

CONNECTED

A MAGAZINE BY

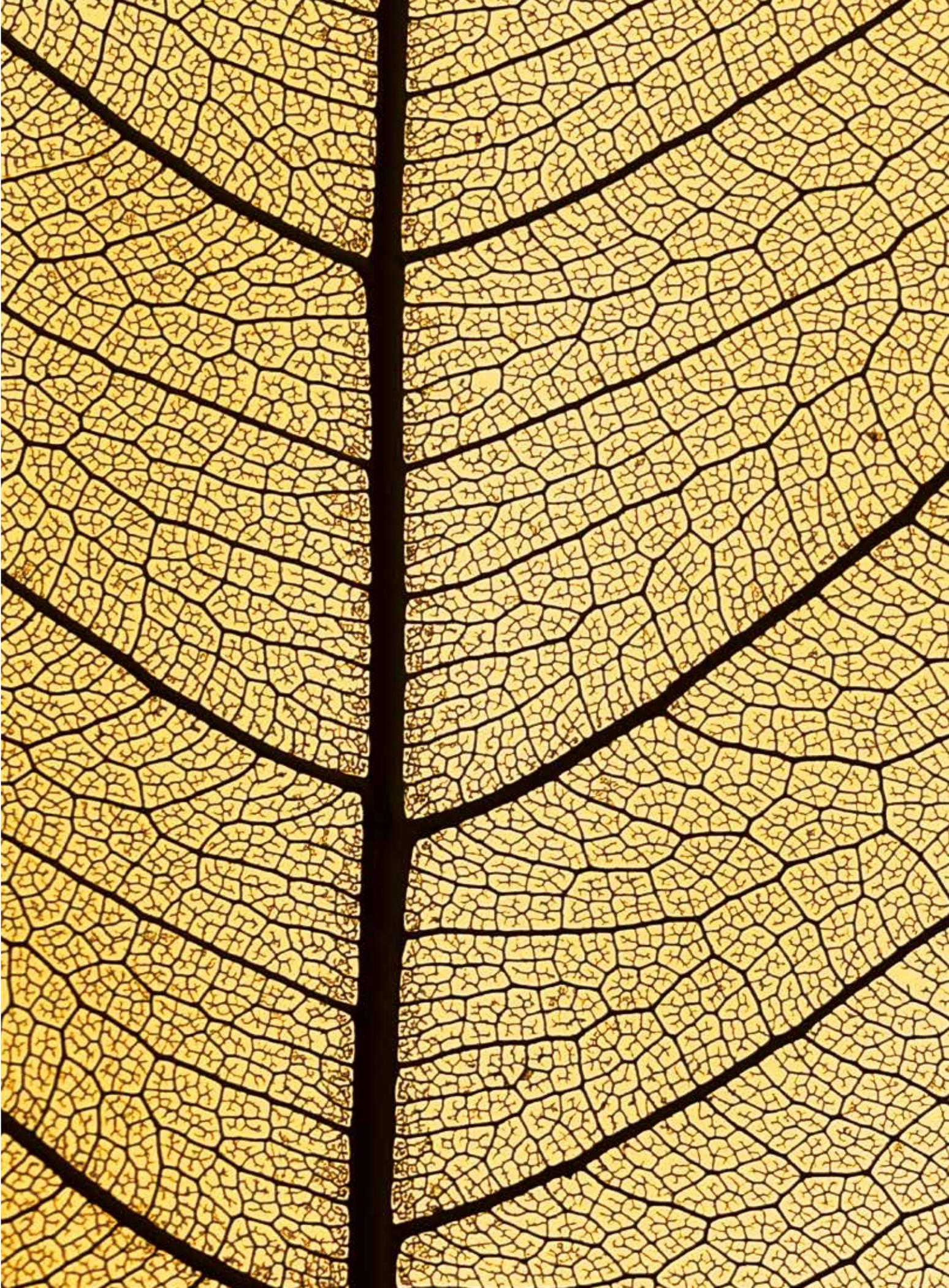


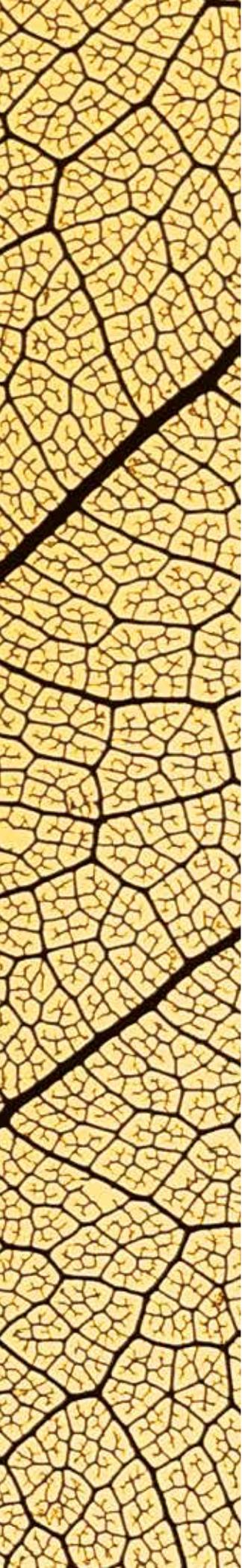
AUTUMN 2017 N° 9

The Energy Driving Innovation

Focal: The Sound of Music

HamiltonJet: Intelligent Propulsion





Necessity is the mother of invention – so the saying goes. Whenever a problem arises, however big or small, people cannot help but try and find a solution.

Today, there is no other more crucial problem that needs to be solved than that of global warming and pollution. The health and survival of our species (and of many others) depend on it. All over the world, an army of scientists, start-ups and companies – many of them LEMO customers – have been analysing, developing and innovating, so that we can produce and consume energy in a cleaner, more sustainable way.

Our special feature pays tribute to this enormous collective effort. We've discussed with an expert in energy transition, visited a solar lab and showcased a number of astonishing projects, such as wind turbine gliders and powertrains for heavy duty vehicles from the co-founder of Tesla.

For such an important issue, everyone can make a contribution, in their own way. We, as a company, have been striving to reduce LEMO's environmental footprint. More importantly, we have been actively involved through the connector solutions that our clean-tech customers have opted for to optimize their technologies.

We are proud to be able to contribute, among so many others, to making our world a better place for future generations.

Alexandre Pesci
CEO LEMO

“There are no passengers
on spaceship Earth.
We are all crew.”

Marshall McLuhan (1911-1980)



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IMPRESSUM

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TECH-BITS FROM AROUND THE WORLD

1. THE SLUG AND THE SURGEON

A Harvard University research team have developed a “band-aid” that can be placed on internal organs. Applied to a perforated heart or liver, these adhesives allow the organs to continue functioning. The basic formula was inspired by the defensive slime secreted by the Arion subfuscus slug, a material having remarkable bioadhesive properties. Since most glues and plasters are toxic and stick very poorly to wet tissues, this discovery may very well revolutionize surgery, as it helps avoid damaging tissues through major surgery.

2. CHINA BELIEVES IN SOLAR ENERGY

China has recently inaugurated the world’s largest floating photovoltaic power station. Designed by the company Sungrow Power Supply, the gigantic plant covers a surface area of over 800,000 square metres and is capable of producing up to 40 megawatts through solar energy. Built near Huainan, a city with a population of almost 2 million in the province of Anhui, it should supply the local network and provide electricity to 16,000 houses. China has set the target of delivering 20% of its total energy requirements from renewable sources.

3. DNA SPREAD

There is a better protection from the sun’s ultraviolet rays than traditional creams. Scientists at Binghamton University in New York have tested a DNA emulsion (from salmon sperm) against UVA and UVB radiation, primarily responsible for skin disorders. The DNA “cream” has blocked 90% of UVB and 20% of UVA absorbed by its substance or reflected by its surface. Even better, tests have shown that the emulsion forms a film, a “second skin”, with enhanced filtering capacity when bombarded by UV radiation: protection further increases with sun exposure!

4. THE SHIRT THAT TURNS INTO A PARKA

Otherlab, a company specialized in intelligent materials, has created a fabric that reacts spontaneously to ambient temperature. Its scientists have managed to develop it by combining common fibres such as nylon and polyester, each of which has different thermal expansion characteristics. Their shirt is self-inflating and traps heat in air pockets whenever outside temperatures are low. As the air warms up it deflates. With time, this new material could help reduce waste in the clothing industry, since we will no longer need to wear several layers.

5. A ROBOT THAT GROWS LIKE A PLANT

Engineers at Stanford University have been working on an interesting robot snake project. It is a tube of thin plastic foil folded inside itself, growing as the robot or rather its “head” progresses with pressurized air pumped into it. Inspired by vines and fungi, this small monster “grows” like a plant and is capable of manoeuvring through inaccessible spaces in order to film them, extinguish an incipient fire and even lift and move objects weighing over 100 kg...



1.



3.



© Jianyu Li, Adam Celiz, David Mooney



2.

© DR



4.



5.

© Stanford University

NEW GENERATION OF *INTELLIGENT* *CONNECTORS*

By Nicolas Huber

LEMO has launched its new Halo LED product, the first intelligent active connectors fitted with 16-million-colour indicators. Configurable through their embedded electronics, they are capable of indicating a wide range of useful information instantly.



LEMO connectors perfectly fulfil their mission of ensuring data transmission from one piece of equipment to another, no matter the environment. The new Halo LED product launched this autumn adds the new function of informing the user via a multiplexed RGB LED indicator arranged in a ring around the connector. This innovation makes life much easier. With information being displayed directly on the connector, the customer no longer needs to integrate an indicator into his equipment.

What information can be displayed by the Halo LEDs? It is for the customer to decide before adding the connector to his equipment. The indicator can be configured as required: status (on/off or blinking), light intensity and of course colours. The multiplexed indicator consisting of red, green and blue LEDs, you simply combine the pulse width modulations of each colour in order to generate the colour of your choice out of among 16 million shades of colour. The indicator's behaviour can also be modified at a later stage, via software, providing maximum flexibility.

Halo LEDs can serve as colour codes making connection easier (which is particularly useful in dark places such as film studios). They can indicate connection status (green: the connector is correctly mated with compatible equipment). In other cases where a piece of equipment should only be connected to another specific piece of equipment, they can confirm the right connection (serving as a safety key). Similarly, LEDs can indicate whether the connected equipment is original (red: it's a copy) or whether the equipment is connected to a power supply. It can also signal data transmission (like blinking diodes in data centres) or for example that the connector needs cleaning (after a number of mating cycles) or has to be replaced (after a selected period).

In certain diagnostic or calibration applications, the user has to repeat the same action over and over again: connect the connector, turn to see the result on the test equipment, pull out the connector, connect it somewhere else, etc. With Halo LEDs, the positive or negative result can be read directly on the connector, which is much faster, practical and reliable.

Halo LED's design is particularly striking. Patented, it's first version presented by LEMO was recognized in spring 2016 at the Hannover Messe (first prize in the i-NOVO design category). This first version featured fewer options and it indicated only two colours.

The new Halo LEDs are available in the OB series, but LEMO is ready to adapt them to other series upon request from customers.

Two more connectors with embedded electronics and LEDs, with different design are being developed.

These three connector types are part of the new IACT™ (Intelligent Active Connectors) launched by LEMO last year. A new era has thus started in the constantly reinvented history of Push-Pull connectors. |

TECHNICAL DATA SHEET

Compatible connectors

- OB series, the same size insulators as the standard OB series (with 2 to 7 contacts)
- Further sizes and B, K and T series available upon request

Light indicators

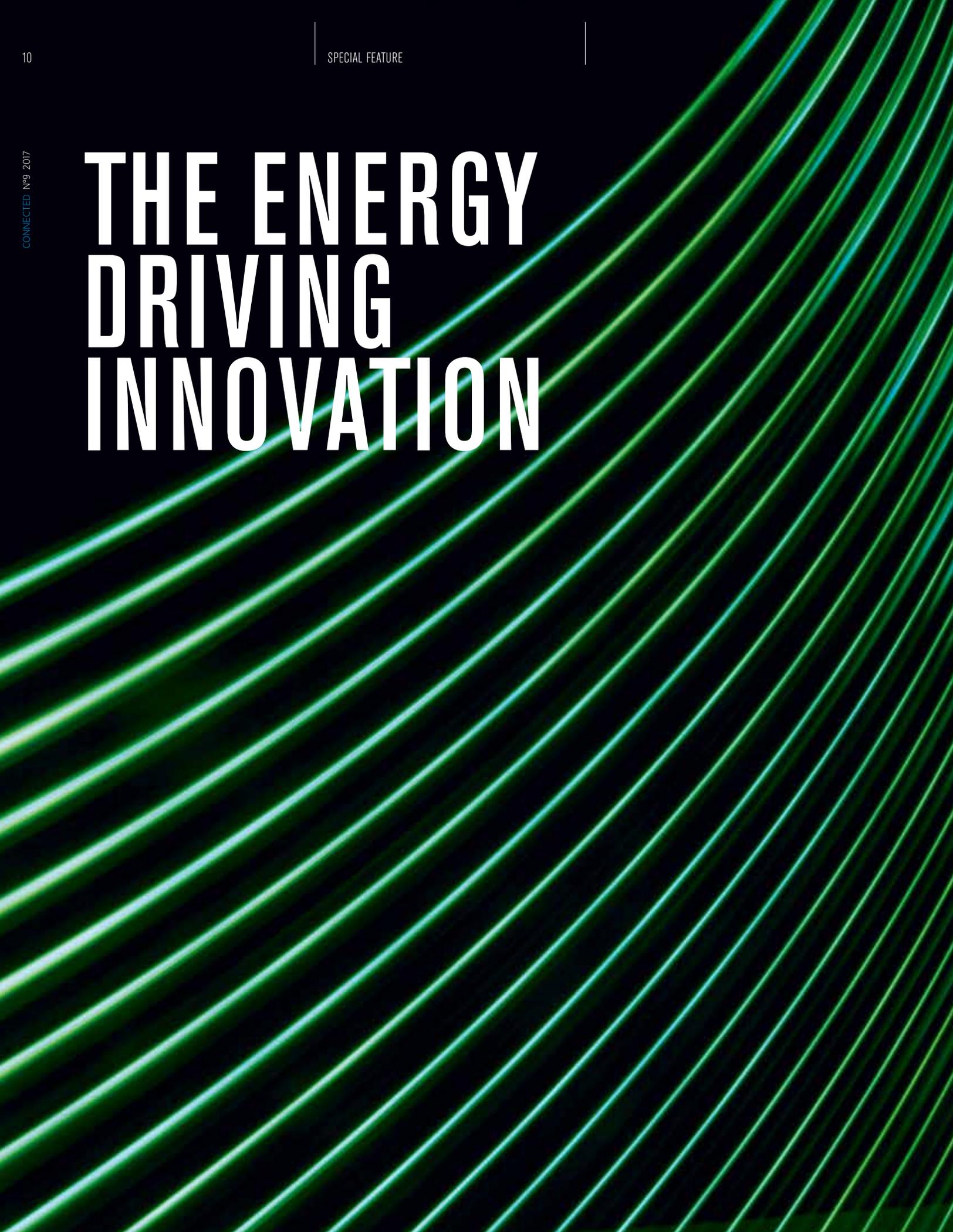
- 1,6 x 1,5 x 0,35 mm LED
- 16 million colours

Available

- Now



THE ENERGY DRIVING INNOVATION



Increasing pollution and global warming are a threat to our very survival. We are caught up in a race against time on a global scale: innovators have been striving to develop ever smarter ways of producing and consuming energy. Their technologies are often brilliant and highly creative. Will they manage to achieve a global impact in time?

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DRIVING FOR ECO-FRIENDLY URBAN JUNGLES

ENERGY TRANSITION IS NOT AN OPTION

Interview with Dr François Vuille, an expert who helps governments, institutions and companies understand the issues and seize the opportunities related to energy transition.



© EPFL



© wx-bradwang

François Vuille (PhD) is the Development Director of the Energy Competence Centre at the Swiss Federal Institute of Technology. He is in charge of research, lecturing and business development. He is also an expert member of a number of Swiss and international committees and boards in the field of energy. François Vuille is the author of two major reports commissioned by the International Energy Agency, of over 30 scientific articles as well as two books on energy transition. He is also the founder of two technology companies Softcar (electric mobility) and Proxipel (bioenergy).

François Vuille, how would you define energy transition?

The definition varies depending on the region, but the idea remains essentially the same. It means a transition from the current global model – energy production heavily dominated by fossil energy, complimented by some renewable energy – to the reverse situation by 2050. In some countries, such as Switzerland, it is associated with phasing out nuclear power, even if it is only a minor contributor of greenhouse gas emissions. In any case, energy transition implies reducing energy waste and using as much renewable energy as possible.

Is the aim to limit global warming?

Indeed! The aim is to keep it below the threshold of +2°C above the mean temperatures before the industrial revolution. This requires massive reduction of the production of greenhouse gas emissions. However, energy transition is also seeking to reduce pollution and to increase energy independence.

For a long time, people kept saying there would be no chance for renewable energy to become dominant, unless it becomes economically more competitive. Have we reached the inflection point?

It depends on the context and the technology. Renewable heat is competitive: you can heat with wood pellets for the same price as with a fossil-based resource. As for electricity of renewable origin, it is also becoming increasingly competitive. By the way, currently, the cheapest kWh in the world is solar (2.9 US cents in hot countries) and prices keep decreasing. We can say in general that for private households, that can use their own production, investing in renewable energy is already profitable.

In terms of investments, a turning point was passed in 2016...

Indeed: for the first time, there were globally more investments in renewable energy than in fossil fuel. At the same time, there is massive withdrawal of funds – trillions of dollars – from fossil energy production infrastructures.

Also last year, almost 90% of new energy resources used in Europe were renewable...

...it is because fossil resources are less and less available. If we want new resources, we must look for renewable energy! Even though there is much more investment in renewable energy, it only represents about 12-13% of the global energy mix. At the same time, fossil fuel consumption continues to increase, especially in countries with strong industrial growth, for which renewable energy is not sufficient. Therefore, several years will be necessary before a switch-over.

Is technological innovation a success factor in this transition?

Innovation was necessary to develop technologies for new renewable energy that are much more high-tech than traditional energies. More innovation will be required in order to continuously improve their energy efficiency. Clean tech is a dynamic growth sector in which thousands of companies are active worldwide (*Editor's note: see the other special feature articles*). Nevertheless, energy transition is already perfectly possible with the existing technologies.



▲ Photovoltaic power plant (Jiangsu Province)

So, innovation is required in other fields ...

Considerable innovation will be necessary in legislation and market systems. The current market is totally biased, it does not provide for natural integration of renewable energy or certain energy efficiency solutions.

How come?

External costs of fossil energy (in particular, the cost of global warming) are not included in their price. If they were, they wouldn't be competitive at all. Electricity from coal, for instance, would cost between 10 and 15 cents per kWh and not the current 3 cents. The idea of a levy on carbon dioxide has already existed in some regions, but it is difficult to implement on a global scale. The other unfair advantage of fossil energy is that it is subsidised all over the world, much more than renewable energy: 500 billion dollars per annum versus 100.

Has market correction, namely in the electricity market, progressed?

A number of market models have been tested in USA, France and Italy... However, it is obvious

that it is not possible to change rapidly from a system that has been in place for a century and that has been working very well. It is a vast project in a sector that is known for being conservative.

What benefits energy transition could bring to a country?

If a country decides to tackle the issue of reducing carbon dioxide emissions on its own, it would not result in anything significant, since it is a global problem. However, working on energy transition could have enormous national benefits! Firstly, by reducing energy dependence on import. Our economies are critically dependent on secure supply. Yet, gas and petrol resources have been decreasing, while our economies have been increasingly dependent and there has been a growing instability in exporting countries. Failure of supply is a catastrophe for a country and its economy, costing rapidly billions of dollars. Investing locally in renewable energy is good for employment, for the economy and for secure supply.

Have there been any cases of failure of supply?

Some major catastrophes with low media exposure, that could have had critical consequences, have been narrowly avoided. Even in highly developed countries, such as USA and Switzerland.

Any other benefits on a national scale?

Decreasing public health costs. In China, South America, India and other countries, pollution from hydrocarbon combustion in downtown areas has generated huge social costs, much higher than what measures to avoid them would entail.

China has announced its intention to increase its solar energy production by 40GWh per annum...

...this is colossal: the equivalent of the production of 8 nuclear power plants! The Chinese have also installed more wind turbines than the rest of the world. China has definitely taken the lead in renewable energy.

As an expert, are you optimistic? Do you think the world will manage a successful energy transition?

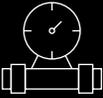
I have no doubts whatsoever regarding a successful energy transition. It will happen out of necessity and future generations will benefit from it. However, I have huge doubts about a successful fight against global warming. Urgent action is needed, but given the speed at which things change, I think we will exceed 2 degrees of global warming. Therefore, we will have to get used to natural catastrophes with more severe consequences, as well as to living in Switzerland without glaciers. | Nicolas Huber

SOMEONE HAD TO THINK OF IT

PRODUCING ENERGY IN AN ENVIRONMENTALLY SUSTAINABLE MANNER IS AN ISSUE THAT HAS KEPT A GROWING NUMBER OF CREATIVE MINDS BUSY ALL OVER THE WORLD. HERE ARE A FEW EXAMPLES OF ORIGINAL PROJECTS THAT COULD POSSIBLY HAVE A MAJOR IMPACT.

STORING RENEWABLE ENERGY IN THE HEART OF THE ALPS

COUNTRY: SWITZERLAND
FIELD: ENERGY STORAGE

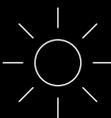


© ALACAES

A pilot project run by a research team from the Swiss Federal Institute of Technology in Zurich enables the storage of surplus renewable energy in a giant battery. The energy recovered is used for drawing in and compressing air in a 120-meter tunnel in the heart of the mountain. Naturally heated to 550°C by compression, the air is then cooled down and the heat is stored in an exchanger. To release energy, the flow is reversed: the air is extracted from the cave to drive a turbine that produces electricity. The cycle could supply a town of 65,000 with energy for 12 to 24 hours.

"INVISIBLE" SOLAR PANELS

COUNTRY: U.S.A.
FIELD: ELECTRICITY PRODUCTION



© Tesla

Tesla's Solar Roof technology uses photovoltaic tiles to cover entire roofs. Technically, they function like any other traditional solar panel. However, there is a major difference from an aesthetic point of view, as these tiles, quite similar to normal tiles, are the first to be actually integrated into the roof. Also, they are extremely durable and weather-resistant. Tesla guarantees them throughout the building's entire lifespan.

HYDROPOWER: STANDS THE TEST OF TIME

With the development of wind and photovoltaic energies, producers sometimes have to manage surplus electricity. *"In Germany for example, the installed wind and photovoltaic power capacity exceeds the country's average consumption"*, explains Peter Matt, Engineering services manager at Voralberger Illwerke, a leader for electricity in Austria*. *"This means that sometimes their production is running at full capacity, whilst consumption is very low. At other times, their production may be close to zero although there is a strong demand. Therefore, it is necessary to compensate for residual load – whether positive or negative – in order to balance the network. In other words, quickly alternating between electricity stored and real-time generation."*

This is a real challenge that only pump turbine stations are capable of handling on a large scale. Such as the Obervermuntwerk II facilities, now being installed by Voralberger Illwerke in western Austria. The principle is very simple: whenever there is a strong demand for electricity, the water stored in the Silvrettasee reservoir, located at 2030 meters, runs down via a pressure tunnel to the future underground power station to drive turbines and generate electricity, then water is discharged into the Vermuntsee reservoir located below, at 1743 meters. Conversely, whenever the demand for electricity is low, the water from Vermuntsee is pumped up to Sivrettasee: an energy reserve ready to be used.

The new facilities will provide for storage of a large amount of surplus energy and this without requiring new water intake, in addition to the existing capacity of 38.6 million cubic meters. Once operational in 2018, Obervermuntwerk II will be able to optimise resources by using the full capacity of both storage lakes.

What is even more special, is that the new facilities will be entirely reversible, thanks to an innovative "hydraulic shortcut" with the help of which the turbine regulates the pump and thus provides for continuous regulation from -360 MW for pumping to + 360 MW for the turbine. With such a degree of flexibility, Obervermuntwerk II will be capable of quickly reacting to fluctuations in the network demand and will achieve an efficiency of approximately 80%, one of the highest as far as large energy storage is concerned.

In these times of energy transition, hydropower has been increasingly establishing itself as a major player in stabilising the global renewable energy supply. This "old" energy thus contributes to integrating new energies in the European market. | Corine Fiechter

**Voralberger Illwerke use LEMO connectors in generators and machines for measuring temperatures.*

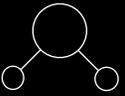




SOMEONE HAD TO THINK OF IT

PHOTOSYNTHESIS IN A BIONIC LEAF

COUNTRY: U.S.A.
FIELD: HYDROGEN PRODUCTION



© Harvard University

Harvard University scientists have developed a bionic leaf capable of reproducing the process of photosynthesis. Immersed in water, the device absorbs sunlight and splits water molecules into oxygen and hydrogen with the aid of a catalyst. Hydrogen can produce electricity thanks to a fuel cell, but there is more than that. Combined with genetically modified bacteria, hydrogen can also be used for producing petrol and other liquid fuels. The system is ten times more efficient than natural photosynthesis.

“The facility will be capable of quickly reacting to fluctuations in the network demand”

LAMPS CHARGED BY GRAVITY

COUNTRY: U.K.
FIELD: LIGHTING



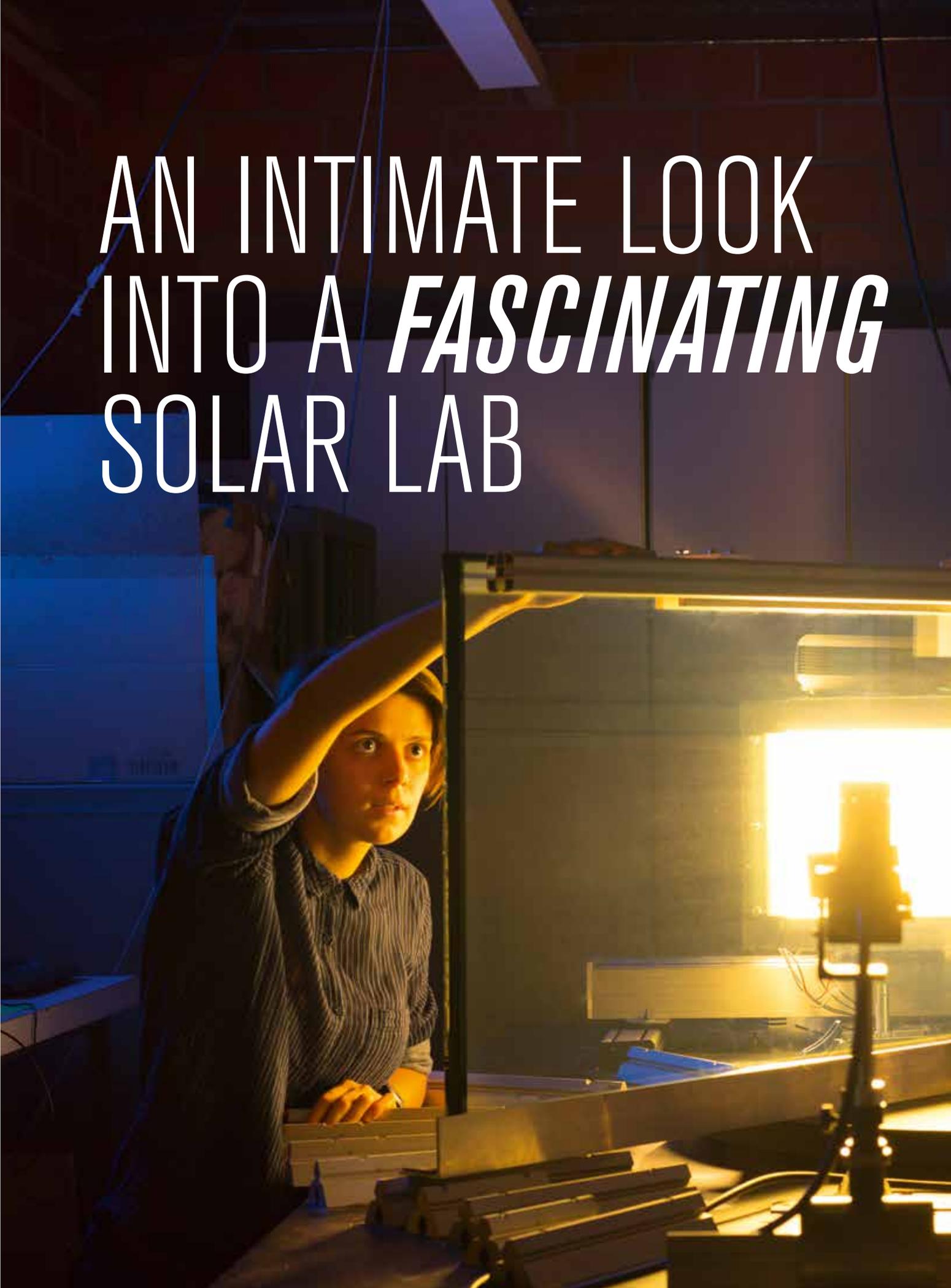
© Gravity Light

Intended for developing countries, Gravitylight is a LED lamp that works thanks to gravity. A simple bag of stones or sand, for example, activates a generator as it slowly falls by the effect of its own weight. The device can also serve as an electric generator for small appliances and it aims at replacing petrol, fuel, or kerosene. Rechargeable in a few seconds (the time it takes to fill the bag), the present model can supply light for about half an hour.



© Illwerke vkw

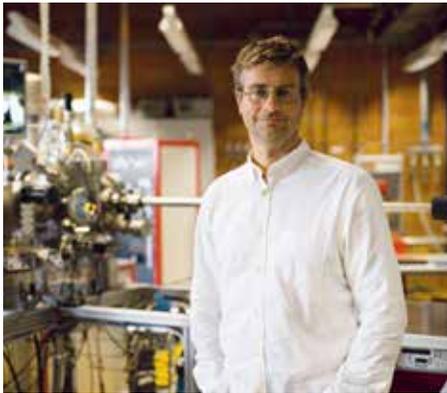
AN INTIMATE LOOK INTO A *FASCINATING* SOLAR LAB





© C.F. Møller. Photographer: Adam Mørk

▲ Copenhagen International School



▲ Andreas Schüler



▲ Processed glass samples

Photos of Copenhagen International School, covered with revolutionary solar panels, have made the news around the world. Andreas Schüler, the solar energy physicist who was the project leader from day one, has shown us around his laboratory in Lausanne, Switzerland.

If you are looking for the LESO-PB (Solar Energy and Building Physics Laboratory), one of the 350 laboratories of the EPFL (Swiss Federal Institute of Technology in Lausanne), you'll have to go right into the heart of the campus, (a small city on its own), where almost 14,000 people, including 10,000 students of 150 different nationalities come every day.

The discreet entrance is situated under a footbridge. Who knows how many such labs there are in the world, hidden in narrow campus streets? These little-known places of invention that give birth, after so many late nights at work, to technologies that will change tomorrow's avenues, airports and cities.

At the end of a windowless corridor, ironically, in a dusky light with no sunshine, Andreas Schüler suddenly appears. He comes up to meet us and, after short presentations with his team of young scientists from all over the world, he is eager to discuss our topic.

On the threshold of his laboratory, he starts by showing us the charts and plans posted all over the wall. He comments in French with a German accent and makes us think of the archetypal figure of a scholar who is keen to communicate with us, simple mortals. His enthusiasm is infectious, he wants to tell and show it all, to enlighten us. In his kind way, he wants us to understand. Obviously, he starts by talking about the major project that has just been completed and that has made us visit him in his scientific den.

Andreas Schüler is a German physicist who graduated from the university of Freiburg im Breisgau (the city of Fraunhofer, a major solar institute). He got his PhD in Basel on the topic of optical and electronical characteristics of nanometric structures called "thin films". Upon arrival at the EPFL, he joined the LESO-PB, Professor Jean-Louis Scartezini's laboratory, dedicated to energy efficiency and the integration of renewable energies into the built environment. He led research which culminated after 12 years, last February, with the inauguration of Copenhagen International School's new building in Denmark.

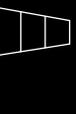
The facades being entirely covered with solar panels, a total of 12,000, the building attracted worldwide attention for the EPFL. It is not only the greatest achievement so far by its size, it

◀ Anna Krammer, research assistant and PhD student performing an optical test

SOMEONE HAD TO THINK OF IT

TRANSFORM WIND CREATED BY CARS

COUNTRY: U.K.
FIELD: ELECTRICITY PRODUCTION



A young Pakistani businessman has developed Capture Mobility, a wind turbine that captures and uses air turbulence created by cars on motorways. Helical-shaped, it measures 1.2 m and it can also capture solar energy thanks to its integrated panels. The device is capable of producing 7 kilowatts a day, which is 24 hours of electricity for a home and it costs only 200 dollars.

LOW-COST WAVE POWER

COUNTRY: FRANCE
FIELD: ELECTRICITY PRODUCTION



A French start-up HACE (Hydro Air Concept Experimental) has developed a machine that captures wave energy at very low cost and transforms it into electricity. The system uses simple floaters that, by rising and falling thanks to the waves, compress air in cylinders. Releasing this air activates a turbine that generates electricity. A first 200 kW industrial prototype should be ready by 2018 and this technology could provide up to 1 KW/m² with only 30-cm waves.



▲ Jing Gong, research assistant and PhD student showing us an intelligent window sample



is also and above all an innovative process, the application of thin films on glass panels, which makes the building so unique: deposited on the glazing of solar panels, these fine nanometric layers control reflected wavelengths of light and therefore the façade's colour. We are then led into the lab for further explanations.

As soon as we step into the room, an impressive object draws all our attention. We discover a striking installation, a sort of a giant engine bristled with tubes, portholes and bolts, connected to a myriad of pumps. Is this thing used for changing dimensions? Or is it a time machine? The answer is yes, for we are in a nanotechnology lab and this machine is used for testing new materials and processes that will be used for tomorrow's solar panels.

The scientist explains: "The machine is used essentially for the vacuum deposition of thin layers, to test new materials. We use a process called cathode pulverization. There is a target on a water-cooled magnetron. Electric power creates a plasma. In the plasma, there are ions and these ions bombard the target's atoms that are sputtered. The target's material is deposited on the substratum, which is a glass sample of 7.5 x 7.5 cm, forming a very thin layer on its surface." It is this very thin film layer of 10 to 200 nm, sometimes made up of several

superimposed layers that determines the solar panel's colour.

The facades of Copenhagen International School are covered with sea-green panels, aesthetically matching the waters of the Øresund strait, as the institution is standing on its banks. When imagining their buildings, architects can at last choose out of a whole range of colours. Solar panels are actually part of the architectural concept and this is what we call urban integration.

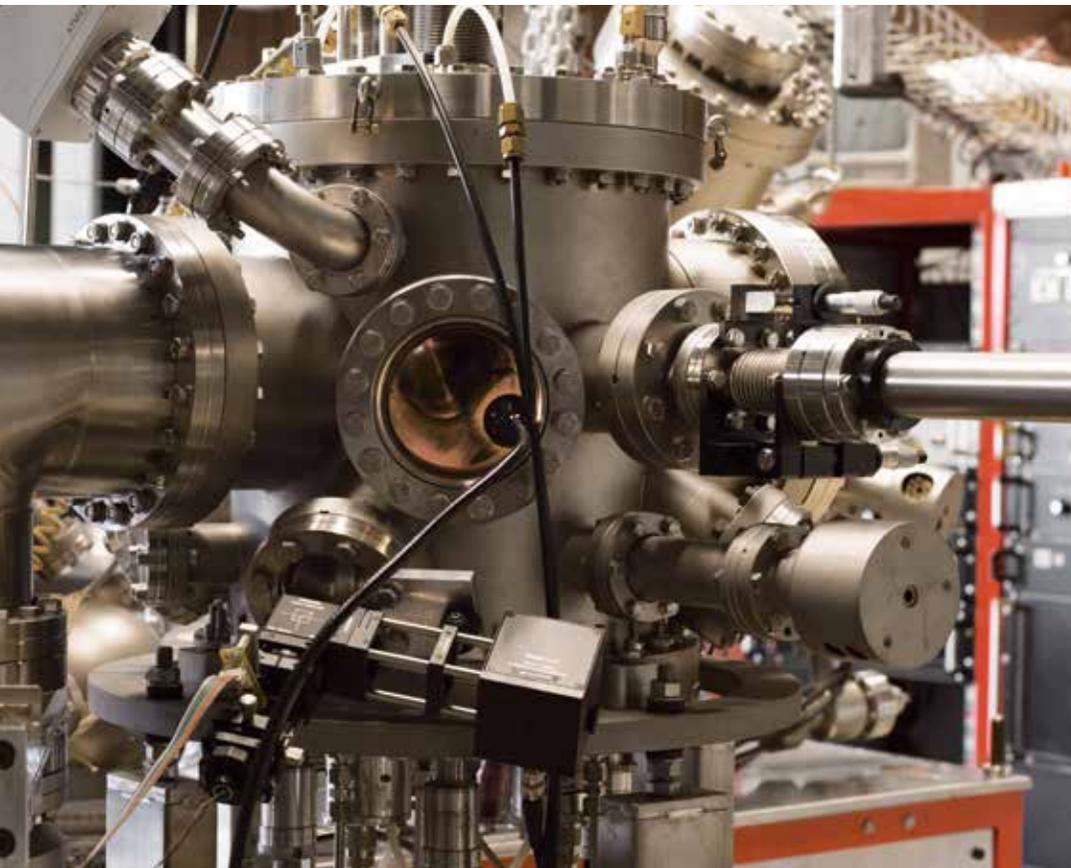
As no pigments are used, light reaching the solar collectors is not absorbed. Even though perceived colours may vary, the primary aim is achieved: "Energy conversion is under control. The Copenhagen building can produce 300 MWh per annum, which is half of the school's energy consumption."

Coloured panels developed and tested by the laboratory then went through a successful technology transfer process. SwissINSO, a spin-off of the EPFL, has contacted various glass and (photovoltaic and photothermal) solar panel manufacturers. The coloured glass panels used in Copenhagen were produced by Emirates Insolaire in Dubai. The photovoltaic panels using these glass panels were manufactured by SolarLab.

"In the Middle East and in Asia, there are many glass buildings. Moreover, they endorse the creation of joint-ventures. We found the best conditions in Dubai and they had the machines capable of producing what we needed", meaning 3x6-meter glass panels with a homogeneous thin film, the thickness of which never varies by more than 5 nm, the limit that guarantees the colour.

Chemical, optical and thermal experiments, the laboratory has many more surprises. In an adjoining room, scientists are working on intelligent windows. Finely profiled, they direct light differently depending on the sun's position and therefore, on the season. In the winter, they will be able to redirect light entering a room, to enhance natural light. In the summer, they will also be capable of focusing part of the sun beams so that they are reflected outside, to limit heat. As one of the scientists inclines the sample to show us the structure, Andreas Schüler is clearly keen on talking about something else.

Led into a small workshop, we discover an apparently ordinary window. Our host, all smiles, tells us about its story. Railway companies wanted to equip their trains with windows containing low-emission layers, to better keep heat inside the carriages. The problem is that these windows impede the use of mobile phones



▲ The impressive device for testing new materials

by blocking their waves. The only solution known at the time was to install signal amplifiers to pass the waves through the inside of the trains. Antennae were to be changed every 4 to 8 years, following the evolution of mobile telephones.

"To a person with a hammer, every problem looks like a nail" says our scientist with an enigmatic smile, once the context is introduced, then he explains: *"We are thin film specialists, so we approached the problem from our point of view! We proposed the idea of working on electron mobility inside the thin layer of windows. We ended up by finding a new solution: microwave windows."*

Thanks to a new process which laser-grooves thin films, Andreas Schüller, his colleagues and partner engineers have created a window with all the thermal characteristics of low-emission-film windows, but with small "spaces" in their structure, so that telephone waves can pass through. No more signal amplifiers, no more new investments every 4 to 8 years. The trains that have been equipped were successfully tested by Swisscom, the major telephone operator in Switzerland.

The possible implications of this technology are mind blowing. *"In the future, buildings will be full of connected devices exchanging data through Wi-Fi and packed with sensors to control light,*

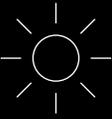
temperature, detect the presence of people... waves will have to pass through everywhere". Long working days are ahead for Andreas Schüller's team, in the silence of his lab. Thermochromic materials, logical devices or electric circuits changing characteristics according to temperature, their drawers are full of projects.

As the sun is setting, Mr Schüller suddenly remembers that he has a project for the evening. A conductor in his laboratory, he is also a volunteer pianist and entertainer for children's shows, for which he also composes music. Tonight, there's a rehearsal. | Renzo Monti

SOMEONE HAD TO THINK OF IT

AUTONOMOUS SOCKET

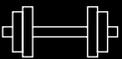
COUNTRY: SOUTH KOREA
FIELD: ELECTRICITY PRODUCTION



Two young South Korean designers have created an autonomous portable socket. The size of a big biscuit, Window Socket has a small solar panel on one side and a standard 2-pin socket on the other. It is enough to stick its suction cup on a window and solar energy is directly transformed into electricity! Then all you have to do is connect and charge, for example, your smartphone.

PEDAL AND PRODUCE ELECTRICITY

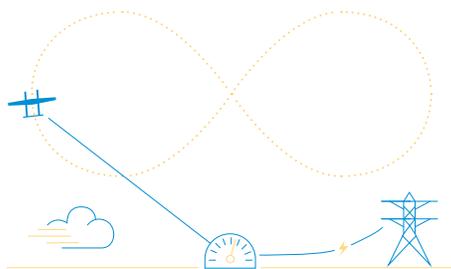
COUNTRY: INDIA
FIELD: ELECTRICITY PRODUCTION



In India, a billionaire philanthropist and former mathematics student from Princeton University has invented an exercise bike which produces electricity while you are working out. An hour pedalling provides enough energy to supply a home for 24 hours. Once it's developed, the device could provide a means of gaining "free-of-charge" energy independence in particularly disadvantaged areas.

DRONES TO CONQUER *UPPER WINDS*

A few hundred meters high, well above large turbines, winds are stronger and more constant. How best to harness them? The idea of a “flying wind turbine” goes back to the early 19th century, but it took as long as the late 20th to be actually explored. Ampyx Power, a Dutch company created in 2008, now with a team of 45 experts from 20 countries, has come up with an astonishing solution: wind farms of tethered drones.



It is a complex technology relying on a simple principle. The drone is connected via a cable to a generator placed on the ground (or on water). While flying at an altitude between 200 and 450 meters, in figures of eight, it pulls on a cable driving a generator, which converts movement into electricity. All this happens automatically: the drone, packed with sensors, takes off, flies and lands on its platform without any assistance.

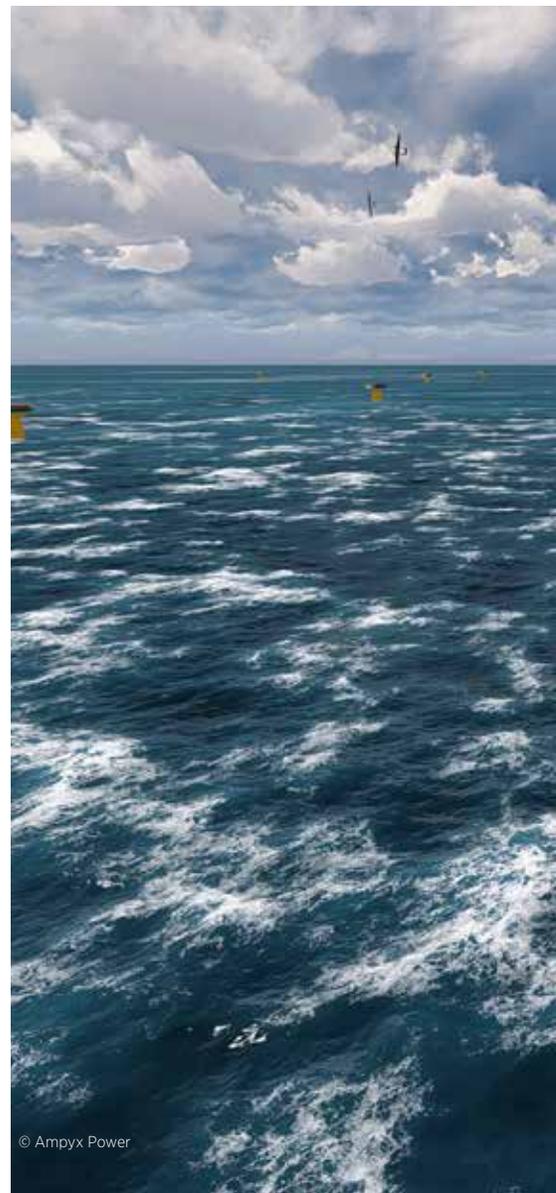
Smaller than a single blade of a wind turbine, the glider and its platform require 90% less material, meaning drastic cost reductions. The drones can be used both on and off shore, also where it is economically impossible to install traditional wind turbines, thus multiplying sites suitable for generating wind energy. Ampyx Power also highlights that the visual, noise and environmental impact is much less than that of large wind turbines. As for danger of collisions with birds, due to the zigzagging drones and the cables, the first estimations show the same risks as with wind turbines.

After three generations of prototypes, Ampyx Power is almost ready to fly a fully functional prototype in real conditions. As far as 24 hours/7 days a week autonomy, avionics, night flight and extreme conditions are concerned and in case of emergencies, such as sudden drops in the wind or cable breakage: everything will be tested, analysed and improved.



© Ampyx Power

▲ The Ampyx Power team



© Ampyx Power

European Aviation Safety Agency certified commercial models are scheduled for 2020. The first ones will be 2.0MW systems with a 30 m wingspan. They will replace wind turbines with similar power in early offshore wind farms, as they will arrive at the end of their lifetime. Their platforms will be installed on the masts of the removed turbines.

The second, 3.0MW models, will address the re-powering of second generation offshore wind turbines. Ampyx Power is currently studying the feasibility of using them on floating platforms.

Onshore installations will only start being deployed after the operational track record has been established offshore. This is another major potential market for the Dutch company.

Ampyx Power estimates that the energy yield of one of its parks, once optimized, will be two times more than conventional wind parks, at a mere fraction of the costs.

The International Renewable Energy Agency, an intergovernmental organization to promote adoption and sustainable use of renewable energy, has full trust in the various airborne wind turbine technologies. In their 2017 report, they estimated a major impact on the wind turbine market as of 2025. | Nicolas Huber

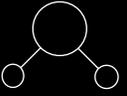
▼ The autonomous aircraft landing on its platform



SOMEONE HAD TO THINK OF IT

ENERGY STORING PAINT

COUNTRY: AUSTRALIA
FIELD: HYDROGEN PRODUCTION



The Royal Melbourne Institute of Technology (RMIT) have developed a “solar paint” capable of producing hydrogen from atmospheric humidity combined with sunshine. Synthetic molybdenum sulphide contained in the paint absorbs solar energy and humidity and transforms it into hydrogen. Hydrogen can then be used for fuel cells or for fuelling vehicles. The paint can be applied onto the façade of a building or on any other surface.

AUTONOMOUS NATURAL LIGHT TRANSMITTED BY FIBRE OPTICS

COUNTRY: FRANCE
FIELD: LIGHTING



French start-up Echy wants to make the sun shine even in confined spaces without windows. Considering that most lighting is used during daytime, the founders of the company have developed a revolutionary system. Captured by panels and lenses turning towards the sun all day, light is transported inside by fibre optic bundles and distributed “live” by natural lamps with no UV nor artificial heat. Ecological, it can save up to 60% of the cost of electricity, according to the start-up. The other advantage of the system is that natural light has positive physiological and psychological effects.

WRIGHTSPEED

DRIVES FOR ECO-FRIENDLY URBAN JUNGLES

Nitrous oxides, hydrocarbons, particulates, brake dust and noise pollution: heavy-duty diesel vehicles, such as delivery trucks or buses are a nightmare for modern cities. To deal with public discontent, urban authorities have strived, for a number of years, to reduce transport and noise pollution by introducing curfews or limiting access to certain areas. However, most heavy vehicles driving around cities are necessary and useful to the community: they provide for public transport or garbage collection. This is where electric powertrains designed by Wrightspeed come into the picture. They offer a cost-effective and durable propulsion solution without compromising the smooth organization of our cities.

Created in 2005 by Ian Wright, one of the founders of Tesla Motors, Wrightspeed explores a simple basic idea. For sure, electric vehicles represent the future of road transport, but they are still very expensive to manufacture. So, on which vehicles would it be the most cost-effective to install an electric powertrain? Also, how to ensure that the fuel cost savings are well over the costs incurred by this technology? The solution proposed by Wrightspeed is to equip short distance frequent-stop heavy-duty vehicles. Typically, those we come across or use in our daily urban lives.





© Wrightspeed

Wrightspeed has completely reinvented the construction of conventional heavy-duty vehicles by replacing standard drive systems with new generation powertrains. Mounted on each axle, electric engines are coupled to the wheels via an advanced transmission. The system uses electronic software controls powered by a battery pack rechargeable from a standard socket. The big challenge of this system is to keep the battery pack small and lightweight enough without extra high costs. In this case, how can we ensure that trucks or buses run all day without being recharged? Wrightspeed offers an ingenious solution: a range extending turbine generator. Directly modelled after aeronautics, the device completes the powertrain and ensures functioning over longer periods of time. Whenever necessary, the turbine starts operating to generate energy and recharge the batteries.

This range extending turbine generator is the only component that requires fuel for operating – diesel or natural gas. However, its consumption is 60% lower and emits about 90% less nitrous oxides, hydrocarbons and particulates compared to a standard diesel engine. Even though the system cannot function without any fossil energy, it is much more cost-effective, with considerably less impact on the planet.

Thanks to all these benefits, Wrightspeed powertrains have managed to convince private and public services throughout the world. They can be found in California on FedEx delivery vans in San Jose and on garbage trucks in the San Francisco Bay Area, on public transport in Wellington (New Zealand) and Amman (Jordan). Wrightspeed will help to make our cities cleaner and better places to live. | Alexis Malalan

HIGH IMPACT

By Renzo Monti

Data acquisition systems developed by DTS help study crashes and their impact on the human body with unprecedented precision. Created in a garage 27 years ago, the company is now a key player on the market for automotive safety. But there is more to discover.



▲ Airplane crash test



© DTS

▲ Data collected in the heart of the action

You have to go back to the seventies to discover the origins of DTS (Diversified Technical Systems). Already back then, automobile safety was a major concern for US car manufacturers. Steve Pruitt, DTS' current CEO and Chairman, Mike Beckage and Tim Kippen were three young engineers who prepared cars for a company specializing in crash tests. They loved it! *"We liked to think that we could save lives, remembers Steve Pruitt. A crash test costs a lot of money, you have to get it right the first time. We also used to love the rush of adrenaline the moment you launch the car!"*

During a crash test, the car hits an obstacle. The aim is to collect data to understand what happens during the impact, especially to its occupants. Placed on and around the dummies, an array of sensors measure data to be able to analyse injuries.

In the early days, technologies used by the engineers were still rather rudimentary. *"We could place about thirty sensors, but the recording material could not be put on board. Data used to be transmitted over a cable to an adjacent room, where they would be recorded on a magnetic tape and sent to an external lab to be digitalized."*

As they became experts in the field and with the arrival of computers as of the late eighties, they decided to create their own company. In 1990 they founded DTS in a friend's garage in Seal Beach, California, a town in which the company headquarters are still located. As of 1995, they could fully focus on their project and in 1996 they launched their flagship product, TDAS PRO, the first small-sized data acquisition system designed to fit on board the vehicle during a crash.

The turning point came when General Motors, who own the largest crash test sites in the world, decided to update their systems with TDAS PRO. Then DTS won the contract and created TDAS G5 a data recorder placed inside a new revolutionary dummy capable of assessing side impacts, the WorldSID. The small company moved up a level.

Today, DTS systems support 400+ sensors in a single test, some of which are inside the dummy. Data processing software is developed in-house and the control boxes become more and more sophisticated, resistant and

smaller in size. They are also modular, such as the SLICE PRO models, ultra-slim and stackable, for which connector size is crucial. *"We have designed SLICE PRO entirely around LEMO connectors, which are the smallest and most reliable you can find"* admits Steve Pruitt with a laugh.

Aviation, sports or biomechanics, the modular design and ultra-small solutions of the company can be used wherever impact or vibration measurement counts. The diverse applications can sometimes be surprising. For creating crash test dummies that are the closest possible imitation of human bodies, but also for research, DTS works with universities to help measure critical injuries on cadavers, known in the world of biomechanics as postmortem human subjects. DTS systems have also been used to develop new crash test dummies, on rodeo riders, aerial acrobatics pilots and even on a Guinness World Record stunt diver who jumped from 36 feet 7 inches into a shallow wading pool.

DTS has also been working with the US Army for a number of years. Steve Pruitt makes it clear: *"We only engage in programmes to improve the safety of soldiers."* The company has equipped around 60,000 helmets with sensors, for instance to alert doctors of possible risks of head injuries following a shock. Another ongoing project called WIAMAN since 2015: the creation of the first "underbody blast test dummies" that will be placed in vehicles blown up by explosions.

DTS has managed to preserve its values. Present in 25 countries, the company counts over 500,000 DTS data acquisition channels in use worldwide. Its three founders are still there, like 27 years ago, at the head of a fully privately owned independent company that never licenses its intellectual property to third parties. After so many years, the passion remains, asserts Steve Pruitt: *"We have 35 R&D people and DTS keeps progressing. My two co-founders and I can keep doing what we love: inventing, innovating and sharing."* Their very first fully watertight system, the SLICE IP68 has just come out featuring miniature waterproof LEMO connectors. There is every reason to believe that the company will stay active for many more years to come. |

"We liked to think that we could save lives"

THE SOUND OF MUSIC

By Nicolas Huber

At the forefront of acoustic research, the French company Focal has just launched its latest products: Kanta loudspeakers and Clear headphones. Another step further in their quest for pure sound for all music lovers.





A fine specialist in acoustic equipment, Focal is a global leader in high fidelity loudspeakers. Since 1979, the French brand has been striving to push the boundaries of technology to achieve exceptional sound quality. Their stated objective is to get always closer to the original sound of performers, regardless of the type of music, whether classical, electro, song or ethnic instruments. So, it is not a coincidence that Focal is among the rare audio companies which continue to invest in acoustic research, which also means a large number of patents. Particularly committed to “Made in France” quality, Focal continues to design, develop and manufacture its products on French soil.

Focal’s collections target both individuals and professionals. Its hi-fi audio systems are adapted for all private or public environments. Focal also provides for travellers, with Listen Wireless and Spark Wireless headphones as well as for cars. The brand is also a major player in recording studios with monitoring speakers designed to meet the standards of large and small organizations.

Every product generation incorporates a number of innovations, adding to the previously developed special features. So do the company’s two latest creations, Kanta loudspeakers and Clear headphones. Focal launched them during the Rocky Mountain Audio Fest, a major US trade show for consumer audio and home entertainment, early October in Colorado.

Kanta is available in gloss or matt finish, with eight colours, including “Gallic blue” and “white Carrara”, to match every interior.

In addition to its aesthetics, Kanta is a real technical gem, every single element of its design adds to the performance. In particular, volume control guided the R&D engineers’ research, who managed to reduce distortion, music’s great enemy. The upper register is rendered by the new IAL3 tweeter in pure beryllium, absorbing the effect of waves. For the first time in a Focal device, a flax sandwich cone is combined with a beryllium tweeter. Thanks to this combination, musical warmth and clarity can be preserved. Kanta is also characterised by a brand new material, a high-density polymer used for moulding its façade in one piece. A promising material for acoustics, as it eliminates sound diffraction phenomena.

Clear is a top-range headset for home entertainment that combines a number of assets. It is capable of reproducing sound details with remarkable accuracy, tonal neutrality and high-level dynamic. In other words, Clear aims at a sound quality comparable to a loudspeaker. A major challenge if we consider that a listener distance of only a few centimetres requires a complete rethinking of headphones domes to achieve what Focal describes as a “plane wave in extremely near field”.

Clear is equipped with new generation full-range loudspeakers. It is a more open design than that of the Clear headphones launched in 2016. There is innovation in terms of comfort as well, thanks to innovative microfibre pads with micro-perforations and an equal distribution of weight around the head – these headphones have been designed to be forgotten. Just like all Focal products, Clear is equipped with a complete connection set. It is delivered with LEMO connectors and three cables fitted with a cotton-braided sheath to prevent electrostatic charge. |



The Clear Headset ▶



AHOY TO A PERFECT STOP!

By Alexis Malalan

How to stop a boat at a given longitude and latitude to the nearest second and then maintain its precise position without an anchor or a buoy? This is the challenge that New Zealand company HamiltonJet has successfully met, thanks to their expertise in water jet propulsion.

Somewhere off the coast of the UK a service boat is approaching an off-shore wind farm at high speed. The sea is too rough for safe mooring and too deep to anchor. The vessel manages to stop right next to the platform to unload goods and personnel. Against the waves, it manages to maintain its position with amazing precision. The operations go smoothly as the captain stays at the command post without doing anything special.

This technical feat is made possible thanks to the combination of two technologies. On the one hand, water jet propulsion systems that HamiltonJet specialises in. On the other hand, the latest innovation of a company based in Christchurch, New Zealand: JETanchor, a revolutionary positioning system.

Mentioned as early as the 17th century, water jet propulsion technology has only been fully developed since the nineteen-thirties and forties. It was then further developed in the fifties by a New Zealander, Sir William Hamilton. He worked out the correct design and proved the efficiency of the system, especially for river navigation. Since then, the system hasn't stopped improving. It has brought success to the company named after its founder "Sir Bill" – HamiltonJet, a global leader in the sector.

In order to understand this technology, we should first take a look at its biggest rival, the propeller propulsion system. Used on a very wide scale, it works with action and reaction: placed under the boat, the propeller rotates at high speed, pushing the water backwards, which pushes the vessel forwards. You also need a rudder to change direction.

Even though based on the same law of action and reaction, water jet propulsion systems use a different mechanism. In fact, they work like a pump: water is drawn by a submerged intake, accelerated through a turbine and discharged by a nozzle at the stern of the boat, thus creating the required driving force. There is no need for a rudder, as the stream of water is steerable. By changing directions to the right or to the left, the water jet steers the vessel in the required direction. Moreover, by lowering a deflector, the water jet is redirected under the hull to propel the boat in the astern direction, to stop abruptly or even to move sideways by the simultaneous coordinated action of several jets.

In order to coordinate all these functions, obviously, advanced control systems are required. This is where JETanchor comes into the picture. Completing the basic manoeuvres (move forward, steering, move backward, berthing), the

latest product of the HamiltonJet factory has been fitted with a GPS guidance system with the help of which the captain is able to determine the exact coordinates of the location where the vessel needs to stop. Upon arrival at the requested destination, the system acts on the direction and power of the water jets to control and keep the boat stationary. Everything is automatic, significantly reducing the workload of the skipper.

Also, the latest generation system moves towards greener mobility, since it uses much less fuel than traditional manual guidance.

Intelligent propulsion, extremely agile, safe and durable: systems developed by HamiltonJet have given a new dimension to navigation. Today, 60,000 vessels are equipped by HamiltonJet worldwide: from lifeboats, to coast guard patrol boats, pilot vessels or ferries. One lesson to be learned from this success story: whether on sea or elsewhere, it is not enough to sail quickly, but you also need to be able to stop in the right place, at the right moment. |

1972 LEMO USA – *HOW IT ALL STARTED*

By Renzo Monti



▲ Silicon Valley

Even though LEMO connectors were launched on the US market exactly 50 years ago, the LEMO USA subsidiary company was officially created only 5 years later in 1972. LEMO's sales director from 1965 to 1996, Walter Straessle was the one who discovered the New World for the Swiss headquarters. He recalls some memorable moments for us.



Spring 1972: Richard Nixon is the president of the United States. All across the nation, people rush to the cinemas to discover *The Godfather*. They listen to Lou Reed and Cat Stevens on the radio. The television audience looks forward to season 2 of the new popular series *Columbo*. This is the country that Walter Straessle is about to travel around to find his “reps”, official representatives who would sell the Swiss company’s connectors in America.

When he lands in Los Angeles in April 1972, Mr Straessle has mixed feelings. *“I was of course excited about starting to do business with the Americans!”*, he smiles. However, as he is about to start his first prospecting tour in North America, he is feeling a bit intimidated as well. *“Even if we had no doubt an excellent product, I didn’t know exactly what to expect. Our connectors had been distributed in USA since 1967 by agents, but setting up a company successfully and launching direct sales was another story! I was aware that it was a huge market and that their way of doing business was much more aggressive than ours in Europe.”*

Once in the country, Walter Straessle quickly adapts though. People soon start calling him “Walt” and he discovers a dynamic, stimulating and friendly environment *“It was quite casual, with excellent relationships, easy and direct contacts.”* It is exactly this relaxed informal way of doing business that made him understand the more subtle challenge of this new supposedly aggressive market.

“I immediately understood that with our new American colleagues it was essential to keep our feet on the ground! Without going against this precious enthusiasm, keeping the best of its extraordinary energy, whilst limiting their tendency to take strategic risks. We had to find the right people, the appropriate balance.”

It is in Berkeley, near San Francisco that the sales director gets in touch with Bob Wersen. At the head of a small connector workshop, with five other people in a modest wooden building, Bob is a serious engineer, interested in working with LEMO. *“He was*

our first official contact, explains Walter Strassle, and later our first official representative. From that day on, we started talking about LEMO USA.” It was a providential choice, given that back then nobody was even dreaming of Silicon Valley.

Convincing LEMO’s founder to take a chance on starting business in California was anything but easy. *“Léon Mouttet, LEMO’s CEO was worried about the 9-hour time difference. He preferred the east coast, along the famous route 128 around Boston. This is where major technological companies were set up at the time, around MIT and Harvard.”* Very impressed by his visits at Stanford University, Walter Strassle insists and ends up getting Léon Mouttet’s trust. It would be in California and they prove to be right.

Bob Wersen became LEMO USA’s first director and was responsible for finding customers and establishing a network. It wasn’t an easy task. The market existed indeed *“Wherever there are cables, there are connectors!”* smiles Walter Strassle, but there was a problem: the patent. *“LEMO was the sole manufacturer of these products and other connectors were never 100% compatible.”* This meant a major risk for the customer and it was certainly not by accident that success came through a rather special market: medical, which was well advanced in the States. LEMO’s first customer is a medical device manufacturer.



“The only way to understand this market and to face competition was to go and see the customers”



This is the start of a long adventure and, more importantly, that of a tremendous amount of work. For many years, two or three times a year Walter Straessle travels around the USA to meet customers, to explain about the products, to reassure them. *“Direct contacts were very important, even crucial. The only way to understand this market and to face competition was to go and see the customers, listen to their needs, keep proposing new ideas.”*

Of these meetings, based on discussion, trust and intuition, Walter Straessle recalls a memory that represents LEMO’s philosophy in the United States particularly well. One day, he was talking to a potential customer whose start-up company manufactured small devices to be placed on patients’ finger tips to measure blood oxygen and pulse. The man said: *“You know Walt, we will never be a big customer for you”* Walter Straessle replied: *“There are no big or small customers. Only good customers.”*



▲ LEMO USA, in Rohnert Park (California)



▲ Walter Straessle (in the middle) at a directors’ meeting in the seventies. To the right, Marcello Pesci, father of the current CEO.

Shortly afterwards, the small company’s turnover shot up to 2 million dollars, which was a fairly considerable amount in the seventies.

Since its early successes, LEMO USA has been making steady progress. The first inventory, necessary to ensure the growing number of deliveries, was stored in an area rented in Santa Rosa’s Business Center, near San Francisco. Additional space had to be rented every two or three years, until the first US factory was inaugurated in 1983 in Santa Rosa.

To conclude on a typically American note, we ask Walter Straessle whether he remembers any crazy moments, or strong emotions which would mark the history of LEMO connectors in the United States. It takes only a second before a beaming smile shines up on his face as he answers: *“The 1984 Olympic Games in Los Angeles. For the first time, mixed cameras required mixed fibre optic and electric contacts. LEMO was capable of equipping them.”*

45 years after the creation of LEMO USA, now located in Rohnert Park, the LEMO Group generates 40% of its turnover in USA.

THE LEMO GROUP IN THE UNITED STATES TODAY

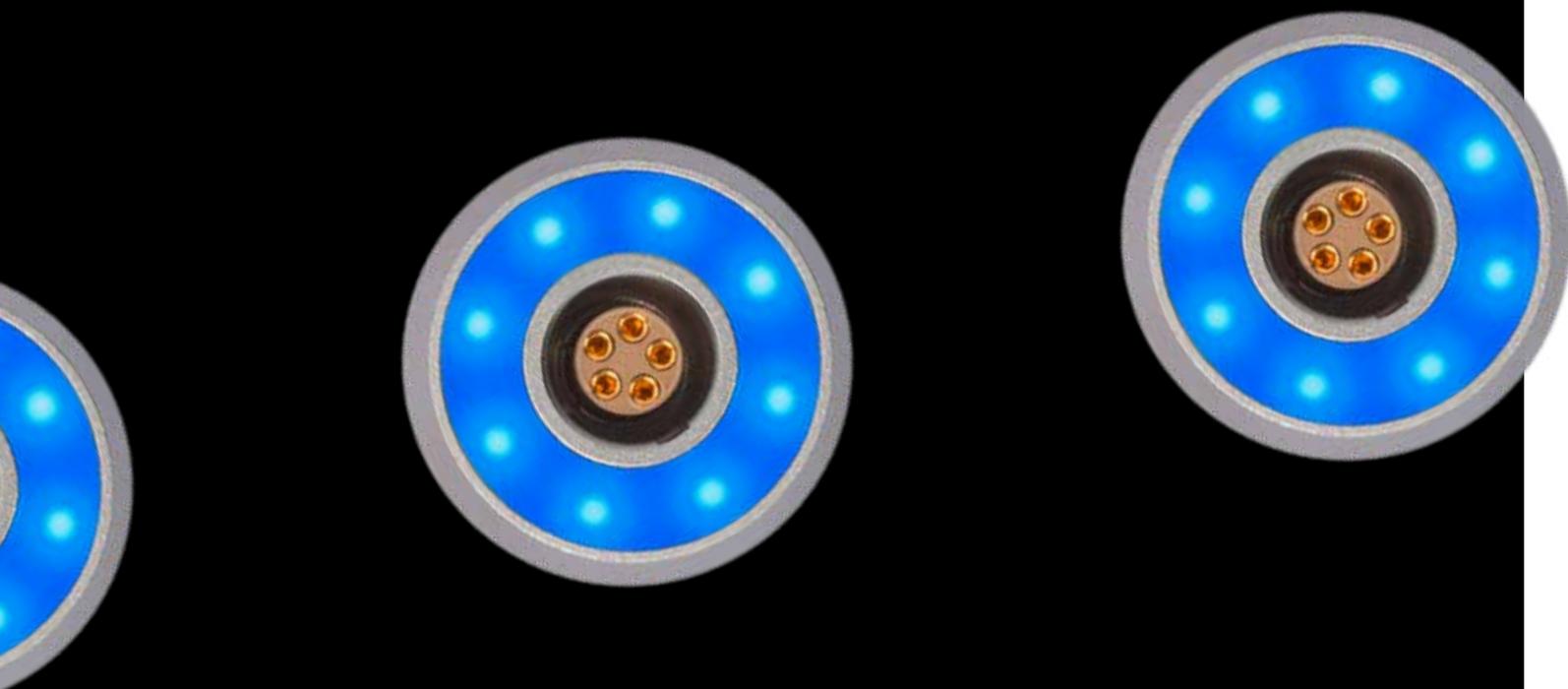
2 subsidiary companies:
LEMO USA Inc. and
NORTHWIRE Inc.

3 production sites :
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Osceola (WI), Santa
Teresa (NM)

400 employees



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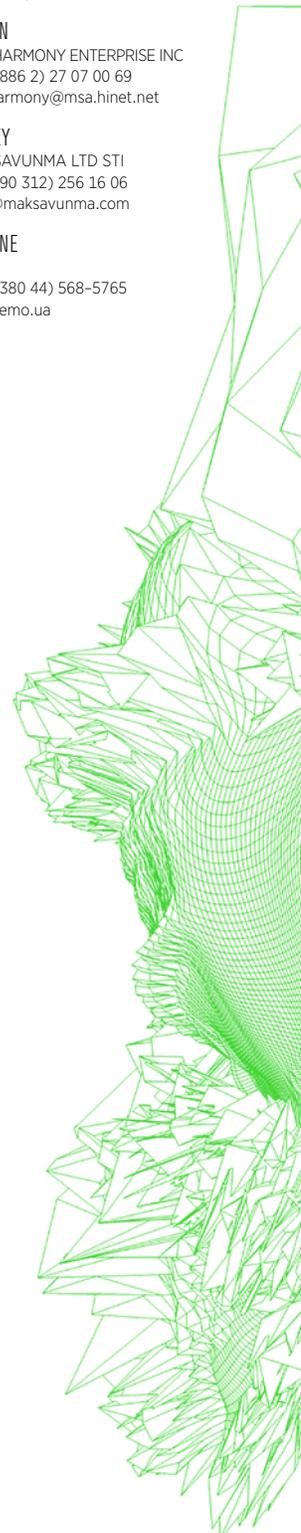
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