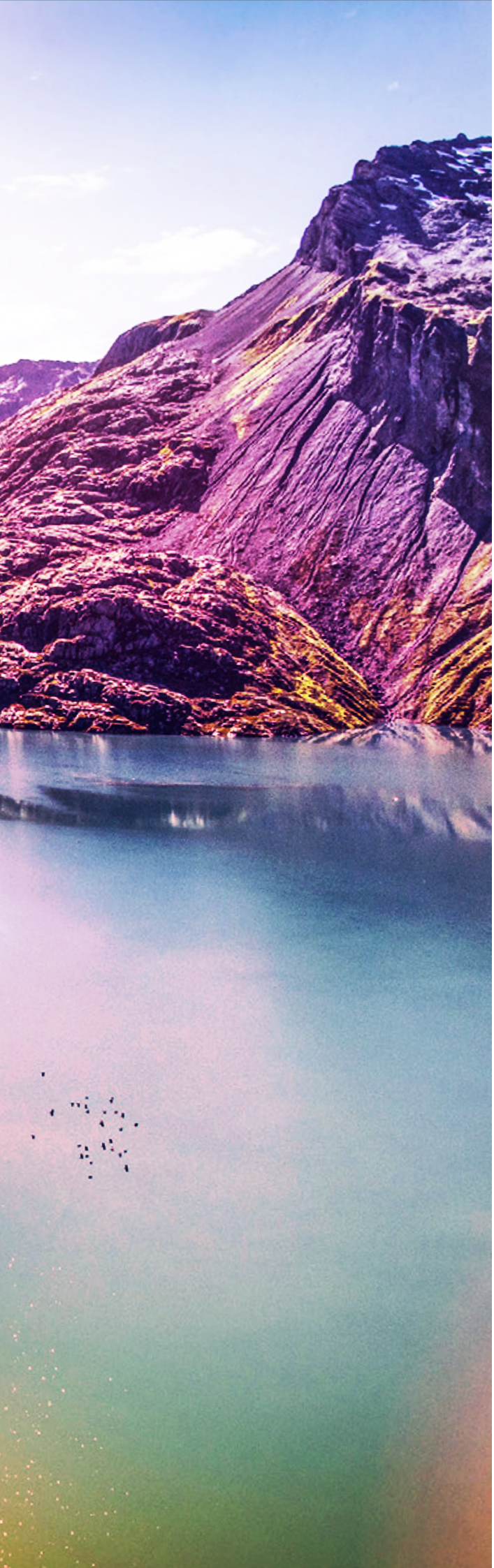
SWISS CLEANTECH REPORT

4th edition



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Confédération suisse
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Swiss Confederation

Swiss Federal Office of Energy SFOE

Federal Office for the Environment FOEN

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SWITZERLAND GLOBAL ENTERPRISE
enabling new business

Cleantech
Western Switzerland Sustainability Cluster Alps

Swiss business can lead the way towards sustainable and inclusive prosperity

Today, it would be simply unprofessional for a business manager not to consider the risks associated with our planet's limitations. This is because our existing value-creation model will not work in the long term, either environmentally or socially. It is therefore high time that we created the framework conditions that will enable us to progress towards sustainable and inclusive prosperity.

There are now more than eight billion human beings on planet Earth – and our natural resources are running out. We must therefore learn to do more with less. One of the ways of achieving this is to develop initiatives that encourage businesses to stop focusing solely on increasing their financial worth and dividends and start thinking also about their impact on our social, human and environmental capital. Another is to invest in clean technologies and make use of every single innovation that enables us to limit the impact of human activities on the environment.

Swiss business has a key role to play in opening up this new approach. Our country has successfully created prosperity despite having very few natural resources and this has always given our industries a clear direction, forcing us to focus on innovation. Furthermore, Switzerland enjoys a culture of excellence in technology. Our education and training system, which boasts a host of learning pathways including universities of applied sciences and federal institutes of technology, is unique. What's more, these specialist science and technology universities, which rank highly internationally, are a hotbed of talent, particularly in the field of cleantech, providing the next generation of knowledge and skills needed to bolster the know-how already permeating the country's economic fabric.

We must invest all these assets in creating sustainable and inclusive prosperity. We now have no choice but to act to change our model, switching from an extractive polluting economy to a regenerative economy.

André Hoffmann
Vice-Chairman, Roche Holding AG
Co-founder of InTent

Introduction to the context and the subject of cleantech

In other countries, Switzerland's image is one of Alpine landscapes, crystal-clear lakes, chocolate and luxury watches. Many people are aware that Switzerland is also at the cutting edge of innovation in a number of fields. This innovation is happening in watchmaking and pharma/biotech of course, but fewer realise that it also applies to the country's green technologies, or cleantech as we like to call it.

The purpose of this report is to present Switzerland's dynamic and innovative approach to green technologies and sustainability, and in particular to showcase the efforts that the country is making in combating climate change and reducing CO2 emissions to work towards a carbon-neutral society.

With its stable political, economic, social and financial framework conditions, Switzerland is a hotbed of innovation, a fertile breeding ground that encourages the emergence of innovative technologies and practical solutions. In this report, we present these solutions, all of which are helping to bring about a more sustainable future for current and future generations and which are already helping us meet the Sustainable Development Goals championed by the United Nations.

This fourth edition of the Swiss Cleantech Report provides a snapshot of Switzerland's global innovation credentials, demonstrating that the country is a cleantech nation in its own right. Of course, we could do better. It is important to remain humble and bear in mind that the optimum is very rarely the sum of several maximums. Rather, the optimum, or creating a balance, is about weighing up the possible solutions. Because of its federalist culture, Switzerland is expert in doing this, and with its strong values, the Swiss nation can certainly be a source of inspiration to other regions and countries.

What is cleantech ?

DEFINITION AND CLASSIFICATION

Cleantech refers to the technologies, techniques and services that enable us to exploit natural resources in more efficient ways. It involves an extremely diverse range of products, services and processes developed not just to provide superior performance at lower cost but also to reduce – or even eliminate – their negative impact on the environment.

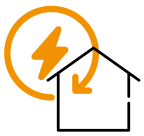
And all this must of course be achieved while consuming our planet's natural resources in a more responsible way. It is important to realise that cleantech is about much more than simply using technology. It also encompasses all those activities and services that raise awareness of environmental and energy issues and bring about direct action to safeguard the environment and preserve natural resources. Societal and behavioural aspects are therefore playing an increasingly important role, supported by digital technology, mobile apps, IoT and AI that facilitate access to and the processing and distribution of specific data.

ARTIFICIAL INTELLIGENCE

HYDROGEN

HYBRID TECHNOLOGIES

PREVENTION OF NATURAL DISASTERS



ENERGY EFFICIENCY

MISCELLANEOUS

SUSTAINABLE CONSTRUCTION /PROPTECH

OTHER

ENERGY EFFICIENCY

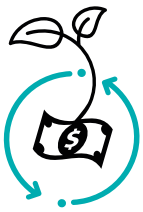
PHOTOVOLTAICS

HYDROPOWER

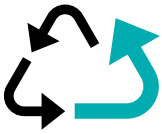
SMARTGRIDS

ENERGY STORAGE

OTHER RENEWABLE ENERGIES

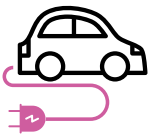


CIRCULAR ECONOMY

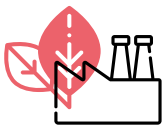


WASTE, RESOURCE EFFICIENCY, RECYCLING

ADVANCED MATERIALS



ECO-MOBILITY



INDUSTRIAL ECOLOGY /CONSULTANCY

AGRONOMY AND COMMERCIAL FORESTRY

ENVIRONMENTAL TECHNOLOGIES

TRANSPORTATION

FINANCE

SUSTAINABLE FOOD PRODUCTION

WATER

RENEWABLE ENERGY PRODUCTION AND DISTRIBUTION

SERVICES

AGRITECH

RESOURCES

CLEAN TECHNOLOGY CLASSIFICATION

The Sustainable Development Goals

A REALITY IN SWITZERLAND

The Sustainable Development Goals (SDGs) refer to a set of 17 objectives established by the member states of the United Nations. These SDGs constitute the reference framework for sustainable development on a global scale. They follow 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, businesses, 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 meeting these goals. And this is where cleantech comes in. It can help meet some of these goals more quickly, more effectively and more cheaply.

Throughout this publication, you will find references to these 17 goals, highlighted by a separate icon for each one.

Source: https://www.un.org/sustainabledevelopment/

Switzerland, international climate protection partner

For decades, Switzerland has been a stakeholder in the major climate protection agreements. The country has also passed laws and adopted national strategies (the Energy Strategy in 2007 and the Long-term climate strategy in 2021) to reduce emissions and promote renewable energy. It has also adopted a net-zero strategy designed to achieve carbon neutrality in the long term.

Here is an overview of the different practical initiatives and commitments made by Switzerland in recent years.

INTERNATIONAL

The Kyoto Protocol
Signed in 1998 in a bid to slow climate change by taking steps to protect the climate.

The Blue Peace initiative
This Swiss initiative uses a diplomatic approach to encourage cross-border cooperation in the sustainable management of water resources. Water plays an essential part in climate strategies and is a major issue, particularly when access to water is limited by cross-border constraints. It then becomes a potential source of conflict, impeding the implementation of climate strategies.

The Paris Agreement
Signed in 2017, thereby committing to reduce its emissions by half by 2030 (based on 1990 emissions) and taking into account some of its emissions reductions abroad.

NATIONAL

The Energy Act

The Fukushima nuclear disaster in 2011 led Switzerland to re-evaluate its energy policy and look at ways of transitioning to more sustainable energy sources. The construction of new nuclear power plants was banned. In the light of this decision and the international energy situation, a transformation of Switzerland's energy industry is essential. With this in mind, the revised Energy Act, adopted by the Swiss people in 2017, aims to promote renewable forms of energy, reduce energy consumption and improve energy efficiency.

The CO2 Act

A first version of the Federal Act on the Reduction of CO2 Emissions came into force in Switzerland as early as 2000. Its aim was to reduce greenhouse gas emissions to slow climate change.

The Climate and Innovation Act

Following the publication of the special report by the Intergovernmental Panel on Climate Change (IPCC) on the consequences of global warming of 1.5°C, in August 2019 the Federal Council set the objective of net-zero greenhouse gas emissions for Switzerland by 2050. By adopting the new Climate Act in 2023, Switzerland has for the first time in its history the legal means in place to accelerate the transition to renewable energy.

The Climate and Innovation Act also earmarks CHF 2 billion of financial support over 10 years to replace gas and oil boilers with more climate-friendly heating systems, plus an additional CHF 1.2 billion of support to encourage technological innovation by businesses.

> **Cleantech today is profitable, creates jobs and protects the environment. By modernising our infrastructures and making them more efficient, it will allow the world to decarbonise.**

Bertrand Piccard
Initiator, Chairman and Solar Impulse Pilot

From words to action

SWISS PROGRAMMES SUPPORTING CLEANTECH

Switzerland has introduced a wide range of laws, ordinances and incentives to promote climate protection and a zero-carbon society. In addition to this legal framework, practical tools are now also available in Switzerland to help businesses and individuals to innovate and to consume less and more responsibly. Here are a few examples.

EnAW

The role of EnAW, the Energy Agency of the Swiss Private Sector, is to promote energy efficiency and the transition to sustainable energy sources in the economic sector. EnAW helps businesses to optimise their energy consumption by providing advice, technical expertise and financial incentives. The agency plays a key part in promoting a greener, sustainable economy by encouraging businesses to adopt responsible energy practices.
www.aenec.ch

ProKilowatt

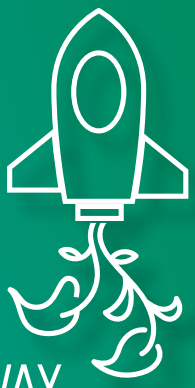
The purpose of the ProKilowatt programme, set up by the Swiss Federal Office of Energy, is to encourage Swiss businesses and institutions to improve their electrical energy efficiency. It offers financial support and incentives to encourage investment in energy-saving measures. Thanks to ProKilowatt, a large number of businesses have been able to lower their energy consumption, reduce their costs and contribute to Switzerland's energy transition. Since the programme was launched in 2010, it has supported more than 870 projects and programmes to the tune of some CHF 370 million. This has resulted in savings of around 1,000 GWh of electricity a year, the equivalent of the annual electricity consumption of approximately 185,000 households.
www.prokw.ch

The Technology Fund

The Technology Fund is a political instrument of Switzerland's climate strategy. Run by the Federal Office for the Environment, it offers loan guarantees to Swiss businesses developing new products that contribute to a long-term reduction in greenhouse gas emissions. Since 2014, the fund has issued 165 bonds worth a total of CHF 265 million. The scheme has been effective in reducing CO2 emissions, saving 6.3 million tonnes of CO2 equivalents (tCO2e) between 2014 and 2021.
www.technologyfund.ch

The Buildings Programme

The purpose of the Buildings Programme, developed by the Swiss federal government and the cantons (local authorities), is to reduce the energy consumption and CO2 emissions of Switzerland's building stock. Various measures such as investing in renewable energy sources for heating and improving building insulation are helping to achieve this objective. Switzerland's cantons have the power to award grants to projects designed to reduce energy consumption. Every year, more than CHF 600 million are invested in this sector.
www.leprogrammebatiments.ch



LEADING THE WAY IN INNOVATION AND CLEANTECH

In the various innovation and climate protection performance indices, Switzerland is frequently very well placed. Here is how Switzerland has performed in three recently published indices.

1st place

Global Innovation Index 2023 – WIPO
https://www.wipo.int/global_innovation_index/en/2023/

1st place

World Talent Ranking 2022 (quality of the workforce) – IMD
https://www.imd.org/centers/wcc/world-competitiveness-center/rankings/world-talent-ranking/

7th place

ESG Index (environmental, human rights and health & safety risks) – Global Risk Profile
https://risk-indexes.com/esg-index

Pilot and Demonstration (P+D) programme
The Swiss Federal Office of Energy (SFOE) promotes the development and testing of new technologies, solutions and approaches related to the economical and ecological use of energy, the transmission and storage of energy and the use of renewable forms of energy. The Pilot and Demonstration programme acts as an interface between research and the market. Its main aim is to help increase the status of development of new technologies so that they can ultimately be brought onto the market.
www.bfe.admin.ch/pilotdemonstration

Environmental technology promotion
The federal government promotes the development of technologies, industrial plants, processes and products (goods and services) that reduce damage to the environment in the public interest. This scheme backs pilot and demonstration projects and projects designed to improve efficient consumption of resources and to increase the competitiveness of the Swiss economy. It supports projects in the following fields: waste and recycling, biodiversity, contaminated ground and sites, climate, noise reduction, air quality, hazard prevention, water, and efficient use of resources. Around CHF 4 million in funding is made available every year.
https://www.bafu.admin.ch/bafu/en/home/topics/education/innovation/umwelttechnologiefoerderung.html

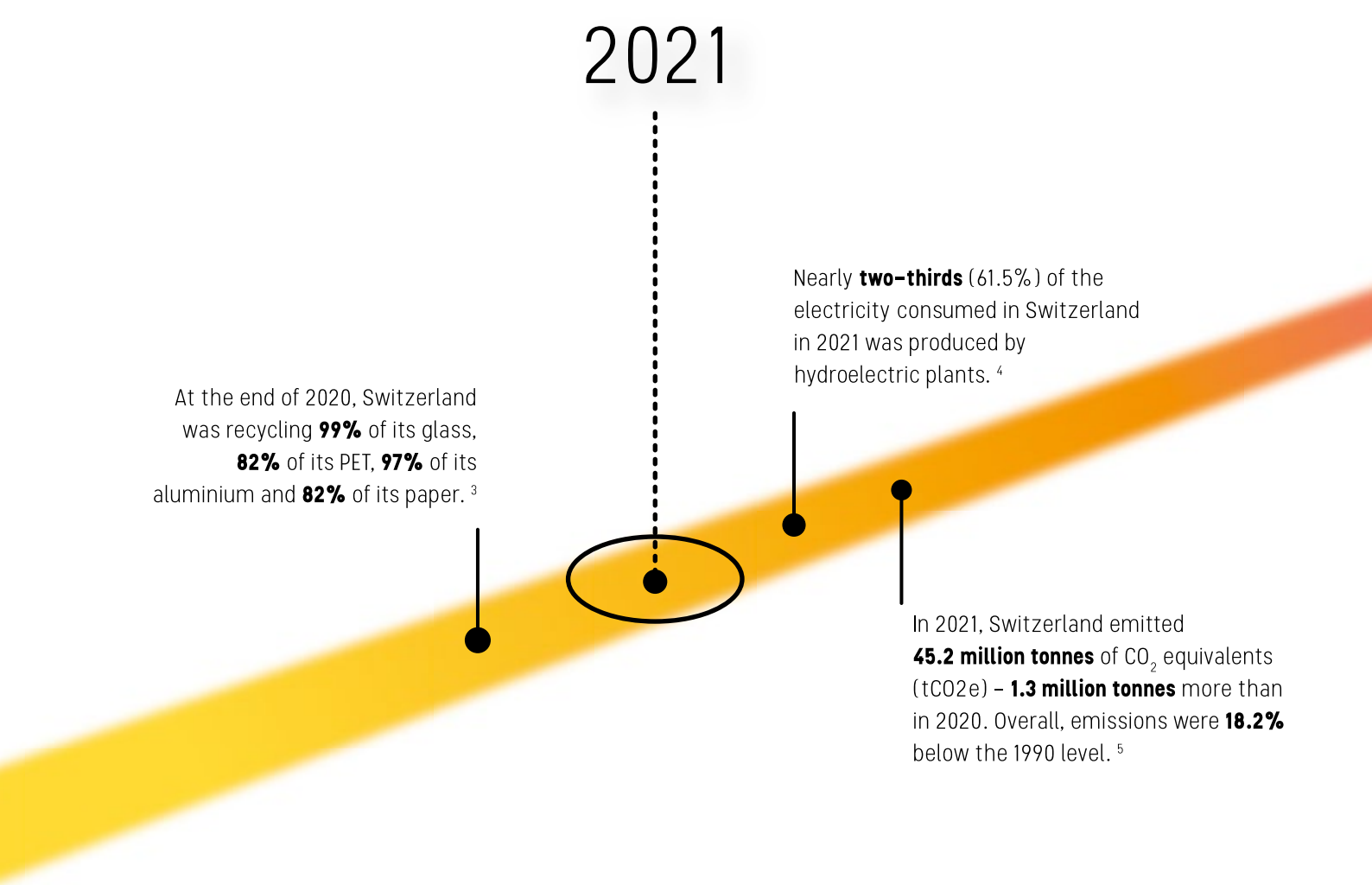
"Adapting to climate change" pilot programme
This programme, run by the Federal Office for the Environment from 2018 to 2022, supported 50 practical climate change projects. It involved public and private organisations from various regions of Switzerland introducing adaptive measures in areas such as drought prevention, dealing with very high temperatures and mitigating flooding. The results obtained are helping Switzerland prepare for future changes in the environment.
www.nccs.admin.ch

REPIC
REPIC (Renewable Energy, Energy and Resource Efficiency Promotion in Developing and Transition Countries) is a Swiss government interdepartmental platform whose primary objective is to transfer know-how and technology in order to develop renewable energy, energy efficiency and efficient use of resources in developing and transition countries.
www.repic.ch

Swiss Import Promotion Programme (SIPPO)
This program is supported by the Swiss State Secretariat for Economic Affairs (SECO) within the framework of its economic development cooperation. In collaboration with a network of experts in the SIPPO partner countries (see weblink below), selected business support organisations (BSOs) promote the export capacity and performance in specific sectors of export-ready companies in targeted countries.
www.sippo.ch

Switzerland's cleantech credentials in figures

In Switzerland, **97%** of sewage is treated at wastewater treatment plants. [1]



[1, 2 3 & 5] Federal Office for the Environment, [4 & 6] Federal Office of Energy, [7] Swisssolar, [8] Federal Statistical Office, [9] Suisse Energie

2022

With a carbon footprint of **12tCO_2e** per inhabitant in 2020, Switzerland is still well above the global limit, which is 0.6tCO_2e per inhabitant per year. [2]

In the first half of 2022, **one in four** newly registered cars in Switzerland was fully or partially electric. [8]

In 2021, **53%** of property owners in Switzerland already had a heat pump or said they might consider installing one. [6]

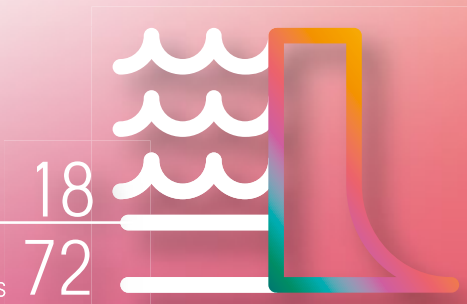
Approximately **9100** electric vehicle charging points were available in Switzerland at the end of 2022. [9]

By the end of 2021, nearly **150,000** solar installations with a total power output of 3.65 gigawatts had been installed in Switzerland. They covered 6% of the country's electricity needs. [7]

If we want to reduce our carbon emissions, we must firstly acknowledge the CO2 impact our actions are having and promote the use of every clean technology that helps us to reduce our energy consumption.
With its experience in electricity, Switzerland is very well positioned to develop products and solutions that are tried and tested when it comes to reducing our carbon footprint. The Swiss Confederation must do everything it can to foster this development and prevent Swiss businesses from moving abroad. The cleantech boom is an extraordinary opportunity to create jobs and innovations.

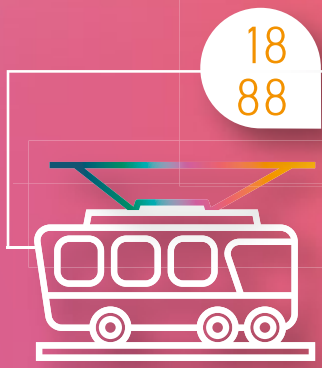
André Borschberg
Co-Founder of H55 and Solar Impulse Pilot

Significant dates that have marked Switzerland's enduring love story with cleantech



1872

Construction of the Maigrauge Dam is completed. This is the first concrete dam in Europe, built to supply the city of Fribourg with drinking water and power the region's industry.

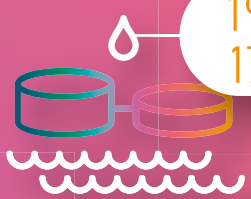


1888

Switzerland begins to electrify its rail network on a massive scale, ahead of other countries. Electrification begins with the country's tram routes and branch railway lines. The first section to be electrified in Switzerland is the Vevey–Montreux–Chillon tram line, in 1888.

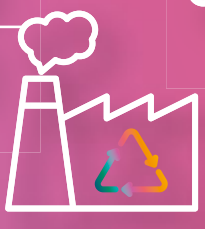
1891

Founding of the Swiss company Brown, Boveri & Cie (BBC) in Baden, later to become ABB, a key player in electrification and energy technologies.



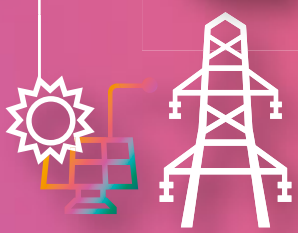
1917

Construction of Switzerland's first waste water treatment plant, in St.Gallen.



1961

Opening of KEZO, the first waste processing and recycling plant, near Zurich.

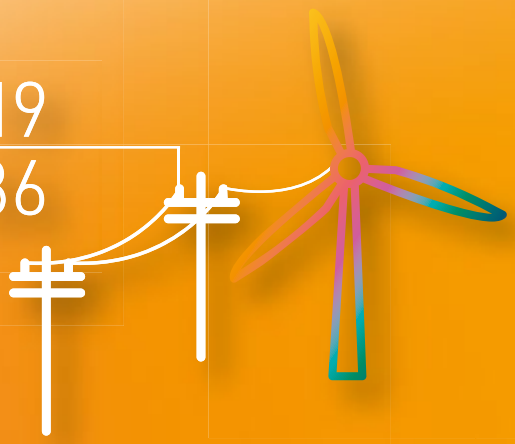


1982

Switzerland becomes the first country in Europe to connect a PV solar power system to the electricity grid. This installation is still in operation today.

1986

Switzerland's first wind farm to be connected to the electricity grid becomes operational. The country's first wind turbine is still going strong 30 years on, although it does require major maintenance.



1991

BATREC builds a battery recycling plant at Wimmis. Switzerland has one of the highest battery return rates in Europe.

1992

Opening of the first biogas processing plant in Switzerland, at Gossau, which uses organic waste to produce biogas and electricity.

1993

The first soil washing plant is opened in Zurich by Eberhard. This facility helps protect the environment by washing rubble and soil contaminated with harmful substances.

1997

Opening of the first commercial wind farm in Switzerland, at Mont-Crosin.

2011

The Federal Council announces its intention to phase out the use of nuclear power.

2017

A fourth treatment stage is introduced at waste water treatment plants. Powdered activated charcoal or ozone is used to remove micropollutants.

The start-up landscape in Switzerland

A country's dynamism can be measured in different ways. The number of new companies being established, in particular innovative start-ups, is a good barometer of its level of innovation. Below are a few facts about fledgling Swiss cleantech businesses

CLEANTECH START-UP KEY FIGURES

50
Every year, around
new cleantech start-ups
are established in Switzerland

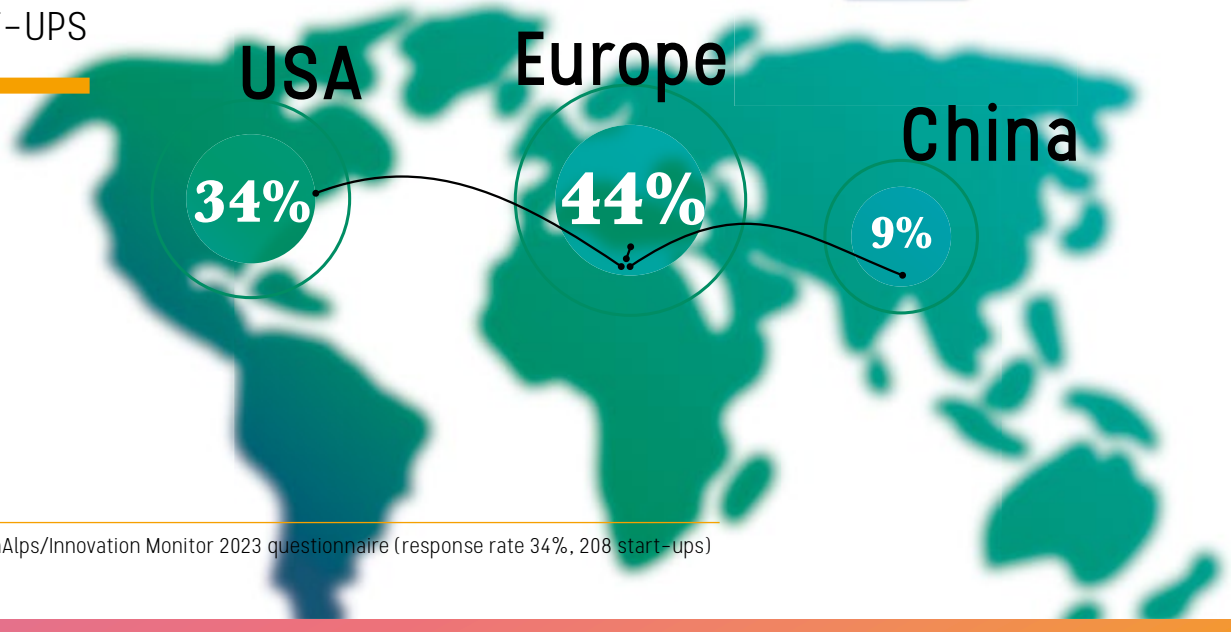
Every **sixth** start-ups
is in the cleantech industry

>430
clean technology start-ups
created over the last
10 years are still active

70%
the percentage
of women employed
in companies
is increasing

30%

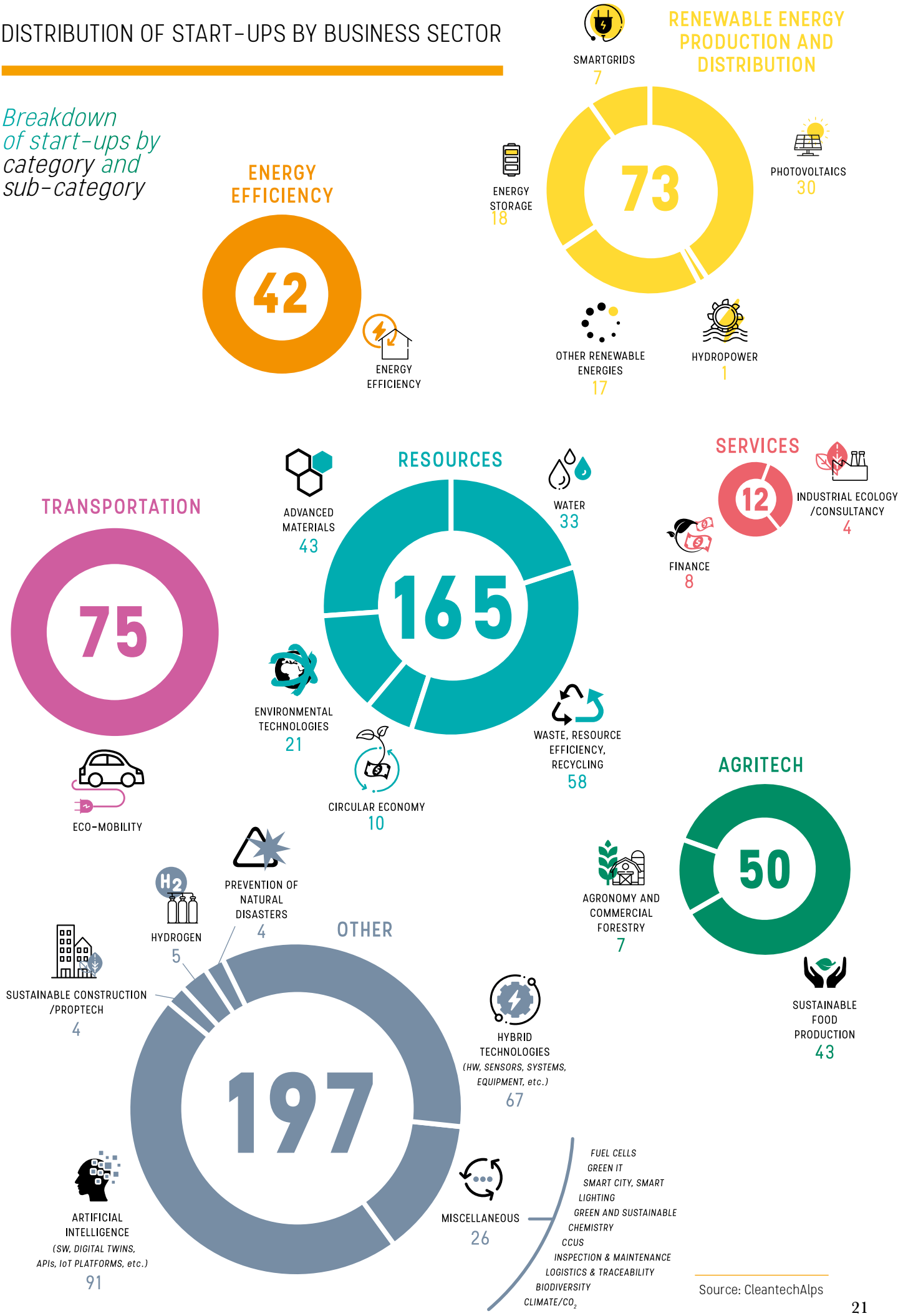
EXPORT TARGETS FOR SWISS CLEANTECH START-UPS



Source: CleantechAlps/Innovation Monitor 2023 questionnaire (response rate 34%, 208 start-ups)

DISTRIBUTION OF START-UPS BY BUSINESS SECTOR

Breakdown of start-ups by category and sub-category

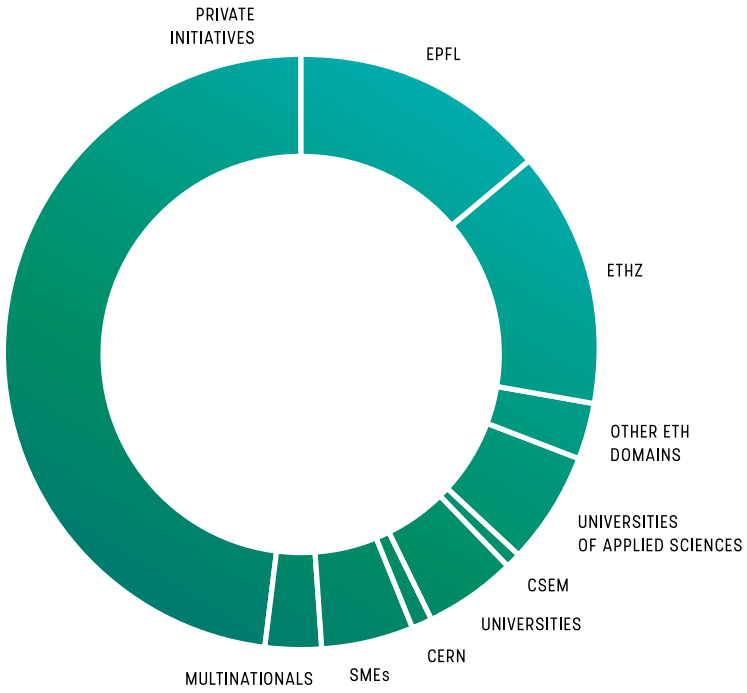


Source: CleantechAlps

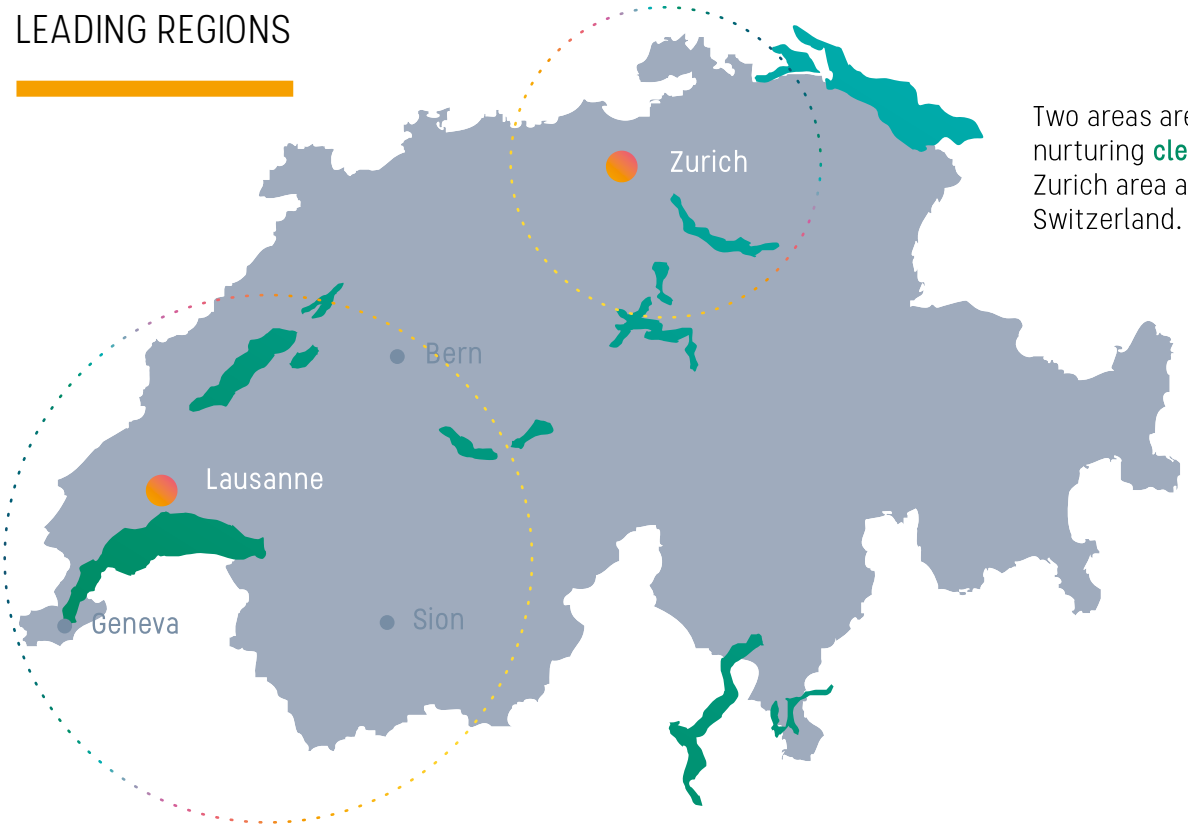
EMERGING SECTORS

DISTRIBUTION OF START-UPS ACCORDING TO THEIR ORIGIN

The Swiss cleantech start-up ecosystem is characterised by the complementary and well-balanced generation of spin-offs by academia (**45%**) and the private sector (**55%**) through personal initiatives, SMEs and multinationals.



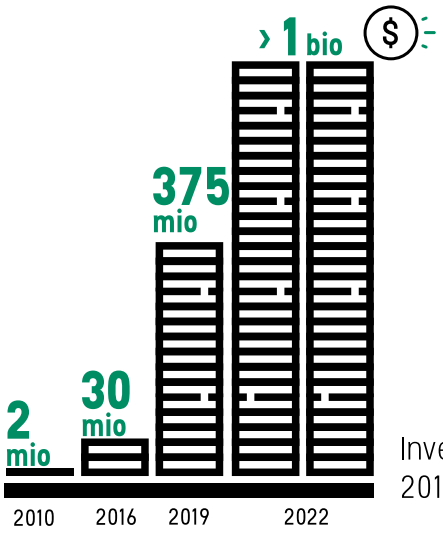
LEADING REGIONS



Two areas are particularly prolific in nurturing **cleantech start-ups**: Zurich area and Western Switzerland.

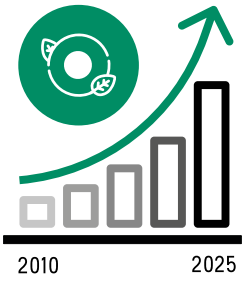
Source: CleantechAlps

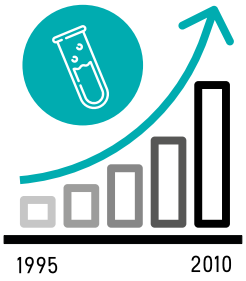
INVESTMENT



Investment in 2010, 2016, 2019 and 2022 (US dollars).

The investment curve in Swiss cleantech businesses is similar to that seen in biotech 10 to 15 years previously.[1]





SWISS PORTAL FOR CLEANTECH START-UPS

Launched in 2017 by CleantechAlps, this portal brings together in one resource the country's cleantech start-ups. Every one of Switzerland's fledgling innovation and tech companies (which have a high growth potential or a sustainable impact) is listed on this website. The site's search functions – by keyword, sector and geographical location – give the nation's cleantech start-ups the visibility they need among the media, investors and industrial partners. This continually updated database is also a reliable source of information for generating statistics for the sector.

www.cleantech-alps.com/en/start-up

Source: CleantechAlps, Cleantech Group
[1] Venturelab

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

INDUSTRY

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

EXTERNAL OFFICIAL NETWORK

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

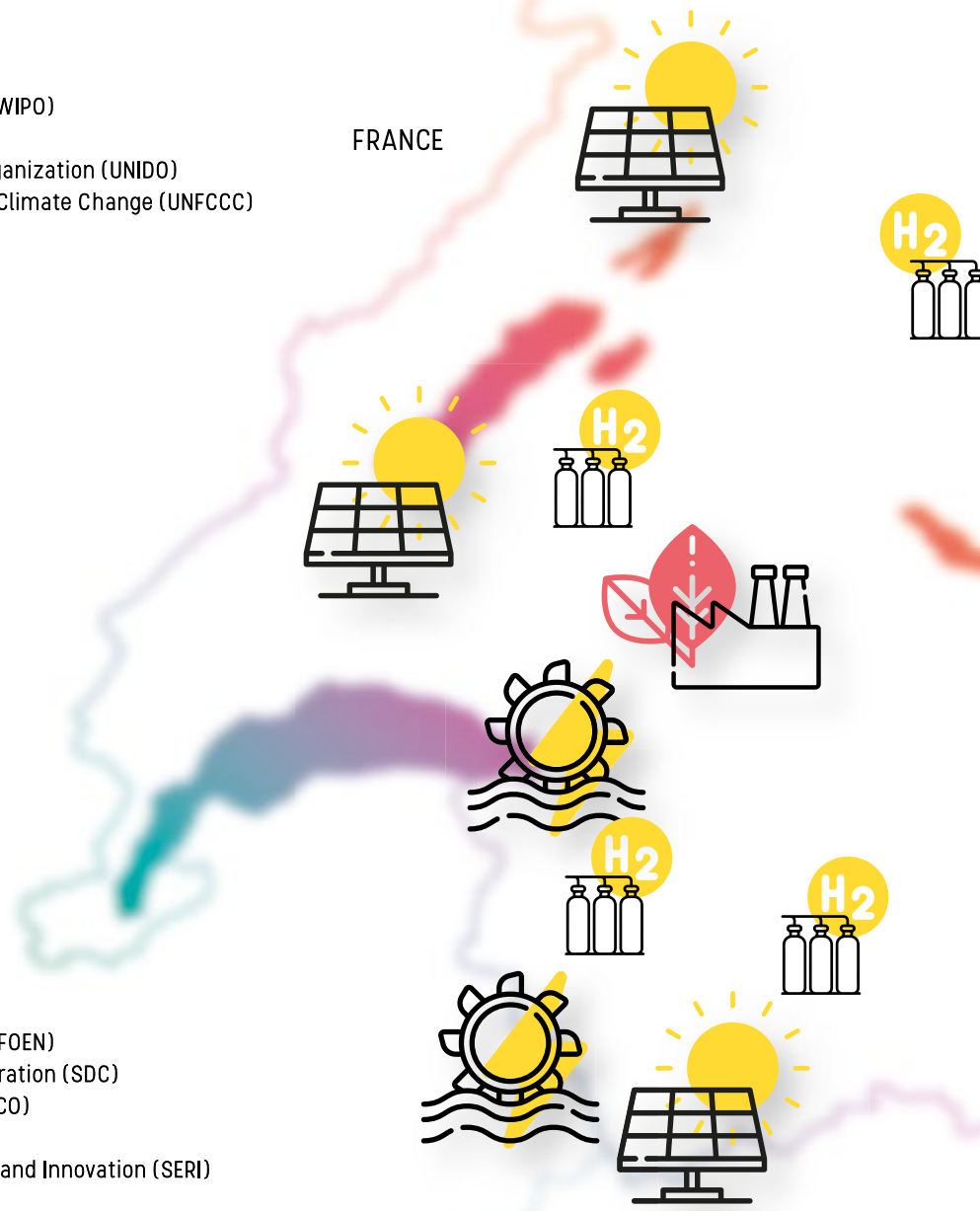
SWISS CONFEDERATION

- 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

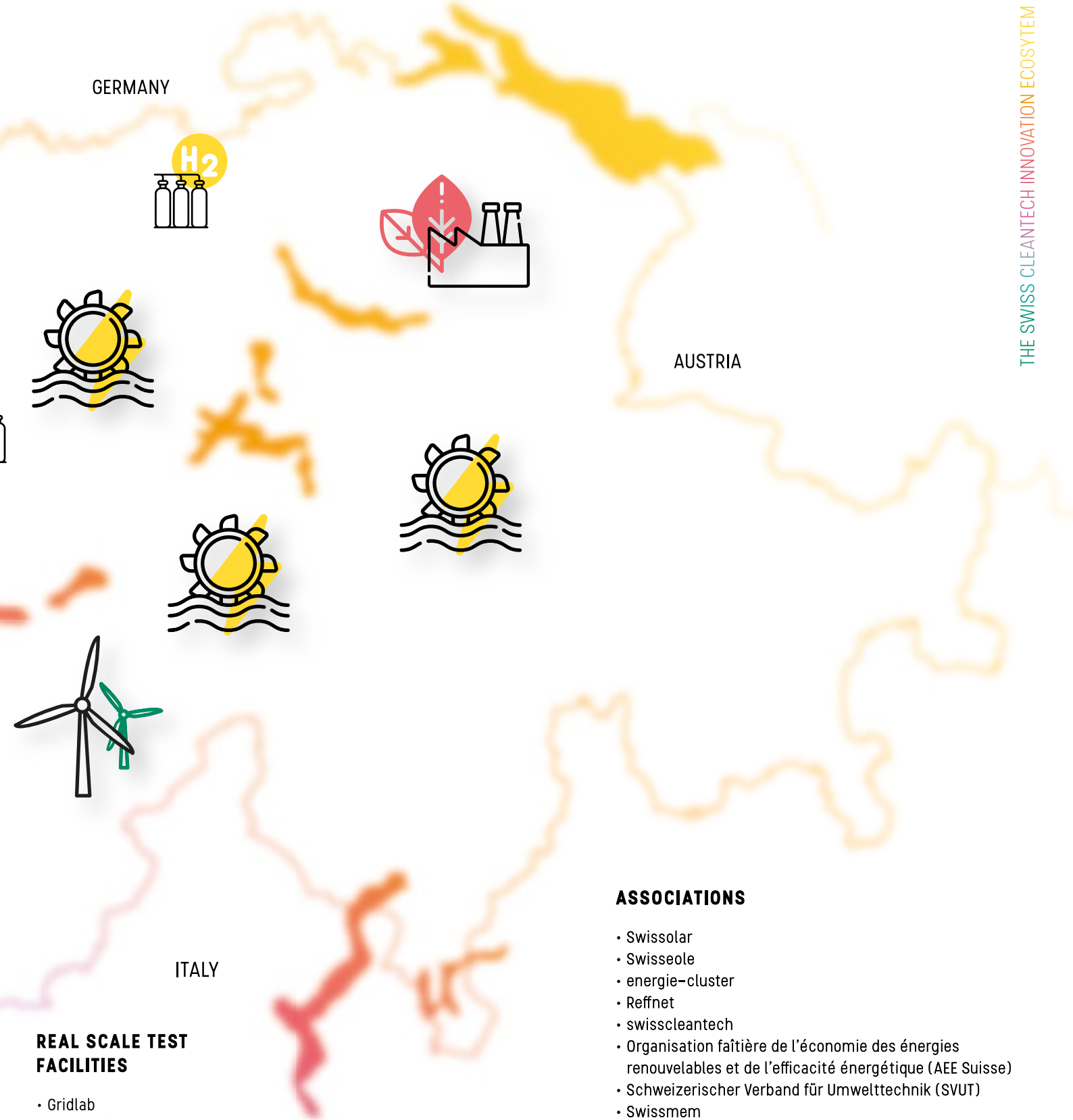
- Ecole polytechnique fédérale de Lausanne (EPFL)
- Eidgenössische Technische Hochschule Zürich (ETHZ)
- Adolphe Merkle Institute
- Swiss Federal Laboratories for Materials Science and Technology (EMPA)
- Paul Scherrer Institute (PSI)
- Swiss Federal Institute of Aquatic Science and Technology (EAWAG)
- 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 Recherche sur l'Environnement Alpin (CREALP)

FRANCE



INCUBATORS AND TECHNOLOGY PARKS

- TecOrbe
- BlueFactory
- BlueArk Innovation Hub
- Microcity
- Bluebox
- Energypolis & Alpole
- Impact Hubs (ZH, BE, GE, VD, NE, …)
- TechnoParks (ZH, LU, AG, …)
- Creapole
- Ecoparc Daval
- Ecopole FLASA



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

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 faîtière 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'Energie pour l'Economie (AEnEC)
- Swisspower

The broad field of cleantech entails significant challenges and opportunities for Swiss training and education. The fact that so many stakeholders are involved reinforces our country's ability to innovate.

Martina Hirayama
State Secretary
Federal Department of Economic Affairs, Education and Research (EAER)
State Secretariat for Education, Research and Innovation (SERI)

Switzerland and the Sustainable Development Goals

Since 2016, Switzerland has aligned its sustainable development strategy with the UN's 2030 Agenda, the global reference framework for all sustainable development policies. In June 2021, the Federal Council adopted its new 2030 Sustainable Development Strategy, reaffirming its willingness to contribute, alongside every other nation on the planet, to meeting the Sustainable Development Goals (SDGs) both nationally and internationally by 2030.

In many respects, Switzerland enjoys a privileged situation when it comes to sustainable development. However, like other countries, it still has work to do in various fields if it is to complete implementation of its 2030 Agenda in time. The federal government is henceforth focusing on three priority areas: sustainable consumption and production; climate, energy and biodiversity; and equality of opportunity and social cohesion. Its strategy also determines how civil society, the economy, the financial market, alongside education and training, research, and innovation, can help further sustainable development and identifies the framework conditions required for success. Lastly, this strategy defines the contribution to be made by the federal government through its benchmark-setting role.

Compared to other countries, Switzerland was able to begin working towards the 2030 Agenda goals from a comfortable starting point. In areas such as education, healthcare, infrastructures and competitiveness, it was in a good place from which to move forwards. Nevertheless, in terms of both domestic and foreign policy, Switzerland has some way to go if it is to meet all of its objectives by 2030. More action and coordination are required, particularly in the three priority areas listed above.

To meet these goals, Switzerland is going to have to make determined policy decisions in all sectors and secure the commitment of all of Swiss society. In the coming years, the SDGs will have to be integrated more closely into the different policy areas, strategies and budgets, without losing sight of the systemic approach.

In addition to the federal government, the economy has a part to play in achieving these objectives. It will do this through innovation, in particular in the environmental technologies sector where, each in their own way, many Swiss companies are helping to reach these goals. Specific examples of how they are doing this are provided after the introductory section of this report.

The cleantech patent landscape from the Swiss and SDG perspective

In comparison with other countries, Switzerland accounts for only a small number of cleantech patents[1], but Swiss inventions in this field are of high quality. They also match the international technology trends addressing the United Nations Sustainable Development Goals (UN SDGs). This is the observation made by the Swiss Federal Institute of Intellectual Property.

ANALYSIS SETS/ BACKGROUND INFORMATION

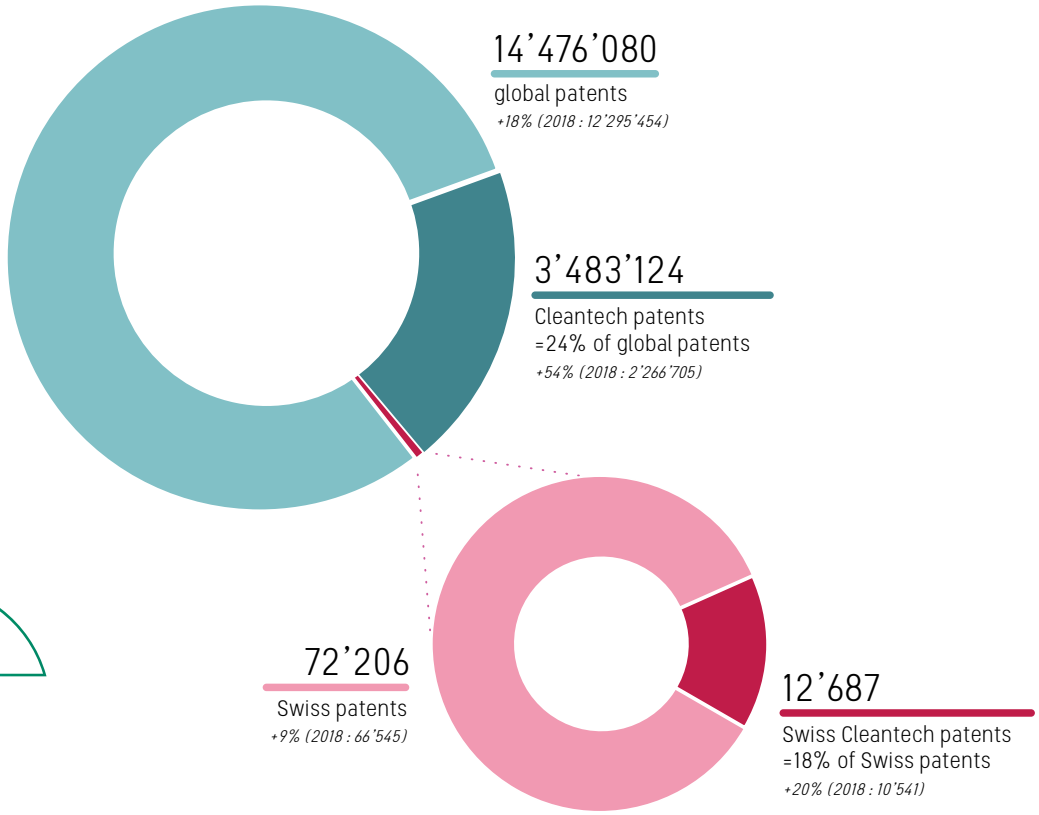


Figure 1: Total numbers of global and Swiss-invented patents 2022. The darker sectors represent the cleantech patents. The percentages indicate the relative contributions of Swiss inventions of the global patent portfolio as well as of the cleantech patent portfolio. The portfolio growth rates since 2018 are shown in the bottom line in italic.

[1] The term patents in this article refers to active patent families as of 31.12.2022.
A patent family comprises all patents worldwide relating to the same common technological content and referring to the same original priority application.
Active patent families are defined as patent families with at least one family member granted and in force, or pending at a given time point.
A portfolio refers to a collection of patents, for example all cleantech patents invented in Switzerland.

Worldwide, the number of active patent families has doubled between 2008 and 2018, from 6.5 to 13 million. During the same period, the number of cleantech patents has increased from one to over two million active families.

From 2018 to 2022, the cleantech patent portfolio grew significantly, in proportion much faster than during the previous decade, both globally as well as the Swiss-invented patents. However, the Swiss-invented cleantech patent portfolio growth rate is more moderate than the global one (20% compared to 54%).

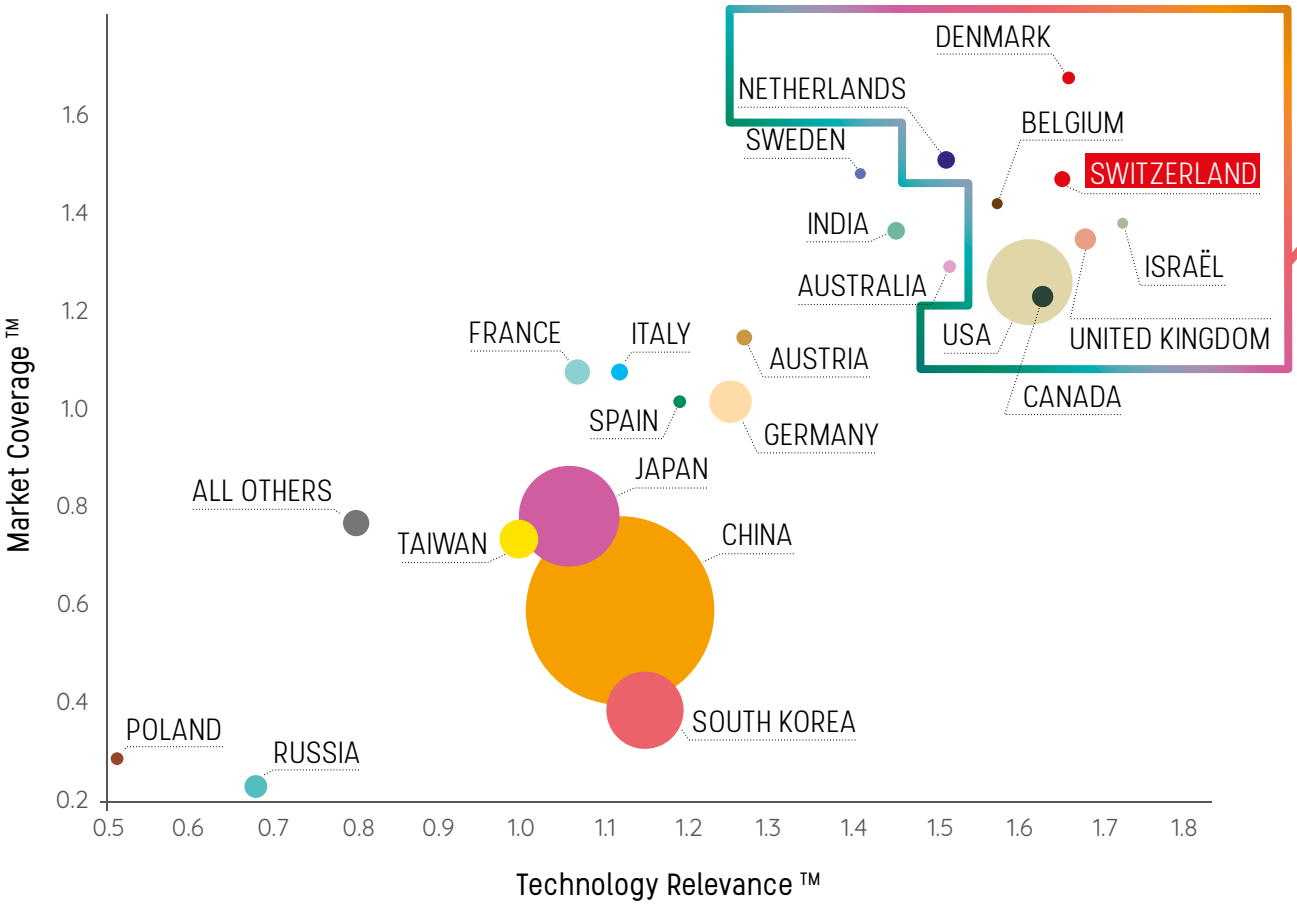
In both cases the cleantech growth rate is distinctly higher than the overall growth rates, namely 9% for Swiss inventions and 18% globally.

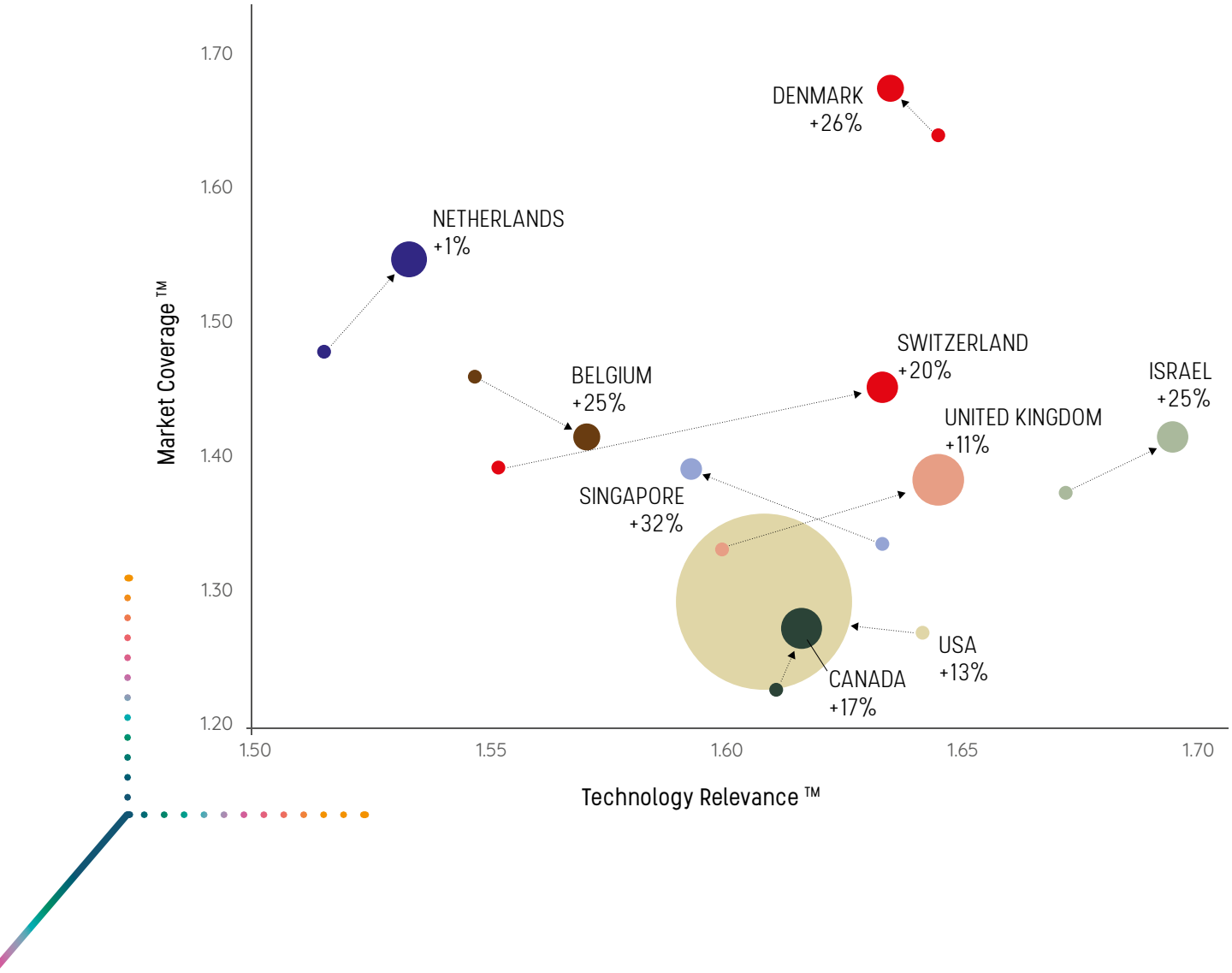
The high global growth rates are predominantly driven by inventions out of China and to a lesser extent out of South Korea. Accordingly, the relative contribution of Swiss inventions to the global portfolio is decreasing.

The dynamics of the cleantech sector is gaining in relative importance, with the number of cleantech patents growing faster than the number of patents overall, both globally and in Switzerland.

Figure 2 shows the global cleantech patents split by the various countries of origin of the inventors. The bubble sizes represent the number of active patents for each country of origin. The x and y axis represent the two independent patent quality parameters, Technology Relevance™ and Market Coverage™ (see definition in the footnote).

The overall picture in 2022 remains similar to 2018. The framed upper right quadrant represents the sweet spot comprising the patent portfolios of high average quality in both dimensions. The changes within this sweet spot between 2018 and 2022 are shown and discussed on page 33.





TRENDS IN THE SWEET SPOT 2018–2022

The arrows indicate the qualitative changes, i.e. the shifts within the coordinates of Technology Relevance™ and Market Coverage™ [2] for the top 9 countries of origin for cleantech patents from 2018 to 2022 (origin of inventor).

The percentage numbers represent the quantitative changes, i.e. the portfolio growth rates for each inventor country between 2018 and 2022, irrespective of the quality parameters.

The bubble areas represent the relative portfolio sizes at the end of 2022.

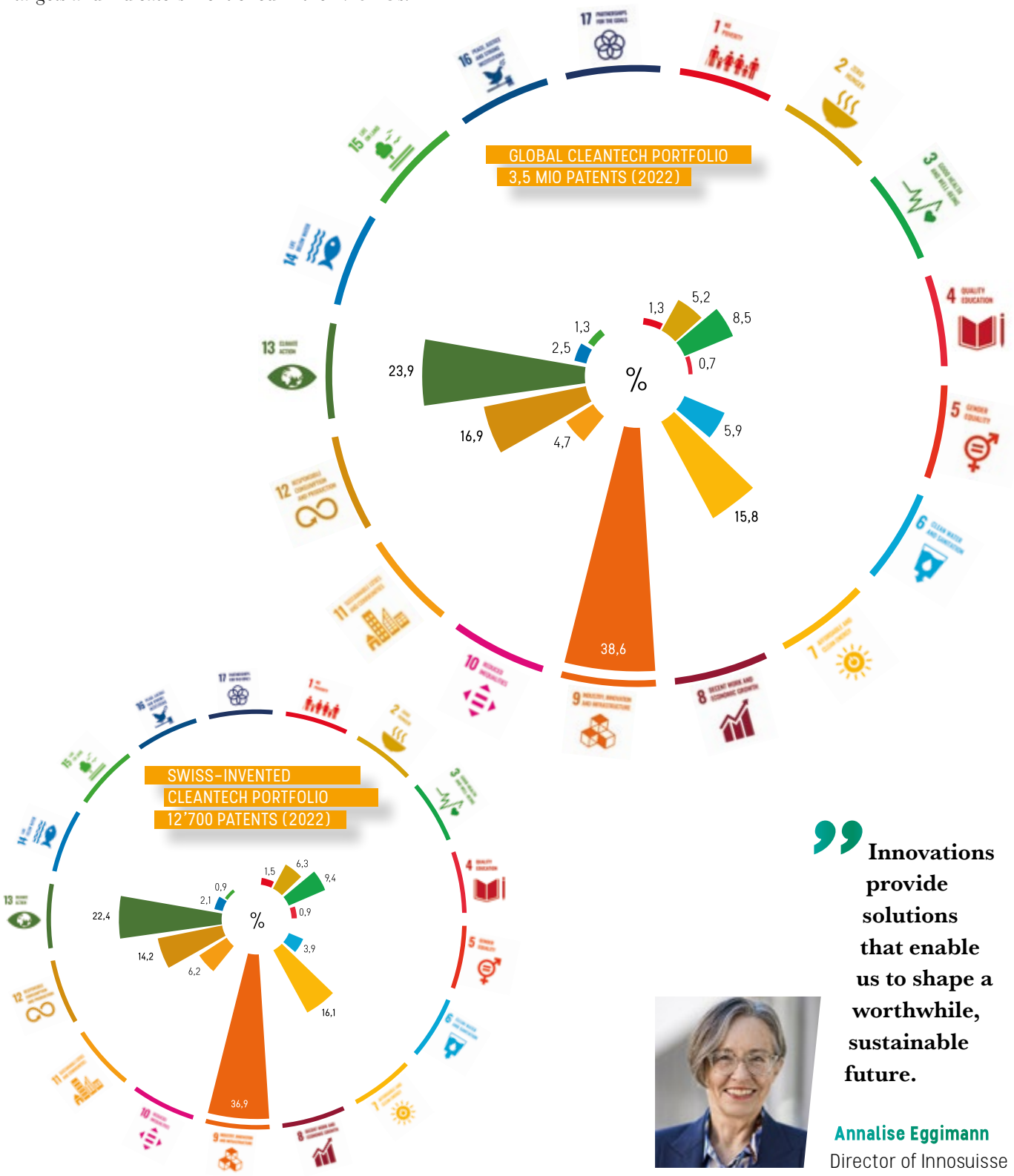
Compared to the other eight countries in the sweet spot, the Swiss-invented cleantech portfolio shows the strongest positive shift in terms of Technology Relevance, a slight increase for the Market coverage and an average increase in portfolio growth.

[2] Technology Relevance™ and Market Coverage™ are qualitative parameters available in the patent analysis software PatentSight used for this report.
For more information: www.patentsight.com/patentsight-patent-asset-index

CLEANTECH AND SUSTAINABLE DEVELOPMENT GOALS

Cleantech contributes significantly to the SDGs. In order to establish a logical, transparent protocol to assess the sustainability compliance of entities from the perspective of patents, 100 technology sectors have been defined, based on the targets and indicators mentioned in the 17 SDGs.

Our collections of cleantech patents, global and Swiss-invented, were mapped to the 17 SDGs and the 100 underlying technology sectors.



Innovations provide solutions that enable us to shape a worthwhile, sustainable future.

Annalise Eggimann
Director of Innosuisse

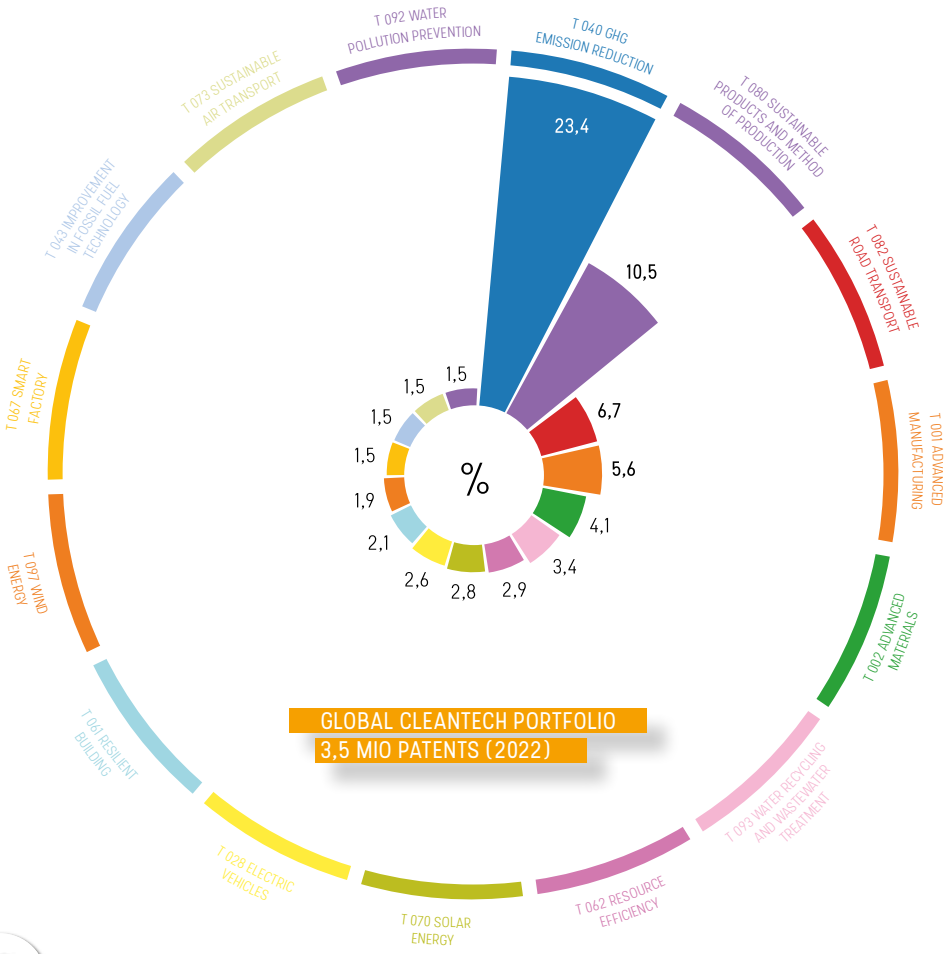


Figure 3: Sunburst graph depicting the global and Swiss-invented cleantech patents to the specific SDGs.

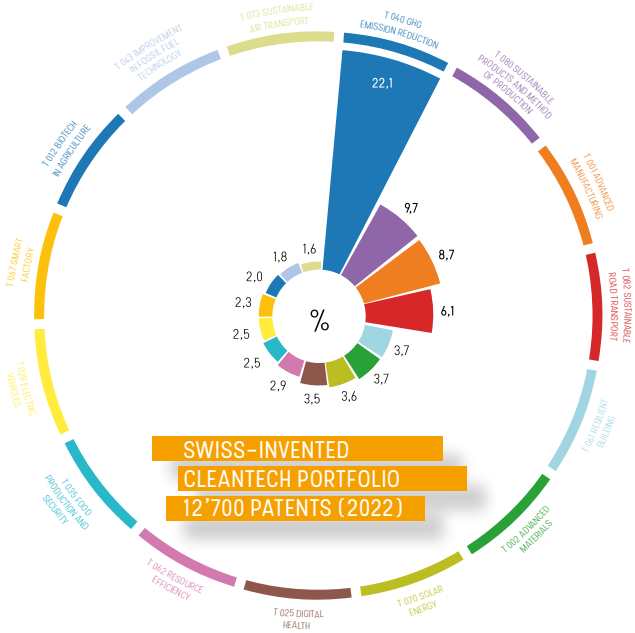


Figure 4: Sunburst graph depicting the global and Swiss-invented cleantech patents to the underlining technology fields.

The SDG sunbursts of the global cleantech patent portfolio and the Swiss-invented subset are strikingly similar, despite the large difference in portfolio size.

When assessing the underlying technology fields, "Greenhouse Gas (GHG) Emission Reduction" represents the most prominent technology field within SDG-related cleantech sectors in both portfolios.

However, some differences between global and Swiss-invented cleantech patents become apparent when comparing the top 15 technology fields of both portfolios. The technology fields, "Advanced Manufacturing", "Resilient Building", "Solar Energy" and "Digital Health" are more prominently represented in the Swiss-invented portfolio.

"Because it possesses only renewable energy sources, Switzerland is naturally at the cutting edge of innovation in energy efficiency and renewables.

Roger Nordmann
Member of the Environment, Spatial Planning and Energy Committees of the Swiss Parliament

For details and specific definitions for assigning patents to UN SDGs, see the LexisNexis website:
https://knowledge.lexisnexisip.com/patentsight/united-nations-sustainable-development-goals

Switzerland Global Enterprise (S-GE)

Switzerland Global Enterprise (S-GE) is the official Swiss organization for export and investment promotion. With a unique global network, S-GE supports Swiss companies in their international business and helps innovative foreign companies on their way to settling in Switzerland:

www.s-ge.com

S-GE works with partners to support Swiss and Liechtenstein SMEs globally with their expansion, including with the active search for and brokering of business opportunities.

In association with Swiss cantons and regions, S-GE promotes high value-adding projects to settle companies in Switzerland and boost the country as a location for innovation. The focus with respect to companies settling in the country is on future technologies and ecosystems with high innovation potential.

As a private non-profit organization, S-GE supports its customers at locations throughout Switzerland and worldwide. S-GE operates its own teams at so called Swiss Business Hubs at 22 locations worldwide. The Swiss Business Hubs are integrated into the diplomatic missions of the Swiss Federal Department of Foreign Affairs (DFA). S-GE is present in many other countries through the respective Swiss diplomatic missions or through its own global partner network, which includes bilateral chambers of commerce, industry associations and local experts. The organization supports Swiss companies efficiently and effectively on the ground.

S-GE provides information and advice on target countries as well as sectors and identifies market opportunities. This service is provided through on-line support including user-friendly tools and resources, market reports, through one-to-one advice, and also through events, missions and online tools. This support is provided for all Swiss companies from industries promoting cleantech and for all stages of international development.

Within the Infrastructure Team Switzerland, an initiative run in collaboration with the Swiss Government, Swiss industry associations, the Swiss Export Risk Insurance SERV, S-GE supports Swiss companies and organizations looking to participate at large-scale infrastructure projects worldwide. It is committed to exploiting the economic opportunities that arise for Swiss companies from the increasing demand for innovative and sustainable large-scale infrastructure:

www.infrastructure-solutions.swiss

SWITZERLAND GLOBAL ENTERPRISE
enabling new business

Thanks to excellent innovation ecosystems, Switzerland is predestined as a business location for the development and commercialization of cleantech solutions.

Simone Wyss Fedele
CEO S-GE

Sustainable finance, a no-brainer for the Swiss financial sector?

Switzerland's financial industry has a prominent place on the international stage, accounting for a quarter of the world's cross-border asset management. Many years ago, it began moving increasingly towards sustainable finance. The country's financial system plays a crucial role in achieving its climate and sustainable development goals. And sustainable development applies as much to Switzerland's banks, insurance companies, asset managers and pension funds as it does to their clients.

As far as financial regulation is concerned, in December 2022 the Federal Council adopted the report on the sustainability of the financial industry and its position on the prevention of greenwashing. The report's conclusions also apply to the systematic integration of ESG (Environmental, Social and Governance) factors in financial and investment decisions.

By implementing 15 measures during the period 2022 to 2025, Switzerland's financial sector must continue building on its world-leading position in sustainable finance. The measures set must make it possible to obtain more high-quality data on sustainable development by encouraging, among other things, the publication of information concerning the climate compatibility of products.

In general, there is room for improvement in the transparency of the financial sector. This can be achieved by encouraging financial institutions to join international net-zero alliances or to apply the recently introduced Swiss Climate Scores (SCSs), for example. The SCSs establish best-practice transparency aimed at making financial products compatible with the climate goals, thereby encouraging investment decisions that will help achieve those goals.

The Federal Council is also keen to encourage investments that, in addition to providing a financial return, have a measurable positive effect on society or the environment. It intends to contribute to the transition to a sustainable economy through, for example, its role in international organisations, where it supports initiatives working towards setting a global CO2 price.

Lastly, the federal government (through the Department of the Environment, Transport, Energy and Communications and the Department of Finance), regularly conducts voluntary climate compatibility tests with financial institutions to analyse the extent to which Switzerland's financial sector is aligned with the global temperature targets set by the Paris Agreement and to assess how much progress is being made. The authorities are committed to improving these tests on an ongoing basis.

In addition, Switzerland's financial industry is doing its bit to support this change, organising events such as Building Bridges in Geneva, a sustainable finance summit chaired by Patrick Odier, the former President of the Swiss Bankers Association. Every year, international economic and financial players and institutions come together at this summit, which has become a must on the sustainable finance events calendar. The attendees meet with the express purpose of accelerating the transition to a global economic model aligned with the SDGs.

"The country's financial system plays a crucial role in achieving its climate and sustainable development goals.

With the boom in digital technologies, financial technology companies are also increasingly playing a role in the financial industry, either as innovation partners working with conventional financial players or by occasionally taking over from them in the added-value chain, where new links are emerging.

Fintech companies thus play a vital role in making sure that Switzerland's financial marketplace becomes more sustainable and in ensuring its future competitiveness. Switzerland is therefore also banking on the potential of digital technology in sustainable finance.

The fintech sector is thriving, as illustrated by the selected examples at right, which are not by any means an exhaustive list.

Inyova

An impact investing company whose portfolio focuses solely on businesses with a traceable impact
https://inyova.ch/en/

3rd eyes analytics

Offers a hyper-personalised wealth planning sustainability solution for banks and insurance companies, enabling them to help their clients make sustainable investments tailored to the SDGs.
www.3rd-eyes.com

Impaakt

This company carries out impact studies and provides impact scores and analyses to enable its customers to assess the impact of their investments, including with respect to ESG criteria.
www.impaakt.com

> **Blending Swiss innovation with pioneering sustainable finance is recipe for successfully mastering the global challenges ahead.**

Patrick Odier
President, Swiss Sustainable Finance and Chairman, Building Bridges Foundation

Sustainable chemistry in Switzerland: innovation and the environment hand in hand

Sustainable chemistry has become a priority in Switzerland, where the chemicals industry is turning increasingly towards environmentally friendly practices. With its long tradition of innovation and precision, Switzerland is carving itself out a leading role in green and sustainable chemistry, and this has major implications for industry and society as a whole.

One of the main challenges faced by sustainable chemistry is finding alternatives to conventional chemicals, most of which are the product of fossil resources that have a negative impact on the environment and our health. Scientists and manufacturers have made significant progress in producing biosourced compounds and materials and introducing more environmentally friendly manufacturing processes in doing so. These innovations are reducing greenhouse gas emissions, minimising energy consumption and producing less waste.

> **”Collaboration between the different stakeholders is essential to promoting sustainable chemistry**

Another major challenge facing the chemicals industry is bringing about the transition to a more circular economy – as is also the case for other industries such as construction and food processing. Switzerland is actively encouraging the re-use and recycling of chemicals and stepping up its waste processing. Many Swiss chemicals companies have introduced responsible management programmes designed to minimise the risks posed by chemicals to the environment and human health throughout their life cycle.

Collaboration between the different stakeholders is essential to promoting sustainable chemistry. Chemicals companies are working closely with universities, research institutes and the regulatory authorities to develop innovative solutions and guarantee product safety. Public-private partnerships have also been set up to support research and development in sustainable technologies.

In addition to the technical challenges involved, regulatory and political issues also come into play in sustainable chemistry. Switzerland has introduced strict regulations to guarantee the safety and sustainability of chemicals, designed to protect the environment and public health while at the same time encouraging innovation in the sector.

In practice, green chemistry in Switzerland is backed by SusChem Switzerland, the country's umbrella association, which is a member of the Brussels-based SusChem European Technology Platform for Sustainable Chemistry. SusChem Switzerland was started up in 2013 as a Europe-focused showcase and forum for Swiss sustainable chemistry projects and for implementing innovative solutions designed to have a favourable impact on the environment for future generations. To this end, the association brings together businesses (SMEs, multinationals and start-ups) and facilitates collaboration between all the green chemistry stakeholders, in line with Switzerland's national carbon and greenhouse gas reduction strategy.

"Innovative technologies to carbonise industry are absolutely essential. They are the only way that Switzerland will be able to achieve the 2050 net-zero goal we have set ourselves.

Tanja Zimmermann
Director of Swiss Federal Laboratories for Materials Science and Technology

"The environment is a springboard for our progression towards a conscious transformation to a committed and sustainable "ecolonomic" model.

Olivier Ferrari
Co-founder of CONINCO Explorers in finance SA and ONE CREATION Impact finance

"Solar, wind, hydraulic, electric mobility, storage, heat pumps, efficiency and smart technology: at the heart of the transition, Switzerland is innovating!

Christophe Ballif
Director of Sustainable Energy Center at CSEM, director photovoltaics and thin film electronics laboratory at EPFL

GROUNDBREAKING GREEN CHEMISTRY START-UPS

Many companies, including Switzerland's big chemicals groups, are actively pursuing green chemistry, working hard on a daily basis to reduce their environmental impact. In the wake of these large companies, start-ups are emerging and leading the way in more sustainable ways of using chemicals. Below are a few examples of these promising fledgling companies.

Depoly
This start-up has developed a chemical process capable of endlessly recycling PET and other plastics.
www.depoly.co

Bloom Biorenewables
A recently founded company that extracts petroleum product substitutes from biomass.
www.bloombiorenewables.com

Deasyl
Recycles locally collected waste vegetable oils. It is also developing some innovative glycerol-recycling processes.
www.deasyl.com

Plastogaz
This start-up has developed hydrocracking technology that turns hard-to-recycle plastic waste into circular feedstocks for the chemicals industry.
www.plastogaz.com

Abioniv
This company has developed a disinfection process that produces an end product which can be used to recycle phosphorus.
www.abioniv.com

Embion
Uses its own biomass-processing technology to re-use by-products generated by the agri-food industry, creating high-value functional ingredients from natural produce.
www.embiontech.com

Tide Ocean Material
Produces and markets high-quality raw materials derived from plastics recovered from the sea and coastal areas. These materials come in the form of granules for plastic injection, yarn for textile applications, and filament for 3D printing.
www.tide.earth

FluidSolids
This company has come up with technology that turns organic waste into biodegradable composite materials that replace conventional plastics.
www.fluidsolids.com

Clean Carbon Conversion
Its ultra-high-temperature hydrolysis (UHTH) technology is an efficient and flexible way of turning organic waste into clean synthetic gas.
https://cleancarbonconversion.com/

The Swiss cleantech industry is crucial to us achieving net zero. We are proud of these enterprises. They are the reason why Switzerland is world champion in the innovation stakes. To ensure that remains the case in the future, we need the right regulatory framework conditions.

Michael Mandl
Co-Director
Swisscleantech

We must create a new technology-based humanism to enable us to come up with a world that makes use of renewable energies and is free of fossil fuels.

Raphaël Domjan
President and pilot
SolarXplorers SA

Process and energy system integration is the key for translating laboratory-scale fundamental research to scalable applications driving energy transition.

Prof. François Marechal
Industrial Process and Energy Systems Engineering, EPFL

Training and research are powerful levers for change to ensure a sustainable balance between humankind and our environment.

Luciana Vaccaro
President of
swissuniversities

Promoting sobriety without neglecting the advancements of cleantech. Together, they pave the way for a decarbonized future. Let's support this synergy for tangible impact.

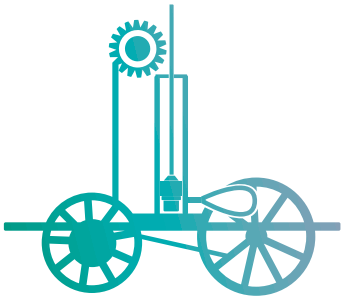
Paolo Pizzolato
Head of Venture Capital,
Romande Energie

Joël Mesot
President of
ETH Zurich

To transform the energy system, we need politicians, scientists, industry and society to come together. Through the Coalition for Green Energy & Storage (CGES), Switzerland's technical higher education sector is contributing to this major national imperative.

From de Rivaz to Domjan

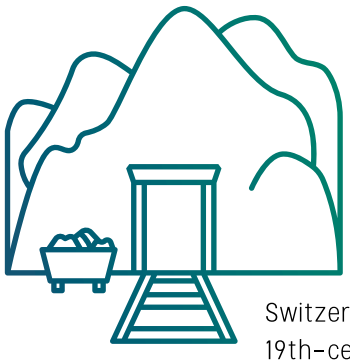
THE CLEAN ENERGY PIONEERS



François Isaac de Rivaz

1752–1828

Two hundred years ago, the Swiss engineer François Isaac de Rivaz invented an internal combustion engine fuelled by a mixture of hydrogen and oxygen.



Alfred Escher

1819–1882

Switzerland's most influential 19th-century politician and economic leader, famous for founding the Federal Institute of Technology and the Gotthard railway company. He was the brains behind the Gotthard tunnel. Today, the new 60-km-long Gotthard Base Tunnel (opened in 2016), which links northern and southern Europe, is the longest railway tunnel in the world.

Charles Eugene Lancelot Brown

1863–1924

Walter Boveri

1865–1924

Brown & Boveri

In 1893, Brown & Boveri constructed Europe's first alternating current thermal power station in Frankfurt. They also built the first electric railcar, and in 1896 opened the first electric tram service in the world, in the city of Lugano.

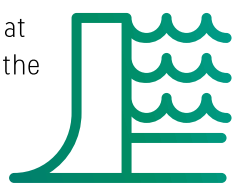
Alfred Stucky

1892–1969

Jean Landry

1875–1940

Jean Landry was one of the founders and the first president of the energy company EOS (which later became Alpiq). Together with his fellow engineer Alfred Stucky, in 1964 he built the Grande Dixence Dam, at 285 metres, the tallest gravity dam in the world. Alfred Stucky was involved in building more than 35 dams in Switzerland and around the world, including Greece, Iran and Morocco. He took over from Jean Landry as the director of the University of Lausanne engineering school, today known as EPFL.



1908–1981 Ernst Stadler

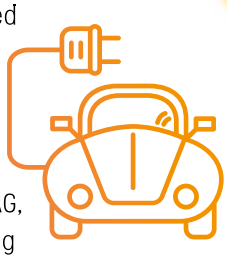
In 1942, Ernst Stadler founded the Stadler Rail company, launching the first diesel and battery-electric locomotives in 1945. Today, Stadler Rail is one of the world's leading suppliers of trains, and has also produced a hydrogen-powered train.

1952 André Borschberg

Driven by the desire to push the boundaries of what is possible in both technology and human endeavour, André Borschberg is an entrepreneur whose passion for exploration is matched only by his persistence in driving economic, environmental and spiritual growth. Together with Bertrand Piccard, he completed the first flight around the world with a solar aircraft (Solar Impulse).

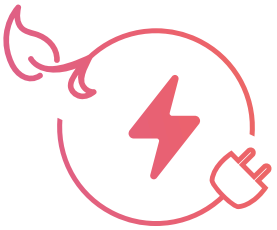
Josef Jenni 1953

He is one of the pioneers of solar energy. His "Tour de Sol", established in 1985, was the first motor race for electric vehicles powered by photovoltaic energy instead of internal combustion engines. With his company Jenni Energietechnik AG, he also constructed the first building in Europe to be heated entirely by solar energy and the first detached family home to have all its energy needs supplied by solar power.



Bertrand Piccard 1958

Explorer, psychiatrist, ambassador for clean technologies. The first man to fly around the world in a balloon (Breitling Orbiter) and in a solar aircraft (Solar Impulse). As Chairman of the Solar Impulse Foundation, Bertrand Piccard has succeeded in his mission to select 1000 profitable solutions to protect the environment and support clean growth.

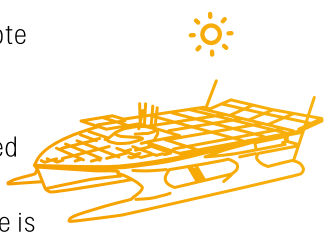


1963 Doris Leuthard

President of the Swiss Confederation in 2010 and 2017, Doris Leuthard was responsible for a key change in direction of Switzerland's energy policy. Following the Fukushima nuclear disaster in 2011, she took decisive steps to help bring about the energy transition. She won the day in 2017 when Swiss voters backed the Energy Strategy 2050, which includes the decision to gradually abandon nuclear power.

Raphaël Domjan 1972

He is an eco-explorer and lecturer who campaigns, through his foundation PlanetSolar, to promote solar energy as a means of combatting climate change. His catamaran PlanetSolar completed the first solar-powered circumnavigation of the globe. He is now developing SolarStratos, which aims to be the first aircraft powered only by solar energy to reach the stratosphere.



58 practical solutions and innovations

TOUR OF SWITZERLAND

On the following pages, we present more than fifty practical projects that demonstrate the innovative spirit of Switzerland's cleantech companies. They show that behind the framework conditions and regulations, there is a long line-up of businesses working hard on a daily basis to come up with innovative solutions that are helping to combat climate change and work towards a zero-carbon society.

Of course, this selection is not exhaustive, but it provides a useful snapshot of Switzerland's capacity for innovation. For every solution put forward, we also reference the Sustainable Development Goals that it is helping to meet (see page 11). In most cases, these innovations are already up and running in many countries, where they are helping to resolve some of the issues faced locally. In this way, Switzerland is passing on its expertise and know-how in different areas of cleantech innovation.

Each of the following pages also contains a QR code that will take you to more detailed information about the innovation concerned.

Stripping greenhouse gas from the atmosphere

Climeworks

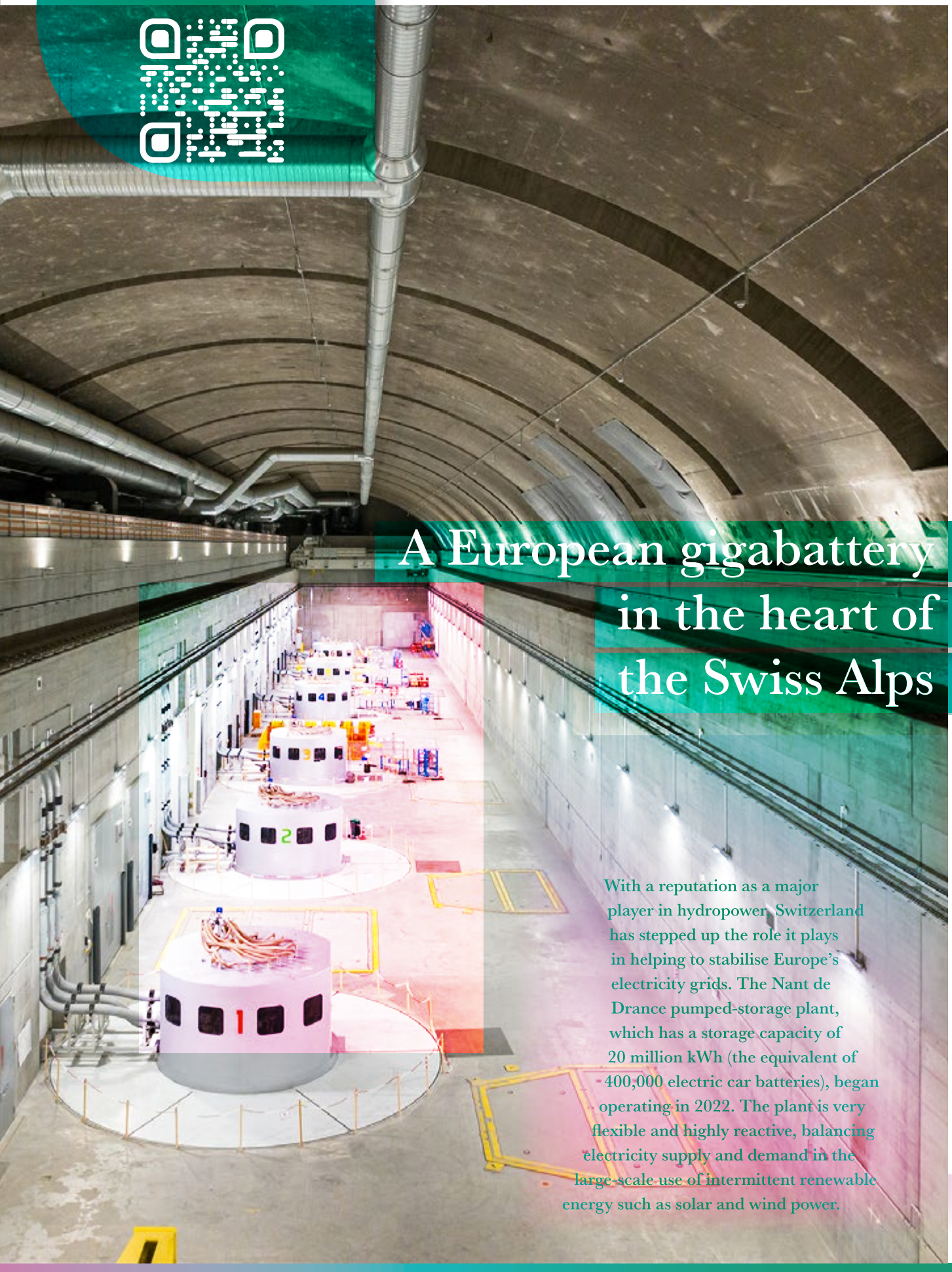
Just a few years ago, the idea of capturing the greenhouse gas carbon dioxide from the atmosphere and permanently storing it or reusing it in a carbon-neutral way seemed bold, to say the least. Today it has become a whole new branch of industry. Climeworks AG has been a pioneer in this field since 2009 and now strips CO2 from atmospheric air on an industrial scale.

Climeworks AG

www.climeworks.com
contact@climeworks.com

Nant de Drance SA

www.nant-de-drance.ch
info@ndd-sa.ch



A European gigabattery in the heart of the Swiss Alps

With a reputation as a major player in hydropower, Switzerland has stepped up the role it plays in helping to stabilise Europe's electricity grids. The Nant de Drance pumped-storage plant, which has a storage capacity of 20 million kWh (the equivalent of 400,000 electric car batteries), began operating in 2022. The plant is very flexible and highly reactive, balancing electricity supply and demand in the large-scale use of intermittent renewable energy such as solar and wind power.

Nant de Drance

Clean alternatives to diesel trains

Not so long ago, the railway seemed more like a relic from the 19th century than a modern mode of transport. Today, however, the vision of combustion-free mobility is giving rail-based transport a huge boost – and is behind the growth dynamics of an industry in which Stadler is a global leader. The Swiss company has recently entered the market with both a hydrogen train and a battery train that can be used to electrify diesel train routes without the need to build new lines.

Stadler Rail AG

www.stadlerrail.com
stadler.rail@stadlerrail.com

A solar pump for smallholders

Particularly in tropical and subtropical regions, agriculture is practically impossible without irrigation – a mechanical water supply is indispensable for cultivating fruit and vegetables. To replace the omnipresent diesel pump, ennos AG has developed a pump that runs exclusively on solar power. It is specifically tailored to the needs of small farmers and has so far mainly been used in African and Latin American countries.

ennos AG

www.ennos.ch
info@ennos.ch

The new way to enjoy meat

Planted Foods AG

www.eatplanted.com
hello@eatplanted.com

Planted Foods AG is one of the fastest growing start-ups in the field of alternative proteins. Four years after its founding, it was already the Swiss market leader, had a presence in 6000 retail outlets across Europe and supplied 5000 catering customers. Producing food from plant proteins emits less greenhouse gas than meat and requires less water. And it boosts animal welfare: well over a million chickens have been saved so far from the slaughterhouse because people ate Planted products instead of animal meat.

Turning concrete rubble into a carbon sink

neustark AG

www.neustark.com
hello@neustark.com

Large quantities of concrete are used as a building material around the world. Its main component is cement, whose production generates huge amounts of CO2 emissions. neustark AG has developed a process whereby the concrete from demolished buildings can be used to capture the greenhouse gas. The CO2-injected recycled concrete can be used in the construction of roads and new buildings, etc.

Neustark

Distran

Ultrasound camera for gas leak detection

It is well-known that bats use ultrasound to navigate their way through the dark. Distran AG uses the same physical principles in its ultrasound camera to detect gas leaks in refineries, power stations and industrial plants. The early detection of gas leaks not only avoids financial losses, it also reduces climate-damaging greenhouse gas emissions.

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Distran AG

www.distran.swiss
info@distran.ch

Daphne Technology SA

www.daphnetechnology.com
info@daphnetechnology.com

Reducing pollutant emissions on land and at sea

Daphne Technology develops filtration systems that reduce the greenhouse gas emissions responsible for global warming. Designed for land-based and maritime applications, its innovative solutions are aimed at the industries facing the biggest decarbonisation challenges, including maritime transport, oil and gas production sites, mines, cement works and energy producers. The company's processes designed to reduce sulphur oxides and methane emission have been shown to be effective in full-scale prototypes, enabling it to move on to the pre-industrial stage. Daphne Technology is also developing systems designed to capture CO2, nitrogen oxides and nitrous oxide.

Daphne Technology

Using AI to keep our cities clean

Cortexia has developed a unique system that automatically and objectively measures and maps the cleanliness of city streets using onboard cameras coupled with an AI system. Several major Swiss and European cities have already adopted the system, making savings of around 20% in resources while increasing the cleanliness of their streets. The company is also working on a way of improving the quality of organic waste collected, using a system that measures the contents of refuse-collecting vehicles with a view to increasing the quantity of recycled biomass.

Cortexia SA

www.cortexia.ch
info@cortexia.ch

Cortexia

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Storing solar power in used batteries

Libattion

Electromobility is set to grow massively in the coming years, and with it the consumption of batteries. Libattion is already working on ways to upcycle old electric-vehicle batteries: it reuses their intact battery cells to build modular, scalable stationary battery energy storage systems, thus strengthening the circular economy.

Libattion AG

www.libattion.com
info@libattion.com

Haelixa AG

www.haelixa.com
info@haelixa.com

Authenticating sustainable production with DNA markers

Haelixa has developed a novel method for tracking the provenance of textiles and other goods across the production and supply chain. Goods are marked with a spray containing an invisible, forgery-proof DNA marker. Companies can use the marking process to prove that their products come from environmentally sound and socially equitable production, for example.

Haelixa

Using the IoT to the advantage of sustainable development

OrbiWise SA

www.orbiwise.com
contact@orbiwise.com

The Internet of Things (IoT) solutions developed by OrbiWise are already used in several countries around the world, across a wide range of fields. The company's software, based on LoRaWAN® technology, is suitable for networks of all sizes and is used by millions of smart city devices – controlling waste management, street lighting, etc. – as well as by smart metering systems for buildings. OrbiWise's latest development is a noise pollution monitoring solution that enables the rapid implementation of noise reduction measures.

A new generation of solar cells

In 1953, Hans Meyer and Willy Burger founded a company that manufactured watch components. Now, 70 years later, Meyer Burger Technology AG has positioned itself as a European manufacturer of long-lasting, high-performance solar modules and solar cells. The market for the Swiss company's photovoltaic products plays a central role in the transition of the global energy supply towards sustainability.

Meyer Burger

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Meyer Burger Technology AG

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mbtinfo@meyerburger.com

ExerGo SA

www.exergo.com
hello@exergo.com

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Revolutionising low-temperature thermal networks

ExerGo has developed the world's first district heating and cooling network (DHCN) solution to use CO2 instead of water as its energy carrier. This technology is the most compact and cost-effective solution for densely populated urban areas. Using CO2 as the heat carrier also makes an 80% saving in primary energy compared to systems that use fossil fuels. Having proved in a demonstrator at Energypolis that its technology works, ExerGo is marketing this solution to public utilities companies, property owners and developers, and businesses who want to exploit their residual heat.

ExerGo

Making solar buildings more attractive

Solaxess

www.solaxess.ch
info@solaxess.ch

With its nanotechnology-based coloured film compatible with every kind of photovoltaic panel, Solaxess is set to be a major player in the aesthetic integration of solar power. This technology unique to Solaxess turns solar panels into construction elements for building roofs and façades that can even be used on protected historical buildings. The technology is already mature, going into industrial production in 2022, and is likely to lead to the rollout of photovoltaic energy on a massive scale in our towns and villages.

Swiss Centre for
Electronics and
Microtechnology (CSEM)

www.csem.ch
info@csem.ch

A catalyst for technological innovation

A host of disruptive technologies have come out of CSEM's laboratories and test benches. With one foot in science and the other in industry, this organisation is a driver of technology transfer, including in the renewable energy sector. In the Sustainable Energy Unit, an international team of more than 80 scientists and industry professionals work on photovoltaic technologies, batteries, and network management and digitalisation. All these innovations have industrial applications that contribute to sustainable development and the energy transition.

CSEM

Kyburz

Kyburz Switzerland AG

www.kyburz-switzerland.ch
info@kyburz-switzerland.ch

Kyburz Switzerland AG made its name with three-wheeled delivery vehicles for the Swiss Post. This vehicle has become a popular export item, with customers not only in Northern and Eastern Europe but also in Australia and New Zealand. The company is not resting on its laurels, however. It is investing part of the income from its business operations into developing an economically and ecologically advanced form of battery recycling.

Thoroughly thought-out electromobility

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Commercial vehicles can be electric too

The name Designwerk has been a byword for innovations in the field of electromobility for more than 15 years. Today, the company is applying its experience to developing fully electric drive systems for trucks and commercial vehicles for waste disposal and snow clearance. With these speciality vehicles, it is opening up previously unknown areas of application for electric mobility, not only in commercial and industrial enterprises but also in the infrastructure services of local councils.

Designwerk Technologies AG

www.designwerk.com
info@designwerk.com

Cyltronic AG

www.cyltronic.ch
info@cyltronic.ch

Cyltronic

Electricity is more efficient than compressed air

Cylinders are used in industry as linear actuators, creating motion in a straight line. Cyltronic AG has developed a cylinder that uses electricity instead of compressed air, consuming only a fraction of the energy. And it can be easily retrofitted into existing systems, too. Electric cylinders are also an interesting prospect for machine manufacturers: the cylinders can significantly increase their products' energy efficiency, thus adding reduced operating costs to their benefits.

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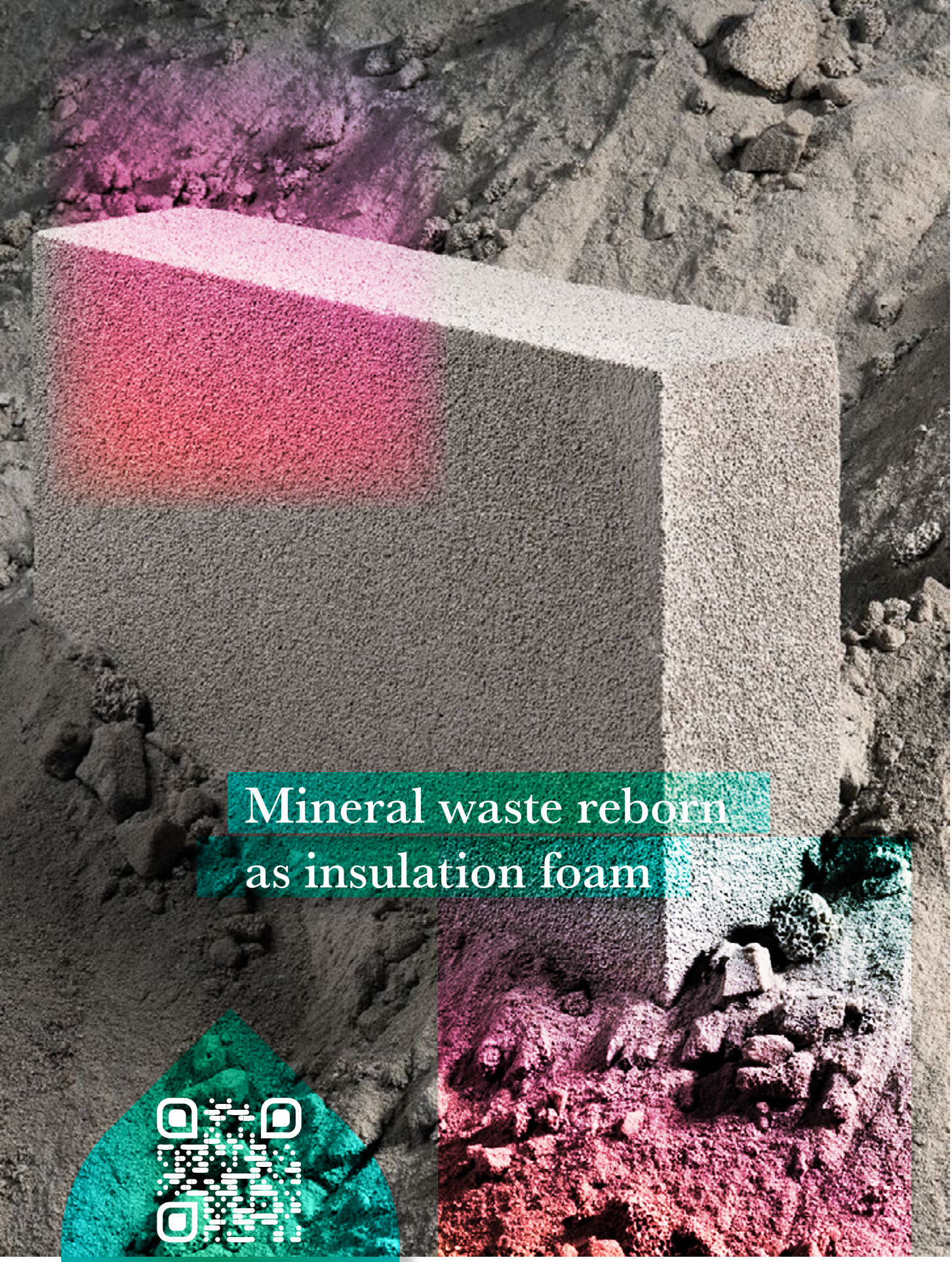
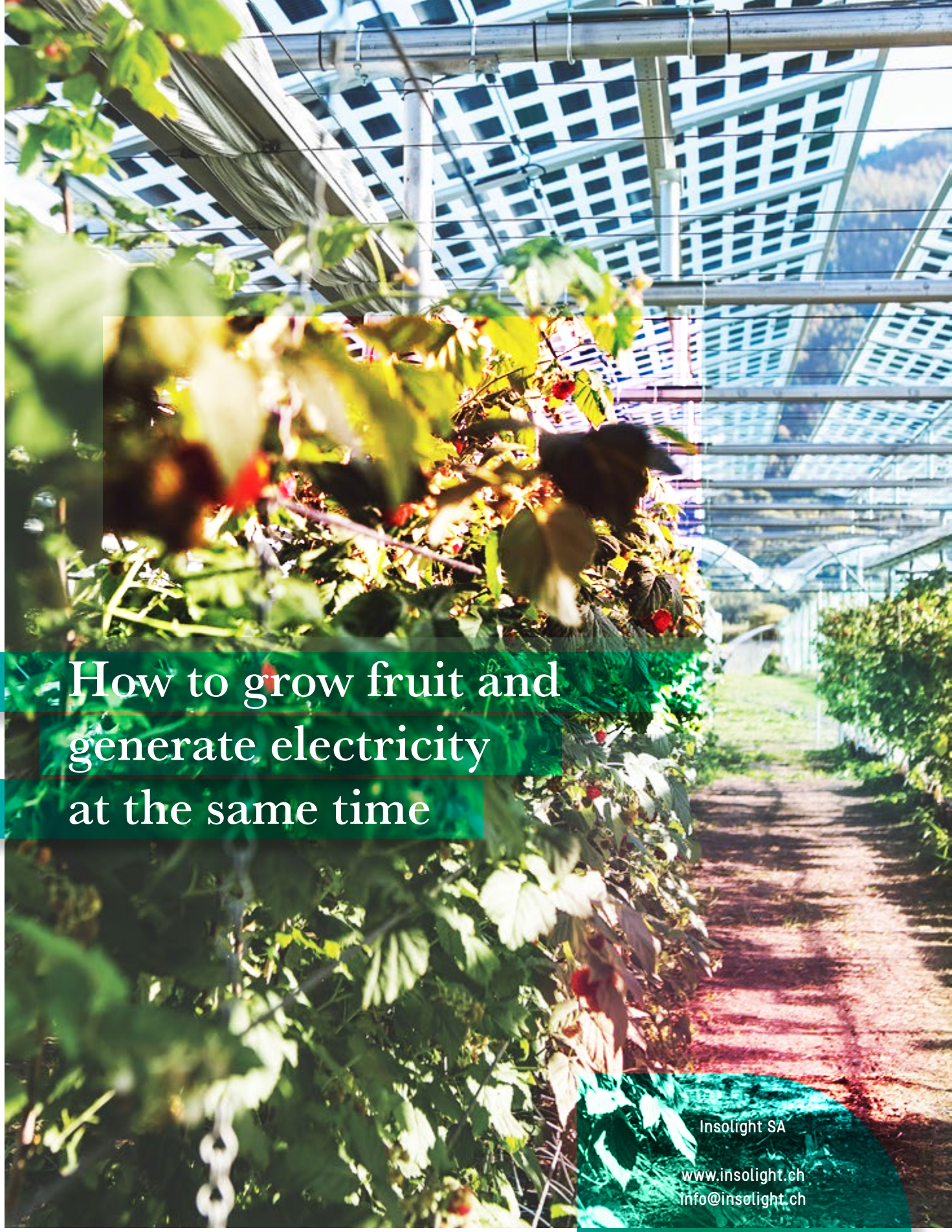
Mineral waste reborn as insulation foam



FenX AG

www.fenx.ch
info@fenx.ch

Effective insulating materials are key to keeping heating energy consumption low in new and existing buildings. FenX has developed a waste-based insulation material that improves the sustainability of buildings. The foaming technology used in its production can also be employed to make products for other industries from different waste materials and thus strengthen the circular economy.



How to grow fruit and generate electricity at the same time

Insolight

Insolight SA

www.insolight.ch
info@insolight.ch

Effectively combining agricultural production and photovoltaic power generation on the same site is now possible thanks to the agrivoltaic system developed by Insolight. This crop protection system features a movable screen and translucent PV cells that turn the sunlight not needed by the plants into electricity. The potential for this technology in Switzerland is 5 GWp of installed power over 5,000 hectares. But Insolight is looking beyond Switzerland's borders, with some 30 commercial projects currently in the pipeline around Europe.

Aeler Technologies SA

www.aeler.com
info@aeler.com

Delivering the container of the future

With its connected containers solution offering a higher payload, a more aerodynamic shape and better protection for the goods inside, AELER Technologies is set to revolutionise global freight forwarding. The storage volume of its containers is up to 17% bigger than standard models, reducing the number of containers required. And with its innovative subscription-based system, AELER also addresses the empty shipment problem, paving the way for a drastic reduction in the environmental impact of the logistics sector.

Geothermal energy without drilling

The underground geothermal panels developed by enerdrape turn any below-ground infrastructure into an energy source. These panels are installed on the walls of underground structures and capture the surrounding geothermal energy and waste heat regardless of the ambient temperature. Connected to a system of heat pumps, this unique, drill-free geothermal technology could satisfy up to 60% of a building's heating (or cooling) requirements.

Enerdrape Sàrl

www.enerdrape.com
marketing@enerdrape.com

Enerdrape

Working towards a goal of net zero aviation

For aviation to transition to electric power, it needs electric propulsion and storage systems. To this end, the Solar Impulse spin-off H55 is developing electric propulsion systems capable of fully electric flights. They are currently certified for two-seater pilot-training planes, the aim being to install them in 19-seater planes in the near future. This is a first step towards massively reducing the carbon footprint of the aeronautical industry. In partnership with Pratt & Whitney, H55 is set on flying regional aircraft with hybrid engines before the end of the decade. This represents potential carbon savings of 30% compared with a conventional aircraft in the same category.

H55 SA

www.h55.ch
contact@h55.ch

SmartHelio

SmartHelio Sàrl

www.smarthelio.com
solar@smarthelio.com

Predictive software for solar plants

The software developed by SmartHelio is capable of anticipating and diagnosing faults in photovoltaic installations using data collected by a variety of existing devices. It also features an exclusive dynamic climate modelling tool to improve their climate resilience. This technology improves the performance of solar plants by 10%, saving one tonne of CO_2 per GWh each year. Through its offices in Switzerland, India and the US, the company has around 50 customers all over the world.

7 AFFORDABLE AND CLEAN ENERGY

Solar self-sufficiency for all

smartsuna

Working together with Studer Innotec, the Swiss manufacturer specialising in powering off-grid sites, smartsuna designs and markets systems that provide smart solar self-sufficiency. The company's turnkey installations were developed primarily for residential applications but are also aimed at collective housing and industry. Combined with a battery, the NEXT3 inverter enables flexible management of current flows between photovoltaic production and consumption. This technology achieves 75% energy autonomy for a typical detached house.

smartsuna

www.smartsuna.ch
info@smartsuna.ch

Nexxiot

En route to clean, transparent logistics chains

More and more objects are being integrated into networks of smart devices – known collectively as the 'Internet of Things'. In line with this trend, Nexxiot AG fits goods wagons and shipping containers with GPS-enabled sensors powered by solar electricity, bringing transparency to global supply chains. This also allows freight forwarders and cargo owners to document the environmental impact of goods transport and achieve their sustainability goals.

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Nexxiot AG

www.nexxiot.com
info@nexxiot.com

Bloom Biorenewables

Bloom Biorenewables Ltd

www.bloombiorenewables.com
info@bloombiorenewables.com

Replacing oil with plants

Drawing on its advanced knowledge of plant chemistry, Bloom Biorenewables has developed a technology that effectively separates all the components of biomass. This enables it to extract not only the cellulose but also the lignin and hemicellulose from plants. These compounds are set to replace fossil-fuel carbon compounds for use by the fine-chemicals industry and in the manufacture of plastics and commodities for the building industry. Once it has secured these markets, the company plans to produce renewable fuels for the aviation industry and maritime transport, enabling it to reduce carbon emissions on an international scale.

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DePoly

DePoly SA

www.depoly.co
contact@depoly.co

DePoly is a company with a mission: to create a sustainable circular economy for plastics with an innovative chemical process that breaks down plastics into reusable raw materials. With the reprocessed plastics treated at ambient temperature and no pre-washing or sorting required, this solution generates materials identical to those produced by the oil industry. Currently at the industrial demonstration stage, the technology could significantly increase the proportion of recycled plastics in the world – which at the moment is just nine percent.

Revolutionising plastics recycling

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A showerhead that proves less is more

Gjosa SA

www.gjosa.com
info@gjosa.com

While water is a scarce commodity in many places around the world, it remains practically unlimited and cheaply available in high-income countries. However, when you take a closer look, it is clear that a lot of energy is required to produce hot water. Reducing hot water consumption is therefore an important part of efficient energy use. The start-up Gjosa has developed a technology for showerheads that uses up to 80 percent less water and reduces energy consumption by the same amount.

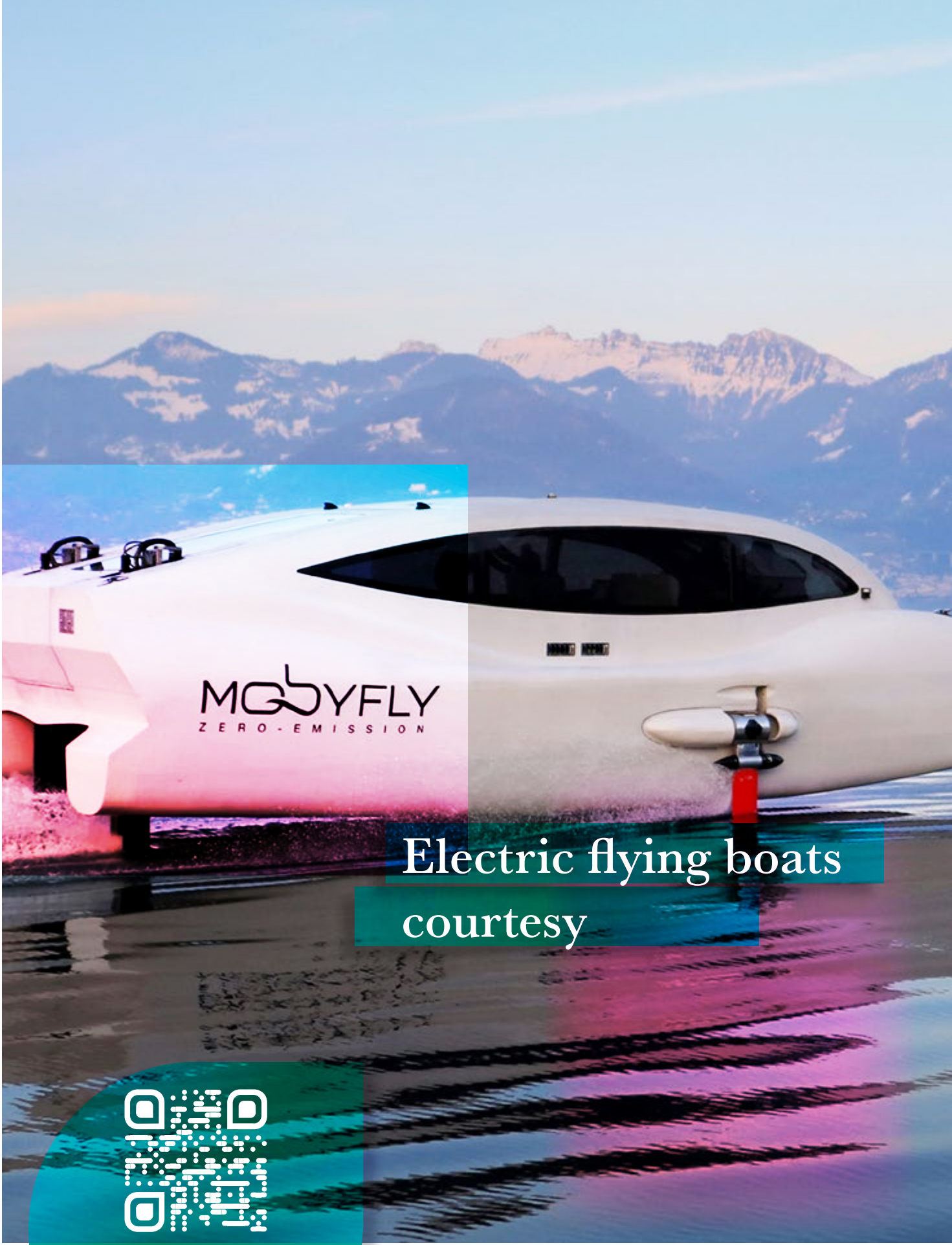
Urbio

Urbio SA

www.urb.io
contact@urb.io

Using AI to reduce the building sector's carbon footprint

Urbio has set its sights on accelerating the transition of our towns and cities to a sustainable model, particularly in the building sector. The company has developed a decision-making tool that uses AI to generate a choice of optimised energy infrastructure solutions. This speeds up and helps prioritise projects and also aids in securing investment by simulating the costs, benefits and carbon impact of the measures under consideration. Urbio estimates that its solution will help the building sector cut several gigatonnes of cumulative carbon emissions by 2050.



Electric flying boats courtesy

MobyFly SA

www.mobyfly.com
info@mobyfly.com

The fast, carbon neutral hydrofoil boats developed by MobyFly have been put through their paces on Lake Geneva under real-life conditions. They are available in three sizes – accommodating 12, 60 or 300 passengers – and consume up to 80% less energy than conventional diesel ferries. The innovative company, which was named a technology pioneer by the World Economic Forum in 2023, offers an efficient, cost-effective solution to road traffic congestion in waterfront towns and cities.

Improving water-use efficiency

AQUA4D

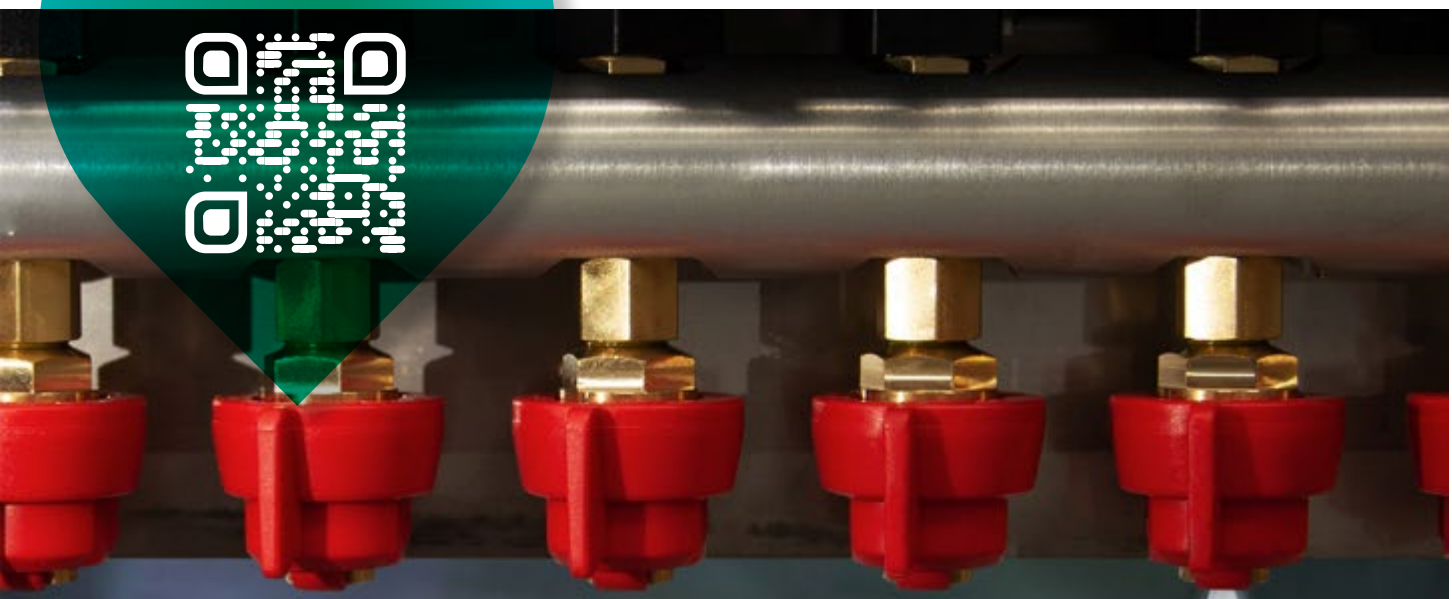
AQUA4D
Planet Horizons Technologies SA

www.aqua4D.com
info@aqua4d.com

AQUA4D uses resonance-field technology in an environmentally friendly water treatment. Present in more than 40 countries, its technology is used in irrigation, where it results in a 25% saving in water and fertiliser while increasing yields and restoring the soil. This chemical-free treatment process is also an efficient way of protecting water pipes in buildings. With business booming since the post-Covid recovery, over the next few years AQUA4D is set to double its turnover annually.

Ecorobotix SA

www.ecorobotix.com
info@ecorobotix.com



Using AI in the fields

With ARA, its ultra-high-precision AI smart sprayer, Ecorobotix is reducing the use of conventional plant protection products by 70 to 95%. This revolutionary tractor-towed technology scans the field, identifying which plants need to be treated and applying a precisely controlled dose of the required products. This results in healthier, more abundant crops with a lower environmental impact.

A transport drone with hybrid propulsion

Dufour Aerospace

Dufour Aerospace AG

www.dufour.aero
info@dufour.aero

Just a few short years ago, the use of drones to transport goods was still the stuff of science fiction. But this vision is becoming increasingly real: Dufour Aerospace AG is about to launch an unmanned light aircraft that can be used, among other things, to deliver urgent medical goods. Its hybrid drive reduces fuel consumption tenfold compared to helicopter flights.

Droople

Keeping tabs on water

The IoT technology developed by Droople means that water monitoring can now be decentralised to each treatment and distribution point. As a result, its data capture and analysis system not only optimises water systems maintenance but also changes user behaviour – making measurable water savings. Now mature, Droople's technology is being marketed mainly in Europe and the United States.

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Droople SA

www.droople.com
contact@droople.com

Turning to hydrogen to reduce our dependence on carbon

GRZ Technologies SA

www.grz-technologies.com
info@grz-technologies.com

A high-density battery, a compressor, a chemical reactor used to make synthetic methane: GRZ Technologies is tapping into the promise of hydrogen to further the cause of the energy transition and reduce our dependence on carbon. Its storage solution, eight to ten times more concentrated than a lithium battery, is now being used on large solar and wind farms and in industry too. And the company has also developed a compressor used by filling stations for hydrogen-powered vehicles. Lastly, its power-to-gas system is set to replace fossil methane with 100% renewable carbon-neutral methane in a host of applications.

eSMART Technologies SA

www.myesmart.com
info@myesmart.com

eSMART Technologies

Eco-smart buildings

The building automation specialist eSMART offers real estate managers a simple and compact connected management solution that covers all the technical aspects of a building. Residents can also view their real-time energy consumption through the user interface, with effective monitoring resulting in energy savings of up to 20%. eSMART's solution has already been installed in 10,000 dwellings in Switzerland and elsewhere in Europe and the company is currently developing a pilot project in Dubai.

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Grid-eMotion® Flash – wireless charging for e-buses

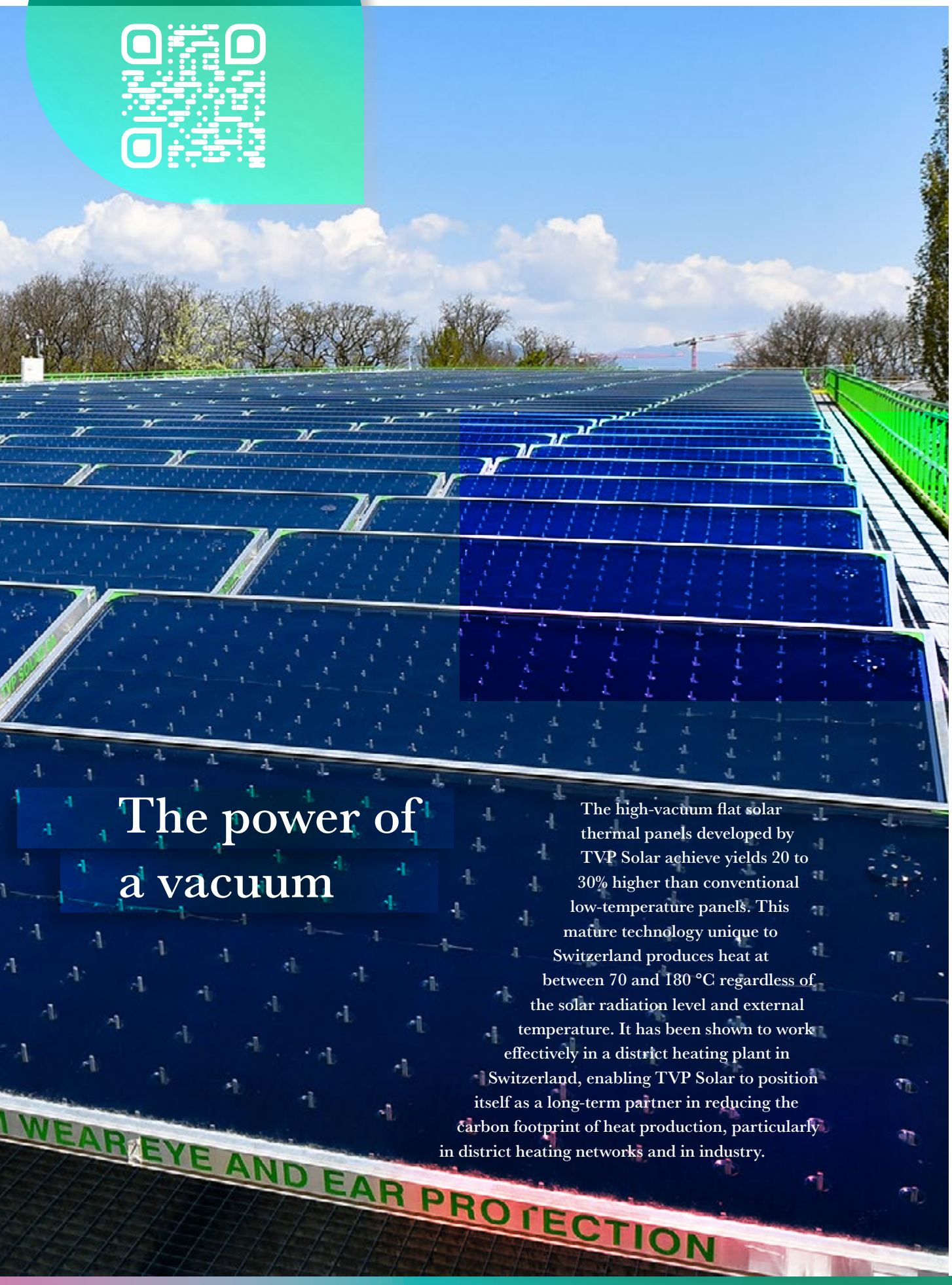
Hitachi Energy Switzerland Ltd.

www.hitachienergy.com

Hitachi Energy's recharging solution for electric buses has proved a success in commercial operation in Geneva and Nantes. Grid-eMotion® Flash technology, the only system of its kind in the world, is catching on in other cities around the world, including in a new trackless tram network in Brisbane, Australia. Through an articulated robotic arm connected to a battery, e-buses fitted with the technology can recharge at bus stops in just 20 seconds. This mature solution is now in pole position to help European operators significantly reduce the carbon footprint of their bus fleets.

TVP Solar SA

www.tvpsolar.com
info@tvpsolar.com



The power of a vacuum

The high-vacuum flat solar thermal panels developed by TVP Solar achieve yields 20 to 30% higher than conventional low-temperature panels. This mature technology unique to Switzerland produces heat at between 70 and 180 °C regardless of the solar radiation level and external temperature. It has been shown to work effectively in a district heating plant in Switzerland, enabling TVP Solar to position itself as a long-term partner in reducing the carbon footprint of heat production, particularly in district heating networks and in industry.

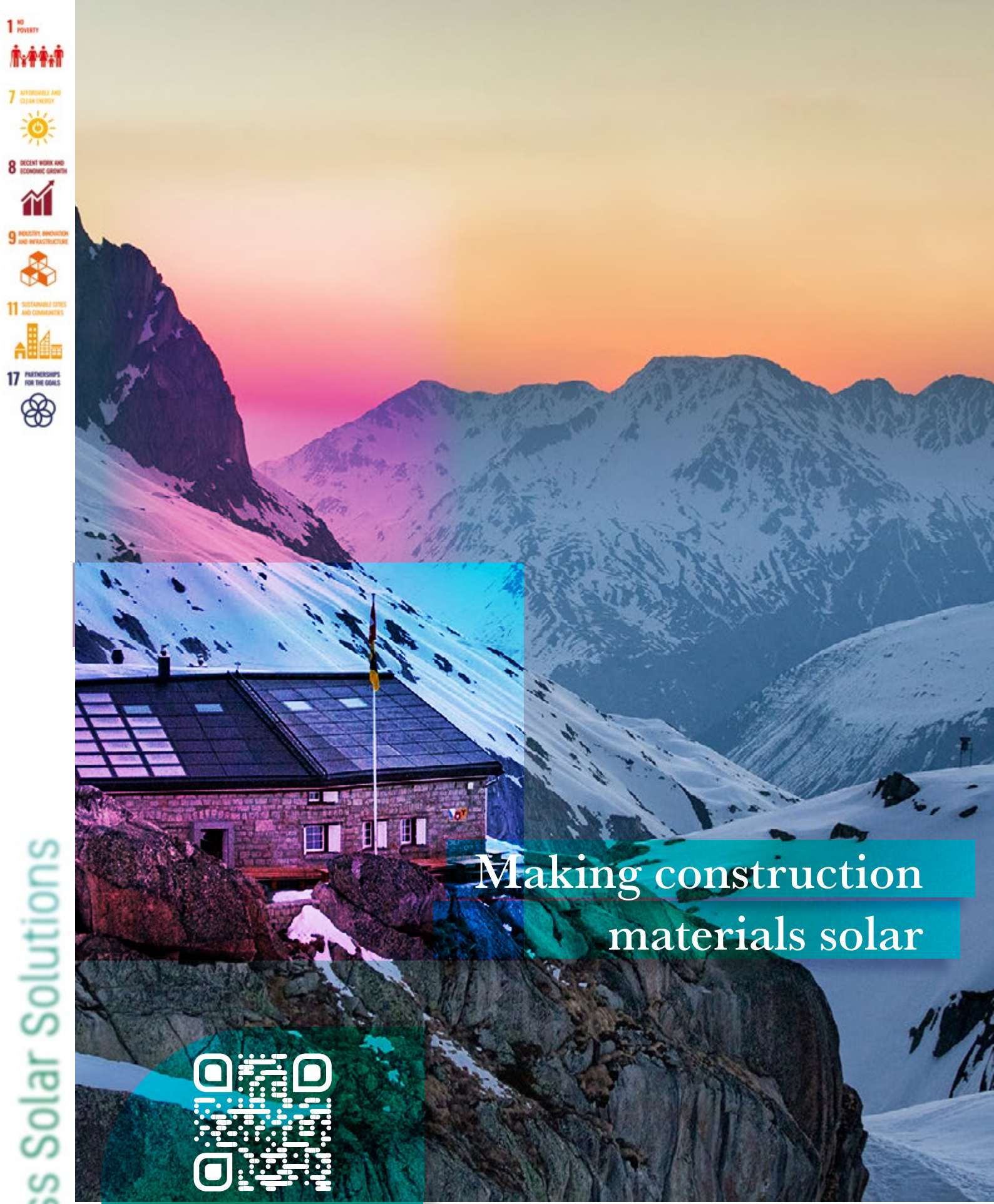
ZERO-C
Climat Gestion SA

www.climatgestion.ch
admin@zero-c.ch

ZERO-C

State-of-the-art refrigeration

Superior performance, reduced maintenance, natural fluids and no oil. That sums up the ammonia compressor developed by the industrial refrigeration specialist ZERO-C. A twentieth of the size of the models currently on the market, this ground-breaking technology is also up to 16 times lighter, while performing up to 20% better. A unique solution that is set to help reduce the carbon footprint of buildings, industry and district heating networks in the near future.



Making construction materials solar

3S Swiss Solar Solutions

3S Swiss Solar Solutions AG

www.3s-solar.swiss
info@3s-solar.swiss

3S Swiss Solar Solutions develops and produces attractive integrated photovoltaic solar modules for roofs, façades and balconies. From individual family homes to large apartment blocks and commercial buildings, along with parking shelters, ski lift terminals and even mountain huts, the company fits solar panels to around 15 buildings every day, helping to reduce the building sector's carbon footprint. With two production lines in Switzerland, 3S is also able to mass-produce the products developed by start-ups and research laboratories.

Making water safe

bNovate has revolutionised the monitoring of the microbiological quality of water by automating the process, replacing conventional methods. The company's compact mobile monitoring devices, designed for industrial use, optimise water treatment processes. Installed directly on a drinking water pipe, one of bNovate's devices continuously measures the water quality. Another is used for routine sample testing. This technology improves the health security of water and also helps to reduce CO2 emissions by optimising water treatment processes.

bNovate Technologies SA

www.bnovate.com
info@bnovate.com

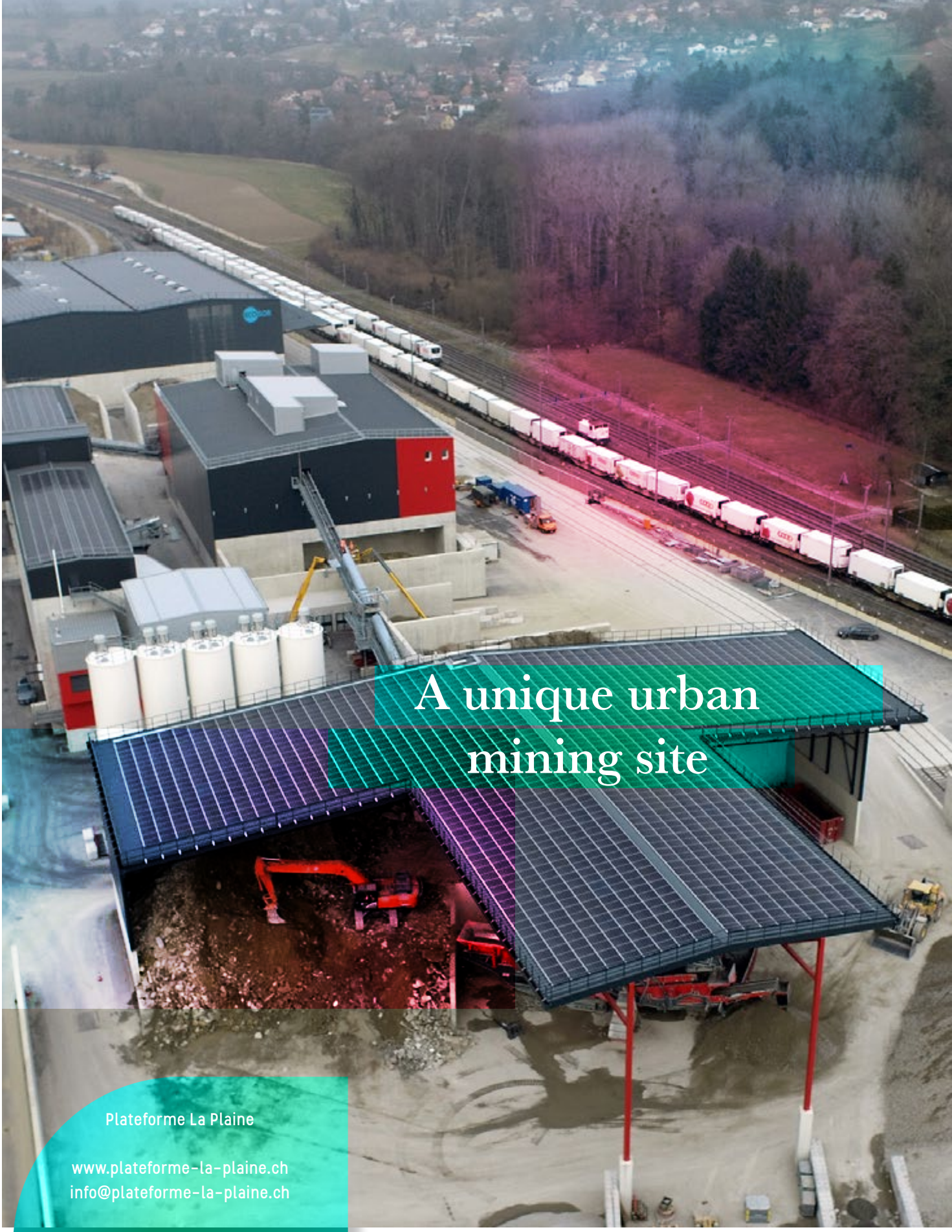
bNovate Technologies

Microlino AG

www.microlino-car.com
info@microlino-car.ch

The best of both a motorbike and a car

An easily manoeuvrable electric vehicle that allows two people to travel in urban traffic, protected from the weather – that is the basic idea behind the Microlino. The vehicle, from the manufacturer of the same name, is now in its second generation. With a consumption of 6 to 7 kWh per 100 km, the 500-kilogram vehicle uses only a third of the electricity of a normal electric car.



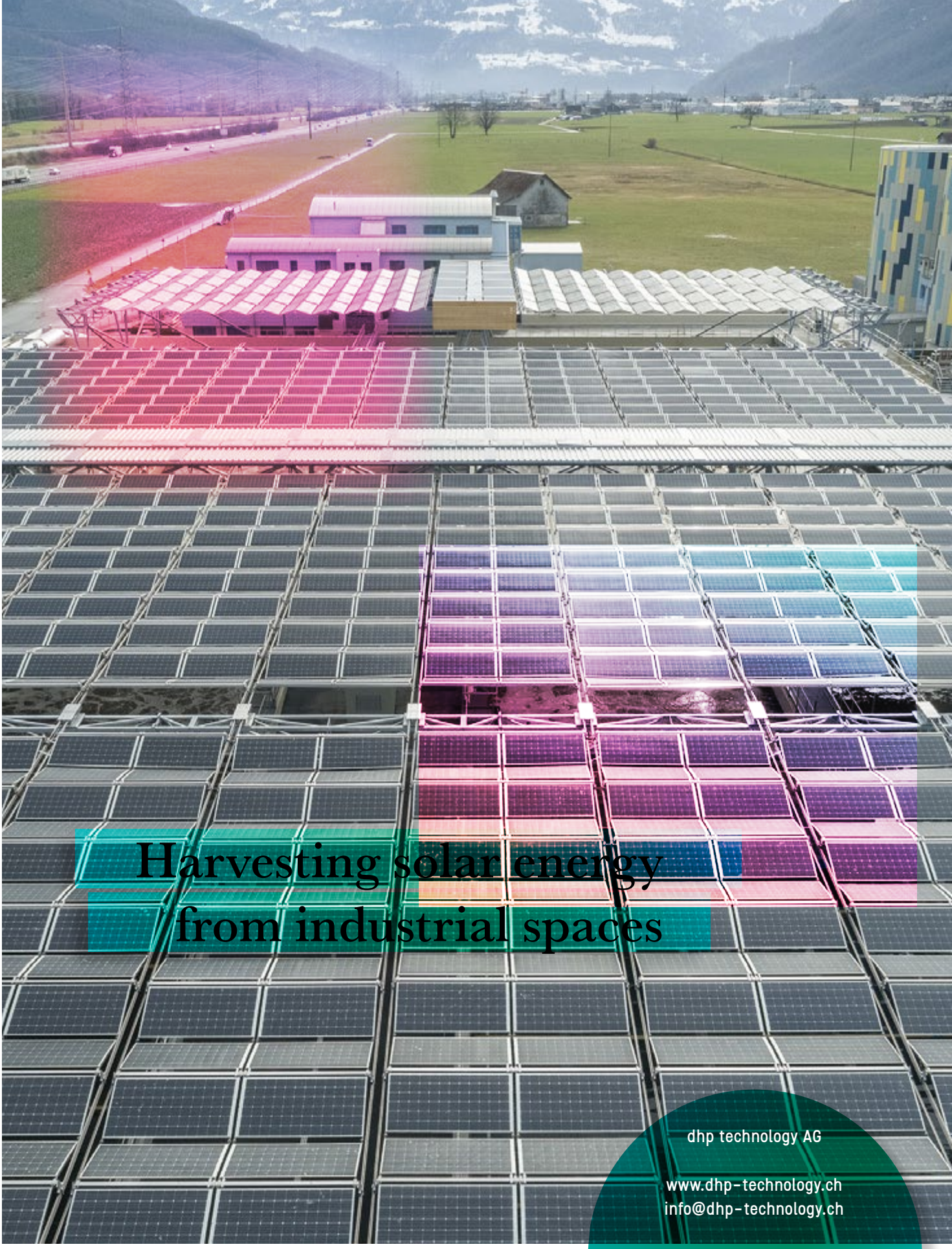
A unique urban mining site

Plateforme La Plaine

www.plateforme-la-plaine.ch
info@plateforme-la-plaine.ch

Plateforme La Plaine is a pioneering concept in the recovery and re-use of mineral materials to prevent them ending up in landfill. This processing facility with a capacity of 150,000 tonnes a year, set up by a consortium of four businesses working in complementary fields, has also put in place a raft of measures to limit the use of road transport. It is an all-encompassing and sustainable set-up that addresses the problem of our diminishing natural resources and stands as a shining example of urban mining and re-recycling.

dhp technology



Harvesting solar energy from industrial spaces

dhp technology AG

www.dhp-technology.ch
info@dhp-technology.ch

Wastewater treatment plants (WWTPs), car parks and logistics areas offer large open spaces for harvesting solar energy. dhp technology AG exploits this potential with a folding roof made of photovoltaic modules. WWTP clarifiers are already being used throughout Switzerland to generate renewable energy. Now the company is diversifying and internationalising its business.

Vatorex AG

www.vatorex.com
hello@vatorex.ch

Vatorex

Heat treatment helps bees survive

The varroa mite is partly responsible for the increase in annual bee colony losses. Vatorex AG has developed a biological heating process to protect these valuable insects. The innovative solution combats bee mortality and safeguards the output of commercial beekeepers. It also makes a direct contribution to bolstering agricultural yields and preserving biodiversity.

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Transforming waste into wealth

SELFRAG's goal is to increase recovery of basic materials from incinerator bottom ash (IBA) by improving the recycling rate. The company's unique selective fragmentation technology enables this waste to be transformed into valuable resources, contributing to a circular economy. This innovative patented process uses high-voltage pulses to recover 50% of bottom ash (more than three times greater than current best practice). The volume of waste to be sent to landfill is halved, and more than 700 kg of CO_2 is estimated to be saved per tonne of IBA treated. The first plant opened in 2023, and a further six or seven IBA treatment plants should be up and running in Switzerland and abroad by the end of this decade.

SELFRAG

SELFRAG AG

www.selfrag.com
info@selfrag.com

ID Watch

ID Watch SA

www.idwatch.ch
info@idwatch.ch

Sustainability and innovation lie at the heart of the manufacturing process used to make the eco-watches conceived and developed by ID Watch. Adopting the principles of the circular economy, its timepieces comprise a case made of 100% recycled stainless steel melted in a solar oven – with a carbon footprint 165 times lower than standard stainless steel –, an upcycled movement and a strap made of organic material. ID Watch is out to prove to the traditional watchmaking industry that the circular economy, luxury and profitability can go hand in hand.

The circular economy on your wrist

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14 LIFE BELOW WATER

17 PARTNERSHIPS FOR THE GOALS

Credit cards made from Swiss wood

Swiss Wood Solutions

Swiss Wood Solutions AG

www.swisswoodsolutions.ch
info@swisswoodsolutions.ch

Wood is widely used today as an energy source, building material or raw material for furniture-making. But Switzerland's native wood species are capable of much more than that, as Swiss Wood Solutions AG has shown. When hardened using a special process, this renewable resource can be used to make such widely diverse products as components for musical instruments and credit cards. The products offer an alternative to the deforestation of tropical woods – and to the use of plastic in everyday items.

Smart traffic control

The term ‘smart city’ refers to the use of ICT to network infrastructures in order to upgrade urban living spaces and gear them towards sustainable use. LTS Light Technic Solution AG contributes to the smart city concept with internet-based solutions not only for traffic management but also for energy and water supply, and waste disposal.

LTS Light Technic Solution AG

www.lts-ag.ch
office@lts-ag.ch

AIK Technik AG

www.aiktechnik.ch
info@aiktechnik.ch

Turning municipal waste into recyclable materials

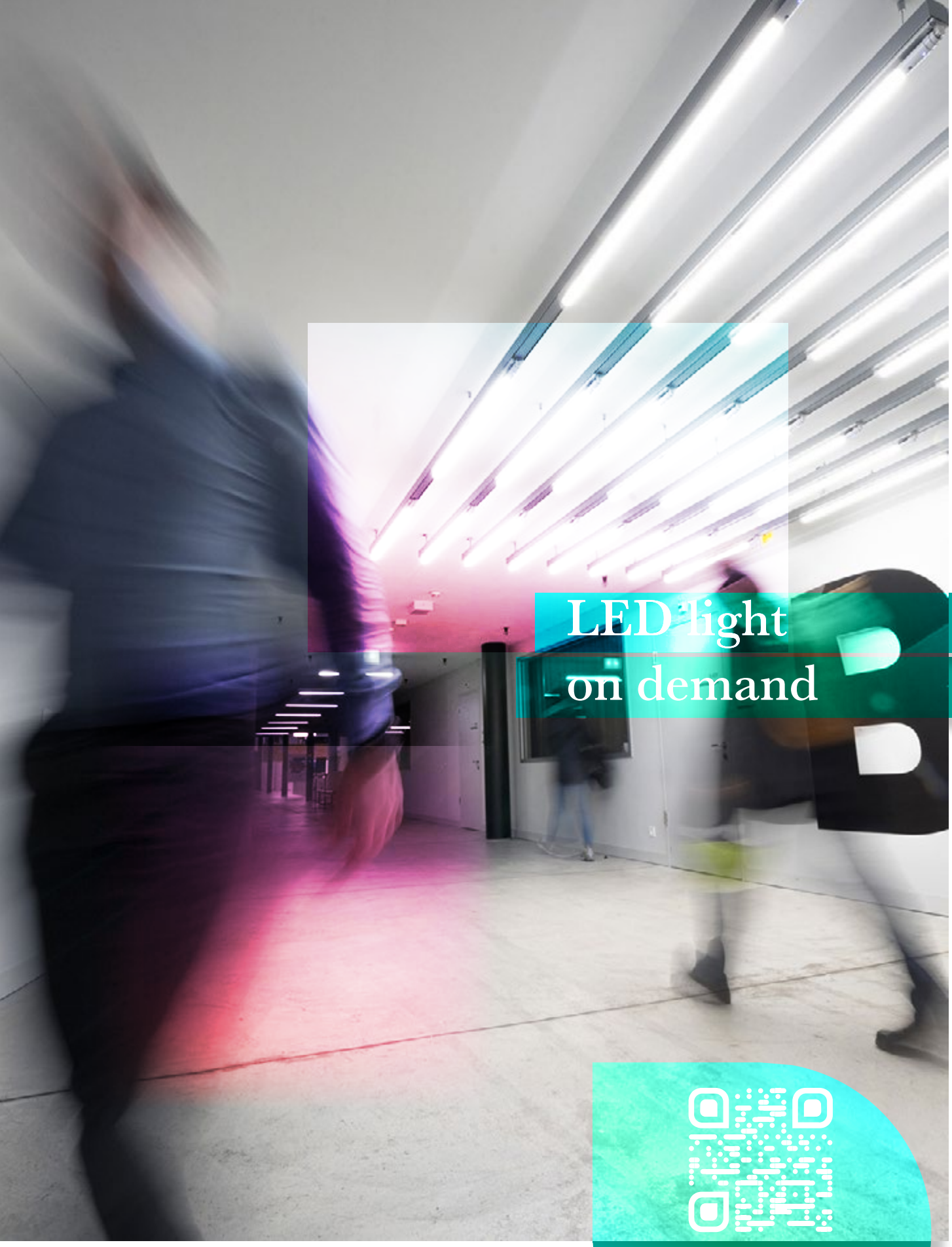
Waste disposal at the roadside or in landfills is anything but sustainable. Today, waste incineration plants are considered to be the best form of municipal waste disposal. For these plants to be able to incinerate waste in an environmentally friendly manner, modern technologies are needed to treat residues and recover recyclable materials. AIK Technik AG not only builds fly ash treatment plants but also offers contaminated soil cleaning processes.

Synhelion AG

www.synhelion.com
media@synhelion.com

Jetting off with carbon-neutral kerosene

Aircraft propulsion requires energy sources that can store huge amounts of energy in a small volume, just like the jet fuel kerosene does. Synhelion AG has developed a production process for a fossil-free, carbon-neutral fuel based on solar heat. When combusted in the aircraft engine, the solar fuel emits only as much carbon dioxide as it absorbed from the atmosphere during production.



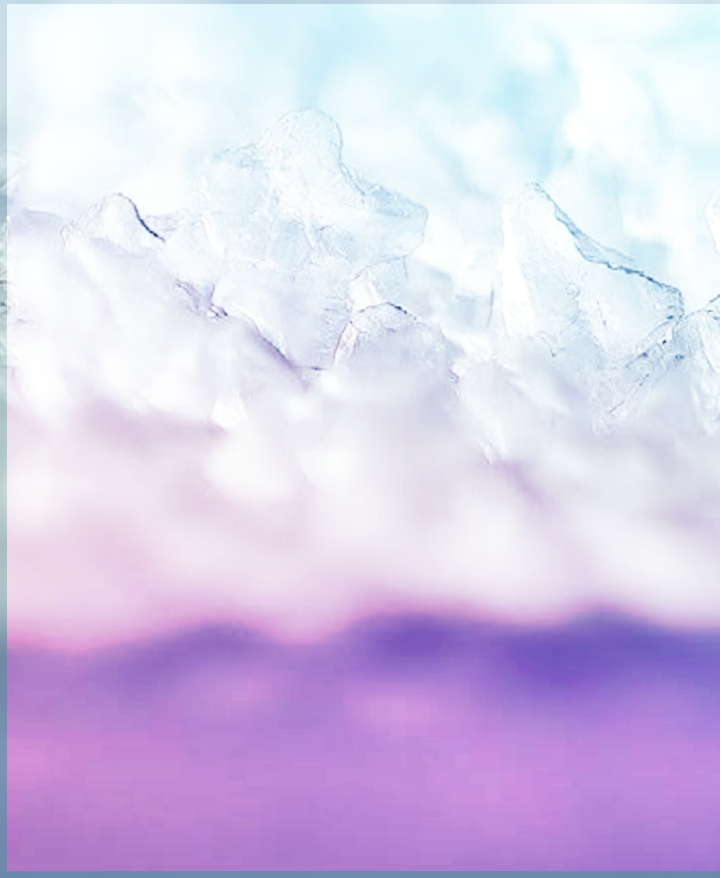
LED light on demand

The introduction of LED technology has enormously improved energy efficiency in the lighting sector. LEDCity AG shows that it can be improved even further: the company adds a control system to LED tubes that ensures the lamps are only switched on when light is actually needed. The system reduces power consumption by around 90 percent compared to standard LED lighting.

LEDCity AG

www.ledcity.ch
info@ledcity.ch

High-performance insulation that is sprayed on



Aeroskin Tech

Aeroskin Tech AG

www.aeroskintech.com
info@aeroskintech.com

Nowadays, new builds are generally constructed with good thermal insulation, which helps to keep heating energy consumption low. However, there is a huge backlog of existing buildings requiring energy-efficient renovation. Aeroskin Tech AG has developed an efficient aerogel-based insulation material that can be applied to walls with a sprayer and is more cost-effective than conventional aerogel insulation boards.

Campus Energypolis

www.energypolis.ch
cedric.dorsaz@hevs.ch

A full-scale demonstration platform

By supporting every stage of the development of innovations, Energypolis Campus is helping to demonstrate a host of technologies. The three buildings on the site form a full-scale test lab for trialling new energy systems in real-life conditions, creating a link between basic research and industry. The site's demonstrator has proved the effectiveness of a unique way of using CO_2 in the production and distribution of heating and cooling energy, helping to make the towns and cities of the future energy self-sufficient and bolstering the energy transition.

Energypolis

Panatere SA

www.panatere.com
info@panatere.com

Panatere

The eco-alchemist

The precision machining specialist Panatere has joined the circular economy. Having established a recycling network for stainless steel production scrap, the company recycles 100 tonnes of the useful metal every year. Its mission is to encourage the adoption of eco-friendly materials that don't involve the use of fossil fuels or electricity. By building a solar oven in the heart of the Swiss Jura's Watch Valley, Panatere plans to minimise the carbon footprint of the recycling process.

6 CLEAN WATER AND SANITATION

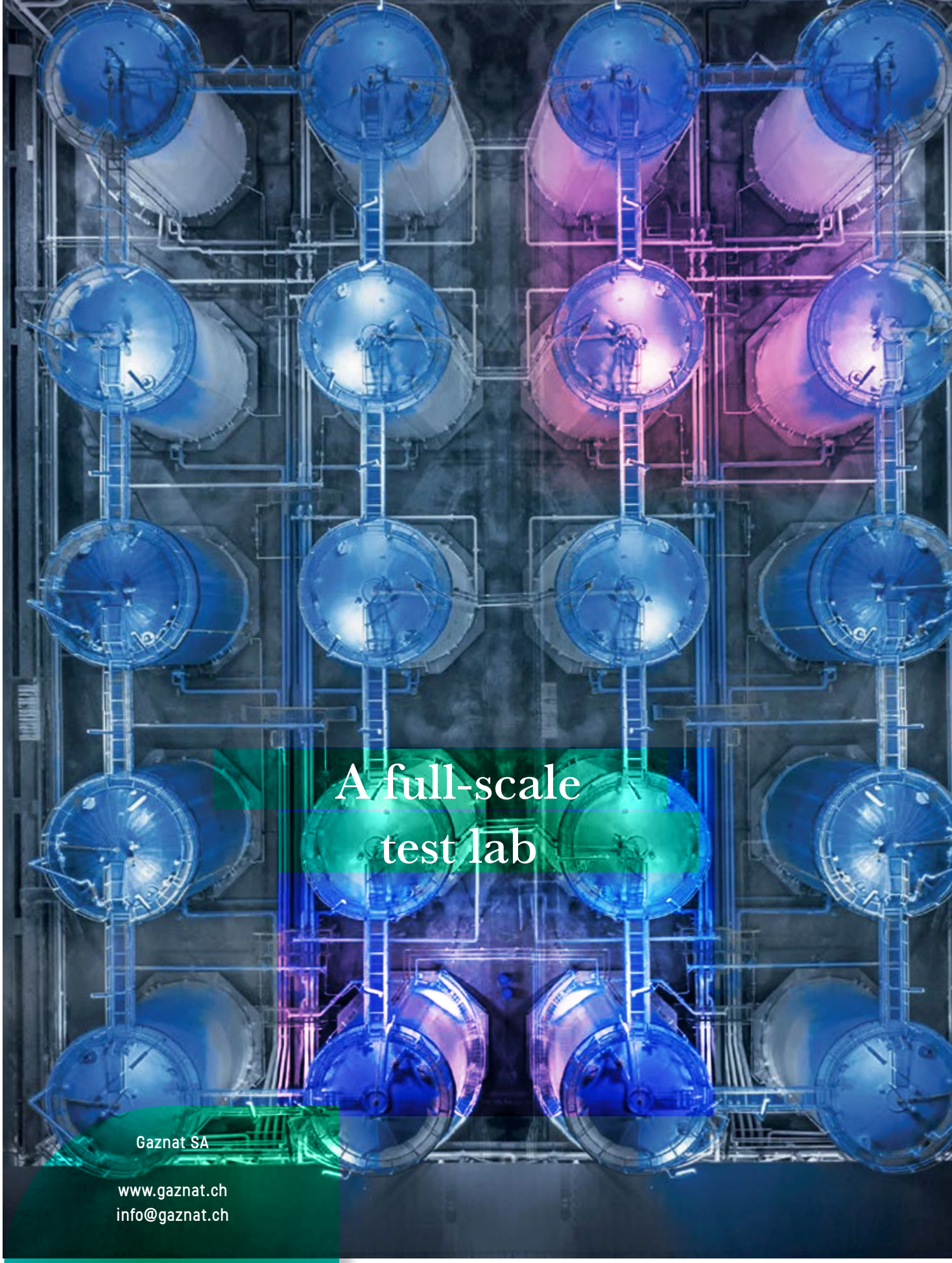
7 AFFORDABLE AND CLEAN ENERGY

8 DECENT WORK AND ECONOMIC GROWTH

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

15 LIFE ON LAND



A full-scale test lab

Gaznat SA

www.gaznat.ch
info@gaznat.ch

Gaznat

Gaznat's main job may be supplying and transporting high-pressure natural gas to western Switzerland, but the company is also working on ways to contribute to the energy transition through innovative projects to develop new technologies. To help decarbonise the gas industry and society, working with scientists at EPFL Valais-Wallis, it is testing two major innovations on an industrial scale in its Innovation Lab: a methanation reactor and CO2 capture membranes.

The innovation pipeline

We round off our panorama of Switzerland's cleantech innovations with a series of projects and fledgling businesses developing products that are not quite ready to be introduced on a large scale but which feature promising technology. The companies feeding their developments into the innovation pipeline will without doubt add to the panoply of mature Swiss cleantech solutions in future years.

LOTS OF (OTHER) INNOVATIONS

Oxara

Towards a more sustainable construction industry

Oxara is developing a number of earth-based sustainable construction materials. Its range of admixtures and binders is cement-free and made up mostly of clay and construction waste, demonstrating the start-up's focus on the circular economy and waste recycling.

www.oxara.earth

Vir2sense

Finding the right balance between fuel consumption and emissions

Vir2sense makes sensors that monitor CO2 emissions. Used in the marine and power generation sectors, these sensors improve the accuracy of the data collected in the most problematic environments. They could help the captain of a ship, for example, to strike the right balance between fuel consumption and greenhouse gas emissions.

www.vir2sense.com

Fireforce Technology

Burning wood without producing noxious smoke

Fireforce Technology converts biomass into heat energy efficiently and with extremely low gaseous pollutant and particulate emissions. This disruptive technology does not require a smoke filtration system, opening up the way to clean combustion of all types of wood.

www.fireforce-technology.ch

Helping sewage works clean up their act

Upwater offers sewage works ways of reducing their greenhouse gas emissions and energy consumption and improving the stability of their processes. This spin-off of the Swiss aquatic research institute Eawag measures for example gaseous effluents to quantify nitrous oxides emissions, then proposes ways of reducing them.

www.upwater.ch

Upwater

Recycling composite materials

Composite Recycling has developed an effective way of separating the glass fibres, resin and plastic that make up composite materials, making it possible to recycle them more efficiently through pyrolysis and other methods.

www.composite-recycling.ch

Composite Recycling

Turning waste into valuable resources

TreaTech has developed a technology that uses catalytic hydrothermal gasification (HTG) to convert a broad range of waste streams. This technology turns the waste into valuable resources such as renewable gas, clean water and minerals such as phosphorus and nitrogen.

www.trea-tech.com

TreaTech

Using electric vehicles to store energy

Sun2Wheel is developing smart electromobility recharging and storage solutions. The company's main focus is on bidirectional charging, which uses EVs themselves as powerbanks, in place of a permanently installed battery.

www.sun2wheel.com

Sun2Wheel

Autonomous groceries delivery with zero emissions

Loxo is developing an innovative delivery service featuring a driverless electric vehicle that makes grocery deliveries on request.

www.loxo.ch

Loxo

Qaptis

Capturing CO2 directly at the exhaust pipe

Qaptis is marketing CO2 capture technology that can be used to retrofit existing truck fleets. It has developed a system that can be attached to truck exhaust pipes to recover the heat and energy required to sequester the CO2 in liquid form.

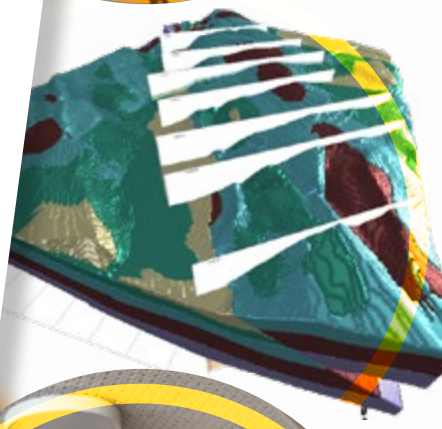
www.qaptis.com

ISSKA

3D geological and hydrogeological modelling

ISSKA has developed a web-based service, Visual KARSYS, that provides 3D geological and hydrogeological modelling. It enables users to create 3D models of their geological surroundings and visualise groundwater flows. In this way, Visual KARSYS helps prevent natural hazards and enables users to better manage and protect underground water resources in karst areas.

www.visualkarsys.com



NanoCleanAir

Removing nanoparticles to provide cleaner air

NanoCleanAir is developing technology designed to remove toxic nanoparticles from exhaust gases and the air. This technology can also be applied to the filtration of fine dust and biogenic aerosols such as viruses and bacteria. The toxic substances are removed by filtration and catalysis.

www.nanocleanair.ch

CompPair

Extending the lifespan of composite materials

CompPair has developed a technology that extends the lifespan and reduces the maintenance costs of composite materials. The start-up uses self-healing technology featuring a resin that gives materials the ability to fill cracks themselves.

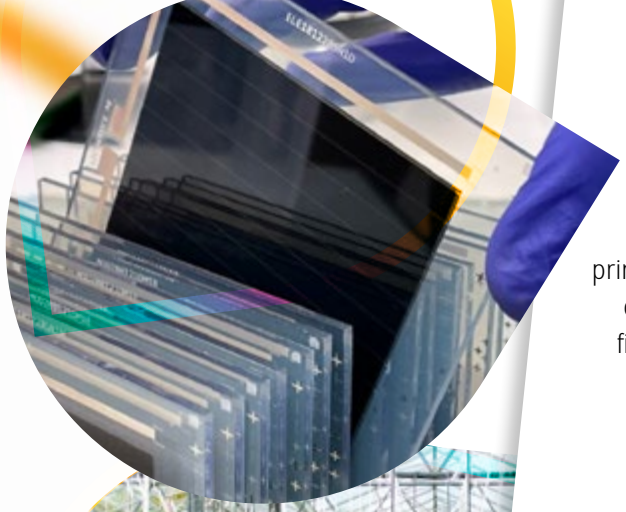
www.comppair.ch

Freesuns

Ultra-modular photovoltaic roofs

Freesuns has developed a range of modular photovoltaic tiles that can be tailored to any style or shape of roof. These innovative tiles are suitable for all new and renovated buildings of any size.

www.freesuns.com



Digitally printed solar cells

Perovskia Solar is developing fully customisable solar cells made of perovskite. The start-up uses digital printing technology to make the cells, which means they can easily be tailored to the surface to which they are fitted. This technology is particularly suitable for small portable devices with low energy consumption.

www.perovskia.solar

Perovskia Solar

Improving the carbon footprint of greenhouses

Infrascreen is marketing an innovative nanomaterial that reduces heat loss through radiation, making more efficient use of the thermal potential of agricultural greenhouses.

www.infrascreen.com

Infrascreen

Getting smart-grid-ready hardware to work together

Neolec has come up with a modular, future-proof plug-and-play solution designed to optimise energy self-consumption in buildings. The set-up works by enabling smart communication between the equipment involved, such as a boiler, batteries, heat pumps and solar panels. It has also developed another innovative energy storage management system: Elec4Africa, developed for emerging countries, kicks in automatically when a power cut occurs.

www.neolec.ch

Neolec

The car with probably the lowest carbon footprint in the world

Softcar is producing a new generation of urban vehicles made out of biopolymers and composite materials in which the entire-life-cycle CO2 emissions are taken into account. The number of components in these circular-economy-friendly vehicles is deliberately limited to 1800 (compared to around 50 000 for a conventional car). The first cars are due on the market by 2025.

www.softcar.com

Softcar

An on-demand detergent and disinfectant solution

Aquama has developed a detergent and disinfectant solution than can be produced directly by consumers and businesses. Its patented technology is based on an electrical chemical activation process.

www.aquama.ch

Aquama

Voltiris

Solar installations designed specifically for agricultural greenhouses

Voltiris is increasing the productivity of agricultural greenhouses. By installing solar panels, this start-up produces electricity from light – without affecting the light inside the greenhouse. These easy-to-fit installations feature coloured filters that let through only the wavelength of light that the plants need, using concentrators to focus the unused part of the spectrum to produce up to 70% of the energy needed to heat the greenhouse.

www.voltiris.com

GreenGT

High-power-density electric-hydrogen propulsion solutions

GreenGT is a company specialising in electric-hydrogen technologies that conceives and develops products for motor sports (the Le Mans 24 Hours) and the haulage industry (40-tonne trucks), as well as infrastructures and regional planning facilities. The company's USP is its propulsion systems, which have an unrivalled weight-to-power ratio, coupled with its expertise in the whole hydrogen value chain and its use in regional planning for example.

www.greengt.com

Yasai

Creating vertical farms to minimise land-use impact

Yasai builds and manages vertical farms. This start-up creates circular food production systems in towns, cities and regions where agricultural resources such as fresh water and fertile arable land are hard to come by. Their method involves less use of pesticides and lower production costs.

www.yasai.earth

WattAnyWhere

Off-grid renewable energy

WattAnyWhere has developed a power generator that provides clean electricity in places with no access to the grid. The generator, which uses a fuel cell to generate the electricity required, is fuelled by renewable ethanol (bioethanol). Applications of this system include charging points for electric vehicles.

www.wattanywhere.com

Railway tracks can produce energy too

Sun-Ways installs removable solar power plants between railway tracks. Not only do these installations have no impact on the landscape or environment, but Sun-Ways' patented rail-fixing system also enables a large number of solar panels to be laid mechanically in a very short time.

www.sun-ways.ch

Sun-Ways

Taking battery recycling to the max

Librec has developed an innovative and efficient process that achieves the highest possible recovery rate of the metals used in old EV batteries (lithium-based batteries). All of the recyclable materials are fed back into the production of new batteries, without the use of chemicals. Librec is even capable of recovering the graphite, which accounts for up to 20% of the weight of a battery.

www.librec.ch

Librec recycling

Productive farming in town and city centres

Umami grows herbs and vegetables in urban locations. The system devised by this start-up, based on vertical farming, creates optimum climate and nutrient conditions capable of achieving growing cycles up to three times faster and up to nine times more productive than conventional methods.

www.eat-umami.ch

Umami

A zero-emissions boat that discharges only water vapour

Almatech Space and Naval Engineering has developed a reliable, zero-emissions fast boat. Called ZESST, it features hydrogen-powered engines and hydrofoils, resulting in an 85% energy saving, providing unrivalled passenger comfort – and emitting nothing more than water vapour.

www.zesst.ch

Almatech

More sustainable insulating foams made from biomass

Groam converts agricultural biomass waste streams into a variety of new biodegradable foams. The foams can be used as insulation, in protective packaging for electronic goods, to replace plugs used in hydroponic farming and in the fashion industry, for example.

www.groamtech.com

Groam Tech

Switzerland hosts countless highly innovative climate tech startups and SMEs. Together, they pave the way for more sustainable business practices.

Simone Riedel Riley
Partner at emerald.vc and General Manager of the Swiss Technology Fund

Innovative minds are paramount to a successful transition. Entrepreneurs and the technological progress they drive play a crucial role in achieving net zero by 2050 – both at home and abroad.

Christoph Mäder
Chairman, economiesuisse

Courageously investing in cleantech innovation is our key solution if we are to address urgent energy and environmental challenges and shape a sustainable future.

Bahaa Roustom
VP Marketing & Business Development Swiss CSEM

The innovations developed by Gaznat, particularly our methanation reactor and carbon capture membranes, will help us to achieve the climate goals that Switzerland has set itself.

Gilles Verdan
Director, Head of Networks Gaznat

If we want to reach the SDGs by 2030, we need to double our efforts – within governments at all levels, civil society, the science community and the economy!

Markus Reubi
Swiss Delegate for the 2030 Agenda

Accelerating the pace towards sustainability and developing new relations between people and nature require transformative solutions. Let's move to innovate together.

Olivier Jacquat
Head Hub Bern & Management board member | Wyss Academy for Nature

Partners

Swiss Federal Office of Energy

To underline the strong will to accelerate the transition towards a sustainable economy and an energy system based on renewable energies, Switzerland is going forward with new Energy and Climate Acts. Those are taking into account the importance of the Cleantech industries including research and development. With its three funding instruments, the Swiss Federal Office of Energy (SFOE) promotes application-oriented research, pilot and demonstration projects as well as larger interdisciplinary research consortia and therefore the development of new markets for sustainable energy use and supply.

www.sfoe.admin.ch

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Federal Office of Energy SFOE

”Sustainable technologies to tackle the NetZero Target are becoming increasingly efficient and the time has come for the industry to implement them. As part of the Climate Act, the Swiss Government decided to set incentives for early adopters of innovative technology to decarbonise with a founding program of 200 Mio/year.

Philippe Müller
Head of Energy Research and Cleantech at the Swiss Federal Office of Energy

Swiss Federal Institute of Intellectual Property

The Swiss Federal Institute of Intellectual Property (IGE-IPI) is Switzerland's central point of contact for all matters concerning patents, trademarks, geographical designations of origin, design protection and copyright. IGE-IPI is also responsible for preparing intellectual property legislation, advising the federal authorities, and representing the interests of Switzerland in international intellectual property organisations and initiatives such as WIPO GREEN.

www.ige.ch

IGE | IPI

”Intellectual property is a key nutrient for a flourishing cleantech innovation ecosystem, and cleantech innovations are helping to achieve many sustainable development goals.

Catherine Chammartin
Director General of the Swiss Federal Institute of Intellectual Property

Switzerland Global Enterprise

Switzerland Global Enterprise (S-GE) is Switzerland's official export and investment promotion agency. It is present throughout Switzerland and in more than 27 countries. S-GE supports Swiss SMEs, especially cleantech companies, with international business development and helps innovative international companies become established in Switzerland. S-GE provides value to customers and creates prosperity for Switzerland through a unique national and global network of partners.

www.s-ge.com

SWITZERLAND GLOBAL ENTERPRISE
enabling new business

Anja Fiedler
Chief Export Promotion + Global Network, Deputy CEO Switzerland Global Enterprise

"Cleantech offers important business opportunities for internationally active Swiss SMEs and their innovative solutions.

Daniel Zürcher
Head of Section Innovation at the Swiss Federal Office for the Environment

"Cleantech will become one of the megatrends of the 21st century and the Federal Office for the Environment will support Swiss companies in playing a major role in its development.

Swiss Federal Office for the Environment

The mission of the Federal Office for the Environment (FOEN) is to ensure the sustainable use of natural resources including soil, water, air and forests. It is responsible for protection from natural hazards, safeguarding the environment and human health from excessive impacts, and conserving biodiversity and landscape quality. It is also responsible for international environmental policy. Environmental policy currently faces a range of major challenges, such as climate protection, biodiversity conservation and resource management

www.bafu.admin.ch

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Office for the Environment FOEN

CleantechAlps

CleantechAlps, created on the initiative of the cantons of western Switzerland, is the force driving regional and national activities to promote the development of the cleantech sector in Switzerland. It fosters cooperation between the country's economy and academic and public sectors and gives stakeholders greater visibility, providing them with access to networks. As a technology generalist and a specialist in cleantech innovation systems, CleantechAlps can put you in touch with the most appropriate contact for your needs.

www.cleantech-alps.com

Cleantech Western Switzerland Sustainability Cluster Alps

"Repeated crises such as the Covid pandemic and the Ukraine war have revealed the fragility of a globalised economy. Cleantech is definitely a means of building a more sustainable and resilient society.

Laura Schwery
Deputy Secretary-General of CleantechAlps

Swiss innovation creating a more resilient economy

In Switzerland, as elsewhere, our resources are running out, leaving us with a complex new reality. In the face of shortages of raw materials, geopolitical tensions and the impacts of pandemics, rethinking our modes of production and consumption is now a sine qua non, not just for business but for society as a whole.

In this time of change, the circular economy is emerging as an essential paradigm shift. It is no longer a question of simply recycling materials but of completely rethinking our actions throughout the product life cycle, for example by reinventing product design from scratch.

Switzerland the pioneer, with its economic fabric teeming with solutions, is at the forefront of this approach. The circular economy provides us with a framework and is becoming a sort of compass that offers stability and opens up the way to a more resilient and more balanced future. In this landscape, the initiatives of CleantechAlps and its partners, the authors of this Swiss Cleantech Report, stand out like a beacon, striving to accelerate the transition to a more sustainable society targeting net-zero emissions by 2050.

The potential of the solutions coming out of Switzerland and other countries is vast. Our challenge now lies in deploying them on a vast scale and, in particular, making far-reaching changes to the legal framework to allow this to happen. Economically viable game-changing solutions are waiting in the wings. This is a major challenge, but one that Switzerland is determined to meet through our policy of collaboration open to everyone involved.

Sustainability is no longer simply an objective; it is a necessity. Switzerland, with its commitment to clean technology, is forging a path to a greener future.

Join us in this collective quest for a more sustainable society in which the circular economy will guide us towards resilience, balance and a regenerative economy.

Eric Plan
Secretary General
of CleantechAlps

IMPRESSUM

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www.swisscleantechreport.ch

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