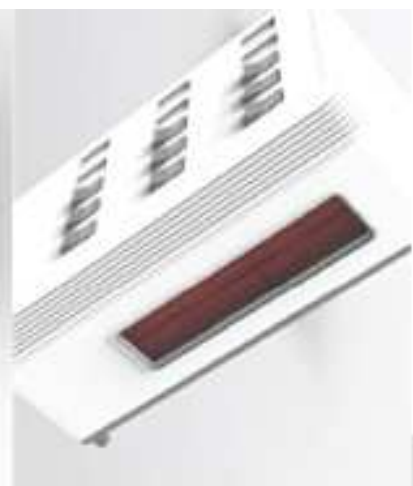# PRESS KIT

MOBILITY, SMART DEVICES, ENERGY, E-HEALTHCARE, BLOCKCHAIN, FOOD TECH

CEA @CES2019
January 8-11, 2019

CONTENTS

CEA, SPEEDING INNOVATION FOR INDUSTRY

CEA is a leading global research organization, driving the development of new technologies and innovation. In 2017, Clarivate Analytics ranked CEA the most innovative government research organization in Europe and the second-leading most innovative worldwide. CEA researchers are active in four areas: defense and security, low-carbon energy (nuclear and renewable), technological research for industry, and basic research.

As a government research organization, CEA helps to maintain the competitiveness of France's economy by developing new technology and transferring knowledge, know-how, and technology to industry, and by disseminating the results of its scientific research.

CEA Tech, the CEA division in charge of technological research and technology transfer will be exhibiting at CES 2019 with their partners.

THE WORLD'S LARGEST TRADE EVENT FOR THE DIGITAL TRANSITION

CEA will be exhibiting at CES Las Vegas—the premier international event for connected devices, IT, and the digital transition—for the fourth year running. This year, CEA will spotlight applications for our technologies in fields like e-healthcare, energy, mobility, food tech, and the digital systems of the future. Visit the #CEATechVillage booth (no. 51253) at Eureka Park to explore five demonstrator systems and prototypes built on technologies developed at CEA labs. CEA is also supporting three startups this year: PowerUp, Connecting Food, and Diabeloop. Another four startups developing the results of CEA research will also be exhibiting at CES: Ethera, Kalray, Sport Quantum, and Aryballe Technologies.

Each year, CES attracts more than 170,000 visitors from around the world, including professionals from the high-tech and other industries, industry media, and the general public. The CEA research scientists and engineers attending CES will be available to discuss potential technology development and investment partnerships. Last year, CEA tallied up nearly 400 meetings at CES resulting in more than 40 research contracts with partners.

Like every year, this year CEA will promote a selection of its most innovative technologies at the world's leading electronics-industry event. And, because CES is consumer-focused, CEA will bring home valuable insights into the latest trends in tech and emerging user needs.

FROM RESEARCH TO INDUSTRY: NURTURING TECHNOLOGIES INTO INDUSTRIAL PRODUCTS AND SERVICES

CEA's technological research targets the "gap." Our innovation-intensive programs focus on bringing technologies to maturity, nurturing them from the lab to industrial scale-up. Research at CEA targets developments that have become too capital-intensive and specific to be pursued by basic research programs run by academic labs and that present a level of technological and commercial risk that is too high for companies to make the necessary investments. This is the "Death Valley" of innovation and, under pressure from increasingly complex technology and the need to shrink time-to-market, the valley is only becoming deeper. On average, it takes four to five years to ready a technology for industrial scale-up. It then takes another three to five years to reach mass production.

While a technology is being nurtured to maturity—a process that is necessary in order to overcome the industrial and financial hurdles to mass production—CEA draws on broad, deep knowledge and technological know-how[1] to build prototypes for all industries and companies of all sizes, well in advance of production roadmaps.

CREATING AND DISSEMINATING KEY ENABLING TECHNOLOGIES

CEA creates technological innovations to make businesses more competitive by bringing them enhanced performance and differentiated products.

CEA Tech's 4,500-strong staff develops, protects and transfers enabling technologies covering the vast majority of traditional industries through to the most advanced high-tech industries. CEA Tech services address companies of all sizes and, with regional branch offices across France, CEA is positioned to support local partners with their innovation strategies, creating value and long-lasting jobs across France

FOSTERING OPEN AND COLLABORATIVE INNOVATION

CEA TECH: 4,500 STAFF, 3 INSTITUTES, AND 45 TECHNOLOGY PLATFORMS

CEA Tech's strong results-based culture is built on in-house experts with experience in both research and industry and on proven methods for transferring technology to industrial facilities. A 4,500-strong staff representing 55 nationalities delivers a range of services to CEA Tech's industrial partners across three specialized institutes, CEA-Leti, CEA-Liten, and CEA-List:

• CEA-Leti: nanoelectronics, microcomponents, and medical systems

• CEA-Liten: new energy technology

• CEA-List: software-driven systems (cyberphysical systems, artificial intelligence, data processing, formal methods, and advanced manufacturing)

The three CEA Tech institutes are positioned at the center of the innovation process, conducting R&D programs at the CEA Tech technology platforms—where the vast majority of R&D projects, from proof-of-concept testing through to prototyping, take place.

Many of the technology platforms are unique in Europe. The platforms' high-level experts and advanced software and equipment meet CEA Tech partners' needs in terms of technology development.

Thirty of the technology platforms are located in the Auvergne-Rhône-Alpes and Ile-de-France regions of France, both high-tech hubs, with an additional fifteen industry-specific platforms in other regions of France. By pooling resources, CEA Tech has made these platforms accessible to industrial companies of all types and sizes at a competitive cost.

CEA Tech invests an average of €100 million in the platforms each year to maintain their capabilities at the state of the art.

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[1] Materials, advanced manufacturing, microcomponents, nanoelectronics, medical systems, cyberphysical systems, cybersecurity, data intelligence, energy efficiency, solar energy, energy grids and storage, and the CO_2-hydrogen cycle

CEA has implemented a comprehensive strategy to accelerate and intensify its partners' research and innovation capabilities. To round out the organization's core research and development activities, for the past fifteen years CEA Tech has offered innovation services that enable its partners to come up with user-driven scenarios for tomorrow's markets.

While CEA's overriding objectives are, as always, to bring its partners new know-how to bolster their positions on their current markets, to help them address new markets, and to support them in developing innovation ecosystems, the organization's innovation services also promote a collaborative approach favorable to generating synergies and stimulating creativity. As a result, CEA Tech partners benefit from diverse approaches targeting various stages in the innovation process.

With CEA's portfolio of technologies as a common foundation, researchers, professionals from industry, designers, and students from diverse backgrounds work together to:

- Connect industrial companies to each other
- Generate disruptive new ideas
- Support innovation: creativity sessions, tech intelligence, innovation marketing, specifications for R&D and demonstrator programs, concept design, fast prototyping, user-centered development
- Support industrial scale-up
- Provide access to equipment/office space

All of CEA's open innovation capabilities will soon be housed under one roof at the future Open Innovation Center in Grenoble. The future OIC will help companies rapidly design, build, and test prototypes.

STARTUPS: A KEY PILLAR OF CEA'S TECHNOLOGY TRANSFER STRATEGY

For more than 20 years CEA has implemented an aggressive startup policy that has earned the organization recognition for its support for new businesses. Today, startups are a key pillar of CEA's technology transfer strategy. CEA has spun off more than 204 high-tech startups, with more than 75% positioned on deep tech applications creating more than 5,000 jobs. The majority of CEA startups operate on the microelectronics and integrated systems, digital technology (AI, cyber, etc.), biotech, and energy markets.

Startups—which can develop technologies for multiple industries—are the right choice for disruptive, high-risk technologies in emerging fields. And startups play a key role in developing new industries.

A few noteworthy examples are the development of the SOI industry by Soitec, a CEA startup that is now a publicly-traded company that employs some 800 people.

Initially, CEA support for startups was primarily given to spinoffs of CEA labs. Today, CEA Tech supports a much broader range of projects generated by innovation ecosystems in cooperation with partners. Startups can be created to develop CEA technologies, with or without a designated entrepreneur within the CEA. CEA can help identify an entrepreneur from outside the organization. Startups from outside the CEA can also receive support. CEA Tech can also help startups find the technologies they need, conduct R&D, or provide custom support.

A COMPREHENSIVE STARTUP BOOSTER

CEA now provides the full range of support services for high-tech and deep tech startups, especially in the early stages of their development. For growth-stage startups, CEA Tech can become a long-term partner, providing a broad palette of technical services (access to R&D platforms), innovation services (intellectual property/patents, strategic marketing, and market intelligence), and a vast network of industrial companies and financers from the public and private sectors.

CEA support for startups can take the following forms:

- identifying research projects in the labs that would make good potential startups and nurturing them to maturity ;

- expanding and securing technological innovation through intellectual property and exclusive licenses ;

- supporting projects during the incubation phase, including financing the founder's salary (up to three six-month periods) and providing zero-interest business loans once the company has been legally established ;

- holding founding shares when the company is established and investing in the company during the bootstrapping and series-A fundraising rounds, in particular through CEA-Investissement and funds managed by Supernova ;

- providing R&D partnerships to increase a startup's capacity for innovation ;

- providing access to technology platforms ;

- hosting startups during their first few years ;

- generating business for the startup by providing access to the CEA ecosystem and network of industrial partners and promoting the startup at trade fairs, through the Regional Tech Transfer Platforms, etc.

A STRONG REPUTATION FOR PROVIDING DEEP TECH STARTUPS WITH TARGETED SUPPORT

The CEA has earned recognition for its leadership supporting high-tech startups, the majority of which can be considered "deep tech". Of the 204 CEA startups created, 74 (36%) have raised a total of about 1 billiard euros, and five are publicly-traded (Soitec, Kalray, Theranexus, Tronics, and Pixium).

2018 was a particularly successful year for startups created by the CEA, which raised a total of €150 million.

CEA-affiliated investment funds (CEA-Investissement, ATI, Supernova Invest2) represent around 10% of total investment in CEA startups, proof of the leverage these funds provide.

Startup	Funds raised (in millions of euros, 2018)
Diabeloop	13.5 (September 2017)
Kalray	47.7
Isorg	24
Aledia	30
ISKN	10.5

A DEDICATED INVESTMENT POLICY

Investment fund **CEA-Investissement**, a wholly-owned subsidiary of the CEA, was created in 1999 to support the organization's startup strategy. With €72 million under management, CEA-Investissement is a pioneer in high-tech bootstrapping funding. The fund supported the development of the Emertec funds, and managed fund ATI (a €38 million high-tech bootstrapping fund investing in companies in the CEA's technological scope: energy, the environment, microelectronics, nanotechnologies, materials, optics, life sciences, etc.) until 2017. French government investment bank Bpifrance and major corporations (BioMérieux, EDF, Safran) are also affiliated with ATI.

In 2017, the CEA and Amundi (Crédit Agricole) formed a long-term partnership to support high-tech startups, founding **Supernova Invest**, which manages and provides advisory services for five funds, including CEA-Investissement (created in 1999) and ATI (created in 2013) for a total of €250 million.

Companies financed through funds managed by Supernova Invest receive personalized support developing and implementing their go-to-market strategies. They also benefit from a close partnership with shareholder CEA, which can provide access to the CEA's network of experts, intellectual property, and research infrastructures, substantially reducing these companies' capital expenditures and accelerating their growth. These companies can also work with Crédit Agricole to find banking solutions to meet their needs.

CEA DEMONSTRATORS AND STARTUPS

PIXCURVE

Curved image sensors make optical systems lighter and more compact without compromising image quality

WHAT PIXCURVE DOES

Pixcurve is an innovative solution for the imaging market. This new technology makes it possible to manufacture optical components that are curved like the human retina. The result? Fewer lens elements are required in devices like digital cameras, smartphones, microdisplays, and virtual-reality glasses, reducing camera form factors by half without altering image quality. With Pixcurve, camera manufacturers can finally get the cost effective, compact, easy-to-assemble optical components they need to bring their products to new levels of performance.

Pixcurve—a world first—has not yet been integrated into any commercially-available products. This breakthrough technology has the capacity to impact a wide range of optical systems. It is exactly the kind of innovation the sluggish digital camera market has been seeking to give it a much-needed second wind.

WHAT'S NEW

The digital camera market has taken a huge hit from the massive adoption of smartphones. While it is true that digital cameras are bulky and expensive, they do deliver image quality that surpasses that of smartphone cameras. With Pixcurve, Leti, a CEA Tech institute, has developed an innovative solution for the visible imaging market. Curving optical components has the capacity to bring a number of improvements:

FORM FACTOR

Curved optical components reduce the number of lens elements required, in turn slashing the energy consumption of embedded components and shaving substantial weight off of the final product—with immediate benefits to the consumer. For digital cameras, reducing the number of lens elements from ten to six cuts the size of the final compound lens by more than half (60%). The overall length of the optical system is also shorter—all without compromising on image quality.

PERFORMANCE

Pixcurve technology enhances image quality. Curved image sensors reduce—and in some cases, totally eliminate—optical aberrations like curvature of field and the vignetting effect. They also deliver increased brightness and a wider field of view.

COST

The cost of systems integrating Pixcurve technology will be lower than today's systems. The lower cost will be made possible by the reduction in the number of lens elements and the elimination of aspheric lens elements, which will no longer be needed.

ASSEMBLY

When fewer components are used, assembly is greatly facilitated—a major advantage for manufacturers.

TARGET MARKETS

The benefits Pixcurve delivers—mentioned above—will add value to products on several markets. First, Pixcurve technology enhances image quality. Second, it helps reduce product size and weight, both crucial factors on the markets targeted. These improvements, which will impact many sensors, constitute a competitive advantage on the photographic equipment, imager, smartphone, embedded systems (for drones, cars, defense, space, and astronomy), and connected device markets.

Manufacturers of high-end digital cameras will benefit from enhanced image quality and ease of assembly while making their formerly-cumbersome products smaller and lighter in weight. Manufacturers of smartphones, GoPro-type cameras, microdisplays, and virtual reality glasses will also benefit from enhanced image quality. The automotive industry will find a solution that meets its cost and reliability requirements, while the industrial process control market will benefit from more compact devices.

KEY FIGURES

- 10 patents
- 60% reduction in volume for DSLR camera modules

PIXCURVE @ CES

Visitors to the Pixcurve booth at CES will be able to see "before/after" examples on two tablets, illustrating the substantial reduction in form factor Pixcurve curved sensor technology can bring and proving that there is no loss in image quality. A video presenting the technology and its potential applications will also be playing at the booth.

LOTUS

Richer touch interaction through hyper-localized feedback

In recent years, touch interfaces have multiplied, becoming the new standard for human-machine interaction. However, the narrow range of expression offered by touch interfaces limits the features that these devices can deliver.

WHAT LOTUS DOES

LOTUS, which stands for LOcalized Tactile Feedback on smart sUrfaceS, is a novel solution that enhances the user experience with an interactive touch surface that is both tactile and haptic. Previous touch interfaces—if they were able to detect the positions of several fingers—could only provide haptic feedback in the form of vibration over the entire surface.

The technology developed by researchers at List, a CEA Tech Institute, offers two advantages: It makes it possible to detect the position of multiple fingers and the pressure exerted by each of them; and it also delivers individual haptic feedback to each finger. Coupled with a visual interface, Lotus enables the user to interact with digital content and offers unparalleled tactile rendering of texture and relief. This haptic-feedback technology leverages piezoelectric transducers that control vibration, enabling rich, realistic, and detailed multi-user interaction.

WHAT'S NEW

Over the past decade, we have been doing less and less clicking and more and more tapping, zooming, pivoting, and swiping. Unlike some of the currently-available solutions, where the entire touch surface vibrates, LOTUS technology delivers feedback to each finger exploring the surface individually. The result is unique, hyper-localized haptic feedback at any point on the surface for very advanced multi-touch rendering that also makes it possible for several users to explore the surface simultaneously.

LOTUS factors in vibration amplitude and, therefore, compatibility with perception thresholds, for a degree of precision and repeatability never before seen. This, combined with the low latency of the entire computational loop, makes LOTUS a truly unique solution in the world of touch interaction. The technology is also evidence of CEA Tech's leadership across the entire haptic chain, from acoustical

vibration control through to microfabrication and packaging of the solution, which, for this demonstrator, was completed by CEA Tech institute List.

Cost and size were also major considerations in the development of the solution. Affordable, commercially-available components like piezoelectric buzzers were used and the transducers are just tens of microns thick. These advantages will make the solution even more attractive to manufacturers.

TARGET MARKETS

This technology has gained traction over the past several years, finding applications on competitive markets like consumer electronics, transportation, and, more generally, new human-machine interfaces in a variety of fields.

Digital technology, mobile phone, and automotive-industry majors have already adopted LOTUS. Today, several startups have expressed interest in using LOTUS to reinvent humans' relationship with machines and create a simpler, more effective, and enjoyable user experience.

KEY FIGURES

- 4 patents

LOTUS @ CES

Visitors will be able to explore an opaque, pad-type surface positioned on a six-axis force sensor and coupled with a tablet and a large screen displaying a variety of human-machine interfaces and interactive games.

SIGMA CELLS

Compact, lightweight, fast-charging batteries for electric mobility

Electric-powered transportation is booming. However, the industry must still overcome a number of challenges in the area of battery management. Currently, if one cell in a battery pack fails, it generates a fault on the whole battery pack. At best, this puts the battery pack out of service until it can be repaired. At worst, the battery is discarded. CEA Tech has developed a switched cell technology that will revolutionize batteries by lengthening their lifespans and reducing weight and form factor.
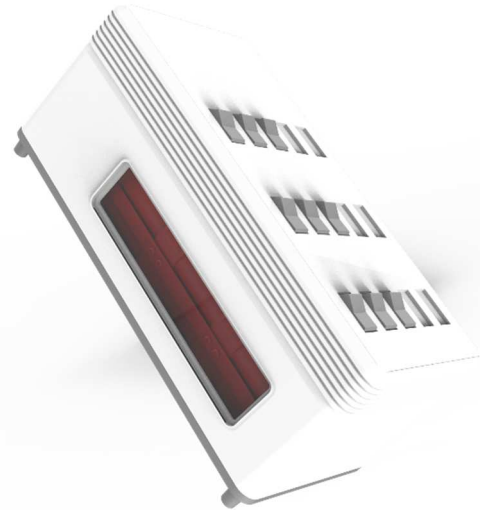
WHAT *SIGMA CELLS* DOES

Sigma Cells is CEA Tech's latest smart-cell technology for electric mobility. Traditional battery architectures were revisited to create a multi-cell power supply, generating many benefits.

WHAT'S NEW

This revolutionary technology serves as the battery's brain. Sigma Cells ensures service continuity by governing the smart use of battery cells. If a cell is about to fail, Sigma Cells finds a reliable alternative pathway, preventing downtime. Sigma Cells also extends battery life and lifespan by taking advantage of the intrinsic physico-chemical characteristics of each cell.

Sigma Cells is the world's first three-in-one battery solution with integrated switching, charging, and BMS functions. Through its two institutes, Leti and Liten, CEA Tech drew on its extensive knowledge of electric mobility, from battery chemistry to advanced motor control, to develop Sigma Cells.

COMPACT FORM FACTOR AND PERFORMANCE

Sigma Cells' three main functions—switching, charging, and BMS—are integrated right into the battery pack. The innovative BMS architecture and operating mode delivers the switching and charging functions by default.

In addition to freeing up space in the vehicle cabin, the position of the batteries in the vehicle is flexible, because the system operates off of traditional grid voltage.

Sigma Cells also delivers enhanced performance for all three main functions. The integrated charger and bidirectional system enable faster (more than 20% faster) charging directly off the grid at no additional cost. Furthermore, any standard electrical outlet in any region of the world can be used for charging. The switching yields are also optimal, resulting in a reduction in the associated overheating and reducing the need for the cooling liquid conventionally used.

EXTENDED LIFESPANS AND EASY MAINTENANCE

The advanced BMS provides access to individual cells at all times; the cells that charge most efficiently are used first, and cells that are no longer cycling optimally are avoided. This smart cell switching solution—built on better prediction of charge status and battery health—has a direct impact on system lifespans and brings users the added convenience of knowing how much battery life they have left. Plus, diagnostics are completed while the battery is in use, eliminating the hassle of traditional maintenance. With Sigma Cells, all three main functions are integrated into the battery pack; the integrated BMS's innovative architecture and software perform charging and switching automatically.

TARGET MARKETS

Sigma Cells technology has not yet been released on the market. It is designed to respond to the needs of the rapidly-growing electric mobility market, addressing all battery types (electric bikes, cars, buses, boats, and more). The technology is also compatible with the demands of a wide range of storage applications (grid regulation, power supplies for servers, electric tools, portable power banks, self-powering buildings, etc.). Production is slated to begin in September 2019.

Electromagnetic Compatibility (EMC) is how well an electrical or electronic device or system can operate in its electromagnetic environment without generating interference with the things around it.

KEY FIGURES

- 10 years of R&D
- 3-in-1 battery solution providing all the electrification functions of a system
- More efficient power conversion, with losses cut in half
- Two times fewer charging status and battery health estimation errors
- Battery life improved by 20%
- Battery lifespan lengthened by 15%
- Switching losses divided by 100
- Reduced cooling requirements
- Low electromagnetic interference (EMC* emissions slashed 100-fold)

SIGMA CELLS @ CES

A battery equipped with Sigma Cells technology will be installed on an electric bike. Visitors will get a first-hand look, and will even have an opportunity to physically remove a battery cell to prove that the battery still works because Sigma Cells has found an alternative pathway!

FACE

The electrical and electronics architecture for tomorrow's connected and autonomous vehicles

The electronics in today's cars lag far behind what consumers are accustomed to in the devices—like smartphones—they use every day. On the digital technology market, a new product can be implemented in just weeks, something that can take up to two years in the automotive industry. This is because the way automotive technologies are integrated hasn't changed much since the 1950s. With each passing year, new computers are added to cars to bring drivers new features. The result is that today's standard cars have up to 70 or more computers, and many of them use different communication protocols. Cars are so packed with computers, cables (more than 2,000), and complex and rigid electrical and electronic networks that there simply isn't room for more.

WHAT FACE DOES

With the advent of connected and autonomous vehicles, new electrical and electronics architectures will be crucial to simplifying the integration of new features and shortening time to market, helping manufacturers deliver on their promises of autonomy. List, a CEA Tech institute, has designed a flexible, high-performance computing platform that is compatible with existing infrastructures while facilitating the integration of new services—especially for connected and autonomous vehicles.

WHAT'S NEW

As the number of features in motor vehicles increases, so does the number of sensors and processors. Further compounding the problem is the fact that these devices present a broad range of operational safety, cybersecurity, and performance characteristics.

To meet the challenge, FACE distills all processing resources in a scalable, modular and centralized computer that manages all services.

This new concept built on a single centralized computer and secondary computers—linked by an Ethernet network—that will transmit data generated by the vehicle's sensors (cameras, LiDAR, radar) and switches (engine, airbags, brakes, lights).

The primary direct advantage of bringing all processing resources into a single computer is space. Face will reduce the number of computers—and associated cable bundles—, potentially cutting the amount of space needed for computers in half.

Face will also make adding complex new features to a vehicle faster and easier by taking full advantage of all data generated by the vehicle and by harnessing software to add value. These advances will prepare today's cars to transition into the future.

Finally, by bringing many features together in a single piece of hardware, Face eliminates interference between components. The solution's software architecture and robust integration process were designed specifically to overcome this challenge.

The purpose of the FACE project is to leverage the CEA's know-how in critical software and advances in processors, networks, and software development to bring the automotive industry the same transformation that brought the aeronautics industry into the future two decades ago.

FACE @ CES

The physical appearance of the Face architecture will be represented by a centralized, modular computer that communicates via the car's Ethernet network with distributed systems, managing a variety of switches—like parking lights, brake lights, and blinkers—and gathering data from the vehicle's LiDAR and cameras. The Face demonstrator system will safely run a speed control application combined with obstacle detection and lane-change warning features. New features—like pedestrian detection—can be added at any time in the vehicle's lifecycle.

TARGET MARKETS

Automotive OEMs and suppliers will be on the front lines. However, rapid progress toward the autonomous vehicle will create demand from other stakeholders, like major digital technology companies and mobility specialists. As new features are developed for these new electronic interfaces, traditional manufacturers will gradually undergo a major shift. In the future, their role will be to integrate software into vehicles, combining and reusing software components from multiple sources. In the process, time to market will become much shorter.

According to McKinsey & Company, up to 15% of new vehicles sold in 2030 could be completely autonomous. For now, some substantial technical and regulatory obstacles still need to be overcome. However, flexible electronics architectures like Face will be one of the main facilitators of the development of the autonomous vehicle.

MULTI ENERGY STATION

An energy architect for tomorrow's energy systems

The global energy landscape is changing at an unprecedented pace. As economies around the world search for ways to go carbon-free, some major shifts are challenging our current energy systems: Digital technology is rapidly making inroads into the energy market, electric mobility is expanding, distributed energy production is on the rise, and more renewable energy is making its way into energy grids.

These changes are creating numerous opportunities for industrial companies to innovate. As a key partner of the energy transition in France, CEA Tech institute Liten covers the entire energy value chain, from technology to user services. Liten can draw up specifications for, dimension, and manage any energy system, taking into account the full range of system constraints and user needs.

WHAT MULTI ENERGY STATION DOES

Energy systems will play a key role in overcoming the challenges of the energy transition by balancing energy supply and demand at the local level. Dimensioning and managing energy systems is a complex blend of technology, economics, and customer satisfaction.

Effective management necessarily takes all of these issues into account. Liten, a CEA Tech institute, has built on optimized energy storage solutions combining batteries and hydrogen to develop efficient, environmentally-friendly mobility services designed to boost local consumption of locally-produced solar energy, enabling the area served to be virtually independent from the grid.

WHAT'S NEW

Multi Energy Station leverages robust software know-how to process large volumes of heterogeneous data, modelling the operation of and interactions between the various components (hydrogen, solar, batteries, heat networks, etc.) of an energy system. Multi Energy Station is a much richer solution, incorporating data on commercially-available technologies and technologies under development at Liten labs, as well as component reliability, performance, and aging data for different use scenarios. The sheer level of detail helps dimension energy systems as efficiently as possible for their intended use over time and enables users to see what their energy systems look like now and how they could evolve in the more distant future as new technologies are implemented.

Multi Energy Station is built on Liten's in-depth knowledge of the technologies that make up the solution:

– The high-temperature electrolyzer for environmentally-friendly hydrogen production and reversible energy storage

– The development of high-performance batteries (both in terms of energy and power) that address safety and lifespan issues for stationary and mobile storage

– The rollout of "everywhere" photovoltaics, with optimized costs and yields (HET PV, flexible PV, etc.)

The CEA is pursuing its efforts to improve robustness and data security and to protect the software from hackers.

The next generations of high-performance, smart, and secure batteries and longer-lasting, more affordable fuel cells are also on the drawing board at CEA labs. Additionally, the CEA is investigating forecasting models to predict performance during operation and degradation over time.

TARGET MARKETS

The Multi Energy Station solution will respond to the needs of mobility-related energy infrastructures, isolated sites, and self-consumption. Energy systems designers and other energy specialists assigned to large projects like hotels, hospitals, shopping centers, and industrial facilities will also derive many benefits from the solution. Certain mature energy system dimensioning and management technologies have already been transferred to urban planners, battery manufacturers, and professionals in the mobility and construction industries—these stakeholders will also benefit from Multi Energy Station.

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KEY FIGURES

- More than 1,000 patent families

MULTI ENERGY STATION @ CES

Visitors will be able to experience Multi Energy Station first-hand through a serious game in which they will have to cope with the many different factors that must be taken into account in coming up with solutions to energy challenges. Here, visitors will tackle the problem of a highway rest stop that must be able to fill/charge hydrogen and electric vehicles for one year. They will be challenged with dimensioning the station and managing it.

POWERUP

PRECISION BATTERY MANAGEMENT AND MAINTENANCE

The number of batteries is growing exponentially as the proportion of renewable
energy in the energy mix increases, electric-powered mobility expands, and the number of self-powered devices rises. Battery life tends to decrease over time, a problem that PowerUp set out to solve in order to support the energy transition. PowerUp's novel battery management and maintenance solution is ideal for the managers of fleets of battery-powered equipment and for consumer applications.

WHAT POWERUP DOES

Charging Li-ion batteries so that they last as long as possible is a challenge for the operators of fleets of battery-powered equipment.

PowerUp, a startup founded in 2017, has developed a new smart charging system that solves this problem. Managing battery performance is a new and major challenge. It is currently impossible to know how long a battery will actually last. This is because battery manufacturers' data is based on standard testing—not real-world use. Lithium-ion batteries do have battery management systems, but these systems do not offer accurate charging status and battery health data, making it impossible to optimize battery lifespans.

PowerUp is a startup that aims to maintain batteries' factory performance over time using a charge-optimizing algorithm and battery status supervision software. The solution will give fleet managers the possibility of actually seeing the status of their batteries in real time.

WHAT'S NEW

PowerUp's smart chargers can help double the lifespans of Li-ion batteries and make predictive maintenance easier. The company's smart chargers determine the optimal charging conditions according to battery temperature, charge status, and level of degradation.

Specifically, PowerUp leverages models covering various Li-ion chemistries and algorithms integrated into the charging modules to limit aging-related losses tied to the charging regime and schedule. PowerUp also generates very accurate battery health indicators using voltage signal analysis and acoustical measurements.

Equipment fleet managers can also benefit from PowerUp's supervision module, which centralizes the data from all chargers, facilitating predictive battery maintenance, a more efficient and less expensive alternative to the systematic periodic replacement of batteries. PowerUp is based on several years of research on battery degradation mechanisms at Liten, a CEA Tech institute.

TARGET MARKETS

The main markets targeted will concern companies with fleets of battery-powered equipment, where guaranteeing performance is a major need. Specifically, the railway, special equipment (forklifts), and backup battery markets will be on the front lines. Other markets will include portable, battery-powered tools and battery-powered personal vehicles like electric bikes and scooters.

KEY FIGURES

- 7 patents
- Battery lifespans doubled
- Battery health indicators accurate to within 3%

PowerUp is currently being implemented by the backup battery division of a partner, working on the commercialization of its solutions towards important storage systems users as ENEDIS, which operates France's national electricity grid, and SNCF, which operates France's national rail network.

Secondary markets will include consumer electronics like smartphones and tablets. PowerUp is currently working with a telecommunications company on a future product for this type of application.

Today, PowerUp is raising capital to ramp up research and development and get its products to market.

CONNECTING FOOD

Blockchain for a transparent food industry

WHAT CONNECTING FOOD DOES

Connecting Food offers a suite of blockchain-based digital solutions to ensure the traceability of food manufacturing chains and perform real-time audits to verify that each product complies with various requirements (geographic origin, organic, GMO-free, etc.). Results can be displayed directly on consumers' phones: Consumers simply scan a product to see the product's history, and proof that requirements are being met. Connecting Food builds and protects brand equity (for food brands, producers, and restaurant chains, for example) by bringing transparency about their products to consumers. The Connecting Food suite of solutions uses blockchain technology to render data immutable. However, blockchain alone cannot guarantee that the information registered is true, or that food products are actually complying with requirements.

To solve this problem, Connecting Food developed LiveAudit®, a breakthrough innovation. LiveAudit® guarantees that each and every food product truly keeps the promises made to consumers on the product labels. Connecting Food leveraged List's technological expertise to develop this groundbreaking system. The company's research partnership with List resulted in a robust and revolutionary solution: the first software able to audit a product in real time, before registering on the blockchain.

Connecting Food feels strongly that transparent food manufacturing is good for society. The company donates 5% of its revenue to an incentive fund rewarding farmers who participate in the platform and for the quality of their work.

CONNECTING FOOD AND LIST, A CEA TECH INSTITUTE

Many big supply chain firms already use blockchain technology to register flows of goods. Connecting Food is the only player on the market offering a B2B auditing solution to ensure that registered data is trustworthy and hence restores confidence. The partnership with List enabled Connecting Food to develop an innovative solution to digitalize the whole auditing process and make it "live", i.e. in real-time.

LiveAudit® is capable of:

- Verifying automatically the respect of a product's commitments

- Raising alerts when one stage in the chain does not respect commitments

- Providing proof that audit results are correct

The solution is dynamic and based on algorithmic research on formal proof in real time; it can validate and detect incoherencies along the processes of a food manufacturing chain. It tracks each action all along the food manufacturing chain, from the farm to the retailer, and indicates whether the product is compliant or not, notifying the decision-makers as soon as possible. Non-compliant products can then be re-oriented towards other food manufacturing chains, with different requirements, reducing industrial food waste.

WHAT'S NEW

Connecting Food launched its platform in the summer of 2018 and already has several clients in France and Europe on different food manufacturing chains, and is ready to be launched internationally in other European countries and in the United States. Based in Station F, the world's largest startup campus, Connecting Food quadrupled is workforce in just a few months and plans to hire 10 to 20 additional employees in 2019. In 2020, Connecting Food aims to be the European reference in food transparency and digital audits.

TARGET MARKETS

Connecting Food Solutions are targeted towards all actors in the farming and food manufacturing industries wanting to create value through food-manufacturing-chain transparency.

CONNECTING FOOD @ CES

The Connecting Food LiveAudit® demonstrator is an interactive game. The visitor plays the role of a quality manager of a pancake brand, checking that each packaged product is compliant with its commitments, which reveals how hard it is to audit in real time 100% of a product's ingredients.

For example, to make pancakes it takes flour, milk and eggs. In the game the brand promises the consumer GMO-free wheat, milk from grass-fed cows, and free-range eggs. How can you be sure that these promises are respected by every supplier of the brand?

How do you prove to the consumer that each product is really compliant with its promises?

The player is quickly overwhelmed by all the products passing through the chain, and never manages to audit every one of them. It is only by applying LiveAudit® to the supply chain that the player can discover how all products can be digitally audited, how non-compliant products can be oriented towards other food manufacturing chains, and how each product batch reaching the end of the chain is certified compliant.

DIABELOOP

A personalized, automated type-1 diabetes management system for children

Type-1 diabetes, an autoimmune disease, affects several million children worldwide. More than half of the cases of type-1 diabetes are diagnosed before the patient's 20th birthday. And the disease affects more than just the child—the entire family must cope with managing treatment every day.

Diabeloop, working in partnership with Leti, a CEA Tech institute, has been committed to improving the quality of life of type-1 diabetes patients and their loved ones since 2015.

WHAT DIABELOOP DOES

Diabeloop, working in partnership with Leti, a CEA Tech institute, has been committed to improving the quality of life of type-1 diabetes patients and their loved ones since 2015. Diabeloop's first product, the DBLG1 System, was unveiled at CES last year. It virtually completely automates type-1 diabetes management by reproducing the pancreatic function destroyed by the disease. Consisting of powerful algorithms integrated into a secure terminal, this integrated system continuously measures blood sugar using a subcutaneous sensor, and delivers insulin via a subcutaneous pump.

AT THE END OF 2018, THE DEVICE OBTAINED THE CE MARKING, A CRUCIAL STEP TOWARDS MARKET RELEASE

Over the past several months, Diabeloop has been focusing on its latest mission: to give pediatric care a boost, not only improving the quality of life of each child in the short term, but also their long-term perspectives. As always, the company strives to free caregivers of much of the day-to-day decision-making associated with managing the disease.

WHAT'S NEW

Diabeloop's new system, the DBL4K, will be the first-ever medical device for the treatment of type-1 diabetes designed with input from children and their loved ones. The system can be personalized, and its modular design can be tailored to each patient's physiology and lifestyle. The system's features and ergonomics were also designed with children in mind.

TARGET MARKETS

The product, currently in clinical trials, is for families and healthcare providers. It will address the e-health and medical device markets in Europe and the United States and, more broadly, the therapeutic innovation and artificial intelligence markets.

Diabeloop continues to pursue an ambitious R&D roadmap to address other types of diabetes while gradually ramping up efforts to commercialize its first-generation product, the DBLG1 System, in Europe and the United States.

After a first round of fundraising in 2017, Diabeloop launched its second round of fundraising at the end of 2018.

DIABELOOP @ CES

A display will illustrate the system, with images of the system worn by a patient (for the adult version, already on the market). Other images will illustrate use of the new version (for children).

APPENDIX: ISSUES AND BUSINESS SECTORS ADDRESSED BY CEA TECH

CEA technological branch (CEA Tech) produces technologies capable of making businesses in all industries more competitive. CEA Tech's services benefit:

- Transportation and mobility: land transportation, the naval and maritime industries, aeronautics
- Public health and the environment, the Silver Economy
- Farming and food manufacturing
- The manufacturing industries: Factory of the Future, apparel, fashion and luxury, wood
- Security, cybersecurity, nanosafety
- Renewable energy production (solar energy production, energy storage and distribution, new energy carriers like hydrogen), energy efficiency (for transportation, buildings, and industry), smart cities, energy solutions for mobile devices
- Information and communication technologies: Internet of Things, electronics, microelectronics

CEA is creating tomorrow's technologies in all of these industries, supporting industrial R&D partners in their efforts to leverage innovation to boost their competitiveness, and inventing innovative solutions to support the transformations affecting our society:

- Sustainable planet: CEA Tech is developing new technologies for energy and the environment to support the transition to a more sustainable planet. Research topics include custom materials synthesis, bio-inspired design, and the transition to digital and distributed energy systems combining very-high-yield solar technologies, smart and energy-efficient lighting, energy efficient systems for buildings and mobility, storage for intermittent renewable energy, and grid integration.

- Digital society: Whether it is through hardware or software, CEA Tech is at the cutting edge of digital technology with research covering tomorrow's electronic components, massive data processing and analysis, cyberphysical system design and validation testing, the digital factory, the Internet of Things, and e-services.

- Public health: CEA Tech is developing targeted, noninvasive nanosystems for medicine, innovative treatment protocols, high-performance medical imaging systems, software for diagnostics, and more— all to transition healthcare providers and patients toward more personalized, less invasive treatments that will, increasingly, be delivered on an outpatient basis.

CEA is capable of combining the most advanced digital technologies with industry-specific technologies to support businesses in their efforts to innovate, remain competitive, and successfully navigate these transitions, especially when digital technology disrupts their traditional business models.

A MODULAR RANGE OF ENABLING TECHNOLOGIES FOR TOMORROW'S PRODUCTS

CEA provides key competencies built on enabling technologies developed over a long history and through multiple iterations shaped by constant observation of major global trends in industry.

CEA's ability to combine and integrate these enabling technologies across the value chain from material to system underpins a strong potential for innovation in the design and manufacturing of a wide range of high-added-value products and services ready for businesses to transform into an immediate competitive advantage.

CEA stands out for its enabling technologies for:

- Digital solutions: microelectronics, microcomponents, photonics, software, data intelligence, artificial intelligence
- Energy: materials, storage, photovoltaics
- Healthcare

The organization is also committed to overcoming major challenges at the system level:

- New-generation cyberphysical systems
- Cybersecurity
- Advanced manufacturing (Industry 4.0)
- Grids for the energy mix
- Medical devices

CEA possesses fabrication and prototyping capabilities that position the organization to build out-of-the-box demonstrator systems well in advance of production roadmaps for its partners. When transferring technologies to partners, CEA Tech protects its innovations through an intellectual property portfolio that is unique in Europe.

ABOUT CEA

CEA is a major global government research organization that drives innovation defense and security, nuclear energy (fission and fusion), technological research for industry, and basic research (materials science and life science).

LEARN MORE

► [bit.ly/CES2019_CEA](bit.ly/CES2019_CEA)

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