on data relating to the income generated by the installation) and SOLARSPLIT Monitoring (to optimise installation use with practical recommendations). SOLARSPLIT's technology extracts and aggregates data from the community's solar installations, and each service uses this data and artificial intelligence to respond to different use cases. Over the next three years, the start-up, founded in 2023, hopes to increase Switzerland's annual installed capacity by around 50 MWp – saving 2000 tonnes of CO₂. It also intends to encourage the replacement of fossil-fuel heating systems with heat pumps.

MATURITY

SOLARSPLIT has set up an initial community of around fifteen installers in the canton of Neuchâtel to test the beta version of its application, monitoring more than 1500 solar installations. The public version will be available later in 2024, and services will be gradually rolled out. The company's sights are set first on western Switzerland and then the entire country, with the aim of eventually expanding into the rest of Europe. Several financing rounds in 2024 have raised almost CHF 2 million for this development. SOLARSPLIT has won the Prix BCN Innovation 2023 and the Prix SUD 2024, among other accomplishments.



The chemistry of the future

For Deasyl, the future of chemistry is green, and it is developing innovative processes aimed at decarbonising the sector's products and processes. With a portfolio of patents to its name, Deasyl is now looking to accelerate its industrial development.



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«We are targeting companies in the petrochemical and fine chemicals industries who want to decarbonise their processes.»

— Julien Thiel, CEO & Co-founder

CONTEXT

Deasyl is leading the charge in a revolution aimed at replacing petroleum-based chemistry with bio-based chemistry. Its innovations make it possible to decarbonise the processes traditionally used by petrochemical and fine chemical companies and to recycle some of the byproducts from the manufacture of synthetic fuels. This not only reduces pollutant emissions, but also lowers consumption of energy, water and raw materials – in other words, the processes become more respectful of the environment and less costly. Since its creation in Geneva in 2017, the company has been working with a number of academic institutions and industrial partners – including Chimie ParisTech, Polytechnique Montréal, HEIA FR and the Swiss companies WAB-GROUP® and Helvetia Environnement – to stimulate the adoption of its solutions, based on collaborative innovation. It already holds several process patents relating to new continuous-flow chemistry processes, such as mechanosynthesis.

TECHNOLOGY

Deasyl first worked on a process for manufacturing biodiesel – a synthetic fuel with a carbon footprint 93% smaller than that of fossil fuels. The process also generates glycerol, a byproduct that can be used to reduce the emissions resulting from the manufacture of this fuel by a further 70%. While conventional chemistry pays little heed to reaction times and the associated pollutant emissions, the company has developed innovative processes based on a perfect microemulsion obtained using a continuous-flow mixer-grinder to speed up the desired chemical reaction. Deasyl also holds patents for the development of other products, including bio-based solvents and lubricants with a smaller environmental impact.

MATURITY

The company's business model is based on the development of intellectual property (licence/sale of patents) with industrial partners: for instance, a patent for a mixer-grinder has been sold to Basel-based chemical company WAB-GROUP. Deasyl launched a funding round worth €10 million in 2024 with various strategic partners to accelerate its industrial development. The company is targeting growth markets that need new capacities and are demanding more efficient, ecological and profitable processes, and it has set up a subsidiary in the United Arab Emirates to this end.



500



Zurich



climeworks.com



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13 CLIMATE ACTION



« Of the more than 100 companies worldwide that currently offer CO₂ capture, Climeworks is the undisputed market leader, thanks to a growing number of working plants. »



— Jan Wurzbacher, Co-CEO & Co-founder

Carbon capture on a mammoth scale

In response to the climate crisis, many countries and companies have committed to a net zero target. Because not all CO₂ emissions can be entirely avoided, it is extremely important to remove the greenhouse gas from the atmosphere. Climeworks AG is building increasingly efficient plants that do precisely that.

CONTEXT

Combating climate change is a huge challenge. In recent years, both countries and individual companies have set ambitious targets for reducing CO₂ emissions. As a result, they are making huge efforts to reduce and replace fossil fuels. However, it is clear to observers that, in order to achieve the climate targets, CO₂ must also be removed from the atmosphere. Jan Wurzbacher and Christoph Gebald, both graduates from the Federal Institute of Technology in Zurich, recognised this early on and founded Climeworks in 2009, based on a process that captures carbon emissions from the atmosphere. The CO₂ can be used by industry or stored in the ground.

TECHNOLOGY

After refining its direct air capture technology to make it market ready, Climeworks opened the first commercial plant, Orca, in Iceland in 2021. It is capable of permanently removing 4000 tonnes a year of carbon dioxide from the atmosphere. In mid-2024, Mammoth, a plant that's almost ten times more efficient, went into operation just half an hour away from the Icelandic capital of Reykjavik. Heat and electricity for the CO₂ capture come from a neighbouring geothermal power plant. Climeworks' partner company Carbfix is responsible for injecting the captured CO₂ into the earth, where it reacts with porous basalt rock and turns into stable carbon minerals.

MATURITY

At around 1000 US dollars a tonne, direct air capture is currently only affordable for companies with low CO₂ emissions and large financial resources. The third generation of capture technology, currently in development, should further improve efficiency and cost-effectiveness. By 2027, Climeworks and a consortium of companies plan to build a plant in Louisiana, US, that can initially capture 300,000 tonnes of CO₂, increasing to 1,000,000 tonnes in the medium term, almost 30 times as much as the company's current largest plant, in Iceland. The project is financially supported by the US Department of Energy. To date, Climeworks has raised funding totalling around CHF 820 million. The company is pursuing further projects in California and North Dakota, in the US, as well as in Canada, Kenya, Australia and Norway.

3 GOOD HEALTH AND WELL-BEING

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17 PARTNERSHIPS FOR THE GOALS

CONTEXT

Regulatory requirements in both Switzerland and the European Union (EU) oblige large companies to give a public account not only of their financial affairs, but also of their efforts in the area of sustainability. In the EU, this will apply to companies with 500 or more employees from 2026, and to companies with 250 or more employees from 2028. Switzerland has required sustainability reporting for listed companies with more than 500 employees since 2024.

TECHNOLOGY

Sustainability is a complex issue. It includes reducing energy consumption and greenhouse gas emissions, water consumption, wastewater and waste disposal, as well as social aspects and corporate governance standards.

To support companies in their sustainability reporting, Julian Osborne – a political scientist with expertise in data analysis and financial reporting – has developed a platform and launched it on the market through the start-up Pelt8. The platform allows the supply chain to be included (Scope 3). User-friendliness is supported by the availability of localised versions in German, French and English, and soon also in Italian. The inclusion of AI is also planned.

MATURITY

Pelt8 was founded in mid-2021, and the platform has been operational since the beginning of 2023. In the first 18 months, around 20 companies with 500 to 2500 employees used the platform, mainly in Switzerland, but also in Germany, France and Austria. Users of the non-industry-specific tool include a wine producer, a textile recycler and an IT company. The service is not provided directly to the companies but to the consultants who prepare the companies' sustainability reports, while the end users pay a licence fee to Pelt8. A network of business angels has secured financing totalling almost CHF 1 million as part of the company's development – the start-up aims to break even in 2025.



« Sustainability reporting will soon become as important as financial reporting; regulatory requirements are moving towards combining both topics in a single management report. »

— Julian Osborne,
CEO &
Founder

Sustainability in crystal-clear figures

It is becoming increasingly important for companies to report on their progress in reducing energy consumption and CO₂ emissions as well as on their achievement of other sustainability targets. Pelt8 AG has developed a software platform to help them with this complex task.

Transforming sunlight into raw materials

Having established a low-carbon recycling network for stainless steel production offcuts, Panatere now promotes the widespread adoption of eco-friendly materials that don't involve the use of fossil fuels or electricity. It has installed two solar furnaces in the heart of Switzerland's « Watch Valley ».

CONTEXT

Switzerland imports almost 150,000 tonnes of stainless steel a year, a material used mainly in the watchmaking, medical and aerospace industries. At the same time, some 50,000 tonnes are exported in the form of production offcuts. Panatere specialises in machining parts for the microtechnology industry, and it has set up a near-zero-carbon network for recycling this waste in order to improve the quality of the firm's raw materials. Through this network, it pools the production offcuts of more than fifty companies in the Jura « Watch Valley », working towards a fully circular economy.

TECHNOLOGY

The offcuts are recovered by a collection company and are painstakingly sorted using a rigorous methodology verified by an independent auditing company. They are then smelted in two solar furnaces commissioned by Panatere in La Chaux-de-Fonds in 2024. These demonstrators were financed in large part by a contribution from Switzerland's Federal Office for the Environment and the European Interreg programme, via a consortium with France's University of Franche-Comté, HE-Arc Engineering in Neuchâtel, and several businesses in the Jura region. The solar furnaces – themselves built from scrap steel – use neither fossil fuels nor electricity and are expected to produce 100 tonnes of stainless steel a year.

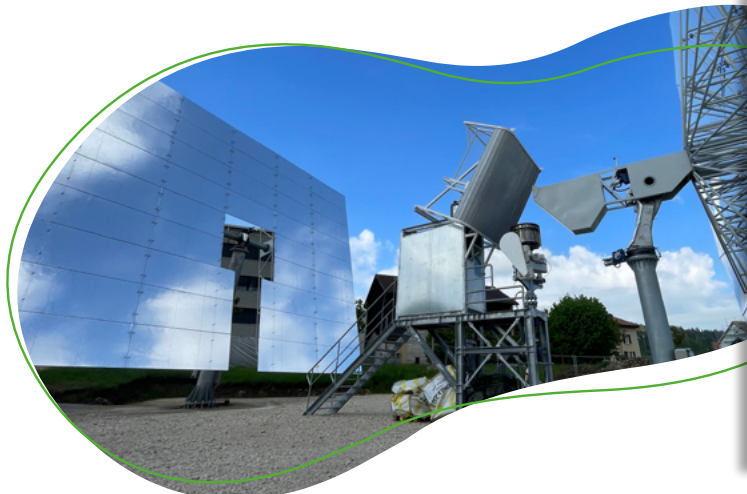
All self-sufficiently and with a near-zero carbon footprint. Third-generation solar reactors that can withstand temperatures of up to 2000°C are also being developed.

MATURITY

Panatere uses only 100% recycled, zero-carbon stainless steel to machine its customers' parts. Demand for this eco-friendly material is strong, and the firm's order books are more than full. By 2027, Panatere aims to be completely self-sufficient in recycling all the region's production offcuts in a large solar processing centre. Several major cities and industries have shown an interest in its business model, including aluminium manufacturers in Germany's Ruhr region, who are keen to shift to a more circular economy.

«By 2027, our solar furnaces will enable all the production offcuts from the Watch Valley to be recycled in a short and completely self-sufficient supply chain.»

– Raphaël Broye, CEO



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«Our technology's potential is colossal: all PET waste that can't be recycled mechanically could theoretically be handled by our process.»

— Samantha Anderson,
Co-founder &
CEO



A plastic recycling revolution

DePoly aims to significantly increase the proportion of recycled plastics worldwide using an innovative chemical process that breaks down plastics into reusable raw materials.

CONTEXT

Plastics are responsible for just over 5% of global CO₂ emissions, and less than 10% of them are currently recycled worldwide – the vast majority are incinerated or sent to landfill. DePoly, a spin-off from EPFL Valais Wallis, aims to combat this environmental scourge by supplying recycled raw materials with a lower CO₂ footprint than petroleum-based products. Its « secret weapon » is an innovative process, based on a chemical reaction, that breaks down plastics into reusable raw materials. With the active support of Energypolis, DePoly operates the Plastic Upcycling Industrial Innovation Platform in Sion, which aims to accelerate developments and trials on a range of plastics. This platform is an ideal place to strengthen links with industrial partners and test processes prior to their industrialisation.

TECHNOLOGY

The depolymerisation process developed by DePoly involves breaking down the chemical bonds in plastics to obtain MEG, mono-ethylene glycol (a liquid) and PTA, purified terephthalic acid (a powder). When the two are reacted together, they produce a PET that's identical to the original material produced by the oil industry. The production of this recycled PET generates fewer CO₂ emissions than that of « virgin » PET. Another advantage is that the process, which takes place at ambient temperature, uses almost two-thirds less energy. Furthermore, there is no need to pre-wash or pre-sort the plastics to be recycled, and the process can also recycle PLA (polylactic acid), PBT (polybutylene terephthalate) and PU (polyurethane).

MATURITY

The chemical process has already proven its effectiveness in a pilot phase. By 2025, a demonstration plant at the CIMO site in Monthey should be able to process around 500 tonnes of PET a year. The first two funding rounds, in 2020 and 2023, raised more than CHF 13 million. A new Series A round, in 2024, is partly earmarked to help finance DePoly's first industrial plant, which should be operational by 2027–2028. While the company is currently active only in Switzerland, it intends to rapidly offer its technology beyond the country's borders. To this end, it is working on proof-of-concept projects with companies in Europe, the United States, Japan, South Korea and Mexico, among others.



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CONTEXT

With the EU's ambitious targets of cutting all transport emissions by 55% by 2030 and reaching net zero by 2050, MobyFly's solution is to make the most of our waterways with electric hydrofoil boats. Its boats are designed for mass transport and are intended to replace smaller traditional ferries – the current 300-passenger craft can consume up to 2100 litres of diesel an hour at high speed. And replacing combustion engines with electric motors drastically reduces fleet operating (energy) and maintenance costs too. This transport solution also has the potential to relieve road traffic congestion in waterfront towns and cities.

TECHNOLOGY

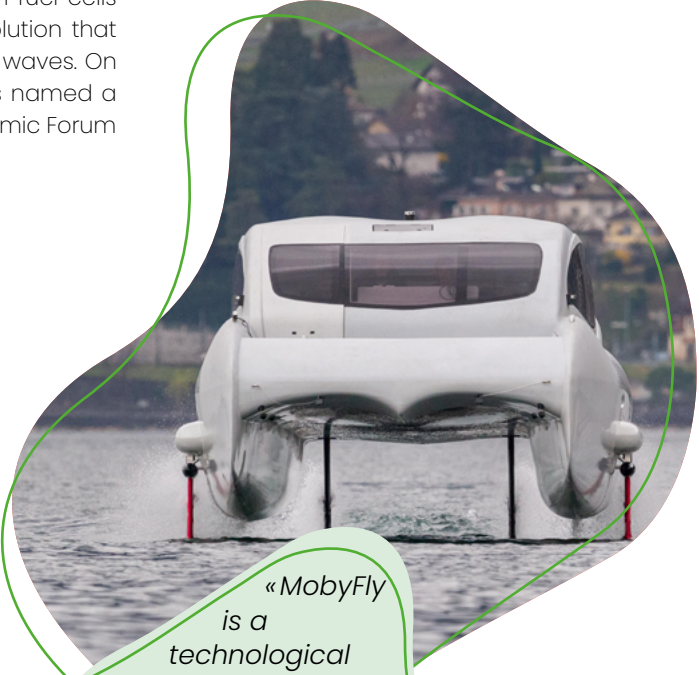
The foils are located under the boat's hull, where they act like the wings of a plane. With enough speed, they create lift, raising the boat above the surface of the water and allowing it to reach speeds of up to 70 km/h, while also saving 70% to 94% energy. MobyFly's foils are retractable, so the boat can be sailed in just 50 cm of water, in other words in any harbour. The first model of the boat is powered by electric batteries (the use of hydrogen fuel cells is under development), making it a solution that produces no noise, smell, emissions or waves. On the strength of this, the company was named a technology pioneer by the World Economic Forum in 2023.

MATURITY

Tests run on MobyFly's small, 12-passenger MBFY10 model (10 metres) under real-life conditions on Lake Geneva have demonstrated the effectiveness of this technology platform – whose flexibility means it can be extended to two other boat sizes, accommodating either 60 to 120 passengers or 300 to 350 passengers. The first pre-production units will be available from the second half of 2025, and the company is counting on a second funding round of about CHF 10 million to bring the product to market. The Kepax group, which specialises in industrial technology, has been a shareholder in MobyFly since February 2024 and is helping to speed up its innovation's journey to serial production. The company already has several customers interested in using this technology for passenger transport, including the Società Navigazione del Lago di Lugano in Switzerland, and Nosso Tejo in Lisbon. The company is targeting the European markets and then Asia, particularly Japan.

Zero-emission mobility above the waves

Fast and carbon-free, the hydrofoil boats developed by MobyFly have been put through their paces on Lake Geneva. They use up to 94% less energy than conventional oil ferries and offer an efficient and cost-effective alternative for mass transport.



«MobyFly is a technological solution designed to provide a complete ecosystem: a high-performance, low-consumption zero-emission hydrofoil, a recharging infrastructure, and access to financial solutions through established partnerships.»



— Sue Putallaz, CEO & Co-founder

As good as actual concrete

Cement production generates high greenhouse gas emissions. Oxara AG has developed a climate-friendly low-CO₂ cement substitute. The ETH Zurich spin-off also offers an additive for the production of easy-to-use clay-based products.

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15 LIFE ON LAND



« We use «waste» materials from the construction industry to produce modern, climate-friendly building materials that contribute to achieving the 2050 net zero target. »

— Gnanli Landrou, CEO & Co-founder



CONTEXT

Gnanli Landrou comes from Togo, Thibault Demoulin from France, and they met in Zurich, while they were working towards their doctorates at the Federal Institute of Technology (ETH). They founded Oxara in 2019 with the aim of using their expertise to develop climate-friendly building materials. With their innovative processes, the two young entrepreneurs can fabricate building materials that generate 70 to 95% less CO₂ during production than conventional building materials. During 2024, they have been looking for investors to enable them to expand their pilot-scale solutions to industrial production.

TECHNOLOGY

Oxara's latest product is a binder that can be used like cement to produce concrete. The source material is mixed demolition waste, which can be reactivated using Oxara's technology and reused in new building materials. While the concrete produced using the technology does not have the load-bearing strength required for bridges, it can be used for the load-bearing walls of multi-storey buildings (strength up to 25 MPa). Oxara had previously developed three additives for the production of cast clay and clay bricks. These transform clay into a modern building material, for constructing both non-load-bearing interior walls and floors, for example, and interior masonry walls made with clay bricks.

MATURITY

Oxara building materials have a low carbon footprint, not only thanks to their innovative manufacturing processes, which eliminate the firing stage for clay bricks, for instance, but also because they recycle demolition materials. The young start-up has so far tested its solutions in the laboratory and in several pilot projects. A pilot building was erected using all the Oxara products on the campus of the Lucerne University of Applied Sciences and Arts in autumn 2024, under the project name MANAL. The production and distribution of the cement substitute and clay additives will be handled by partner companies in the future. Industrial-scale production and marketing of the product should begin in 2025, subject to the successful completion of a new CHF 10 million financing round. So far, Oxara has raised just under CHF 4 million. The start-up is focusing on the Swiss, German and Austrian markets and sees particularly great potential in its latest product, the concrete binder.



A diesel particulate filter that protects against viruses

Andreas Mayer has worked for decades on equipping construction machinery and other diesel vehicles with particulate filters. Now, with his start-up NanoCleanAir, the engineer wants to use diesel filter technologies to protect hospital staff from viruses.

« Filters for diesel particles take some time to become effective. Our virus filters are designed to provide complete protection from the very first second. »

— Andreas Mayer, CEO



CONTEXT

Soot particles from diesel engines are harmful to health. That's why particulate filters were introduced in the 1990s to protect construction workers in the NRLA tunnels from the soot particles from construction machinery – and why, since 2008, it has been compulsory for all Swiss diesel vehicles to be fitted with a particulate filter. Since 1990, Andreas Mayer and his engineering firm have supported the introduction of particulate filters in numerous projects. When the coronavirus pandemic broke out in spring 2020, the then 83-year-old mechanical engineer immediately realised that viruses are roughly the same size as soot particles, so the filters that remove diesel soot should also be able to protect against coronaviruses. That's how he and the rest of the team came to found the company NanoCleanAir.

TECHNOLOGY

A scientific study at the University of Fribourg showed that the filters kept out 99.9999% of viruses – so provided even better protection against viruses than against diesel particles. NanoCleanAir subsequently launched three pilot projects: virus filters were fitted in a school in Lenzburg; a lift cabin constructed by the Bern-based firm Emch Aufzüge AG; and hospital beds at the Inselspital in Bern. This last application has become NanoCleanAir's business case: a canopy – a sort of vacuum cleaner – is installed above the hospital beds. It sucks in the air above the bed and cleans it of viruses using filters, thus protecting hospital staff and other nearby patients from infection.

MATURITY

Particle filters for diesel engines have spread across the globe over the last 25 years: today, around 300 million are in use worldwide. The virus-cleaning canopy for hospital beds, on the other hand, is still in its infancy: two samples have been undergoing testing at the University Clinic for Infectious Diseases at the Inselspital in Bern since February 2022. Although the urgency has eased with the end of the pandemic, Mayer is convinced that his canopy could prove invaluable to hospitals – particularly in protecting the most vulnerable patients. He hopes to see the first orders coming in from hospitals in 2025, paving the way for the product to be fully commercialised.



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Recovering wastewater

The hydrothermal gasification technology developed by TreaTech not only efficiently eliminates liquid waste but also recovers its byproducts. This water-based alternative to incineration has applications in a wide range of industrial sectors.

CONTEXT

While incineration is still considered the most effective way of eliminating viruses, bacteria and micropollutants from waste streams, the method has some environmentally negative aspects. The waste has to be transported to treatment facilities, and many of these do not recover the heat and steam produced during the process. TreaTech's patented modular solution, on the other hand, converts many types of waste that are usually incinerated into valuable resources – products that can be used on site or recycled, and thus contribute to the circular economy.

TECHNOLOGY

The technology developed by TreaTech combines a hydrothermal gasification process with a catalytic process to maximise the recovery of byproducts generated by the treatment of sewage sludge, industrial effluents and liquid agri-food waste. The recovered byproducts include industrial-quality water and mineral salts (such as phosphorous, nitrogen and potassium), which can be used as fertiliser. The organic fraction is converted into methane in a special reactor that separates out the CO₂ emitted by the process – in future, it should be possible to sequester or recover the latter at the end of the process. Depending on the effluent treated, all that is left is a kind of brine that can be disposed of in cement works or landfill. The technology can treat highly polluted water and releases around 95% fewer emissions than conventional incineration processes. The compact apparatus can be installed close to the waste, eliminating the need to transport it.

MATURITY

Founded in 2015, this EPFL spin-off joined forces with the Paul Scherrer Institute in 2019. The pilot plant has been validated, and TreaTech is commissioning its first industrial demonstrator in 2024, capable of

processing 200 kg/h continuously, in partnership with Ecorecyclage, a subsidiary of the Swiss Holdigaz group. Nine million Swiss francs were raised for this purpose in 2023, mainly from industrial firms, including Holdigaz, French companies Engie and CMA CGM, American company Montrose Environmental and Saudi company Sipchem. This has already opened up a number of markets for TreaTech, which is targeting rapid international expansion.



« We are looking to treat liquid mixtures containing a lot of organic matter: the production of methane and other byproducts makes our technology profitable. »

— Frédéric Juillard, CEO





100



Bern



neustark.com



hello@neustark.com

Capturing carbon in concrete

« We want to permanently remove one million tonnes of CO₂ from the atmosphere by 2030 – that's our goal. »



– Valentin Gutknecht, Co-founder & Co-CEO

Carbon dioxide in the earth's atmosphere is a major driver of climate change. neustark AG has found a way to permanently remove CO₂ from the atmosphere and store it in concrete rubble, and the net emission technology is gaining ground throughout Europe.

CONTEXT

It took neustark AG five years, after its creation in Bern in 2019, to reach an important milestone: it had stored 1000 tonnes of CO₂ in concrete using its systems. And then things started happening very quickly: less than a year later, it had doubled the quantity to 2000 tonnes. By the end of 2024, the number of storage facilities should reach around 30. And this is only the beginning: the company's goal is to increase the annual storage capacity to 1 million tonnes of CO₂ by 2030, and to 100 million tonnes by 2050. This will not stop climate change, but it will contribute to achieving the ambitious 2050 net zero target that Switzerland has committed to.

TECHNOLOGY

neustark works with biogas plants, where the CO₂ is produced as waste during methane production. Until now, this greenhouse gas has usually been released into the environment. Thanks to a process developed at the Federal Institute of Technology in Zurich, the gas can now be captured and stored. neustark injects it into concrete waste from the demolition of old buildings, after the latter has been finely crushed. Through a chemical reaction, the greenhouse gas binds to the concrete particles and turns into limestone with a stability of a hundred thousand to several million years. The CO₂-saturated granules can be mixed into fresh recycled concrete or used in road construction, removing the gas from the atmosphere. This process requires energy and therefore also creates CO₂ emissions – but the bottom line is that 93% of the carbon can be removed from the atmosphere, in what is referred to as a «negative emission technology».

MATURITY

Starting in Switzerland, neustark has expanded into Germany, Austria, Liechtenstein and France – and has recently added Great Britain. A further 30 plants are planned. A financing round concluded mid-2024 garnered tens of millions of USD, and the first US plant is planned for 2025. The company generates its income from the sale and maintenance of plants, as well as from the sale of CO₂ certificates, which bring in 350 to 600 US dollars a tonne. neustark expects to reach the break-even point in 2026 or 2027.



Capturing CO₂ on board heavy goods vehicles

This EPLF spin-off is aiming to speed up the decarbonisation of freight transport worldwide. It is developing mobile kits that capture CO₂ at source on any type of heavy vehicle.

« To achieve carbon neutrality by 2050, we will also need to remove significant amounts of CO₂ from the atmosphere. Qaptis's mobile capture system will make it possible to eliminate up to 90% of CO₂ emissions from heavy goods vehicles. »

— Théodore Caby, COO & Co-founder



CONTEXT

Global freight transport is responsible for 10% of all CO₂ emissions. While many climate policies are aiming for net zero by 2050, this sector is struggling to do without fossil fuels and is therefore finding it difficult to decarbonise quickly. Founded in 2021 on the Energypolis Campus in Sion, Qaptis is developing a mobile source capture system that will eliminate up to 90% of CO₂ emissions from heavy goods vehicles (HGVs). The CO₂ is stored in a liquid state on board and emptied out later, to be recycled in carbon storage and treatment facilities.

TECHNOLOGY

Qaptis's patented technology can capture greenhouse gas emissions from a lorry on the move in a way that guarantees a high level of CO₂ concentration using very little external energy. This retrofit kit can be installed on HGVs already in service without the need to replace transportation and logistics companies' entire fleets. Modular and easy to deploy for other types of vehicles, it offers a fast, cost-effective solution for decarbonising combustion-engine vehicles. The company estimates that, if it sells 5000 HGV kits by 2030, the technology could save up to 250 kilotonnes of CO₂ a year, which would help to reduce Swiss carbon emissions by around 1%. To create a truly circular economy, the captured CO₂ could eventually be reused in the agri-food industry; for the production of energy or construction materials; or for the manufacture of synthetic hydrocarbons.

MATURITY

Qaptis now has a working prototype for HGVs. Stationary CO₂ capture tests carried out in partnership with Swiss haulier Friderici Spécial have been a success and have demonstrated the technology's effectiveness. The company is now working on miniaturising the device so that it can be integrated into a lorry for a series of driving tests. A second financing round is under way to raise CHF 2 million, and serial production is planned for 2026, with the Swiss, German and Austrian markets, and then Japan, in the company's sights.



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Vaud



comppair.ch



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CONTEXT

Composite materials are enjoying enormous success. Made of fibres (such as carbon, glass or linen) impregnated with resin, these lightweight structural materials are used in a range of sectors, including sport, space and aeronautics. Although they perform well, they are sensitive to damage and difficult to repair. Less than 5% of them are currently recycled. CompPair's vision is to achieve full circularity for these materials, by not only increasing their lifespan but also developing a solution to improve their re-use.

TECHNOLOGY

CompPair is behind the first sustainable, self-repairing composite material on the market. The HealTech™ product range offers mechanical properties that are competitive with the market standard, with the added benefits of better impact resistance and improved damping. When a temperature of 100°C is applied directly to one of these products for one minute, a unique chemistry acts on damage in the matrix, and the material recovers all its mechanical properties. The process can be repeated more than 60 times. This reparability means that the economic value of products can be retained for longer, without the need to add other materials. This circular economy model could save 50% of the resources associated with composites, thereby reducing products' carbon footprint. CompPair's goal is to maximise the use of its repairable composites in order to achieve the greatest possible impact and enable manufacturers to meet their sustainability objectives.

MATURITY

An EPFL spin-off that has been in business since 2020, CompPair currently markets two ranges of HealTech™ products, for two types of industrial applications: prepregs (fibrous material pre-impregnated with resin) and liquid application systems. The company is also able to respond to its customers' specific needs and is developing other products to round out its portfolio. Its target markets are sport, mobility, luxury and lifestyle, and space and aeronautics. A funding round in 2024 should enable it to pass key milestones in its market growth.

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« The use of HealTech™ composite materials reduces waste because the parts produced can be repaired, extending their life. »

– Amaël Cohades, CEO & Co-founder



Self-repairing composite materials

The materials developed by CompPair aim to reduce maintenance costs and extend the life of composite structures. HealTech™ products incorporate an innovative chemistry that enables damage to be repaired autonomously.

Tasty, locally grown herbs

Cultivating agricultural plants requires a lot of land, and the produce is often transported over long distances to the consumer. YASAI AG produces culinary herbs all year round in Switzerland, using significantly less land than traditional agriculture.



— Mark E. Zahran, CEO
& Founder

« Our herbs generate only about half as many greenhouse gas emissions as produce imported by plane. »



CONTEXT

In 2010, US Professor of Public Health Dickson Despommier published the book *The Vertical Farm: Feeding the World in the 21st Century*. In it, he developed the vision of an agricultural system that produces significantly more on a given amount of land than before. This basic idea inspired Mark E. Zahran, Stefano Augsburger and Philipp Bosshard to found YASAI AG ten years later. In 2024, the young company produced 20 tonnes of basil, Thai basil, mint and coriander in a hall in the Zurich municipality of Niederhasli. The cultivation area is just 1200 m², with six levels of stacked plants.

TECHNOLOGY

The herbs are grown in a hydroponic culture: the roots sit, not in soil, but in a nutrient solution. Because the water is reused, consumption can be reduced by 95% compared to conventional farming with irrigation systems. The plants get the energy they need to grow from LED lights powered by renewable electricity. The waste heat is used to heat the building and could also be used to supply a district heating network in a future facility. Compared to plants imported to Switzerland by plane, YASAI's herbs have half the CO₂ footprint, as a life cycle analysis has shown.

MATURITY

YASAI supplies Coop, Jelmoli and the online platform Farmy.ch, and will soon also be supplying Migros and the Swiss hospitality sector. The herbs are slightly more expensive than equivalent imported products, but they are pesticide free and produced locally all year round. In the first four years of its existence, the start-up has raised CHF 10 million in funding and grants. Since mid-2024, the company has been operating under the umbrella of GreenState AG, opening up new opportunities for growth. A plant with a cultivation area of 10,000 m² is to be built in the canton of Aargau by 2026. Talks are also underway for production facilities in Saudi Arabia and the UAE, where vertical farming can develop its full potential to counteract scarce water resources and limited arable land.



EV batteries: new from old

Many people are thinking about buying an electric car. Librec AG is already working on their eco-friendly disposal: the company recycles lithium-ion batteries via a process that allows 97% of the recyclable materials to be reused.



« With our recycling process, we can make all recyclable materials from lithium-ion batteries available for the production of new batteries. »

– Jodok Reinhardt, CEO

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CONTEXT

With the expansion of electromobility, the number of lithium-ion batteries providing the energy for electric motors is also growing – experts expect the number of EV batteries to increase sixfold by 2030. These units reach the end of their service life after 10 to 15 years, at which point it is possible to reuse individual healthy battery cells. The rest must be recycled. However, it is possible to recycle lithium-ion batteries on a large industrial scale, as demonstrated by Librec AG, founded in 2021: the firm has been operating a recycling plant with an annual capacity of 10,000 tonnes, equal to 20,000 batteries, since October 2024. This should be enough to recycle all the lithium-ion batteries collected in Switzerland by the early 2030s.

TECHNOLOGY

With the support of Innosuisse, Librec has spent the past three years working with academic partners in Switzerland and abroad to optimise its processes. Disused batteries are discharged, dismantled and shredded in a high-tech shredder. Next, the electrolytes' liquid components are removed. This is followed by the main step, which involves the removal of nickel, cobalt, lithium and other valuable materials from the battery electrodes – the «scraping» process used for this is more efficient than previous melting and pyrolysis processes. Librec sends the resulting so-called «black mass» to specialised companies that employ wet chemical processes to separate the recyclable materials so they can be used to manufacture new batteries.

MATURITY

Librec's main investors are the Hamburg-based metallurgy group Aurubis, Galliker Transport AG, and a Swiss industrial group. The company's focus is on larger EV batteries, e.g. from cars, lorries or construction machinery. The volume of recycled batteries will be gradually increased from 2024, and the plant will switch from one-shift to three-shift operation in the medium term. At full capacity, 40 to 50 people will be employed. There are plans to set up two more recycling plants in eastern and western Europe, so that Librec can fulfil its aim of establishing itself as one of the top five European battery recyclers.

« We offer a ten-year guarantee on our batteries, so we want to be able to monitor their state of health over their whole service life. »



— Stefan Bahamonde,
CEO & Co-founder

Giving batteries a second lease of life

CONTEXT

The boom in EVs has led to a sharp increase in consumption of car and e-bike batteries. At the end of their service life, all these used batteries will need to be recycled. But even if they no longer meet the stringent requirements for use in vehicles, they will often still have intact cells with a lot of capacity that can be used to manufacture stationary batteries. That's the business model of Libattion, founded in 2018, which upcycles used EV batteries into stationary energy storage systems for industrial companies and energy suppliers.

TECHNOLOGY

The Zurich-based company takes worn-out batteries and uses them to make high-powered modular racks with a capacity of 100 to 10,000 kWh. It recently also started producing large-scale container batteries with capacities of several thousand kilowatt-hours. By comparison, the figure for batteries in modern electric cars is up to 100 kWh. In 2023, Libattion sold batteries with a combined capacity of around 7,000 kWh, with international sales making up 10% of the total. The following year, production was more than twice that. With a new, highly automated factory opening in 2025, company founders Stefan and Nicolas Bahamonde aim to increase production eightfold. The new factory will be under the same roof as a recycling plant, which will have practical benefits and help to cut costs. Libattion sells its certified products in Switzerland, Germany, Italy, France, Spain and Portugal.

MATURITY

If you want to reuse batteries, you need to be able to reliably assess their state of health throughout their whole service life. To achieve that, Libattion engineers analysed datasets containing thousands of measurements and developed special algorithms. The batteries' efficiency was also increased by 20% by increasing the number of charging cycles. One application for the upcycling pioneer's stationary batteries is to optimise solar farms' self-consumption. That means industrial companies can avoid paying high prices for grid power to cover peak loads. They can also generate additional revenue by providing reserve energy to stabilise the grid. Libattion offers complete solutions including inverters and an energy management system.

The transition away from fossil fuels is driving higher demand for electricity – and for batteries to store it for both mobile and stationary applications. Libattion AG upcycles used EV batteries to manufacture stationary energy storage systems.





8



Vaud



sparrow.city



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A precise and mobile means of measuring air quality

Sparrow Analytics' mobile measurement sensors give everyone access to accurate, reliable data on air pollution. Intended for use by smart, sustainable cities, the start-up's solution is currently in operation in five major Swiss cities, in partnership with the national postal service.

« Our sensors can be easily installed on any type of vehicle to measure pollution levels street by street every day. »

— Maxim Interbrick,
Co-founder & COO

CONTEXT

According to the World Health Organisation (WHO), outdoor and indoor air pollution is responsible for more than 4 million deaths worldwide every year. To tackle the problem effectively, it is essential to have precise and detailed information about it. In view of this, Sparrow Analytics has developed a platform for collecting information on pollution (and noise) in real time in urban environments. It is connected to mobile sensors, providing a far more detailed analysis than fixed measuring stations can.

TECHNOLOGY

The technology developed by the Vaud-based start-up uses artificial intelligence; the software and equipment are protected by patents. The sensors, whose calibration has been certified by the Swiss Federal Institute of Metrology (METAS), can be installed on any kind of urban vehicle and are able to measure the concentration of gases (carbon monoxide, nitrogen dioxide, ozone) in the air every second, making the technology one of the most accurate of its kind in the world. Particulate levels are measured every ten seconds. This information, available in real time on a geolocation platform, provides a better understanding of the impact of road traffic on air quality and enables measures to be taken to protect public health wherever necessary.

MATURITY

A pilot project has been carried out in several European cities, using fleet vehicles (taxis, trams, buses, etc.). Convinced that the data would be more useful if the sensors were placed on vehicles with predictable itineraries, Sparrow signed a collaboration agreement with Swiss Post in 2024. Fifty of the latter's distinctive yellow vans have been fitted with sensors to measure air quality (and noise) in the streets of Geneva, Lausanne, Berne, Basel and Zurich. The start-up's business model is based on a subscription system that gives access to the data. This type of information is obviously of interest to city authorities wishing to improve their residents' quality of life, but it is also relevant to providers of mapping services, such as Google Maps. Sparrow also hopes to market its technology to insurance companies and the property sector. After Switzerland, its sights are set on the United States, where the company has already formalised a collaboration with FedEx for 200 measuring devices to be placed on delivery vehicles. Around CHF 30 million are expected to be raised in 2025 for Sparrow Analytics' international expansion.

Hydrogen-based solutions for storing surplus energy

GRZ Technologies develops systems for storing surplus energy in the form of hydrogen molecules. Its three product lines can be used for a range of energy transition applications.



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« Our vision is to play our part in the energy transition by developing new, industrial-scale technologies that allow energy to be stored in the form of hydrogen – safely, affordably and efficiently. »

– Noris Gallandat, CEO



TECHNOLOGY

GRZ Technologies has developed three product lines: for storing, compressing and converting hydrogen, respectively. All three use materials and systems based on innovative patented technologies. The first product line allows hydrogen to be stored in solid form (metal hydrides) at low pressure, enabling both a high storage density and exceptional safety. The company's compression technology, meanwhile, uses heat rather than electricity for a silent, vibration-less process that requires minimal maintenance. Finally, the methanation reactor can convert hydrogen and carbon dioxide into synthetic methane in a single stage – with a conversion rate of over 99.5%, as was first demonstrated at a compressor station in Sion, Switzerland.

MATURITY

The hydrogen storage systems developed by GRZ Technologies are already selling in large numbers in Switzerland, Germany, Italy, Spain and Scandinavia. Their main field of application is in large solar parks. They can also be used by grid operators to cover peak loads or for peak shaving in industries with fluctuating energy use. The compressor and methanation reactor have been used in several pilot and demonstration projects. One of the projects, which is being run in partnership with Gaznat (a company that supplies and transports gas to western Switzerland), is trialling the production of synthetic methane using solar energy. Another, based at a chemical plant in Visp, is demonstrating the feasibility of hydrogen compression at an industrial scale. The latter project is a collaboration with Messer Gas, with support from the Swiss Federal Office of Energy and The Ark Foundation. GRZ Technologies has raised capital from partners including Hyundai, the Fischer group and Sabanci.

CONTEXT

The founders of GRZ Technologies firmly believe that in order to achieve net zero targets, hydrogen will need to play a key role as a renewable energy source. The Energypolis spin-off, which launched in 2017, supplies integrated systems and hydrogen-related services for various applications in the industrial, transport and energy sectors. Its innovative technologies can be used to store surplus energy and integrate it into the power grid – safely, affordably and efficiently.

An A to Z of hydrogen, with a focus on SOFCs

From engineering to test benches and the manufacture of components, Celectis works in the field of fuel cells, electrolysis and all related activities involving the production and use of hydrogen.



«Thanks to substantial financial support from the canton of Valais, Celectis is growing rapidly and building up a test platform that is unique in Switzerland for developing and marketing SOFC/SOEC/rSOC systems.»

— Steve Joris, CEO

CONTEXT

Provide clean energy solutions to enable an emission-free society – that’s the mission of this young start-up, founded in 2022 in Sion. While it may be young, however, it is no novice in the field, since it can draw on the over forty years of accumulated expertise of its two co-founders. Celectis operates and is developing the Fuel Cell Pre-Industrial Technology Platform in Valais. This test infrastructure is a valuable tool for players in the hydrogen sector to develop prototypes, test benches and energy systems, and speed up the large-scale production of their developments. The company also provides engineering services in the fields of hydrogen and fuel cells, with the aim of supplying integrators with optimised, made-to-measure components for highly energy-efficient systems that emit no greenhouse gases.

TECHNOLOGY

The test benches developed by Celectis can be used to test fuel cells and power-to-gas or gas-to-power systems. The start-up also plans to supply systems for harnessing agricultural biomass using SOFC/SOEC technology, as well as syngas production, and seasonal energy storage in the form of hydrogen or methane. For components, Celectis uses 3D metal printing to optimise geometries and produce parts (heat exchangers, ejectors and reactors) that are much more efficient and lighter, and take up less space. Because they are made from a single piece, they are also safer to use.

MATURITY

A prototype AEM electrolyser for the production of low-carbon hydrogen, using 3D metal printing, is in the test phase, as are prototypes and pilots of heat exchangers and components for high-temperature cells and electrolysers. In collaboration with Metacon AB and Elcogen AS, the company has also developed a 12kW SOFC pilot system that runs on bioethanol. It is being tested as part of the development of charging units for electric vehicles by the company WattAnyWhere. Celectis has won several awards and has filed a number of R&D projects, including several European projects, among which is a highly promising one for making farms energy independent while reducing their ecological footprint.

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« Solaxess' challenge is not filling its order books but meeting higher and higher demand. »

— Sébastien Eberhard, CEO & Founder



© Eddy Motzart

CONTEXT

One billion square metres of photovoltaic panels are installed around the world every year. Unfortunately, however, these systems are often aesthetically jarring. To help them integrate better into their surroundings, Solaxess has developed a solution that allows solar panels to be treated like actual construction products. The aim is to encourage a substantial increase in active solar roofs and facades, while respecting buildings' aesthetic criteria.

TECHNOLOGY

With help from CSEM, in Neuchâtel, Solaxess has developed a technology that allows any photovoltaic panel to be coloured uniformly. It consists of a polymer-based nanotechnology foil that can be integrated directly by manufacturers, whatever the solar cell technology used. The foil is sold in rolls, which are easier to transport and store, and less fragile than pallets of coloured glass. This unique solution – protected by seven international patents – makes it possible to install photovoltaic panels on roofs or facades wherever they are wanted or needed, without spoiling the landscape or ruining the appearance of beautiful buildings, whether they be notable, historic or protected. Beside their aesthetic appeal, coloured solar panels also help to avoid the heat islands generated by large numbers of dark panels in city centres. In 2023, in Lancy, in the canton of Geneva, the four sides of a 55-metre-high residential tower were fitted.

MATURITY

This cutting-edge BIPV (building-integrated photovoltaics) solution has been in series production since 2022, with a current production capacity of about one million square metres of foil a year. Capacity is set to grow further to meet increasingly strong demand. The nanotechnology foils are being bought by photovoltaic panel manufacturers in Europe and, to a lesser extent, in China and Korea. In 2024, Solaxess has been looking into the possibility of transferring its German production back to Switzerland, either bringing it in house or using local subcontractors. The company has raised CHF 2.5 million in new capital to this end.

The aesthetics of solar energy

The nanotechnology-based coloured foils developed by Solaxess make it possible to integrate solar energy into buildings without compromising their aesthetics. This unique solution should contribute to a much more widespread use of photovoltaics.



80



Bern



carvolution.com



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CONTEXT

Drivers can buy, lease or hire their cars. And, for the past few years, they have also been able to subscribe to a car. This has a fixed monthly price, like leasing, but it is cheaper because the cars are already configured. Carvolution AG is the Swiss market leader in car subscriptions. The start-up offers around 50 models, of which 15% (and rising) are electric cars. Small cars start at a monthly cost of CHF 299: the price covers all insurance, taxes, servicing, maintenance and tyre changes, in addition to the hire charge. All subscription cars are new or as good as new. Carvolution operates throughout Switzerland, with a focus on smaller towns and urban areas. There are currently no plans to expand abroad.

TECHNOLOGY

Business economist Léa Miggiano and three other people founded Carvolution in Bern in 2018, based on an existing UK and US business model. The basic idea is that subscribers should always be able to choose the car that suits their family situation (e.g. the addition of children) or their current place of residence (e.g. a move to the countryside). Unlike leasing, a car subscription includes all costs, and the subscription can be taken out for just a few months. This means that people who are happy to get around by bike in the summer can have a car just for the winter. Subscribers receive a standardised package, but Carvolution also gives them options for excess, legal protection or parking damage.

MATURITY

What is innovative about this car subscription provider is the way the subscription is sold. Highly sophisticated subscription management is required to offer customers the best prices. Over the last few years, Carvolution has gradually optimised its service – for example, by introducing an advance payment option, and a mileage package for infrequent drivers. The young company has an equity capital of CHF 50 million but has to hold its own against a considerable number of competitors. It received a vote of confidence at the beginning of 2024, when major British bank Barclays and other investors poured CHF 200 million into the fleet expansion.

New cars on subscription

The trend for a flat rate has reached the world of car users: Carvolution AG rents out cars for periods of between three months and several years at a fixed price – allowing customers to choose the vehicle to suit their circumstances.

« Car subscriptions are taken out for the time and circumstances for which they are needed. This conscious approach makes driving more sustainable. »

– Léa Miggiano, Co-founder & Marketing Manager



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A climate-friendly solar pump

Many little streams make a big river – and that's just as true in the fight against climate change as anywhere else. ennos ag equips small farmers with solar-powered pumps so that they can irrigate their plantations using a renewable energy source.



« The cost of our solar pump can be recouped in 12 to 18 months, thanks to savings on fossil fuel and maintenance. »

– Karin Jeanneret Vezzini, CEO

CONTEXT

In sunny parts of the world, it makes sense to replace diesel pumps with electric pumps that use locally generated solar power to irrigate agricultural land. Since ennos was created in 2016, it has delivered around 8000 solar pumps, mainly in Africa and Latin America. A 0.5 hp pump, powered by a small, 375-watt solar panel, is enough for a farmer in Honduras, for example, to supply their vegetable crop with up to 25,000 litres of water a day. Thanks to solar energy, the farmer saves 1700 litres of petrol a year. Together with the reduction in maintenance, this saves them around 2000 US dollars and 3900 kg of CO₂ a year.

TECHNOLOGY

ennos's basic product is a surface pump, with 0.5 or 2 hp output, supplemented by a solar module. The newer pumps are equipped with a mobile radio transmitter that transmits operating data such as pump performance, energy consumption and operating times to the ennos cloud. This data provides the basis for a pay-as-you-go model that allows small farmers to pay off the pump in instalments in line with their crop yields. It also makes it possible to include the CO₂ saved by the solar pumps in carbon emissions trading. The certificates are sold, via the Danish company CarbonClear, to companies that want to offset their own CO₂ emissions.

MATURITY

A solar pump costs around 1000 US dollars – a price that is sometimes too high for small farmers in poor countries. As a result, climate-friendly investments in solar-powered pumps are often subsidised. In Uganda, for example, the World Bank bears 75% of the investment costs. And ennos Managing Director Karin Jeanneret Vezzini is hoping for similar support in Nigeria. The company



is planning to enter the market in this West African country of over 200 million inhabitants in 2025, and the sales potential is enormous. In order to meet the growing demand, ennos plans to build a second production facility in South Africa, in addition to the existing factory in India.



A brainbox to control the heating

Yord has developed a solution that optimises a building's heating consumption by predictively controlling how it reacts based on its characteristics, the weather and users' habits.



«Our technology makes it possible to reduce heating consumption without changing the source of heat production. It's an affordable and easy-to-implement solution for speeding up emission reductions.»

— Sébastien Bron, CEO & Co-founder

CONTEXT

Three quarters of a building's energy consumption is due to heating, and 55% of heat production systems in Switzerland still use fossil fuels. It was while working on the problem of over-consumption of air renewal systems in the pharmaceutical sector that the co-founders of Yord came up with the idea of transferring the optimisation algorithms to another technology. By characterising the thermal inertia of a building as a function of a number of known parameters, they can adjust in real time the amount of energy to be delivered to reach or maintain the desired temperature.

TECHNOLOGY

The technology developed by Yord at the bluefactory site in Fribourg consists of a box that can be connected to any heating system in any type of building, from detached houses to office blocks and residential rental properties. Wireless sensors measure ambient temperature and humidity, and feed back the information into a database, where it is cross-referenced with weather forecasts and user data. This real-time modelling enables the boiler to be controlled predictively, anticipating heating requirements and maximising comfort. Yord also produces an annual report on changes in heating energy consumption and the savings achieved for its clients. The beta version demonstrated an average energy saving of 23%, equal to 44 tonnes of CO₂ on a total of 31 buildings equipped with the boxes.

MATURITY

The boxes have been marketed since winter 2023/2024, mainly to local authorities and cantons in western Switzerland, for their own building stock. Wherever possible, Yord uses short supply chains for its production: the algorithms are developed in-house, the hardware contains its own electronics – with the exception of the sensors, which are imported from France – and is assembled in Sion. And the data is hosted in Switzerland. The company raised funds in the summer of 2024 to accelerate its roll-out in western Switzerland before extending its market to the neighbouring areas of France. The start-up would like Swiss municipalities and cantons to grant subsidies to their residents to enable them to equip themselves with its solution.

Using AI to boost large-scale decarbonisation in the building sector

The AI-based digital platform developed by Urbio can be used to generate optimised energy infrastructure variants. This decision-making tool aims to help speed up urban transition to a sustainable model by boosting the decarbonisation of buildings.

CONTEXT

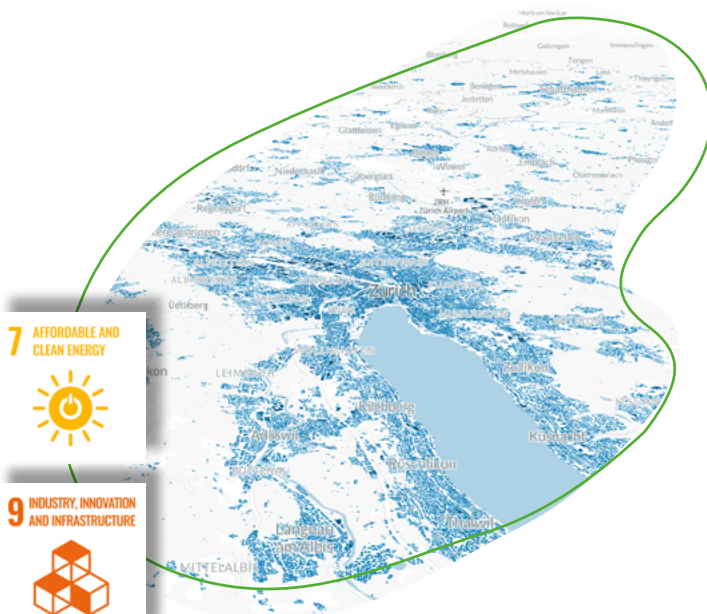
While buildings are responsible for almost 40% of greenhouse gas emissions in Europe, it is often difficult to work out which energy solution has the greatest impact, or to prioritise the projects that will decarbonise this sector most effectively. To speed up the transition to a zero-carbon building stock, Urbio has developed a decision-making tool based on artificial intelligence. The aim is to guide energy transition players towards the projects that can add the highest value, from both an economic and climate perspective.

TECHNOLOGY

This solution consists of a digital platform that provides simple access to all the useful energy information at building and district level, thanks to a «data factory» that gathers and combines dozens of data sources. A digital twin (a kind of energy «Google Maps») facilitates decision making by helping to identify high-impact projects and prioritise them. Generative design algorithms use AI to design optimised energy scenarios, producing results ten times faster than conventional tools – and providing the combined benefit of de-risking investment and speeding up deployment on the ground. Based at the Energypolis campus in Sion, Urbio estimates that its solution – acting as it does as a project accelerator and catalyst – could cut several gigatonnes of cumulative carbon emissions by 2050.

MATURITY

Urbio's digital platform is aimed at energy suppliers, real estate companies and engineering consultancies. The company is actively supported by Energypolis and is already working with a number of major energy providers in Switzerland, including OIKEN, Romande Energie and Groupe E. Its technology is also attracting interest beyond Switzerland's borders, particularly in Belgium. It was selected as part of the net zero plan for the city of Brussels and has enabled the Resolia consultancy firm to win several contracts to successfully map heating networks in the Brussels and Walloon regions without having to carry out the usual tedious door-to-door surveys. Urbio has already raised nearly CHF 2 million from professional venture capitalists and is continuing to expand internationally.



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16 PEACE, JUSTICE AND STRONG INSTITUTIONS



«AI has a key role to play in accelerating the energy transition and tackling the climate emergency.»

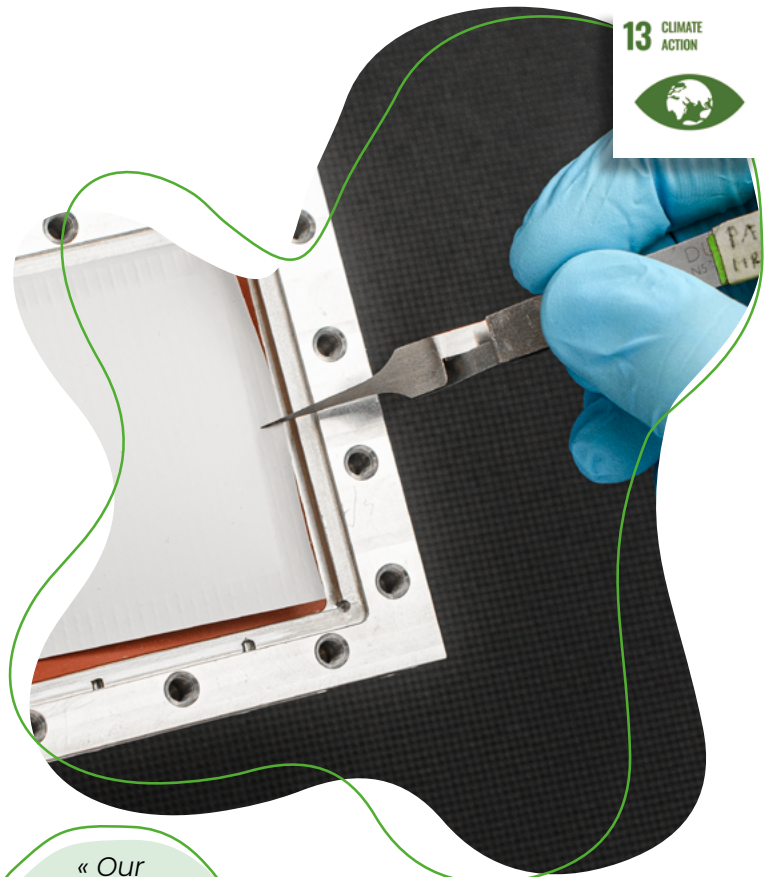
— Sébastien Cajot, CEO & Co-founder



© Daniela Kurtz



13 CLIMATE ACTION



CONTEXT

While climate policies are aiming for net zero, some emissions are difficult to avoid, particularly those from metallurgy and waste incineration. However, the CO₂ – whether it comes from the energy used in production or from the processes themselves – can still be captured. Divea can help any company with industrial chimneys to reduce the impact of their activities on the environment, thanks to its innovative graphene membrane technology.

TECHNOLOGY

Founded in 2024 on the Energypolis Campus, Divea has developed a filter that captures CO₂ directly at source, at the flue outlet. Made from graphene – a material that earned two scientists a Nobel Prize in 2010 – it offers a simple, low-cost solution for companies that emit greenhouse gases. Divea's graphene membrane is just one atom thick – the thinnest in the world. And that's precisely what makes it so effective, capturing 90% of the CO₂ present in flue gases. This CO₂ can then be stored or used in the manufacture of other materials. Unlike existing technologies, the membrane doesn't need heat to work. It is also very compact and can be installed anywhere, including in confined spaces that are difficult to access, such as off-shore oil platforms.

MATURITY

The technology developed by Divea has been validated in the laboratory, and an initial demonstrator began operations in May 2024, in Aigle, in western Switzerland. It is operating on a small scale at GreenGas, the Innovation Lab run by Gaznat, western Switzerland's natural gas supplier, which financed the installation. Divea is aiming to reach industrial scale by 2028. Two funding rounds, carried out between 2024 and 2025, should help finance this goal; further rounds are planned. While the company is targeting the Swiss market in the first instance, some of the world's major aluminium producers have also expressed an interest in this CO₂ capture technology.

« Our graphene membrane is at the physical limit in terms of thickness and is unique in the world, enabling highly efficient and very compact CO₂ capture installations. »

– Karl Khalil, CEO



Capturing CO₂ with the world's thinnest membrane

This EPFL spin-off has developed a solution that uses an effective, low-cost graphene-membrane-based technology to capture the CO₂ from industrial emissions as they exit the chimney.

Tracking the true source of electricity emissions

What if you could monitor the source of your electricity in real time and thus reduce your carbon footprint? That's what this EPFL spin-off on the Energypolis Campus is offering, by providing consumer companies with exceptionally accurate data.

«Our vision is to be the provider of the most reliable and granular data on electricity carbon emissions in the world.»

— Rafael Castro-Amoedo, CEO



CONTEXT

Electricity production is responsible for around 40% of the world's CO₂ emissions. However, it is difficult for consumer companies to trace the source of the electricity they use. The technology developed by Emissium is designed to enable organisations to accurately monitor the carbon emissions from electricity, and thus modify their footprint, in a context of increasingly electrified systems (EV charging, low-carbon hydrogen production, industrial processes, etc.). The technology is based on innovative software and a blockchain that makes the data secure.

TECHNOLOGY

Emissium uses advanced electricity network modelling and machine learning algorithms to guarantee data transparency and accuracy. The extremely granular and reliable data provides figures every 15 minutes, right down to regional level, where the electricity is actually consumed. The quality of this detailed, real-time data far exceeds that provided by the solutions already on the market. The information should enable users not only to draw up accurate emissions reports, but also to effectively reduce their carbon footprint, for example, by adjusting their consumption according to the proportion of renewable electricity fed into the grid at any time of day.

MATURITY

Founded in June 2023 in Sion, the young start-up is currently carrying out pilot projects, including a full-scale demonstrator in Valais. This is the first building block in an extremely large-scale roll-out, involving several major industrial players who want to measure the carbon footprint of their electricity consumption. Thanks to Switzerland's integration in the European interconnected electricity grid, Emissium is theoretically already in a position to supply data to any consumer located in this geographical area. It also aims to offer its services beyond Europe's borders and is raising funds to accelerate its development. The start-up has been recognised for its innovative technology and potential impact on the environment, reaching the final of several competitions and incubation programmes, including the Boost My Startup Challenge organised by WSP in Switzerland and UBS Growth Advisory.





Autonomous low-carbon electricity generators

WattAnyWhere, founded in 2021 at Energypolis, has developed an electricity generator powered by renewable ethanol, designed to speed up the roll-out of fast charging stations for electric vehicles. But that's not all ...



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«Our priority is the supply of 100% renewable and high-power energy for electromobility in Europe, a market valued at more than €140 billion over 10 years.»

— Alexandre Laybros, Co-CEO & Co-founder

CONTEXT

While electromobility is being encouraged throughout Europe as the way to decarbonise the sector, the roll-out of fast charging stations is struggling to keep pace. It requires time and considerable financial investment for operators to be able to access the electricity grid. However, the clean electricity generator developed by WattAnyWhere could well change all that. This 300-kW mobile generator should make it easy to install power generation units that are completely independent of the grid.

TECHNOLOGY

WattAnyWhere's generator has a solid oxide fuel cell (SOFC) fuelled by bioethanol produced from biomass residues, a resource available in large quantities (more than 10 billion litres are produced every year in Europe, equivalent to 36 TWh). This means that the system is actually carbon negative, since the CO₂ produced by the chemical reaction can be isolated during the process and then sequestered. The water can also be recovered and reused in situ. The primary aim of the technology is to enable access to high-power electricity without using the grid, and at a reduced cost. It is ideal for supplying charging points for electric vehicles but can also be used to provide autonomous energy for various commercial activities, or even residential micro-grids.

MATURITY

After validating a demonstrator in the Sion laboratory, in collaboration with Celectis, WattAnyWhere has started on-site demonstrations, with its generator housed in a container. In partnership with OIKEN, it is currently testing its technology's ability to power charging stations. Tests are also being carried out in France – where the company has a subsidiary – at a service station and a supermarket, with a view to optimising their electricity production and consumption. A higher-capacity pilot will follow in 2025. Ultimately, the start-up intends to target other sectors, in particular the maritime industry. On the financial front, WattAnyWhere closed a seed funding round in early summer 2024, raising just over CHF 2 million.

CONTEXT

The lithium-ion batteries used in electric micromobility are made up of several cells welded together, each barely larger than an AA battery. If one of them loses its capacity to store sufficient energy, the others also lose some of theirs. It is estimated that the battery on an electric bike still has a capacity of almost 80% when it is changed and discarded. To combat this waste, Evolium Technologies wants to keep new batteries just for the most demanding applications and cover the needs of 'gentler' applications with second-life batteries.

TECHNOLOGY

In order to add new stages to a battery's life cycle, Evolium Technologies has developed processes for robotising the disassembly, testing and reassembly of the cells into new products. These processes are constantly improved through the use of AI and the collection of test and operating data during the battery's second life cycle. The company also has an unusual, subscription-based business model. The cells sent to subscribing customers are monitored remotely: as soon as one of them is faulty, a replacement cell is sent out and easily swapped in. This ensures that each battery pack has multiple lives. The start-up is aiming to put 5 million individual cells back on the market each year, equivalent to the installation of 8 MWh of batteries a year. It mainly intends to recover batteries used in micromobility – but those used in power tools and cordless household appliances could also have a second life. Cells that are still efficient will be integrated into devices designed for stationary energy storage (SES) applications.

MATURITY

Evolium Technologies was established in 2024 on the Energypolis campus in Sion, following on from a research project started at the Arc University of Applied Sciences (HE-Arc) in Le Locle. The start-up is supported by The Ark Foundation in setting up a pilot production line, and in its commercial development. Financial support has been provided by Energypolis, OIKEN and the Guarantee and Funding Centre (CCF). The company is further developing its technology and implementing pilot projects in preparation for the solution's market launch, planned for 2025. While Evolium Technologies is primarily targeting local geographic markets, it also aims to be replicable, through branch offices, so that it can serve the whole of Switzerland, and even further afield.

Battery lives multiplied

This young start-up, which has made upcycling its hallmark, wants to give lithium-ion batteries a new lease of life in repairable applications, mostly in photovoltaic energy storage.



© Sabine Popilloud | Le Nouvelliste

« The central, unique point of our technology is repairability. Its commercial counterpart is the guaranteed battery capacity that our customers can subscribe to. »

— Alexandre Staub, CEO



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Vaud



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Smart, sustainable containers

AELER Technologies has kick-started nothing short of a revolution in worldwide freight shipping. Thanks to the insulating and aerodynamic properties of its smart containers, the company is paving the way for the logistics industry to reduce its environmental impact on a massive scale.

CONTEXT

Currently, 80% of the world's goods are shipped by container. These huge metal boxes built to a standard specification have barely changed since they were invented in the 1950s. But make way for a game-changer from AELER, based on three elements: the design of the containers, the use of digital technology, and the service offered to users. A giant leap forward that is set to improve the efficiency of the worldwide freight industry, bring down costs and reduce its environmental impact – the latter clinching the argument for its customers.

TECHNOLOGY

More robust and more hygienic than conventional models, these composite containers – made mainly of recycled plastic – have insulating properties that drastically reduce humidity and internal temperature variations. This means that less secondary packaging is required to protect the goods, making a substantial saving in single-use plastic. This quality of insulation is how AELER has won over high-added-value sectors such as pharma, chemicals and luxury goods that transport sensitive cargo. Its containers have also proved a big hit with clients shipping liquids in flexitanks, making a volume saving of 17% – which translates into 20% lower CO₂ emissions. And thanks to IoT technology, these containers continuously monitor a range of parameters, further increasing freight security. Lastly, AELER's business model makes it stand out from the crowd: the company offers its customers a subscription system based on the number of days they are used. By carefully marshalling its fleet, AELER avoids shipping empty containers.

« We have developed a disruptive solution that turns the humble container into a vector of environmental value. »

– David Baur,
Co-founder
& Co-CEO



MATURITY

AELER has 86 depots in 35 countries in Europe, America, South-East and Central Asia, and Australia. The company initially focused primarily on the big hitters in the freight forwarding world such as CCL, NAVEX, TXT and LAM but is now developing partnerships with BCOs (beneficial cargo owners), enabling these intermediaries to offer the technology to their clients. Its BCO customers include JNC Line and TransCargo. In 2024, AELER completed a series A funding round to step up its rollout.

Minimising the impact of the most polluting industries

Daphne Technology is a climate deep-tech company committed to developing and implementing solutions that effectively reduce greenhouse gas emissions in industrial sectors that are difficult to decarbonise.

« The high warming potential of methane underscores the importance of providing effective solutions to control these emissions in both on- and offshore industries. »

— Mario Michan,
CEO & Founder

CONTEXT

Methane (CH₄) is a powerful greenhouse gas that is now known to have a warming potential 28 times greater than that of CO₂. And CH₄ emissions are increasing as various industrial sectors replace liquid fossil fuels with natural gas-type fuels – in other words, with methane. Daphne Technology, created in 2018, has developed a number of innovations to reduce the environmental impact of polluting emissions in sectors that are difficult to decarbonise, such as the maritime and land-based oil and gas industries. These innovations not only reduce emissions but also convert pollutants into value-added byproducts, supporting a sustainable and circular economy.

TECHNOLOGY

The technology developed by Daphne Technology is used in two complementary solutions. The first is SlipPure™, an exhaust system that reduces methane emissions by up to 80%. The other, PureMetrics™, measures and quantifies greenhouse gas emissions in real time, enabling industries to effectively monitor and manage their environmental impact, and take corrective action.

MATURITY

SlipPure™ technology is now installed on ships for demonstration purposes, with an imminent market launch ; PureMetrics™ is market ready, with first orders placed. Daphne Technology is focusing on large-scale applications in the maritime industry and onshore oil and gas sectors in the coming years. It is also targeting other heavy industries such as chemicals and power generation. The company has already raised significant funds, attracting investors such as Trafigura, Shell Ventures, AET Tankers and J.P. Morgan. It remains open to investment proposals and partnerships to support the scale-up and commercialisation of its technologies. Daphne Technology has started its expansion abroad with subsidiaries in Norway and the United States, as well as a local presence in the EMEA and Asia regions.



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Zurich



eatplanted.com



hello@eatplanted.com

CONTEXT

According to an industry forecast, 11% of current meat consumption will be replaced by plant-based proteins by 2035. More and more consumers are opting for plant-based foods instead of meat – and they are helping to reduce climate-damaging CO₂ emissions from agriculture by doing so. Their change in eating behaviour is also reducing the land and water consumption associated with the production of animal-based foods. A team of graduates from the Federal Institute of Technology in Zurich recognised this early on and founded the food tech start-up Planted in 2019. Today, the Zurich-based company produces 14 tonnes of plant-based 'meat' products every day. Its products are distributed through more than 8600 shops and 6500 restaurants across Switzerland, Germany, Austria, the BENELUX countries, France, Italy and the UK. To date, the company has raised CHF 115 million from investors.

TECHNOLOGY

Planted initially used a two-stage process of extrusion and fermentation to produce the plant-based meat. To tailor the products even more exactly to customers' tastes, the 65-strong R&D team developed an optimised fermentation process that's used in the latest products. While peas were previously used as a source of protein, they have now been replaced by soya in a new product line. It is innovations like this that make it possible to produce plant-based meat that is increasingly similar to beef or other meats in terms of colour and consistency. Planted has won a number of major awards, including the TOP100 Swiss Startup Award and the Green Business Award.

MATURITY

In spring 2024, the company launched a plant-based steak that has the same reddish colour as beef and can be cooked on the grill like real meat. This was a significant step for Planted, as it showed that larger cuts can now also be produced from plant-based meat. The company also says that it is close to producing a plant-based roast beef. In recent months, Planted has launched new plant-based lyoner cold cuts, chicken breast and duck on the market, making the company's product range increasingly similar to the counter of a classic butcher's shop.

« No other plant-based steak uses only natural ingredients and no additives. »

– Lukas Böni, Head of Technology & Co-founder of Planted



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ZERO HUNGER



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Like meat, but plant based

Plant-based 'meat' is becoming more and more similar to traditional beef, chicken or duck meat in appearance, consistency and flavour. Swiss market leader Planted is continuously expanding its product range – and increasingly establishing itself on the European market.

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« Sustainable building materials such as our mineral foam insulation are less affected by economic downturns in the construction industry than conventional products. »

— Jens Diebold, COO



Plastic-free, recyclable thermal insulation

A building's sustainability is measured not only by its energy consumption but also by the materials used in its construction. FenX AG is preparing to launch a highly sustainable insulation material made from mineral waste from gravel extraction.

CONTEXT

Materials scientist Etienne Jeoffroy wrote his doctoral thesis on foams at the Federal Institute of Technology (ETH) in Zurich. Together with five other partners, he went on to invent an innovative foaming technology that can be used to manufacture all kinds of products from mineral waste, and in 2019 the team founded FenX AG to commercialise the technology. With seed funding of CHF 2 million and additional financing, the ETH Zurich spin-off developed a thermal insulation material for buildings, using mineral filter residues from gravel extraction and other sources as the raw material. Over its life cycle, the insulation material causes, directly and indirectly, only half as many greenhouse gas emissions as a standard product. This patented solution can replace both plastic-based insulation materials (XPS, EPS) and mineral and glass wool.

TECHNOLOGY

The behaviour and durability of the non-combustible insulation material was tested in several pilot projects on areas of a few square metres. In 2024, FenX worked on scaling up the manufacturing process to industrial production. Tests were carried out with a mixing plant and a casting mould on a one-to-one scale. The firm's aim is to realise its first industrial-scale insulation production, in cooperation with a mechanical engineering company, by mid-2025. Their target is an annual production of up to 150,000 m³ of insulation material, enough to insulate around 1000 buildings. The investment volume required for this is several million CHF.

MATURITY

The insulation material will be produced by an established insulation material manufacturer. FenX will supply the additives required for the foaming process as well as the expertise for the development of new and customised products. Further income should be generated from licence and service fees. In 2024, negotiations on the construction of a factory were underway with several interested parties based in Switzerland, Germany and Austria. FenX is confident of success, despite the current slowdown in the construction industry, as both Switzerland and the European Union are working to achieve higher renovation numbers for existing buildings. In view of this, insulation experts expect business to outperform the construction industry.

Biocement made by microorganisms

MeduSoil develops and sells innovative, sustainable binder products for private and public-sector construction projects. They are produced by microorganisms that naturally occur in large quantities in the soil.



« We have developed a highly robust binder material produced by organic synthesis that reduces the environmental impact of private and public-sector construction projects – at minimal cost. »

– Dimitrios Terzis, CEO & Co-founder



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TECHNOLOGY

Organic synthesis is a well-known process used in the pharmaceutical and food industries. MeduSoil drew inspiration from its applications in those sectors to develop a binder product for the construction industry. It is produced using microorganisms that occur in the soil and groundwater and naturally produce calcium carbonate, a kind of biocement. The Lausanne-based company, a spin-off of Professor Lyesse Laloui's EPFL lab, isolated around 20 strains of microorganisms at a site in Ticino, of which three were ultimately selected. They are cultivated in bioreactors that currently have a capacity of 200,000 litres per year. This is done at room temperature, rather than at the 1000 °C required for cement. The chalk-based materials produced following this « recipe » can be used for a wide range of applications, including construction, stabilising foundations and mitigating erosion.

MATURITY

The biocement's efficacy has been demonstrated in around 20 pilot projects across multiple countries, including Switzerland, France, Austria and Romania. Two products have already been launched on the market: the first a substitute for sand and gravel, the second an alternative for silt. The main target market is Europe (primarily via the company's Belgian subsidiary), followed by North America and geographic regions where there is high demand for stabilisation of underground structures. For instance, a project is currently underway in France with ORSS, an agency that monitors roads damaged by soil desiccation. MeduSoil is also focusing on certain countries that are regularly hit by earthquakes. A funding round completed in late 2023 made it possible to triple the size of the team and build a production plant in Yverdon-les-Bains.

CONTEXT

Construction, whether for private or public projects, is one of the world's most environmentally harmful sectors. That's due in large part to the chemical binder products that are used to agglomerate materials and stabilise soil or building foundations. In response to this ecological challenge, MeduSoil has developed innovative binder products based on biomineralisation. Their main intended function is to secure infrastructure and buildings against geological (earthquakes) and climate-related (erosion, landslides, etc.) challenges. They have the same properties as standardly used minerals and are also very competitive, as they are produced by microorganisms cultivated in bioreactors.

« Our ambition is to use our automated digital monitoring solutions to make water safer everywhere. »

— Serge Gander, CEO



Continuous monitoring means safer water

The Vaud-based scale-up bNovate Technologies has propelled industrial microbiology into the digital age, offering fast, automated solutions for the drinking-water, agri-food, pharmaceuticals, cosmetics and semi-conductor industries.



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CONTEXT

Water is a precious resource and guaranteeing water quality is crucial. bNovate Technologies develops automated flow cytometry solutions for the microbiological monitoring and analysis of water, ensuring efficient and sustainable water management. After being hailed a success by the water industry in Europe, the company intends to roll out its expertise more broadly on an international scale, since its technology can be adapted to local conditions in different parts of the world.

TECHNOLOGY

bNovate Technologies' flagship product is the BactoSense flow cytometer. This robust device can be deployed almost anywhere, directly on the water pipe. Another plus is the fact that it can be integrated into existing systems. This instrument provides precise measurements of bacterial concentrations in just 20 minutes – instead of several days using conventional methods. It is also one of the few devices on the market capable of automatically quantifying bacteria levels in water and the only one that does it almost in real time, simplifying water-quality monitoring. As a result, it does away with the need for disposable plastic test kits and sample transport. The monitoring data can be consulted remotely using communication equipment developed by the company. For the pharmaceuticals industry, which consumes large quantities of purified water, bNovate has developed the portable solution Aqu@Sens MB.

MATURITY

Several hundred BactoSense cytometers are up and running around the world and bNovate is Europe's leading company in this market. It has set up subsidiaries in Germany and the United Kingdom and also in the United States and is actively exploring other parts of the world including Asia, where in 2024 it signed a distribution partnership deal with Singapore-based MattenPlant. In June 2023 the company completed a series C funding round worth CHF 12 million headed up by the investment fund Emerald Technology Ventures based in Zurich and Toronto.

Boosting low-carbon hydrogen production

This EPFL spin-off, established in 2023, is developing oil-free low-pressure scroll compressors. Aimed primarily at encouraging the production of green hydrogen, they should rapidly find applications in a wide range of fields.



« Our innovation will have a considerable positive impact throughout the low-carbon hydrogen value chain. »

— Marianna Fighera, CEO & Co-founder



CONTEXT

The high cost, complexity and inefficiency of low-carbon hydrogen production systems are currently hobbling its widespread use. Particularly problematic is the lack of cost-effective systems for compressing hydrogen at low pressure and moving large volumes of gas at high speed. The oil-free compressors developed by Beyond Scroll provide a solution to this problem and should help to support the hydrogen industry in its pursuit of ambitious targets – 60% of hydrogen from renewable energy sources in Europe by 2035, for example.

TECHNOLOGY

Based on spiral technology, the solution patented by the young start-up consists of oil-free compressors that can operate at any pressure (particularly low pressure), compressing hydrogen without contaminating it. Not only can they be used to design more efficient, more compact and less energy-hungry machines, but they are also easier to assemble and maintain. The result is lower hydrogen production costs and a longer lifespan than the compressors currently available on the market. While this technology can be applied in a number of areas, Beyond Scroll wants to focus primarily on hydrogen. The company believes that its innovation could have a considerable positive impact throughout the green hydrogen value chain.

MATURITY

A prototype was used to validate the device before patents were obtained in 2024. A contract has been signed with the Italian Snam SpA, Europe's largest gas transmission system operator, and several contracts are under negotiation in Switzerland, Europe and Japan. A pilot project is also starting in late 2024, to test the first compressors ordered by an industrial customer. Beyond Scroll has set up its own production lines, with a view to putting its technology into series production. Its sights are set on the global green hydrogen market and all applications requiring low-pressure compression. In the medium term, it is also targeting compressed air, carbon capture and storage, and the heating, ventilation and air conditioning sector. A seed round should enable the company to raise CHF 2.5 million in the first quarter of 2025.

7 AFFORDABLE AND CLEAN ENERGY



Solar energy's electronic brain

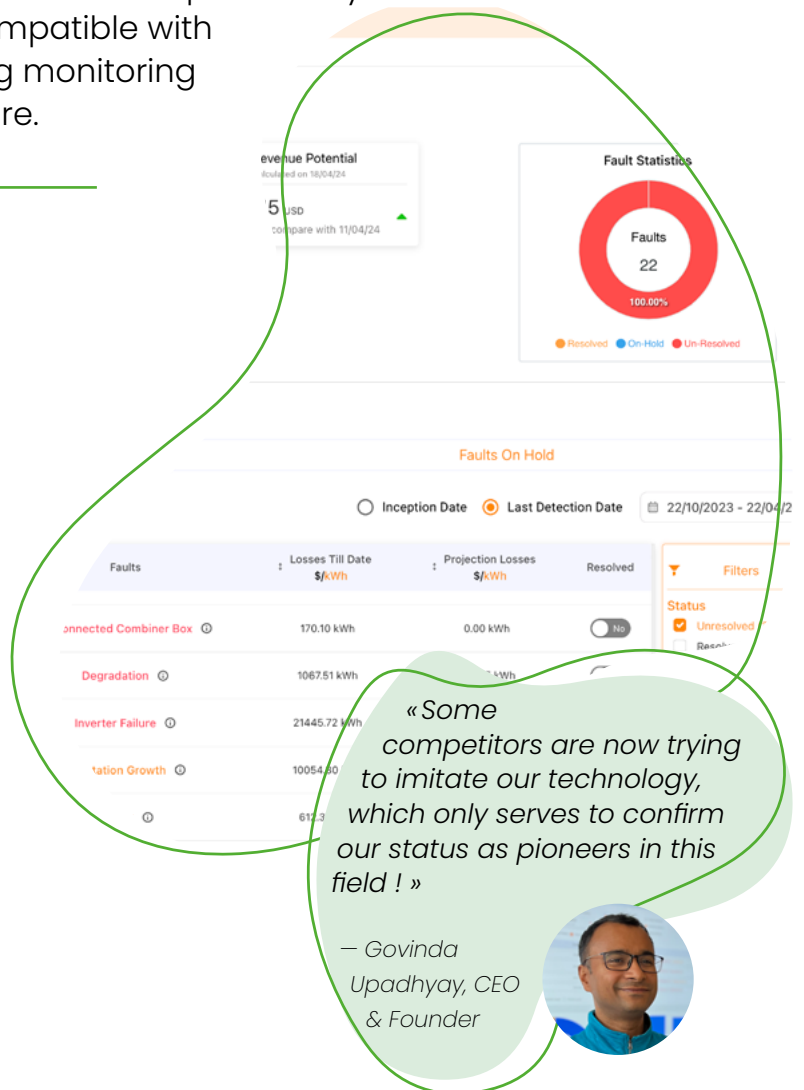
The solution developed by SmartHelio analyses the data from photovoltaic installations to diagnose and anticipate faults, thus improving the plants' performance and profitability. It is compatible with existing monitoring software.

CONTEXT

Malfunctions in solar power plants are mostly detected too late, resulting in substantial costs for the operators. This is because, although the plant monitoring solutions available on the market can collect data, they generally don't provide diagnoses, predictions, or a solution to any problems detected. The smart technology developed by SmartHelio remedies this shortcoming through the use of automation. It is capable of analysing any power plant and should encourage a wider adoption of solar energy by improving the performance and profitability of photovoltaic installations.

TECHNOLOGY

The system uses physics and AI not only to analyse plant data – such as voltage and temperature – but also to predict failures and propose both corrective and preventive measures. This enables operators to act before such failures have an impact on the performance of their installation. The solution also has a dynamic climate modelling tool to improve the climate resilience of the solar panels and increase their operating life. It can increase plant performance by 10%, saving 1 tonne of CO₂ per GWh per year. And the potential is enormous, since SmartHelio's solution can be integrated into existing software. Initially developed for large solar power plants, it is now also available for smaller installations. Crucially, it can detect and predict faults from the very first day of integration, without any historical data.



«Some competitors are now trying to imitate our technology, which only serves to confirm our status as pioneers in this field!»

— Govinda Upadhyay, CEO & Founder



MATURITY

With offices in Switzerland, India and the United States, SmartHelio boasts around fifty customers worldwide, including Tata Power Solar, Schneider Electric and Daystar Power (Shell's African subsidiary). In 2024, the company is raising CHF 2 million to finance the development of battery storage systems, in order to offer a complete energy solution for solar installations of all sizes. At the same time, it is conducting research into a system for optimising energy dispatching, for use by energy distributors.

Using AI to reduce food waste

KITRO develops products and services based on artificial intelligence and the Internet of Things (IoT) to measure food waste and help its clients take sustainable and effective action to manage their foodstuffs.



CONTEXT

In the European Union alone, it is estimated that some 88 million tonnes of food are wasted every year, equivalent to more than 170 million tonnes of CO₂. And Switzerland generates 2.8 million tonnes of food waste, including around 360,000 tonnes created abroad during the production of imported foodstuffs. This waste has a high environmental, economic and social cost, and the catering sector is responsible for 26% of it worldwide. Founded in 2017, KITRO decided to tackle the problem of this mounting waste by developing a world-first solution for automating food waste measurements based on AI technologies. It is aimed at catering establishments all over the globe.

« There is considerable potential for reducing food waste if the solution developed by KITRO is deployed on a global scale. »

– Anastasia Hofmann, Co-CEO & Co-founder

TECHNOLOGY

KITRO's solution consists of a device equipped with scales and a camera to automatically measure and analyse food waste. The waste is identified using something called computer vision, together with machine learning algorithms, and the data and analysis is shared with clients via an online dashboard. Clients can use this information to improve their work processes and reduce avoidable food waste by up to 60%. This represents a saving of between 2% and 8% on their annual cost of goods. Unlike other solutions on the market, KITRO's clients benefit from fully automated plug-and-play technology that is easy to implement, offers significant savings and eliminates human error. A dedicated team also helps clients to implement personalised food waste reduction measures to ensure optimum results. The company estimates that the equivalent of more than 1 million meals, or more than 500 tonnes of edible food, have been saved since its solution was launched.

MATURITY

The technology developed by KITRO is already present in over twenty countries in different regions around the world, and its clients include several hotel groups – among them Hyatt and Four Seasons – as well as hospital and staff canteens. The company intends to focus now on growth in Europe, the Middle East and North America. KITRO was ranked as one of Switzerland's top start-ups in 2022 and has won several prestigious awards.



CONTEXT

At first glance, a paper cup seems environmentally friendly – but it has its flaws. Paper production requires a relatively large amount of wood, water and energy. Then there are the bleaching agents, and the adhesive to glue the parts together. In comparison, the wooden cup from Arbloom Cup AG requires only half as much wood and no glue at all. It was developed by wood engineer Laurent Torriani in 2019 as part of a two-year development project at the Creaholic innovation factory in Biel/Bienne. After several pilot projects, Arbloom Cup AG was founded at the end of 2021 to market the product. Production started on an industrial scale in 2023, and the process was optimised at the beginning of 2024.

TECHNOLOGY

The wooden cups consist of two laminated layers: the base material, made from biomass, and a 0.4-mm-thick wood veneer. The bottom and walls are punched from this laminate and welded together using a patented ultrasonic process. The coating is made of a biodegradable material, rather than plastic. In close cooperation with beer sommeliers, a lot of effort was put into ensuring that users find the flavour pleasant when drinking from the cup. The insulating wooden layer ensures that drinks stay hot or cold for longer.

MATURITY

The cups have been produced on a fully automated machine since mid-2024, and increasing quantities mean that they should soon be financially competitive. Distribution partnerships are already in place with the Feldschlösschen brewery, Young Boys football club and other event organisers, and initial talks have started about licensed production abroad. The cups' use at the YB's Wankdorf Stadium in Bern means that around eleven tonnes of plastic waste can be avoided every year. The FSC-certified wood comes from the EU, and the used cups are composted, incinerated to generate energy, or processed into chipboard for furniture by Swiss Krono in Menznau (LU). Life cycle analyses have shown that the wooden cups generate only a third of the CO₂ emissions of plastic cups. A reusable plastic (polypropylene) cup has to be used 20 times before it is as climate friendly as the wooden cup.

Wooden disposable cups

Paper cups are more environmentally friendly than plastic cups, but wooden cups are even better. This is the thinking behind Arbloom Cup AG's disposable cup made from renewable raw materials. Since the start of 2024, several tens of thousands of cups have been produced every month and used at football matches, festivals and so on.



« Every year, 500 billion disposable cups are produced worldwide. There is enormous potential here in terms of sustainability. »

– Natalia Röthlisberger,
CEO

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The quantity of plastic waste polluting the world's oceans has become a matter of public concern in recent years. It is estimated that 12 million tonnes of plastic end up in the sea every year, a figure that is steadily increasing. This is where #tide's business idea comes in. Founded in 2019, the company works with local partners to have the waste collected and processed into granulate, yarn and filament, which are then used as raw material in the manufacture of a wide range of plastic products. The Dutch Condor Group uses it to produce carpets; the Swiss watch brand Maurice Lacroix, plastic watches and their packaging; and the industrial group Von Roll, protective caps for hydrants.

TECHNOLOGY

Recycling plastic is challenging – especially when the recycled material is not used to make the original item (e.g. PET bottles from PET bottles) but an entirely new product – and #tide turned to the IWK Institute for Materials Technology and Plastics Processing at the Eastern Switzerland University of Applied Sciences for advice. The four most

common types of plastic (PET, HDPE, LDPE and PP) can be processed into practically any product. The jumping-off point is always the end product that will be manufactured with the recycled plastic: the technical specifications of the required recycled plastic are derived from this. The desired plastic is then produced using a customised recipe.

MATURITY

Marine plastic comes from Thailand, Indonesia, Malaysia, Mexico and the Philippines. The waste is recovered by local recycling companies and sold by #tide to customers worldwide. With production in the thousands of tonnes, the company, which is financed by six private shareholders, is now close to the break-even point. The medium-term goal is to increase processing to 240,000 tonnes of plastic waste a year, equal to 2% of the amount of marine plastic litter worldwide. The firm is contributing not only to cleaner oceans but also to combating climate change: every product made from recycled plastic causes up to 80% lower greenhouse gas emissions over its life cycle compared to conventional plastic.



« Political regulations in favour of the circular economy improve our competitiveness. »

– Marc Krebs, Co-founder & CCO

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A second life for marine plastic

PET and other plastics have been recycled for a long time. Tide Ocean SA (#tide) is taking a new approach by specialising in waste from island and coastal regions. The waste is used to produce a low-CO₂ raw material for the manufacture of a wide range of consumer and industrial goods.



CONTEXT

As the former head of sales at Swiss Federal Railways, Gian-Mattia Schucan knows everything there is to know about selling train tickets. In 2013, Schucan set up his own business as a consultant – and set about reinventing how tickets are sold. With FAIRTIQ AG, he developed a payment app that allows you to buy a public transport ticket by swiping right when you get on and left when you get off. After the company was founded in 2016, the app was launched in the Engadin, Fribourg and Lucerne regions. It became increasingly popular and was integrated into the Swiss Federal Railways app three years later. The FAIRTIQ app is currently used for 200,000 journeys every day, making the young company the clear market leader worldwide. A third of users say that the app has increased their use of environmentally friendly public transport.

TECHNOLOGY

Behind every pay-as-you-go ticket, there's a complex process: the payment system uses location data to determine which route and which means of transport the user takes throughout the day to get from A to B. At the end of the day, the best price is calculated for the entire journey, the ticket is billed, and the proceeds are distributed among the more than 600 participating transport companies. The app is constantly being updated to better meet all customer needs. For example, a «ride-along» option for companions, dogs and bikes has been created, and the best price model has been extended to cover longer periods. The developers' long-term goal is a fully automated app that recognises the start and end of a journey without the user having to do anything at all.

MATURITY

While the company's development was co-financed by private investors, the majority of shares are held by the management. The funds generated are being channelled into Europe-wide expansion: in 2024, the payment app was in use not only in Switzerland but also in parts of Austria, Germany, France, the Czech Republic, Italy and Denmark. And almost all the other European countries are in discussions with FAIRTIQ about launching the app on their markets, too. Smartphone-based ticketing also opens up new business models, for example, for data-based marketing, fraud management, flexible pricing structures and comprehensive corporate solutions.

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A single swipe to buy a ticket

To encourage people to use public transport, buying tickets must be as easy as possible. FAIRTIQ AG's business idea is based on this principle: people can buy their tickets by swiping their smartphones. The payment app is currently taking Europe by storm.

« FAIRTIQ has doubled or tripled its journey numbers every year over the past few years. »

– Gian-Mattia Schucan, Co-CEO & Founder





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Fribourg



bcomp.com



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Decarbonising mobility with flax composites

Bcomp specialises in the manufacture of high-tech bio-based materials and is now preparing to conquer the automotive industry. Its technologies, applied to both bodywork and interior parts, have already won over a number of major players in the field.

CONTEXT

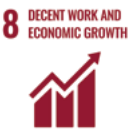
Bcomp's goal is to decarbonise its customers' value chains with its high-performance bio-based material made from flax fibres. Resistant and lightweight, this material initially found use in the sports and leisure sectors, where it appealed especially to ski manufacturers. However, since 2022, the company has been targeting the mobility sector, through motor sport, with both exterior and interior components (such as dashboards and seat backs). Its technologies enable car manufacturers to design lighter, more sustainable interior panels, cutting weight by up to 50% and reducing plastic by up to 70%. Across all its markets, Bcomp's technologies are expected to save thousands of tonnes of CO₂.

TECHNOLOGY

The uniqueness of the composites developed by Bcomp lies in the optimal orientation of the flax fibres used in the manufacture of its high-tech reinforcement fabrics, supplied in rolls or sheets. The company is also making a name for itself with the superior functionality of its semi-finished products, which, depending on their intended use, meet various criteria such as UV or scratch resistance. Rather than simply supplying materials, Bcomp's aim is to meet users' precise needs for each application. And, in the case of visible parts, it can also adapt its products to its customers' design requirements. For now, the resins used to bind the fibres are mainly made from petroleum derivatives. However, the company is aiming to move over to 100% natural resins to further reduce the carbon footprint of its composites. Another avenue for development is the use of recycled plastic. All materials are manufactured in Europe, some at Bcomp's premises in Fribourg.

MATURITY

Bcomp has been present in the sports and leisure sector for several years, in Europe, North America and Asia. In the mobility sector, its customers already include Volvo, Polestar and CUPRA for industrial applications. Nearly CHF 80 million have been raised since 2011, including CHF 36 million in a Series C round in 2024, which will enable the company to expand its markets and increase its production capacity.



© Volvo cars

« After bringing numerous manufacturers in the sports and leisure sector onside, we are now focusing on the mobility sector to make an even bigger impact. »

— Christian Fischer, CEO



A green model for the watch industry

The eco-innovative watches designed and developed by ID Genève prove that the circular economy can also be synonymous with luxury and commerciality. To achieve its aims, the young company is developing its own ecosystem based on the latest low-impact innovations.

CONTEXT

ID Genève is, above all, the story of a conviction – that of its founders, who wanted to have a positive impact on the watch industry by developing the world's most ecological watch. And their confidence was justified, as demonstrated by its second collection of eco-innovative timepieces based on the principles of the circular economy. ID Genève is the first watch brand to be certified B-Corp, in fact.

TECHNOLOGY

The watch cases are made from 100% recycled stainless steel, melted in a solar furnace. Supplied by the Swiss company Panatere, it is produced by recycling waste from machining companies in and around the Jura, and has a much lower carbon footprint than standard stainless steel. The watch movements come from upcycled and reconditioned parts. And the straps are made from bio-based materials, so are also integrated into the circular economy. ID Genève works with the Italian company Vegea to produce a grape marc-based, vegan leather strap and is also developing a felt-like hemp-based strap with the German company Revoltech. Additionally, the start-up is keen to eliminate all chemical binders and is working on a 100% plant-based resin with the American company MIRUM. It has even extended its efforts to its packaging, which is made from seaweed or mushrooms, and it buys its cardboard boxes from local firms that run return-to-work programmes.

MATURITY

After its first collection, Circularity, which came out in 2020, ID Genève presented the Elements collection at the Watches and Wonders international watch fair in 2024. The prototypes, intended for pre-sales, feature hologram engraving directly into the case. Developed in partnership with Swiss start-up Morphotonics, this technology, similar to that used on passports and banknotes, not only authenticates each watch but also traces the origin of each of its components. Several prestigious watch distributors are already selling the young brand's models, including Watches of Switzerland (London and New York), Ethos (India) and Seddiqi (Dubai).

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« Our goal is to develop an industrial-scale ecosystem based on the latest low-impact innovations applicable to watchmaking. »

– Singal Depéry, Designer & Co-founder



An app for farmers

« We see ourselves as an all-in-one platform that encompasses not just farmers but the whole food production chain. »

— Matteo Vanotti,
CEO



Even farming is going digital: food tech company xFarm Technologies SA offers farmers and food businesses a software solution that helps increase the efficiency of their agricultural production and reduce their carbon footprint.



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CONTEXT

Digitalisation is revolutionising the services and industrial sectors – and it's slowly but surely transforming agriculture too. In many countries, software providers are marketing their solutions to farmers who want to modernise their businesses. One Swiss provider is the Lugano-based xFarm Technologies, which was launched in 2017 by Matteo Vanotti, Martino Poretti and Salvatore Ferullo. Its mission: to digitise farming. Today, their software is used by over 400,000 businesses throughout Europe that between them manage six million hectares of land.

TECHNOLOGY

The xFarm app was initially designed to help farmers manage administrative tasks such as reporting and stockkeeping. Later on, other functions were added too. Today, for instance, it can be used to irrigate fields as and when needed based on weather forecasts. Or it can log the activities of tractors and other machinery over the course of a day and record crop yields. The app can also be used by food businesses: the Italian Barilla Group, for instance, implemented an xFarm solution involving 2,000 farmers so that it could measure the carbon footprint of its biscuit production.

MATURITY

xFarm Technologies raised 20 million euros across two funding rounds, which it used to expand from its original primary market, Italy, to the rest of Europe. The young company now has offices in Italy, Spain, France, Poland and Germany, and is currently trying to break into the Brazilian, Indian and Turkish markets. xFarm generates revenue from licence fees that farmers, food companies and machinery manufacturers pay to use its software. With a resolute growth strategy, it wants to establish itself as a global provider of digital solutions for the agricultural sector.

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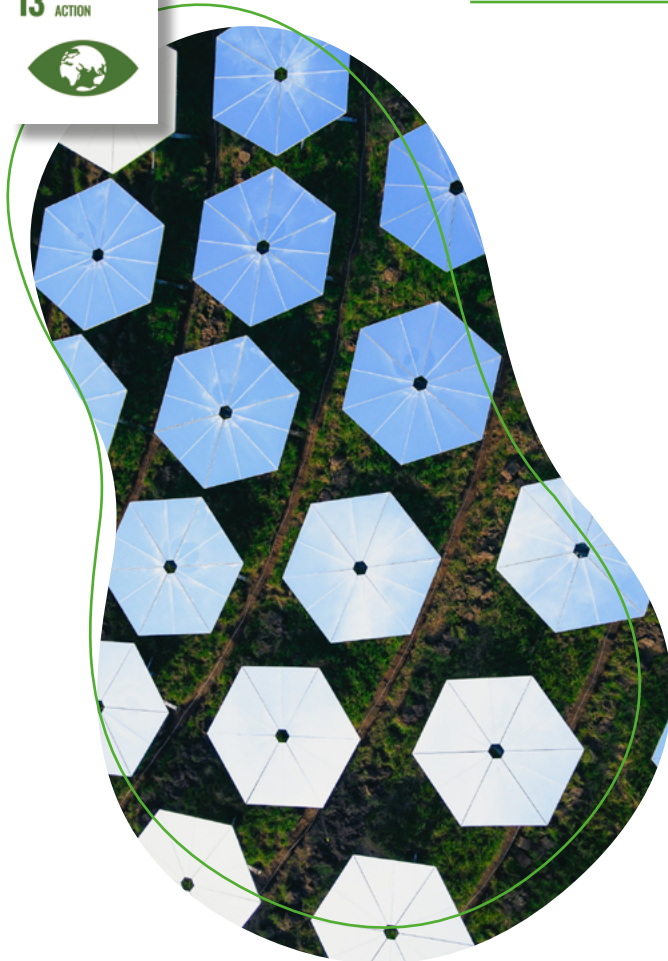


Renewable aviation fuel

In 2024, Synhelion AG opened an industrial-scale demonstration plant to showcase how high-temperature solar heat can be used to produce sustainable fuel for aircraft and other vehicles. Commercial production is scheduled to start in 2027.

« Synhelion is building and operating the first plants ourselves. For future, larger-scale plants, we will award licences to interested fuel manufacturers. »

— Philipp Furler, CEO



CONTEXT

In June 2024, a demonstration plant for the production of renewable 'syncrude' (synthetic crude oil) was opened in Jülich near Cologne. In the months that followed, production was gradually stepped up to several tonnes. Synhelion (founded back in 2016) is already working on its next plant, which will be located in Spain and will produce a thousand tonnes of sustainable crude oil per year. Construction is due to start in 2025. Further plants with even higher production capacity are planned in southern Europe, the USA and the Middle East, with the goal of achieving an annual production volume of one million tonnes by 2033. The solar syncrude can be mixed with fossil crude oil at conventional refineries and processed into kerosene, petrol or diesel. That's good for the climate, because the sustainable crude oil does not contribute on net to atmospheric greenhouse gas levels.

TECHNOLOGY

Renewable crude oil is produced in large solar plants. A mirror field reflects sunlight onto a central receiver in order to heat a transfer medium to a temperature of up to 1,500 °C. A thermochemical reactor converts CO₂ (and in some cases also biomethane) and water into a synthetic gas made up of hydrogen and carbon monoxide. This is liquified into crude oil, which can be processed into conventional fuels at a refinery. Since the crude oil is made using CO₂ extracted from the atmosphere and only solar energy is used in its production, it is virtually carbon-neutral.

MATURITY

There's strong demand for non-fossil fuels in the aviation industry, since planes can't be straightforwardly converted to electric motors. Companies such as Lufthansa, the parent company of SWISS, and Pilatus Aircraft work with Synhelion as partners and investors. They hope to be able to use the synthetic fuels for their aircraft in the medium term. Private and industrial investors have so far invested CHF 70 million in Synhelion. In the near future, Synhelion-licensed plants with annual capacities of several hundred thousand tonnes are to be built, with costs running into the two-digit billion range.



Smart bike parking

Bikes are an eco-friendly mode of transport for short and medium distances. V-Locker AG makes cycling a more attractive option by providing secure, automated bike parking towers with individual lockers where cyclists can store their bikes for a small fee.



CONTEXT

Thanks to the e-bike boom, bikes are now faster but also more expensive, and so there's growing demand for secure storage facilities at train stations and in other public spaces to protect bikes from theft, vandalism and the elements. V-Locker was launched in 2019 to cater to that demand. The company offers parking systems that can be booked and operated 24/7 via an app and allow users to securely stow bikes, helmets and bags for several hours. The first two bike parking towers were opened in 2020 in Münchenbuchsee near Bern, Switzerland, and in Halle (Saale), Germany. There are now 13 towers across Switzerland and Germany, each with six to 120 lockers for a combined total of 530 lockers, which makes V-Locker the clear market leader in both countries.

TECHNOLOGY

The stylishly designed modular towers are up to 11 metres tall and use a paternoster lift system to move the lockers up and down. That minimises the ground area the towers take up, which is increasingly scarce and expensive in cities. The drop-off and return process is automated and the towers can be used round the clock. Bookings and payments are made via an app. Permission to access the locker can be shared with other people. There are plans to add other features too: for instance, it may soon be possible to get bikes repaired while they're parked, or to use the lockers to send and receive parcels. It's also planned to integrate the lockers into transport chains, for instance by enabling bookings on the SBB app.

MATURITY

Bike parking costs CHF 0.50 per hour. In Switzerland, bikes can be stored for 220 hours, equivalent to a month's commuting, at a cost of just under CHF 15. As of 2024, several thousand people have used the service and booked over 250,000 hours of parking. The founders launched the company with their own funds. In 2021, two anchor investors provided around CHF 4 million of capital. V-Locker expects to turn a profit by 2025. The company plans to rapidly expand from Switzerland, Germany and Austria into the Benelux region. There have also been expressions of interest in other European countries, the Middle East and the USA. In mid-2024, projects with a volume of up to 12,000 lockers were in the pipeline.



« At this stage, we no longer see ourselves as a start-up, but rather as a scale-up that is aiming to achieve strong growth across several markets at once. »

— Jens Kirchoff, CEO

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Detecting gas leaks from a safe distance

Leaks at gas-powered plants and facilities can be very expensive for the companies concerned. They're also bad for the environment and contribute to the climate crisis. Distran AG's ultrasonic cameras can detect leaks from a safe distance.

« By identifying gas leaks, companies can avoid expensive, environmentally harmful gas losses. »

— Florian Perrodin, CEO



CONTEXT

Initially, Joël Busset and Florian Perrodin developed a device at ETH Zurich that used soundwaves to locate people trapped under the rubble after an earthquake. Working with industry partners Alstom and RUAG, they then created an ultrasonic camera that can be used to detect gas leaks of all kinds from a distance of several metres. Busset and Perrodin founded the company Distran in 2013 to commercialise the product. The camera is now used in 35 countries, primarily in the oil and gas, power generation, chemical and composite manufacturing industries.

TECHNOLOGY

In summer 2023, the ETH Zurich spin-off successfully concluded a new funding round that raised over CHF 10 million. That money mostly went into developing a sensor to detect hydrogen: a highly explosive gas that is also the great hope for the energy transition. Safe operation of hydrogen refuelling stations requires a system to monitor for possible gas leaks. The Distran sensors can perform this function from a distance of 20 metres. The cleantech company started out by offering portable devices, but now also offers fixed cameras for continuous monitoring of production sites. Experience shows that the costs of undetected gas leaks at sites such as power stations can run into the millions.

MATURITY

The acoustic imaging technology is patented. The cameras are manufactured in Zurich. A glance at the political discussion shows the increasing priority being given to monitoring greenhouse gas emissions. For instance, in 2024 the EU worked on a new methane emissions regulation for the oil and gas industry. The US Environmental Protection Agency (EPA) is expected to grant approval for the Distran solution by the end of 2024. Once that happens, the ultrasonic cameras will be able to fully replace other monitoring systems, instead of merely complementing them.

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« In mid-2024, we received the ZIA PropTech of the Year Award, the highest accolade for start-ups in the European property sector. »

— Evan Petkov, CEO & Co-founder



Sustainable property management

The net zero target is a huge challenge for owners of large property portfolios. The ETH spin-off OPTIML AG provides a data-driven platform that helps property managers and investors optimise their performance in terms of both profitability and sustainability.

TECHNOLOGY

The OPTIML service has been available to managers of large property portfolios since late 2022. That was when Evan Petkov, Jordi Campos and Nico Dehnert founded the company as a spin-off of ETH Zurich. At the heart of its business model is a software platform that uses AI to recommend decarbonisation and investment strategies for sustainable management of property portfolios and renovation plans for individual buildings that factor in both profitability targets and regulatory conditions. Users enter an address and the tool then compiles and evaluates the data available for that location. This data is used to produce a portfolio analysis and environmentally and economically sustainable renovation strategies.

MATURITY

One-and-a-half years after its founding, OPTIML had more than 30 clients, including the property company Swiss Prime Site and the consultancy pom+. Platform users pay an annual licence fee based on the total floor area of their portfolio. A first funding round raised CHF 1.6 million to establish a development and product team. Another funding round took place in mid-2024 so that the company could accelerate software development, extend product features and expand geographically. Its target markets are Germany, Switzerland, Austria and the UK, with plans to gradually move into other EU countries. OPTIML intends to focus on management of international property portfolios.

CONTEXT

Around half of buildings in Switzerland are owned by institutional investors with large property portfolios. These buildings' energy consumption is critical to achieving net zero by 2050, since buildings are responsible for around 40% of Switzerland's overall energy use and a third of its climate-damaging greenhouse gas emissions. Renovation decisions by major property owners will be an important factor in how quickly Switzerland and other countries can transition to a sustainable property industry.

Eating with the climate in mind

Consumers can do their bit for the climate by choosing low-carbon menu options. Eaternity AG provides a platform that restaurant operators and their customers can use to learn about dishes' carbon footprints.

CONTEXT

Food production is responsible for a significant portion of greenhouse gas (GHG) emissions. One frequently cited example is beef and dairy cattle, which release a lot of methane – a gas that is highly damaging to the climate. Fertilisers and rainforest clearance are also important causes. Scientists have found that 34% of global GHG emissions are linked to food. In Switzerland, the figure is 2.1 tonnes of CO₂eq per person per year. But studies suggest that figure could be more than halved by making smart dietary choices: the GHG emissions of climate-friendly food options are up to 90% lower.

TECHNOLOGY

Against this backdrop, Eaternity's mission is to calculate the carbon footprints of different dishes. The idea behind it is that people can only choose a climate-friendly diet if they know the climate impact of the food they eat. The company, founded as a spin-off of ETH Zurich in 2014, developed a platform that shows the carbon footprint of 50,000 different food types. The calculations include all CO₂ emissions generated throughout the manufacturing process and overall life cycle. The company is working to further improve the accuracy and cost efficiency of the calculations.

« We are a commercial enterprise. At the same time, we also see ourselves as an NGO that helps promote climate-friendly behaviour through public information campaigns like www.ayce.earth. »

— Manuel Klarmann, CEO & Co-founder



MATURITY

Over 100 restaurant operators with 1,250 outlets now use the Eaternity platform to help create climate-friendly menus and/or inform customers about the climate impact of different options. Retailers also introduced the Eaternity label in 2019, which rates food on criteria such as climate impact and water use using a three-star system. Eaternity established itself with around CHF 3.5 million in funding from a foundation, innovation grants and various awards. Today, it generates revenue from licence fees that restaurants, food manufacturers and retailers pay to use the platform. The company's main markets are Germany and Switzerland, but it also operates in seven other European countries and the USA.





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Zurich



fluidsolids.com



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« We have delivered several million components so far, mainly to customers in Switzerland and other European countries, but also as far afield as India. »

— Beat Karrer, Founder



CONTEXT

Beat Karrer had an industrial design office for 25 years. Designers are interested in shapes, but also in the materials they work with, and Karrer was inspired to look for a sustainable alternative to plastic – one that was not made from fossil raw materials and did not pollute the environment with microplastics. He teamed up with a chemist and brought in material scientists and plastics technologists, and FluidSolids AG was founded in 2011. The team developed a process that has since been patented several times and can be used to produce biological composite materials from organic waste materials. The first products were launched in 2019.

As good as plastic

Plastic is a potent raw material and a popular packaging material. But its derivation from fossil sources and the persistence of plastic waste are making it increasingly unpopular. FluidSolids AG offers a non-fossil alternative based on fibrous waste.

TECHNOLOGY

FluidSolids uses hemp, cotton, corn cobs, nutshells, wood fibres, coffee grounds and other types of plant waste as its source materials. These fibrous materials can be processed into stable biocomposites with the addition of natural binders and additives. After passing through quality control, the raw materials are shredded, supplemented with additives and finally processed into a granulate. FluidSolids either sells this directly to its customers or manufactures its own products using an injection moulding process. The composite material is available in a standard version and in more specialised forms, such as a fireproof version and one that is approved for contact with food. It is also possible to select a material composition that can be used to make coffee capsules or one that allows the products to be recycled in the paper waste stream.

MATURITY

Products made from the biodegradable composite material include disposable cutlery (for Coop and Migros), lampshades (for Zumtobel) and hangers (for fashion shops). FluidSolids produces the granulate in Zurich, in a pilot plant that has an annual capacity of 200 tonnes. The R&D team, who account for a third of the company's workforce, already have home-compostable coffee capsules in the pipeline. The company does not expect to break even in 2024 but has strong growth plans. In the medium term, three further production facilities are planned in Switzerland and abroad, each with an annual capacity of several thousand tonnes.

Speeding up knowledge transfer in the battery industry

The advancement of electric vehicles depends on high-performance batteries. Battronics AG supports research into new battery concepts, with the primary focus of its consulting services being on ensuring that the findings are quickly put into practice.

« In China, technology transfer takes around five years; here in Europe it can easily take seven to nine years – we want to speed this up with our consulting services. »

– Michael Hess, CEO



CONTEXT

Scientists around the world are working on pioneering battery concepts and chemistries. Michael Hess carried out research at the Bosch Research and Technology Center and the renowned Massachusetts Institute of Technology, in the US, before moving to the Federal Institute of Technology in Zurich for his doctoral thesis. This involved studying graphite electrodes, a component of lithium-ion batteries that plays a key role in charging speed. Armed with the knowledge he'd acquired, Hess founded Battronics in 2017, which has been offering technical advice on batteries ever since.

TECHNOLOGY

Battronics' consulting activities focus on lithium-ion batteries, which are currently installed in every type of electric vehicle because of their high energy density. The company aims to get new research findings, for example on battery chemistry, into full production more quickly. A look at the cathodes that are installed in lithium-ion batteries today illustrates just how urgent this is. These modern battery components were developed around the turn of the millennium, but it then took about five to seven years for them to reach the market and make their impact on electromobility. To accelerate the market launch of new findings, the experts at Battronics offer consulting services on scaling, supply chains, costs and patent protection. Their customers are raw material suppliers, cell manufacturers and users who want to commercialise new battery technologie.

MATURITY

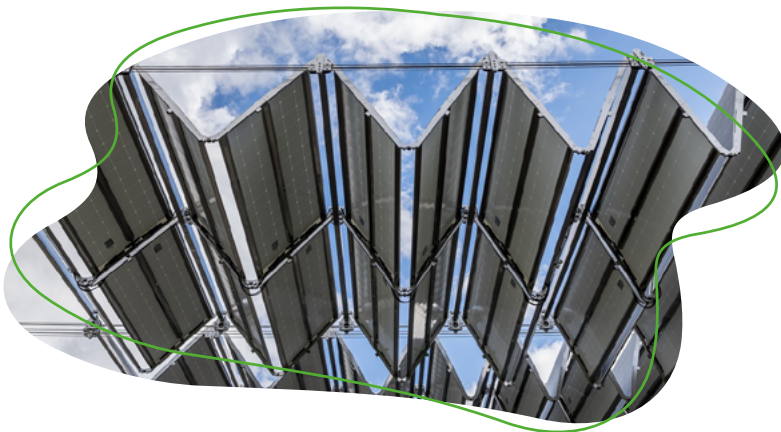
The company is also directly engaged in application-oriented research projects. A Battronics-led consortium, launched in 2024, is researching the supply chains of lithium, nickel and cobalt, the most important raw materials for lithium-ion batteries, with EU funding. Another project, in collaboration with the German battery manufacturer Varta, is researching a low-cost zinc-ion battery that does not require critical raw materials and could be used for stationary energy storage. Battronics has been operating profitably since 2019; the company has had a presence in Germany since 2020 and in Poland since 2023.

Solar roofs over impervious surfaces

Rooftops are particularly suitable for producing solar power, but other impervious surfaces at commercial or traffic sites are also well suited. dhp technology AG has developed a folding solar roof for precisely this purpose. After working with wastewater treatment plants, the firm is now increasingly covering road surfaces.

« The folding solar roof is a pioneering technology for exploiting existing infrastructure for PV. »

– Gian Andri Diem, Managing Partner



TECHNOLOGY

The folding solar roof has demonstrated its effectiveness for over seven years now. In 2025, dhp technology plans to introduce a new generation that will enable standard PV modules to be installed instead of the previously used lightweight ones. This will expand the range of applications and facilitate collaboration with companies that want to incorporate their own modules into the project. Another development goal is to standardise the rope statics, to reduce the complexity of the solar roof. If the production and construction of the supporting structure can be simplified, it will be easier to scale up the technology. Recently, dhp technology has also begun offering a solar calculator for an initial yield estimate for new projects.

MATURITY

The largest system to date, with two solar roofs, will go into operation in Thun in 2025. With an output of 3.6 MW, it will produce the same amount of electricity as a medium-sized wind turbine. Over the next few years, the focus will shift to solar installations on motorway service areas – dhp technology is part of a consortium that will install up to 45 solar roofs on service areas in western Switzerland and the canton of Bern by 2027, on behalf of the Federal Roads Office (FEDRO). Once they are all installed, they will be able to supply up to 7800 households with electricity.

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CONTEXT

The potential for solar power is far from exhausted, and Switzerland is no exception. A particularly good option for expanding photovoltaics is surfaces already in use, in other words, where solar power production is not competing with landscape conservation. Since its inception in 2015, dhp technology AG has built more than 20 photovoltaic systems with an output of 10 MW in such areas, most of them over clarifier tanks at wastewater treatment plants. The company's product is a solar roof mounted on a cable-based supporting structure. In bad weather, the solar modules are retracted, using a patented folding mechanism, to avoid damage. In 2024, the company achieved a turnover of over ten million CHF, doubling the previous year's revenues. Up to now, the company has mainly been active in Switzerland and Germany, but its growth is set to continue with new projects in Austria, Italy and Liechtenstein.

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CONTEXT

H55 wants to play a leading role in decarbonising aviation. The Solar Impulse spin-off has a strong foundation to build on, as it can draw on more than 20 years' experience in design, development, certification and electric-powered flight. It is determined to find practicable solutions for achieving the aviation industry's net zero targets – and so has chosen to focus exclusively on developing certified electric propulsion systems for specific applications and various aircraft types.

TECHNOLOGY

Each of the propulsion systems developed by H55 comprises an energy storage system, battery packs, energy management systems, pilot interfaces and an electric propulsion unit that includes an electric motor and motor controllers. A first system is currently being certified to CS-23 Level 1 (two-seat light aircraft for pilot training). It is designed to be retrofitted in existing fleets to enable fully electric short-haul flights. A number of projects in that area are currently ongoing, in collaboration with the aircraft manufacturers BRM Aero (Czech Republic), CAE (Canada) and Piper Aircraft (US).

MATURITY

Having developed a system that can be retrofitted in light aircraft, H55 now has its sights set on regional aviation, as that will allow it to have an even greater impact on decarbonisation. For instance, it has signed a contract with Pratt & Whitney Canada to develop the energy storage system for a hybrid engine in a 49-seat aircraft. Given the current state of technology, it is unlikely that fully electric flights with more than six to ten passengers will be possible in the next 15 years. But H55 estimates that hybrid flights could cut CO₂ emissions by 30% compared with conventional planes of the same category. The Valais-based company is actively supported by Energypolis and has subsidiaries in Montréal, Canada, and Toulouse, France, so that it can be close to its customers. H55 completed a successful Series C round in 2024 to fund its continued development.

« Electric propulsion systems will soon be installed in types of aircraft that may be less well known than jumbo jets but are just as interesting when it comes to decarbonisation. »

– Martin Larose, CEO



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Emission-free aviation on the horizon

H55, a tech company spun off from the project Solar Impulse, is working to develop certified electric propulsion systems that are clean, quiet, safe and affordable – with the ultimate goal of decarbonising the aviation industry.

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



Revolutionising air transport

Unpiloted aircraft have great potential in the fields of transport, monitoring and surveying. Dufour Aerospace AG's drone can transport loads of up to 40 kg over distances of several hundred kilometres. Following completion of preliminary batches, series production is due to begin in 2025.

CONTEXT

With its tilt-wing design, Aero2 looks like a cross between a helicopter and an aeroplane. That's precisely the idea: during take-off, the four propellers lift the drone vertically into the air. Once it reaches cruise altitude, the wings then tilt the propellers to a vertical position so that the drone is propelled forwards. With a payload of 40 kg, the drone has a range of 400 km, increasing to almost 1,400 km for a load of 10 kg. It's ideal for applications such as transporting urgent medical goods or aerial monitoring/data collection.

TECHNOLOGY

The tilt-wing drone was developed by Dufour Aerospace, which was founded in 2017 by Air Zermatt helicopter pilot Thomas Pfammatter. It's the successor to Aero1, an electrically powered aerobatic aircraft. Aero2 has a hybrid propulsion system. During take-off and landing the rotors are powered by the on-board battery. In cruise flight, the power is supplied by kerosene. At a consumption of just three kilos of fuel per 100 km, the drone can get by with a 12 kg tank. The maximum take-off weight is 208 kg, the cruise speed 150 km/h. And the drone technology is scalable: based on its experience with Aero2, Dufour Aerospace is already planning a larger version with six propellers that can transport a 750 kg payload.

MATURITY

A first preliminary batch of three Aero2 drones was completed in 2024. Eight more are due to follow in 2025. These craft have a slightly lower maximum payload and are not yet licensed to fly over built-up areas, but the drones are ready for use and orders have already been placed by the Swedish drone operator European Medical Drone and the US company Spright. If the certification process runs to schedule, series production could start in late 2025. Dufour Aerospace has calculated that it needs around CHF 20 million of funding in the run-up to market launch. Development work to date has been financed by private investors. The Swiss innovation agency Innosuisse also provided a further CHF 2.5 million grant in 2023.



« By using results from flight simulators, we can cut the development time and costs for future drones by more than half. »

— Thomas Pfammatter, CEO



9

INDUSTRY, INNOVATION
AND INFRASTRUCTURE

11

SUSTAINABLE CITIES
AND COMMUNITIES

12

RESPONSIBLE
CONSUMPTION
AND PRODUCTION

Remote access and monitoring for building services

Heating, ventilation, solar systems and other building systems can only run reliably and energy efficiently if they are controlled correctly. HOOC AG provides a cloud-based communication solution for remotely monitoring and controlling building services.



« Our technology has great potential to save energy and optimise the integration of renewable energies into the power supply. »

— Daniel Berchtold, Co-CEO
& Co-founder

CONTEXT

Modern apartment blocks and industrial buildings are equipped with building services or whole-building automation systems. Founded in 2015 as a spin-off from an established HVAC company, HOOC AG has developed an Internet of Things (IoT) gateway with which building systems can be networked and remotely monitored and controlled. Communication takes place via a secure internet connection (VPN technology) and includes data storage in the cloud. Today, around 350 system integrators in building and industrial automation use the communication solution from the Valais-based company. They use it to monitor the technology of a total of 15,000 systems, including apartment blocks, functional buildings, public institutions and schools, as well as various infrastructure systems in the energy supply sector.

TECHNOLOGY

HOOC generates its income by selling its gateways to system integrators. It also generates licence income from a range of services based on cloud storage. For example, a customer is informed by an alarm if an unusually high temperature is registered in a part of the building. Every building system is represented in the cloud by a digital twin. This has the advantage that less hardware needs to be installed at the end customer's premises and also increases data security. The communication tool is easy to use and secure, and has a very low failure rate of just a few hours a year.

MATURITY

The company was already operating profitably just a few years after it was founded. It now generates around a fifth of its turnover abroad: gateways are supplied to Germany, Austria, Belgium and the Netherlands via a subsidiary in Berlin and other sales channels. And the communication solution has the potential to be used in smart grids in the future – electrical appliances can be networked and controlled, for example, so that they are in operation when solar power production is high. HOOC is also working on an energy pooling solution to utilise groups of buildings and their appliances as virtual power plants.



CONTEXT

Vines are highly sensitive to fungal diseases such as mildew and grey mould and require regular protective treatments. The spray treatments used – whether conventional or organic – must be applied only to the vine stocks and prevented from spreading beyond the vineyard. The Valais-based company DIGITALROOTS has come up with a solution for minimising the risk of spray drift: robotic spraying by drone. Initially developed for use in vineyards, it also has applications in market gardening, large-scale crop growing and even banana plantations.

TECHNOLOGY

A Swiss distributor of the agricultural drones manufactured by DJI, DIGITALROOTS offers a complete range of drone-based services including maintenance, accessories, flying permit applications and pilot training. It has also developed a spraying management software system. Called AgriVision, this system produces detailed reports on drone use frequency and flight zones, the products used, and even the doses applied. By buying the drones and a licence to use the software, customers can do the spraying themselves. Alternatively, DIGITALROOTS' Agri.Aero solution is an all-in-one spraying service. A study begun in 2018 in partnership with Agroscope and the Swiss Federal Food Safety and Veterinary Office (FSVO) has shown that spraying vineyards by drone results in significantly less spray drift than any other method. The result is improved precision, a better-quality application and a product saving of 30% in comparison to helicopter spraying and 45% compared to manual spraying. Using drones also makes life easier for farmers in places that are difficult to access and reduces the risk of exposure to the products used.

MATURITY

DIGITALROOTS describes its sales growth as explosive: from 6 ha in 2018, in 2024 its combined contracts covered an area of 340 ha. Its customers are mainly in Valais and, to a lesser extent, those buying its services in the Cantons of Vaud and Bern. The company markets DJI drones in Switzerland and in France through a subsidiary. It also has a presence in Martinique providing drone treatments in banana plantations. Since it broke into banana growing, DIGITALROOTS has international ambitions.

« What our customers like most is the fact that we share our experience of drone-based vine spraying with them. »

– Sébastien Micheloud,
Director



Using drones in precision agriculture

DIGITALROOTS is a company with a mission: to integrate the latest technology into smart, sustainable agriculture. This drone-based vine-spraying specialist has developed a software solution that optimises both crop treatment management and traceability.

The frontrunner in the hydrogen race

A pioneer of hydrogen mobility technologies, GreenGT operates in the niche market of high-performance vehicles. Following on from racing cars and heavy goods vehicles, it is now developing fuel cell systems for Bertrand Piccard's Climate Impulse aircraft.

CONTEXT

The essential decarbonisation of mobility poses many challenges – and electric batteries will not be able to meet them all, especially those requiring a long battery life and fast charging times. To meet those specific needs, many companies have been looking at hydrogen solutions for several years now. And it is precisely these companies that GreenGT is targeting with its cutting-edge expertise in the development of bespoke fuel cell systems and in engineering and consulting on hydrogen mobility technologies.

TECHNOLOGY

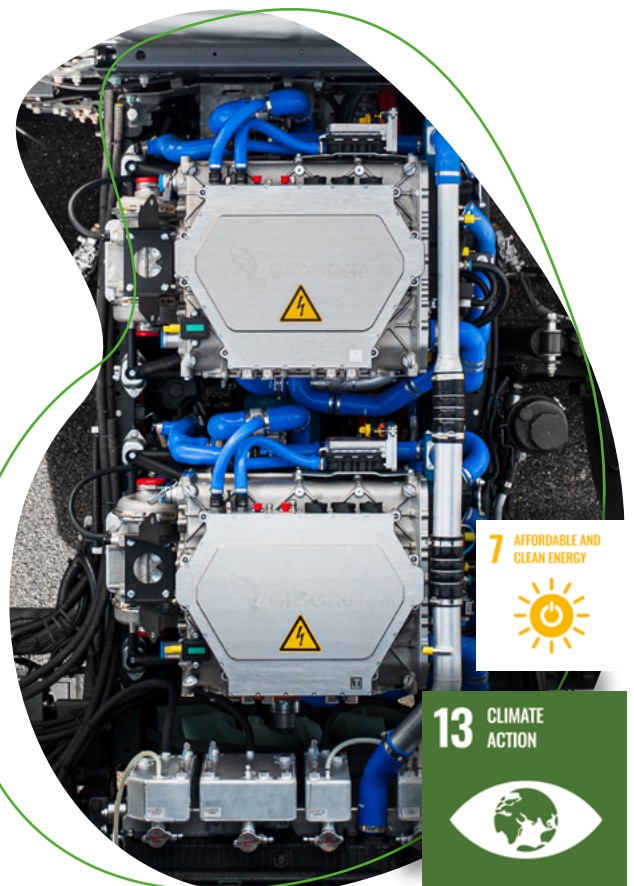
The fuel cell systems developed by GreenGT are aimed at a niche market, and more specifically three application areas: high-performance cars, aeronautics and speciality vehicles. Its solutions offer high power density, thanks to a lightweight technology and very compact integration: they have one of the best weight/power/volume ratios in the world. While GreenGT's origins lie in motor sport – it invented the hydrogen-powered racing car with MissionH24 – its expertise has enabled it to sign a contract with 49 SUD for Climate Impulse, Bertrand Piccard and Raphael Dinelli's project for a non-stop round-the-world flight in a liquid hydrogen aircraft, scheduled for 2028. The company has also made a name for itself in the heavy goods vehicle sector, supplying the high-power hydrogen propulsion unit for a 40-tonne truck as part of the GoH! project.

MATURITY

As the hydrogen mobility market has not yet reached maturity, the company is essentially working on prototypes and pre-series units. Having tested its systems on its own demonstrators for a long time, it is now working on its customers' demonstrators. These include Hyliko, a French company specialising in truck retrofits, and Pratt Miller, an American company operating in motor sport and defence – both part of the global high-performance hydrogen market that GreenGT is targeting with its technology. The company is already marketing its consulting and engineering services in this sector.

« We are proud of our cutting-edge positioning in the supply of high-performance hydrogen systems for mobility. »

– Jean-François Weber, CEO



13 CLIMATE ACTION



**3** GOOD HEALTH AND WELL-BEING**6** CLEAN WATER AND SANITATION**7** AFFORDABLE AND CLEAN ENERGY**8** DECENT WORK AND ECONOMIC GROWTH**9** INDUSTRY, INNOVATION AND INFRASTRUCTURE**12** RESPONSIBLE CONSUMPTION AND PRODUCTION

The world's cleanest car

The Softcar is a new generation of vehicle, in which its entire life cycle is considered. Frugal, lightweight, recyclable and low carbon, this urban electric car has been developed in the utmost secrecy. It's finally ready to be unveiled, bringing cars fully into the circular economy. The company behind it, Softcar SA, intends to create assembly units in cities all over the world.



« The Softcar is great news for the fight against global warming and urban pollution. Electromobility only makes sense if cars are lightweight and the entire life cycle is taken into account. »

—Jean-Luc Thuliez, CEO

TECHNOLOGY

The Softcar has fewer than 1800 parts (compared to an average of around 45,000 for a conventional internal combustion vehicle) and weighs only 640 kg, which is one of the key factors in its performance. Apart from the tyres and light bulbs, every component in this four-seater was developed in Switzerland. With regard to the engine, the electric battery is coupled to a natural-gas range extender, giving the car a range of 2 x 200 km. Every stage in the life cycle of all the products used has been designed to have minimal impact. Measurements of CO₂ emissions throughout the Softcar's life cycle are being validated with the support of the Swiss Federal Office of Energy (SFOE) to confirm that it is the car with the smallest ecological footprint in the world. The company also stands out for its innovative production methods, using small assembly units located as closely as possible to major cities. The car and its production methods are protected by a portfolio of patents, while the business model is based on country-by-country licensing.

MATURITY

After five years of testing, SOFTCAR will have been unveiled to the public at the Paris Motor Show (October 2024). Two vehicles have been showcased: one electric and one equipped with a natural gas range extender. The target market is global, through local assembly centres. Several cities around the world have already expressed an interest in accommodating these production units. The Swiss holding company Holdigaz has contributed its industrial expertise and a new 2024 funding round to finance the Softcar's international rollout, after acquiring a stake in the company in 2019. The first assembly plant is being set up in Switzerland in 2024, and production of the first commercial models will begin once the vehicle has been approved.

CONTEXT

The idea of creating a true urban electric car was the dream of watchmakers Ernst Thomke and Nicolas Hayek; Jean-Luc Thuliez joined the project as CEO at the end of the 1990s. His prior experiences at Swatch Mobile, Volkswagen, MCC Mercedes-Smart and Cree led him to create Softcar SA in 2012. The goal was to establish an industry for high-quality, safe, ultra-ecological, recyclable and low-cost vehicles that could be manufactured anywhere in the world, using a business model that is as innovative as the product itself. And, with that, make a large-scale contribution to decarbonising personal urban mobility.

2

ZERO
HUNGER

9

INDUSTRY, INNOVATION
AND INFRASTRUCTURE

12

RESPONSIBLE
CONSUMPTION
AND PRODUCTION

Transforming biowaste into food ingredients

A Valais-based start-up company is developing an innovative technology and business model for recycling the byproducts of beer brewing. They will be used as raw materials by manufacturers of ingredients for the bakery sector, among others.

« Initially designed for breweries, our solution is also of interest to manufacturers of plant-based milks and fruit juices, and could therefore have a global impact on the food system. »

— Aurélien Ducrey,
CEO & Co-founder



CONTEXT

Every year, European breweries generate some 8 million tonnes of biowaste. Known as draff, it consists of the spent grain used in brewing beer, and it still contains many fibres and nutrients. It was this fact that spurred the co-founders of ProSeed to develop a solution that enables food and beverage producers to transform their byproducts into raw materials for the agri-food industry. In 2023, what started as a master's thesis became a start-up on the Energypolis Campus.

TECHNOLOGY

ProSeed has developed a drying method that stabilises wet byproducts. For example, malt draff from breweries can only be stored for four hours. If it is transformed into barley flakes, however, it retains its properties for at least 18 months. The drying unit is designed to be integrated into a shipping container so that it can be installed as a 'plug-and-play' system at the end of any industrial brewing process. On-site drying avoids the extra weight caused by moisture when transporting unprocessed residues – which are made up of about 80% water. The company has an unusual business model: it sells the machines and buys back the byproducts to market them to the food ingredient manufacturers in its network, who can use them directly. This enables breweries to make a profit from recycling their biowaste, with an estimated return on investment of less than five years.

MATURITY

The first containerised unit is operational in a pilot hall and has the potential to process 500 tonnes of waste a year, with an output of around 120 tonnes of finished product. This 'showroom' unit should enable the technology to be optimised on a real scale. The first commercial containers are expected to be installed at breweries in the second half of 2025. The ingredients produced from the barley flakes, such as protein concentrates, are intended primarily for the bakery sector, in partnership with specialist ingredient manufacturers. Actively supported by Energypolis, ProSeed raised CHF 1.7 million in the pre-seed round and has opened a new financing round of CHF 2 million in 2024. Its sights are set on the Swiss market, with Europe to follow.



5



Fribourg



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UHCS

Building homes out of plastic

Housing millions of people while also recycling plastic waste? UHCS is on its way to pulling off this double coup – its standardised recycled PET profiles could well revolutionise the construction sector worldwide.



« We have developed simple manufacturing protocols so that we can entrust the production of PET profiles to local players anywhere in the world. »

– Igor Ustinov,
CEO

CONTEXT

During his philanthropic activities, Igor Ustinov became aware of the need to develop a rapid, low-cost construction system to provide decent housing for as many people as possible. Drawing on his knowledge of materials and moulding techniques, he invented modular extruded profiles made from recycled and recyclable PET and convinced André Hoffmann to join him on this adventure. Five patents – registered in 120 countries – later, UHCS (Ustinov Hoffmann Construction System) received its first plastic columns and beams for demonstration purposes. UHCS has been supported in its first steps by The Ark, on the Energypolis campus, and is now ready to take off.

TECHNOLOGY

Applying the principles of the circular economy, UHCS aims to revitalise the dormant plastic waste sector to contribute to development without impacting nature. The PET profiles, produced in two sizes – 20 x 20 cm and 30 x 30 cm (for multi-storey buildings) – can be assembled lengthwise, like a construction kit. They are 30 % stronger than wood, and both cheaper and lighter. Their production uses very little water, in a closed circuit, compared with the 300 litres per tonne required for concrete. Designed for constructing floors and ceilings, the extruded profiles are complemented by panels, also in PET, for walls and facades. Different densities provide different levels of load-bearing capacity and insulation, depending on the local climate. The houses built in this way will be modular, easy to disassemble and recyclable. The profiles can be manufactured anywhere in the world by local extrusion companies, as close as possible to where used PET is collected.

MATURITY

The first profiles were manufactured by an extrusion company in St. Gallen, eastern Switzerland, in early summer 2024, enabling UHCS to pursue compliance certification for this new construction material in relation to the Eurocodes and other standards. The company is collaborating with the University of Fribourg to this end. From autumn 2024, demonstrations are starting at the Blue Factory, in Fribourg, and in Turkey, where the government is very interested in this solution for rebuilding homes destroyed by the last earthquake. For now, the other markets targeted are Austria and Germany, where the company hopes to expand via local subsidiaries, in association with local players in the construction industry.

1 NO POVERTY



6 CLEAN WATER AND SANITATION



8 DECENT WORK AND ECONOMIC GROWTH



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



15 LIFE ON LAND



Only turn on the heating when it's needed

« The heating industry is going through a period of transformation that offers great scope for improvements and new business models. »



— Sebastian Hersberger, CEO and Co-founder

The heating industry is far less conservative than is sometimes claimed: Yuon Control AG has developed a heating control system that factors in weather forecasts and buildings' thermic properties to cut energy use by an average of 25%. It is mainly intended for use with district heating.



TECHNOLOGY

The control system reduces energy use without compromising on comfort in people's homes. An optimisation algorithm developed by co-founder Lorin Mühlebach at ETH Zurich ensures that buildings are only heated when necessary. It does so by factoring in weather forecasts. The self-learning system also assesses buildings' thermic properties, such as their heat retention capacity. On this basis, it predicts heating requirements and controls the heating accordingly – for instance, shutting it off if clear skies and warm sunshine are expected in the next few hours

CONTEXT

In Switzerland, buildings are responsible for around 40% of energy use and a third of domestic CO₂ emissions. Heating of residential and commercial properties is one key area where energy savings could be made. Yuon Control, which was launched in Bern in 2020, developed a fully automated heating control system (patent pending) to help achieve that goal. A study by Lucerne University of Applied Sciences and Arts found that it cuts energy used for heating by 9–34% compared with conventional systems. Because the system is mainly used in district heating networks, the savings are multiplied across a large number of buildings.

MATURITY

District heating operators can use the control system to heat buildings in their network in a way that avoids production peaks in the central heating plant. That helps to cut CO₂ emissions, since production peaks are often covered using gas-fired heating. The Landiswil district heating network in the canton of Bern installed a Yuon control system in autumn 2023, and several other Swiss networks have followed suit. Although it is primarily focusing on the domestic market for now, Yuon is already in talks with potential customers in Germany. A first funding round in early 2024 raised CHF 600,000. A second round is planned for the end of the year.

7 AFFORDABLE AND CLEAN ENERGY



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



11 SUSTAINABLE CITIES AND COMMUNITIES



13 CLIMATE ACTION



Save energy when showering

Because modern buildings are very well insulated, their heating energy requirement is often very low. Nowadays, energy use for hot water is often higher than that for heating. And that's where Joulia SA's heat exchanger can help: it reduces the energy used when showering by up to 50%.

CONTEXT

Nowadays, if you want to further reduce energy consumption in the building sector, the best place to start is with hot water, since in new buildings that accounts for a greater proportion of energy use than heating. Joulia offers a solution in the form of a heat exchanger that cuts the energy used for showering by up to 50%. The exchanger is installed in the shower outflow. Pipes filled with cold fresh water absorb heat from the used shower water and reroute it to the mixing valve so that the heat can be reused for the shower.

TECHNOLOGY

The heat exchanger consists of copper pipes with a double-wall design for added safety. It doesn't need electricity to work, and because there are no moving parts it is highly durable. The basic system was developed at the Biel-based innovation centre Creaholic, following which Joulia SA was founded in 2010. The first heat exchangers in their current form were installed in 2015 and are still in use today. The drinking water-certified system is suitable for new showers but can also be retrofitted in existing set-ups if the shower tray is replaced. The Joulia heat exchanger is now certified in accordance with SIA 385/2, the Swiss Society of Engineers and Architects' planning standard for hot drinking water systems in buildings, which confirms that showers with the exchanger use significantly less energy. For planners, that means smaller storage tanks are allowed if showers are fitted with an exchanger.



« With the Joulia-Twinline, our new product line with twice as many heat exchanger pipes, we've achieved another substantial increase in energy efficiency. »

— Reto Schmid, CEO & Co-inventor

MATURITY

Joulia offers the heat exchanger in various sizes and efficiency classes. Over the past few years, the company has successfully expanded sales of its energy-saving solution and formed partnerships with ACO, Duravit, Kaldewei, Meier and other shower part manufacturers. These bathroom products companies are increasingly integrating Joulia heat exchangers into their own shower systems. Joulia grew by 40% annually in recent years and in 2024 sold several thousand heat exchangers. The main sales markets to date have been Switzerland and the Netherlands, but in future Joulia wants to grow its sales in Germany, Austria and the UK too.



A unique agrivoltatics solution

The co-founders of Voltiris got their heads together and came up with a bright idea: using spectral filtering technology to develop the very first solar modules compatible with market gardening under glass, enabling sunlight to do two things at the same time.

« Our spectral filtering technology makes Voltiris the only player on the market capable of successfully combining glasshouse agriculture with solar energy production – without compromise. »

– Nicolas Weber, CEO & Co-founder



CONTEXT

Higher energy costs, pressure to reduce carbon emissions: high-tech-glasshouse market gardeners face numerous challenges, not least because up to 90% of the energy these facilities consume is from fossil fuels. To develop economically viable, resilient, carbon-free food-production systems, Voltiris has come up with a way of using arable land for two purposes simultaneously – producing food and generating electricity – using solar modules compatible with growing crops in glasshouses.

TECHNOLOGY

Using spectral filtering, these solar modules separate off the components of sunlight required for photosynthesis in plants while the unused part of the light spectrum is reflected and focused on photovoltaic cells to generate electricity. This solution, unique to the market, provides a way of producing renewable energy without affecting the yield of the crops grown under the modules. And that's not all: because the modules are installed inside the glasshouses, no planning permission is required. Voltiris estimates that its technology could meet around 65% of the energy requirements of every equipped glasshouse, making a potential saving of 200,000 tonnes of CO₂ per year for Switzerland's estimated 500 hectares under glass.

MATURITY

Since it was founded in 2022, Voltiris has proved its technology works through 15 projects in five countries, demonstrating the agronomic and energy-saving credentials of its solution. In 2023 the start-up set up its first two commercial projects in Switzerland, one of which was for a tomato grower in Geneva in a project owned and funded by the energy company Romande Energie, with the support of the Swiss Climate Foundation, Service Industriels de Genève's Vitale Vert Fund and the Swiss Federal Office of Energy. In 2024 Voltiris began its first industrial-scale project: a hectare of glasshouses in the Canton of Aargau is due to be fitted with the technology by the end of the year. In addition to Switzerland, Voltiris has projects under way in France and the Netherlands. In the longer term, the company has set its sights on the rest of Europe, North America and the Middle East. A round of funding is planned for 2024 to fast track the company's industrial and commercial growth.



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PHOTOS

Adobe Stock, specific credits are indicated below each image.

TRANSLATION

Boomerang Marketing

PRINTING

Imprimerie de la Tour - November 2024 - 500 copies

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WARNING

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