
Pulsiv


Celerum


Exscientia


AquaInSilico

news from the frontier

June 2021

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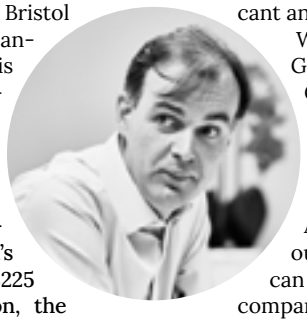
PORTFOLIO COMPANIES STRENGTHEN THEIR TEAMS

We've enjoyed a high level of activity across the portfolio since last time. Exscientia closed two funding rounds and a major deal with Bristol Myers Squibb: Pulsiv and Fieldwork also announced fundraisings; and AquaInSilico is now a United Nations Development Programme Ocean Innovator.



This activity has had an impact. In an April trading update, we said that we anticipated results for the full year to 30 June will be materially ahead of management expectations. Although Exscientia's Series D funding round, which raised $225 million, made a significant contribution, the statement reflected the overall performance of the portfolio – and builds on a strong set of first half results.

I touched last time on the need for us to strengthen the teams of our portfolio companies, and particularly those approaching inflection points marking significant and favourable change.

We've made great progress. The Vaccine Group has appointed Dr Jeremy Salt from GALVmed as CEO. He has also held a senior role at Zoetis, the world's biggest animal health group. Darrel Kingham, formerly of Aixtron and Arm, is Pulsiv's new chief executive officer and Dr Zaki Ahmed has left the University of Plymouth to join the company full time. You can read more about Darrel's vision for the company and how Zaki stumbled on the technology in this newsletter. There's plenty of news to come, so keep an eye on our announcements.

Neil Crabb, Chief Executive Officer

WORLD FIRST AS TOPPS TILES TO LAUNCH ALUSID-MADE PRINCIPLE RANGE BY THE END OF THE YEAR

Topps Tiles is to launch Principle, the world's first range of mass-manufactured tiles made almost entirely from recycled industrial waste before the end of the year. They are being made by Frontier IP portfolio company Alusid.

The UK's largest tile specialist announced the move in its interim results statement published last month when discussing its work in reducing environmental impact.

It highlighted the development of a new range of tiles made from waste material, "such as sanitary ware and waste materials from other production by-products through an industrialised process, which will launch in the second half".

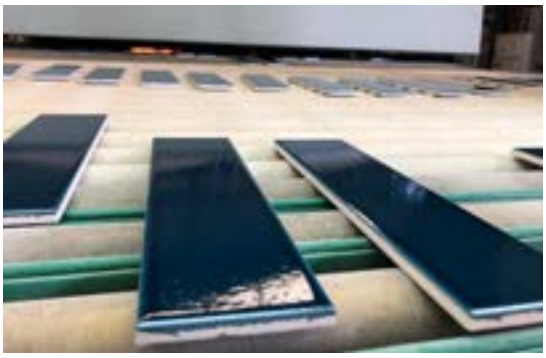
Alusid is now ramping up production of the Principle range so the tiles will be ready for when Topps decides to launch. It follows successful pilot production runs undertaken last year, which proved the company's novel materials and processes could be scaled up for mass manufacture on industry-standard tile making equipment.

The process also uses less energy and water than conventional tile-making techniques.

The tiles, made from a minimum of 95 per cent recycled material, are 29.4cm x 7.4cm x 0.8cm in size and will initially be supplied in four colours – amber, green, blue and white.

The launch builds on the existing relationship Alusid had with Parkside Architectural Tiles, the commercial arm of Topps, which is distributing tiles under the brand name Sequel. These have been made using a batch process at the company's plant in Preston, Lancashire. Alusid's other distributor is Panaz.

Existing customers include COS, part of H&M, Christian Dior, Nando's, Harrods, Selfridges, Amazon UK and Pret-a-Manger.



Top: Alusid tiles emerge after firing
Below: Principle tiles packaged and ready to go

PULSIV: WHY NEW CEO DARREL KINGHAM JOINED THE COMPANY

"THE NUMBERS ARE MIND-BOGGLING"

Darrel Kingham spent more than a decade in senior roles at major multinationals including Arm, where he was general manager of their China business, and at German group Aixtron, as general manager of a nanotechnology group.

But the potential he saw in early-stage Pulsiv and its power conversion technology persuaded him to join the company.

"It's a technology that has global scope," he says. "The growth of renewable energy, distributed power and electric vehicles makes it more relevant than ever, and it could make dramatic improvements around the world.

"I wanted to build something from the ground up – here I can shape the culture, shape the road map, make the big decisions. I was also hugely impressed by the patent portfolio, the quality of people and the results from early prototypes. Taking all those things together, it was a really compelling opportunity."

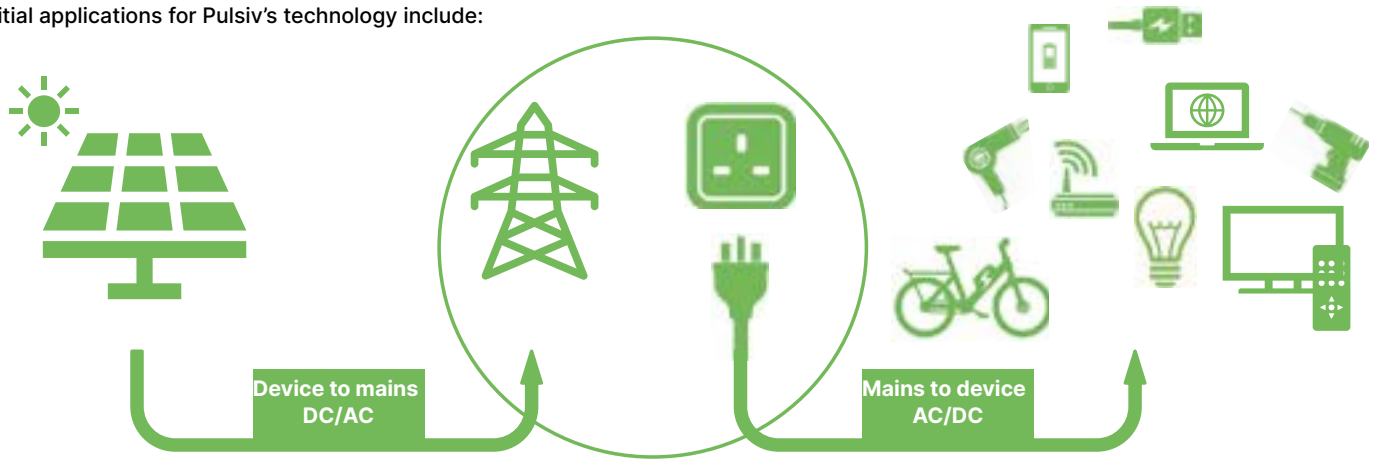
The company is now engaging with leading brands to demonstrate value in commercial applications. "We're aiming to cut costs for the customer, energy bills for consumers and help industry build much better products."

There's also the environmental impact. If Pulsiv's solar technology was adopted globally, Darrel believes it is possible to generate 35GW of untapped potential -- equivalent to 35 coal-fired power stations. The efficiency improvements from the AC/DC converters could be even greater. "The numbers are mind-boggling because most consumer appliances use cheap power supplies that waste power. We're making it possible to deliver high performance without adding cost."

MAKING THE MOST OF ELECTRICITY WHEREVER IT IS CONVERTED

PULSIV IS DEVELOPING A FUNDAMENTALLY NEW POWER CONVERSION TECHNIQUE SET TO DISRUPT EXISTING SOLUTIONS

Initial applications for Pulsiv's technology include:



Solar microinverter - 3% to 5% greater output on average, 30% peak

Upgrade 65W power supplies
Cheaper, lighter, greener 65W to 250W power supplies
Intelligent power consumption

Pulsiv's new chief executive officer Darrel Kingham has set out his plan to accelerate development, scale up and deploy the company's unique power conversion technology.

Setting out a mission of "making the most of electricity wherever it is converted", he based his approach on two key concepts: building something to give to potential customers; and ensuring the company's intellectual property is secure.

In line with these concepts, the company is now developing a range of licensable reference designs to share with potential customers.

There are four main areas for applications:

• To upgrade commodity power supplies of up to 65W to make them greener. These include the power converters used by phone chargers, USB-C adapters, WiFi boxes, and many other high-volume devices. Current converters typically have a power factor – a measure of how efficiently electricity is converted – of 30 per cent to 50 per cent; Pulsiv's prototypes have exhibited a power factor of 90 per cent or more.

• Power supplies in the 65W to 250W range, addressing many high volume domestic devices. At the moment, many companies are forced to create bespoke solutions. Pulsiv will offer greater efficiency and reliability in smaller, lighter-weight form factors, offering greater power density and lower cost per watt.

• A micro controller for better power management to enable consumer products to adjust power consumption in real time. Along with the more efficient converters, this will help to cut energy consumption, costs and bills.

• A solar microinverter, being developed in collaboration with Bosch. Early prototypes have shown this improves the energy output of PV solar cells by an average of 3 to 5 per cent and 30 per cent peak.

DR ZAKI AHMED ON THE ORIGINS OF PULSIV'S UNIQUE POWER CONVERSION TECHNOLOGY

"Rather than teaching inverter principles from a text book, I decided to build one. Something else was happening -- the results were right off the chart."


Dr Zaki Ahmed

Dr Zaki Ahmed, former Associate Professor of Information Technology at the University of Plymouth, "stumbled" across the ideas behind Pulsiv after being asked to teach students solar technology.

An important part of the course involved inverters, which convert the electricity generated a photovoltaic solar cell to electricity that can be used by the grid – from DC to AC. Most conventional converters use low-frequency controllers to extract energy from a cell, and some use high-frequency controllers – but Zaki took a different approach.

"Rather than teaching inverter principles from a text book, I decided to build one ," he says. "My background is in communications, dealing with very high frequency work. So I built my inverter with a very high-frequency controller."

The results surprised him, however, once his inverter was completed. "The inverter models used to predict how controllers behave were not matching my observations," he says. "It was only when I slowed down the speed of my controller that it matched the models."

What he observed was that as he increased frequencies, the energy extracted was greater than expected – there was a "trigger point" when "something else was happening" and which suggested the existing models were incomplete. "The results were right off the chart," he says.

There was clear commercial potential and the company, initially called Pulsiv Solar was formed. Supported an initial equity funding and later Innovate UK grant, Zaki was able to develop and refine the controller designs, combining new electrical circuits and the software algorithms to control them.

The company entered into a collaboration with Bosch to develop the solar microinverter. Lab tests show this extracts up to 30 per cent more energy than the current market leader, and 3 per cent to 5 per cent on average.

Other forms of technology developed are able to convert AC mains power to the DC power used by a huge range of everyday consumer devices and to control power consumption much more accurately.

Early prototypes of Pulsiv commodity power converter have shown a power factor – a measure of how efficiently electricity is converted – of 90 per cent or more, compared to about 50 per cent for conventional converters. To reflect the wider range of applications, the company has changed its name to Pulsiv.

The technology is now protected by 19 patents granted globally across all major territories. There are further applications pending and others are being filed.

Pulsiv has recently completed a £1.5 million fund raising. The company is engaging with major companies and developing a series of reference designs which, when combined with a chip, can be used by industry while protecting the company's IP.

Zaki has also left the University and joined Pulsiv full time as Chief Strategy Officer. "I thought it was the right time," he says, adding the company is now at a stage where it is poised to start generating revenues.

"It's my dream job," he says. "I am being paid to play around and build things."

HIGHLANDS & ISLANDS PROJECT FINDS CELERUM'S AI SOFTWARE COULD HELP TO CUT SUPPLY CHAIN EMISSIONS BY UP TO 40%

Using artificial intelligence based on nature-inspired computing could cut emissions by up to 40 per cent across food and drink supply chains in northern Scotland, a project organised by Highlands and Islands Enterprise has found.

The three-month pilot project brought The Data Lab, Scotland's innovation centre for data and artificial intelligence and the Highland Food and Drink Innovation Network together with Robert Gordon University's Smart Technologies team and its commercial spin out – Frontier IP portfolio company Celerum.

Their task was to explore the potential benefits of an open logistics platform with an AI capability that matched food producers' demand to logistics firms' ability to supply. The idea was to optimise vehicle use by encouraging companies to share loads.

Data was gathered from 24 participants, a mix of food and drink producers and logistics firms, by the Food and Drink Innovation Network. The data, anonymised, was then sent to the University and Celerum.

Their approach is based on nature-inspired computing, which learns lessons from the natural world where evolution has overcome inefficiency. For example, insects, such as bees and ants, choose the most efficient routes when returning to hives and nests or collecting food.

The results were "immensely encouraging", according to The Data Lab. The pilot "identified the potential for significant economic benefits for both producers and logistics service providers. Furthermore, results indicate improved vehicle utilization, which may result in carbon emission reductions of 20-40 per cent, as well as increased resilience in the supply chain."

Having achieved proof of concept, the partners are exploring opportunities for wider testing across Scotland. The software platform could also be useful in similar regions in Spain and Italy.

AQUAINSILICO PART OF UNITED NATIONS PROJECT TO PROTECT ONE OF WORLD'S MOST DIVERSE MARINE ENVIRONMENTS

Soldier fish in the seas around Cape Verde

AquaInSilico is to support work to conserve one of the world's most diverse marine environments after being selected to receive $250,000 as an Ocean Innovator through the United Nations Development Programme's Ocean Innovation Challenge.

The company will use its digital tools to design and implement improvements to wastewater treatment plants on the Cape Verde archipelago, West Africa, home to a globally important coral reef. They will help cut the amount of nutrients, such as nitrogen and phosphorus, entering the sea. The technology will also improve the quality of water provided to the islanders as part of a two-year project called Phos-Value.

If nutrient levels are too high in the water, it causes excessive growth of algae and other nuisance species. This can result in less sunlight reaching the ocean floor and reduced oxygen levels, affecting fish, shellfish and plants.

AquaInSilico's technology will be used to create wastewater treatment processes to recycle nutrients as biofertilisers. Partners in the project include a leading wastewater treatment company with experience in running projects on the islands.

Selection as an UNDP Ocean Innovator is the result of a highly-competitive process and is an important validation of AquaInSilico's technology. The company's software uses a mathematically modelled biological approach to improve phosphorus removal, based on deep understanding and controlling the operating variables that result from biological and chemical processes. Because of this, its algorithms can detect problems, often before they can be diagnosed by humans.

The technology has the potential to allow companies across a range of sectors to tune and adapt their wastewater treatment systems more effectively. It is expected to save them up to 25 per cent of their operating costs.

FIELDWORK TO TRIAL ALPHA PROTOTYPE ROBOT RASPBERRY PICKER AFTER £675,000 FUNDRAISE

An alpha prototype of Fieldwork Robotics raspberry harvesting robot is entering field trials shortly in an important development towards scale up of the technology.

Once the trials are completed, Fieldwork will then be able to focus on preparing the robot design for manufacture. The move comes after the company announced it had raised £675,000 from existing and new investors to accelerate development of the technology for harvesting soft fruit and vegetables.

As well as the raspberry harvester, Fieldwork has also embarked on development of a cauliflower-harvesting robot in collaboration with Bonduelle, one of the world's largest vegetable producers.

The company's technology is designed to be flexible and modular so it can be adapted to harvesting different soft fruit and vegetables. Work is progressing on further agricultural applications, supported by proceeds from the fundraising.

Producers globally are struggling to recruit labour as a result of long-term trends, such as ageing populations and urbanisation.

According to World Bank data, the percentage of the worldwide population working on the land fell from 43.7 per cent in 1991 to 26.8 per cent in 2019.

INSIGNALS WINS €100,000 INVESTMENT FROM PORTUGAL VENTURES

InSignals Neurotech has received a €100,000 investment from leading Portuguese venture capital firm Portugal Ventures.

The funding will be used by inSignals to accelerate the validation and development of its patented technology to aid deep brain stimulation surgery on patients suffering Parkinson's disease. It will also support validation of other applications in neurology and allow the company to expand preliminary clinical trials, strengthen its IP position and grow its team. It is entering collaboration agreements to expand multi-centre clinical trials in Portugal, the Netherlands, Germany and Spain. The company was selected as "one to watch" in the 2020 Nature Spinoff Prize.


Exscientia chief executive officer Andrew Hopkins

BRISTOL MYERS SQUIBB EXTENDS COLLABORATION WITH EXSCIENTIA

The "strength and promise of Exscientia's AI technology and drug discovery expertise" has been further demonstrated by the company's expanded collaboration, worth potentially more than $1.2 billion, with Bristol Myers Squibb, according to chief executive Andrew Hopkins.

This agreement with one of the world's biggest pharmaceutical companies includes up to $50 million of upfront funding and up to $125 million in near to mid-term potential milestones. Additional clinical, regulatory and commercial payments take the possible value of the deal beyond $1.2 billion.

In a Financial Times interview, Hopkins said the deal showed the technology "isn't a promise, but is here today and delivering", adding: "The BMS collaboration is a further validation that the technology really is focusing now not just on discovering molecules but ... on delivering new medicines to the clinic."

Exscientia was behind the first two AI-designed drugs to enter human clinical trials and a third has recently joined them. The advantage of the technology is it can take years off the time taken to discover new drugs by replacing traditional laboratory techniques. The first Exscientia drug, developed in partnership with Sumitomo Dainippon Pharma, took less than 12 months to complete exploratory research compared to an industry average of 4.5 years.

The company has completed two funding rounds this year. It closed a Series C round at $100 million and raised a further $225 million in a Series D round, led by SoftBank, which is providing a further $300 million equity commitment to be drawn at Exscientia's discretion.

DR JEREMY SALT JOINS THE VACCINE GROUP AS CHIEF EXECUTIVE OFFICER

The Vaccine Group has a new Chief Executive Officer. Dr Jeremy Salt has extensive experience in senior roles in animal healthcare across major global organisations in the commercial and not-for-profit sectors.

He joined the company from his role as Chief Scientific Officer of GALVmed, a not-for-profit organisation that develops and makes available livestock vaccines, medicines and diagnostics for small livestock producers.

Before GALVmed, he was the director of Biologicals Research & Development for the Europe, Africa and Middle East arm of the world's biggest animal healthcare group Zoetis. He has completed a PhD in the immunology of foot and mouth virus.

"I am delighted to be taking this leadership role with The Vaccine Group at this important time in its development," he said. "The COVID-19 pandemic has raised the profile of vaccines as a key component of infectious disease control, and the importance of multiple technological approaches has been shown to be critical. The Vaccine Group is well-positioned to contribute to this market with its novel vaccine technologies."

TVG and its international partners have been awarded more than £9 million in grants from UK, US and Chinese governments. It has also signed its first commercial agreement with ECO Animal Health Group and The Pirbright Institute.


Dr Jeremy Salt

DAVID TAYLOR JOINS ALUSID BOARD

The founding chief executive of English Partnerships and Amec Developments has joined the Alusid board of directors as the University of Central Lancashire's (UCLan) representative.

David Taylor CBE is UCLan's Pro Chancellor and Chairman of the University Board, the University's governing body. He has more than 30 years' experience in the private, public and voluntary sectors encapsulating large-scale urban regeneration projects, start-up companies and green technologies.

His company, David Taylor Partnerships, is a specialist in start-up companies and urban regeneration. Its projects include a joint venture with British Land to build homes, a library and a civic centre in Canada Quays, London.

David also initiated a £200 million project in Preston for the University.

He was also a director of the Olympic Development Authority, which organised the London 2012 games. and is Deputy Chairman of Preston North End Football Club, a post he has held for 25 years.