

# THE **AGILITY** EFFECT

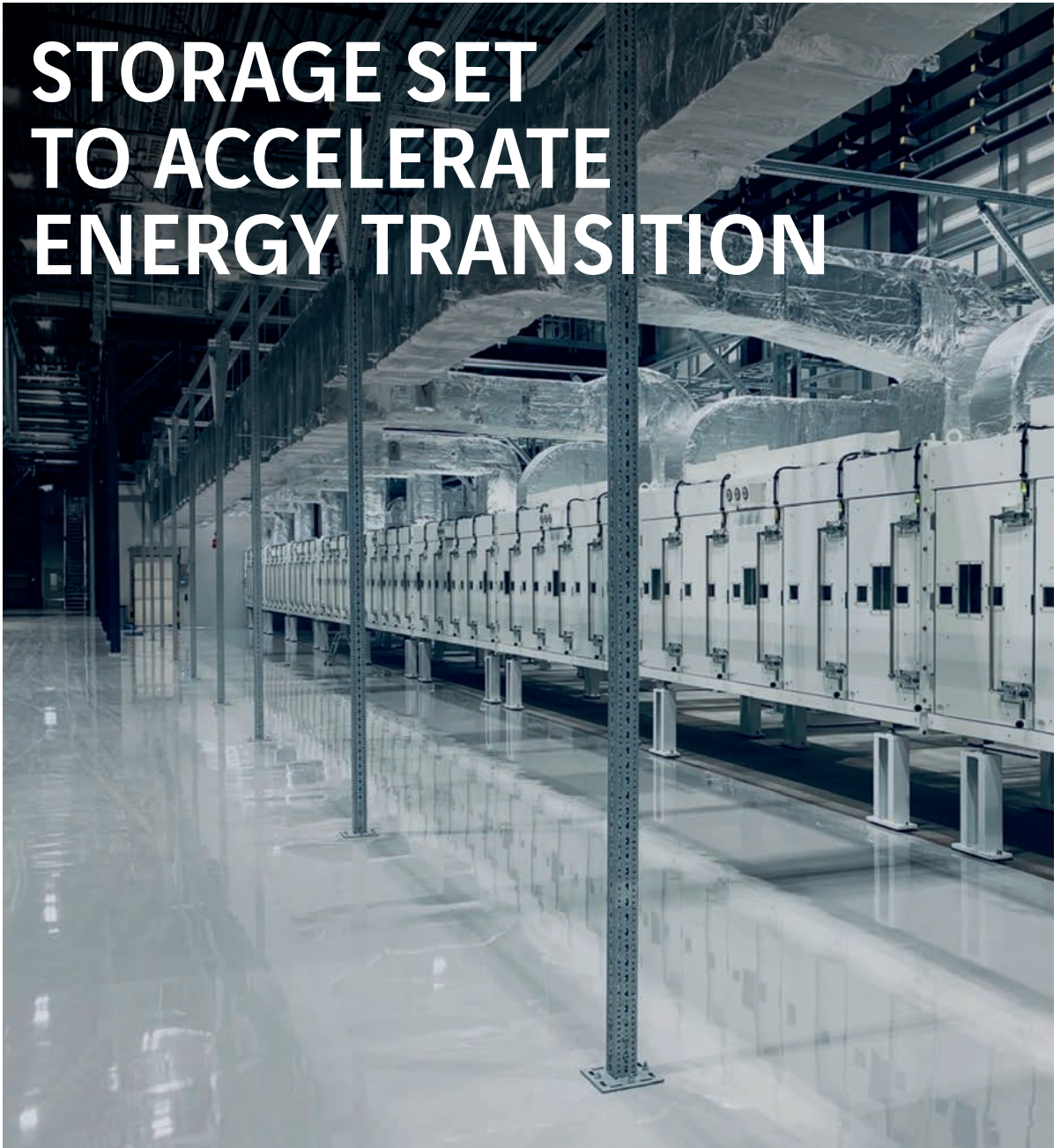
MAGAZINE

MORE ROBOTS  
MEAN SAFER  
CONSTRUCTION SITES

EDF'S ACROBATIC  
INNOVATION  
STRATEGIST

WELCOME  
TO BATTERY  
AS A SERVICE

## STORAGE SET TO ACCELERATE ENERGY TRANSITION



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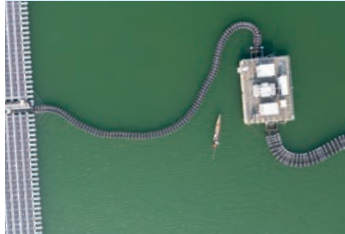
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As is strongly underlined by the current international context, control of energy production and grid integration is at the forefront of economic, political, environmental, and societal concerns. By 2050, the share of electricity from renewable energy sources in the global energy mix is expected to more than double.

To support the development of these sources, whose production is intermittent and decentralized, the issue of electricity storage promises to be crucial.

Energy storage balances production and consumption, ensuring reliable access. However, numerous technical, regulatory, and economic obstacles still hinder the deployment of new storage technologies.

In the feature of this issue of The Agility Effect, you will discover the solutions that address these challenges head on.

Various examples illustrate how initiatives are multiplying and how VINCI Energies business units are accelerating the change, amongst others: utility-scale storage systems in Dunkirk for grid balancing, batteries that facilitate the integration of renewable energies in Corsica, and hydrogen refueling stations in the Paris region.

In this issue, you will discover the different storage solutions, different types of batteries, the role of biomass, and the importance of green hydrogen as a very promising energy vector.

From individual consumer to territories and industry, see how VINCI Energies business units work to provide targeted solutions to our customers and to society, always at the heart of the energy transition.

The magazine also includes an article on a new supercomputer in Belgium and an interview with Aude Vinzerich, Head of innovation strategy at EDF.

I hope you enjoy this issue.

Markus Popp  
Director, Omexom brand





## AGILITY PICTURE

### CALL ME A WATER TAXI!

Self-service cars, bikes, motor scooters, and now electric scooters: urban mobility is constantly diversifying. And we can now add autonomous water taxis to the list. This is a particularly promising solution for towns and cities with a developed waterway network, like Amsterdam, where Roboat III is soon due to enter commercial service on the canals of the Dutch capital's historic centre. Four metres long with an elegant grey-black design, Roboat III can carry up to five people or 1,500 kg of freight. Fully electric, GPS-enabled and equipped with a battery the size of a small storage box, it can recharge itself wirelessly and cruise the Amsterdam canals for 10 hours between charges.



# ROBOTS: PROMISING ASSISTANTS FOR THE CONSTRUCTION INDUSTRY

**The use of robots can meet safety, productivity and recruitment needs in the building and civil engineering sectors. There are just a few obstacles, mostly regulatory, left to remove.**

Construction has the highest accident rate of any professional sector, with 56 work accidents recorded annually per 1,000 employees in France, where the average across all sectors is around 34 per 1,000. The construction sector alone accounts for almost 14% of all work accidents, over 16% of accidents leading to permanent impairment and over 19% of fatal accidents. It also represents 15% of occupational illnesses recorded by the French national health insurance agency. For employers, this accident rate compounds the poor image of the construction trade. This causes them problems with recruiting, in addition to contending with a limited workforce. But the sector is taking steps to improve its appeal, applying a variety of levers: salaries, training, quality of work life and making building trades aspirational. But construction companies also have a non-conformist ally, very discreet but with plenty to offer:

the robot. Of course, using robots on construction sites is not a new idea. On the contrary, it is a recurring theme in industry discussions. It must be said that the presence of robots on construction sites offers numerous advantages. Robots can replace human beings for dangerous or highly arduous work (repetitive tasks, hard physical labour). They are also an army of reservists ready to cover staff shortages at any given moment or according to a schedule. And they help to modernise the image of the construction trades.

## VINCI joint venture

Several companies have already developed high-performance robots. In 2012, the English SME Q-Bot launched a robotic system capable of inspecting and insulating domestic crawl spaces, which are difficult for human beings to access. The French startup PaintUP offers a facade-painting robot. Robots for Site, a joint venture between VINCI Energies, VINCI Construction and Eurovia, provides industrial robotics solutions tailored to the specific needs of construction: mobile, autonomous robots capable of working outdoors in unstable

environments. Pierre Barcelo, CEO of Robots for Site, explains: "In two years, we've developed a dozen robots capable of performing around 20 construction tasks: robots for autonomous handling, scouring metal structures, planing ovoid walls, tiling, sanding floors and walls, drilling slabs/walls or ceilings, and core drilling; an autonomous tool for railway equipment, an arm for handling well-drilling pipes and a formwork renovation workshop." The business unit is working on some 50 internal VINCI Group projects and has favoured easy-to-use solutions, with an average of at most five commands for the operator. Because even if they have very little to do, there is always an operator in the loop!

## Obstacles to overcome

There is a real need and a working solution – so why are robots not more present on construction sites? Various factors still hinder the meeting of supply and demand. In 2019, a study by the Big Data Enterprise and Artificial Intelligence Laboratory in Bristol highlighted the lack of a perceived need to improve productivity, fear of change





INDUSTRY ACCELERATION

# INNOVATIVE LOGISTICS SOLUTION ROLLED OUT TO SPEED UP PARCEL SORTING

**Viapost, the logistics subsidiary of the La Poste group, has invested in a fully automated parcel preparation system, implemented with the support of Actemium. The aim is to adapt to the boom in e-commerce.**

In 2021, France's e-commerce sector for products and services exceeded €129 billion, representing an increase of 15.1% over the year (following a rise of 8.5% in 2020), says Fevad, the French federation of e-commerce and distance selling. This growth in online transactions

**“The solution reduces delivery round preparation time by a factor of three.”**

boosted business in the logistics sector, particularly in the last mile delivery segment. A long-standing player in small parcel distribution, La Poste (France's postal service provider) saw its targets galvanised by successive lockdowns and the expansion of home working. This had an immediate mechanical effect on production at its delivery

centres, medium-sized, medium-throughput logistics platforms, based near large cities.

## Automatic parcel infeed and sorting

Viapost has just introduced an innovative, fully automated solution that sorts parcels by delivery round and uses a singulation process at one of these centres, the Argonay sorting hub to the north of Annecy in south-eastern France. The solution is a first for a mail depot and was achieved thanks to Viapost's partnership with Actemium Lyon Logistics, a VINCI Energies group business unit.

The so-called Sort & Drive method significantly reduces preparation time and falls within a reasonable investment budget due to medium-throughput production calibration.

“Previously, delivery staff picked and sorted parcels on shelves before loading them into their vehicles. Now, the solution manages the infeed of parcels and sorting according to delivery rounds for postal delivery workers, who can load the items directly into their vehicles,” explains Xavier Brun, Actemium Lyon Logistics business manager.

## Threefold reduction in sorting time

The sorting system designed by Actemium comprises four automated unloading lines, each equipped with a telescopic conveyor that enables operators to manually unload parcels from trailers.

The items are then routed on another conveyor system and identified and measured thanks to a scanning tunnel that contains high-resolution cameras for barcode reading. Next comes the weighing, which is performed by a certified dynamic system, followed by delivery to a vertical crossbelt sorter supplied by Interroll.

“The solution, developed in conjunction with our client Viapost, with whom we've been working for 6 years, reduces delivery round preparation time by a factor of three. It means 35,000 parcels can be processed per day for last mile deliveries, which equates to 6,200 parcels per hour, discharged into their delivery round containers via 80 exit doors,” states Xavier Brun. The innovation offers further advantages including reduced maintenance requirements, increased ease of use for operators and low noise levels, removable trolley exits and ergonomic workstations.

and a lack of trained personnel, among others. From a more technical point of view, construction sites often lack the space that robots need to move around.

Another obstacle is the difficulty robots have, even when fed data beforehand, in knowing where they are in buildings under construction, where the spaces are naturally constantly changing. The cost of the devices is not insignificant either.

At Robots for Site, prices range from €40,000 to €350,000.

To be cost-effective quickly, a robot needs to be usable on multiple

sites, i.e. must be multipurpose. For Pierre Barcelo, the real key to

**“In two years, we've developed a dozen robots capable of performing around 20 construction tasks.”**

jump-starting the market is to be found in the regulatory sphere:

“We can only market industrial solutions once they have been certified by a European standard. There is currently no certification that specifically addresses building site activities. But we're working on it: certification should be available from summer 2022.”

The Robots for Site CEO finishes by saying: “Expectations are huge, from eliminating dangerous situations and mitigating the risk of musculoskeletal problems to reducing time and budget overruns. It only needs one or two players to take the first step to set the market in motion.”



# MAKING TRAINS EVEN SAFER THROUGH TECHNOLOGY

**In Italy, Axians took part in a project to improve safety and offer new services to passengers through an innovative ground-to-train data communications system.**

With a trial launched in the Naples region of Italy in 2018 and completed in summer 2021, the Treno Sicuro (Safe Train) project presages the train of the future: connected, intelligent and safe. Campania's transport company EAV (Ente Autonomo Volturno) trialled communications infrastructure installed in a prototype train and along a 4 km stretch through the San Giorgio-Volla tunnel. Equipped with new Wi Fi technologies, the system provides reliable broadband connectivity, even when the train is moving. The aim is to ensure greater safety for customers, and improved monitoring of data, images and train position, but also more efficient in-train services. In collaboration with internet networking equipment specialist Cisco, Axians (through its Italian Business Unit of Transportation Rail and Road) was chosen for this project because of its expertise in installing cutting-edge network architecture and infrastructure on difficult-to-access sites in the transport sector, and underground networks in particular.

The VINCI Energies ICT brand configured and installed the equipment, created the cabling, and coordinated all procurement and project management activities. Antonio Francesca, Operation Manager PA Center-South & Transportation Rail and Road at Axians Italy explains: "The type

of Cisco application we're using enables ground-to-train data communications in real-world traffic situations with negligible data packet loss." "Traditionally, to maintain active communication, the train's communication system has to connect to different antennas.

Switching from one to another sometimes causes the signal to drop. Thanks to Cisco's Fluidmesh technology, the train communicates continuously without any interruptions due to switching antennas." The train therefore benefits from wireless network coverage as well as wired connectivity through access points along the track.

## Improving safety, operations and services

This trial enabled EAV and its partners to test new services and enhance existing ones. In terms of passenger and personnel safety, interaction with the police is improved (video surveillance, VoIP for passenger announcements and emergency calls, virtual police officer for remote security checks, etc.).

Signalling and internal processes are also enhanced (train positions, passenger flows, etc.). Lastly,

**"A model for a new form of rail mobility: safe and packed with new functionality."**

services are improved for users, and tourists in particular (public Wi Fi, advertising and information customised according to the train's location, etc.).

New communication and collaboration tools were also trialled for EAV employees who need to communicate with central office for operational purposes. Antonio Francesca adds, "These improvements were made possible thanks to a DCS (data communications system) capable of transmitting broadband data between different on-board systems (video surveillance, VoIP connectivity, communication of train position data, Wi Fi for the passengers, etc.) and the central command post." To achieve this result, Axians had to overcome numerous obstacles, beginning with installation and cabling compliant with modern safety standards in a train more than 10 years old. But the experience showed Treno Sicuro to be a model for a new form of rail mobility: safe and packed with new functionality.





# WALLONIA BOOSTS ITS HIGH PERFORMANCE COMPUTING CAPACITY

**Cenaero, a research centre in Wallonia, Belgium, has appointed Axians to complete the installation of a new supercomputer. The aim is to accelerate basic and applied research thanks to high-speed computations.**

The world of high performance computing (HPC) is based on petaflops, where one petaflop is equal to one quadrillion floating-point operations per second. In its category, the next supercomputer to be adopted

**“The infrastructure must be both specialised and general, flexible and reliable.”**

by Cenaero, a private non-profit applied research centre in Belgium's Walloon Region, will deliver high computational speeds, with total CPU <sup>(1)</sup> power of 1,137 petaflops and total GPU <sup>(2)</sup> power of 2,262 petaflops. And that doesn't

include the part dedicated to artificial intelligence. With this new supercomputer, Cenaero, which operates mainly in the aeronautical design, spacecraft, manufacturing process, building and smart city sectors, plans to optimise its expertise and engineering services by supporting basic, applied and industrial research. In September 2021, the VINCI Energies ICT brand Axians was selected on the basis of a tender process by Cenaero, commissioned by the Walloon Region, to manage the installation of the computing platform. The project is worth a total of €9.5 million.

“We're responsible for the whole IT infrastructure package, which includes 5-year solution support,” points out Dorin Preda, senior HPC technologist at Axians.

“The contract involves setting up the equipment and indeed software layers to ensure the machines communicate and to manage user interactions, data storage, platform monitoring, task automation and virtualisation.”

## A complex project

Axians has joined forces on the project with HPE (Hewlett Packard Enterprise) for the supply of IT equipment and for performance tests, which form part of Axians' commitments. The VINCI Energies ICT brand is also drawing on the expertise of another Group subsidiary, Cegelec Belgium, to carry out the data centre package, which includes fit-out, electricity, cooling system, site security, and so on. “One of the main challenges in this project is managing the various trades involved,” says Dorin Preda. “Another difficulty lies

in the complex configuration of the solution which is designed to meet the needs of very different user profiles, for example researchers and SMEs. That means the infrastructure must be both specialised and general, flexible and reliable.”

Through this project, which is scheduled for completion by mid-2022, “Axians has shown its ability to manage large, complex projects from start to finish while promoting an ambitious environmental approach that reduces the site's carbon footprint. This is achieved thanks to a liquid cooling system,

where water flows through the servers and which offers the possibility of heat recovery,” sums up Marc Trassoudaine, manager of the Axians HPC business unit.

(1) Central Processing Units or CPUs execute the instructions and processes needed for a computer or operating system. They also determine programme speed of execution.

(2) Graphics Processing Units or GPUs focus on compute-intensive tasks and are designed for parallel processing.







AGILITY **LEADER**

ENERGY

INNOVATION

# AUDE VINZERICH, EDF'S ACROBATIC INNOVATION STRATEGIST

**Head of innovation strategy at utility EDF, this forty-something AI specialist is working to bridge the gap between business goals and technological solutions. This cooperative role requires a healthy dose of agility from Aude, a former French team-acrobatic gymnastics champion.**

Exploring innovative services for heavy equipment like construction plant and trucks, or opening up new possibilities in agriculture, for example by supporting a start-up like agronomic modelling and artificial intelligence specialist ITK, are just some of the ways in which Aude Vinzerich is working

to accelerate the development of net-zero solutions. Appointed in July 2021, the new EDF group innovation strategy director has a jam-packed roadmap to implement. Outlined in January 2022, the utility's innovation strategy follows 14 different topics based on 6 priorities, which have not yet been



made public. "The EDF innovation team includes 50 people. We chose to work with a reduced number of topics so that we could commit fully to them," explains Aude.

Every three months, the Group's innovation executive board meets to decide if a particular topic should be pursued or a particular new project supported. "To do this, we draw on our social foresight capabilities which help us to spot emerging issues that might be in keeping with the Group's key areas of focus and priorities," she points out.

### Marrying up technologies and use cases

The role of Aude Vinzerich and her team is twofold: to identify promising topics for the Group in the medium to long term, and to play a coordination role in engaging the growth business lines linked to the topics selected by the Group and in mobilising the right innovation resources for each project. Several such resources have been deployed in the field of agriculture for example: EDF Pulse Design is involved in ecosystem modelling and opening up opportunities for business lines; the innovation strategy team brings a strategic innovation-oriented vision on various segments of the agricultural sector; and of course EDF Pulse Ventures flagged the ITK start-up for investment.

The principle underpinning all of these projects, whose deployment can vary from three to ten years, is that technologies and use cases must go hand in hand. This blend of science and behaviour is at the very heart of Aude Vinzerich's engagement and training. "During my studies, I had a really hard time choosing between my interest in mathematics and my liking for human sciences, so I opted for a double degree based around linguistics, logic and computer

science," she explains. "I enjoy the in-depth reflection on humans that you get with language and cognitive sciences, but I also need a framework in which to test real-world applications using mathematics, logic and computer science." This choice steered her towards a PhD in artificial intelligence and natural language processing.

**"Our social foresight capabilities help us to spot emerging issues that might be in keeping with the Group's key areas of focus and priorities."**

Aude, who would not describe herself as a geek, sees technology only as "a means to serve humans." On completion of her studies, with two paths to choose from – public research or business – she took the second option, determined to tackle the real world.

"I started off working in an IT consultancy called Telys so that I could carry out a variety of tasks in different industries and get an idea of what I wanted to do." Her various assignments, including one for EDF, led her to discover

the energy sector. "It inspires me as it's not just connected to the environment and humans, due to its essential value, but also to resource management. The main stake in this respect is to know how to pursue electrification while at the same time decarbonising. Finally, EDF's human values match my own."

### Agile cooperation

Having joined EDF in late 2010 to deal with the works council's leave management system, Aude Vinzerich progressed quickly within the Group, moving from IT consultant to manager of the artificial intelligence for IT operations team then AI programme director. In her new role as innovation strategy director, she is working on an area that is particularly close to her heart: bridging the gap between business goals, client aspirations and technology.

The cooperative nature of this work requires a great deal of agility and skills like risk taking, openness to other cultures, ability to step outside of one's comfort zone and quick decision-making. These are all talents that the former French team-acrobatic gymnastics champion has been developing throughout her career and that she will continue to cultivate through her commitment to the Innovation Makers Alliance (IMA), the Actua journal and the Bureau as JFD ambassador for the Margaret Awards which recognise "women in digital technology".

And let's not forget the year-long round-the-world trip with her family, involving more than 1,500km of trekking alongside her two children of 5 and 7, which taught her to adapt and to "put things into perspective." Aude Vinzerich is not one to be fazed by challenges; indeed her next exploit will be learning to play the piano.



The much-needed expansion of renewable energies, which are characterised by intermittent, decentralised production, has created a real need for increased electricity storage capacity. Technical, regulatory and economic obstacles yet to be overcome are holding back the rollout of new storage technologies. Electrical energy cannot be stored directly. Rather, it is transformed into another form of energy for storage, then retrieved and turned back into electricity for use. Each technology can be adapted to specific use cases, but electrochemical storage (batteries and hydrogen) is currently ahead of the field. Initiatives are proliferating, from large-scale storage systems in Dunkirk used to regulate the RTE grid to solutions for integrating renewable energies in Corsica, via the Paris region with its hydrogen distribution network for taxis. And VINCI Energies business units are at the forefront.

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# WHAT ROBUST, INNOVATIVE SOLUTIONS EXIST FOR ELECTRICITY STORAGE?

**Electricity storage makes it possible to manage renewable energy flows and balance the electricity grid. Various storage technologies exist, each with their advantages and their drawbacks. We take an overview of a rapidly expanding sector where innovation is thriving.**

Against a backdrop of international tensions and disturbance in the global energy market, in May 2022, the European Commission laid out its “REPowerEU” plan with three objectives: to implement energy savings, produce clean energy and diversify energy supply sources. Brussels emphasised that this plan is “backed by financial and legal measures to build the new energy infrastructure and system that Europe needs”. REPowerEU forms part of a broader energy transition trajectory at the European and indeed international level. It complements the “Fit for 55” programme – a series of measures designed to reduce Europe’s

greenhouse gas emissions by at least 55% by 2030.

**“Adequate storage is a prerequisite of energy transition.”**

“Adequate storage is a prerequisite of energy transition,” says Markus Popp, Omexom Brand Director at VINCI Energies, the specialist in major electricity grids. The storage issue is a major one,

due not only to the electrification of mobility and manufacturing processes, but also to the evolving energy mix, with the integration of new electricity sources like solar and wind.

“These renewable energies are inherently intermittent because they are subject to variations in wind and sunshine,” adds Markus Popp.

While renewable energies remain limited in the energy mix, techniques for optimising electricity grids make it possible to counteract this intermittent supply. But international targets for reducing the proportion of carbon-intensive electricity are changing the game. Then there are changes in how we





use electricity: the trend toward decentralised electricity production and the increase in individual and collective self-consumption require the ability to use excess energy produced throughout the day at peak demand times.

The benefit of electricity storage is precisely that it provides a solution for balancing production and consumption. But electricity is difficult to store: it must first be transformed into another form of energy, whether mechanical, thermal or chemical (see “The different storage technologies” boxout).

But each storage technology has its limits. “Lithium-ion batteries and hydrogen currently offer the greatest potential for development,” says Frank Westphal, CEO of the Industry and Energies division of VINCI Energies Germany.

### Technologies at different maturity levels

Batteries meet storage needs over a period of hours or days, for low-to-medium quantities of power and energy. Several battery technologies are already mature: lithium-ion, sodium-sulfur,

lead-acid and nickel-cadmium batteries. Others, such as sodium-ion batteries and graphene, are still in the development phase and should be able to address some limiting factors like optimised charging times, storage capacity and the use of less scarce resources.

“LFP (lithium ferro phosphate) batteries are especially promising,” suggests Arnaud Banner, Technical and Innovation Director at Omexom. “Their components are more eco-responsible than those in lithium-ion batteries, because they can get rid of Nickel

and Cobalt. They today already have become the dominant technology for stationary storage.” At the beginning, their low energy density made them unsuitable for electrical vehicles. Nowadays, they have improved and for example, TESLA Motors announced their latest MEGAPACK is free from nickel and cobalt.

Three approaches to battery storage development are currently under way in France: the “RINGO Project” proposed by RTE, “behind-the-meter” (BTM) batteries for private homes, and electric vehicles themselves

(see “Using electric vehicles for energy storage” boxout).

### The promise of hydrogen

And then there is hydrogen, a “chemical” solution to large-scale energy storage and also in electric vehicles. Produced via water electrolysis, hydrogen can be compressed in gas, liquid or solid form. If the transformation process is powered by renewable energy sources, hydrogen becomes a green energy, capable in particular of decarbonising certain industry and transport sectors.

Another application for hydrogen-based storage is the conversion of electricity into gas (P2G or power-to-gas), which converts surplus renewable electricity into gas through water electrolysis. The hydrogen is then stored, or mixed into the natural gas system to reduce its hydrocarbon content.

By 2050, hydrogen’s share in the worldwide energy mix should more than double, from the current 19% to 45%, with 40% produced from solar and 29% from wind. In other words, storage is a crucial issue.

### The different storage technologies

There are currently a range of systems for storing electricity:

- **Gravity storage using water** in pumped-storage Hydro power stations (PSH)
- **Thermodynamic storage** using compressed-air storage systems
- Kinetic **energy storage** using flywheels
- **Electrochemical storage** using batteries or **chemical storage** in the form of hydrogen

In France, PSH technology and compressed-air energy storage have limited potential for development.

Flywheel energy storage (FES) can only provide very short storage times and a limited quantity of stored energy. But electrochemical storage offers far greater possibilities.



### Using electric vehicles for energy storage

A car sits idle for 95% of its lifetime, and average use of an electric vehicle requires less than 80% of its battery capacity for everyday journeys.

When connected to a smart grid, thanks to the energy stored in its battery, a stationary electric vehicle could therefore become a temporary electricity supplier.

It could be used to power homes, especially in peak electricity demand periods. This so-called “vehicle-to-grid” (V2G) technology allows the vehicle’s owner to receive payment in exchange for the temporary use of their battery.



## AGILITY FOCUS

ENERGY

PERFORMANCE

# HOW OMEXOM IS CONTRIBUTING TO ELECTRICITY GRID REGULATION

**Omexom Conversion & Storage has built the largest battery energy storage system (BESS) in France for TotalEnergies in Dunkirk, to the north of the country. The system helps, among other things, to regulate electricity grid frequency.**

The issues surrounding the management of power generation and distribution have never been more critical. Indeed, the international situation in 2022 has shown just how pressing they have become. Renewable energy, in particular, is absolutely central in this respect. But its future, as is well known, is closely linked to the development of storage solutions capable of making it controllable. Optimising the way in which renewables are managed helps to balance the electricity transmission grid. In order to ensure this essential balance between production and consumption, FCR (Frequency Containment Reserve) systems are used to keep grid frequency at its optimum level of 50Hz. Without a storage solution, generated electricity must be used

immediately. What storage does is to ensure a secure electricity supply, regulate frequency and address the intermittent generation of renewable energy sources. The TotalEnergies Dunkirk project provides this reserve function. As part of the project, Omexom Conversion & Storage installed a 61MW/61MWh (available power/available energy) storage system for TotalEnergies Renewables International (previously Total Solar International) on the site of a former refinery at the port of Dunkirk in northern France. It is the most powerful in mainland France.

### Large-scale project

In partnership with Saft (a TotalEnergies subsidiary that delivers electric battery solutions

for industry), the VINCI Energies business unit specialising in energy storage system design fitted 27 battery containers, 27 converters, 29 power transformers, 2 MV distribution boards and 2 MV/HV transformers.

This large-scale project was carried out in two phases: an initial 25MW unit in 2020 followed by a second 36MW unit in 2021, both connected to the French electricity transmission system operator RTE's extra high voltage transmission grid. "The advantage of the Dunkirk site is that, due to its past operations, it already benefits from a high-capacity connection point to the RTE grid. To install a system, whether it's solar, wind or storage-based, finding a connection point is crucial," says Thibault Fauquant, manager of the Omexom Conversion & Storage business unit.

### A number of challenges to be met

"Omexom Conversion & Storage had to meet several challenges during the project: managing a new battery, connecting the first

**"61MW/61MWh storage system is most powerful in mainland France."**

project of this type to the RTE grid – including rigorous certification and Grid Code<sup>(1)</sup> compliance – and overseeing two plants (DK1 and DK2)

simultaneously to achieve certification," explains Thibault Fauquant. The Omexom Conversion & Storage manager also highlights the work done by his business unit to optimise costs: "After starting with 1,000V battery systems, we now use batteries that supply a voltage of 1,500. The benefit of 1,500V technology is that it reduces the intensity needed to obtain the same output. Fewer amperes means smaller cables, and indeed the circuit breakers and the whole protection chain are smaller in size. This reduces all the costs." In addition to managing output, Omexom Conversion & Storage has also installed an instrumentation and control system to manage battery charging and discharging. "All this is very complex. To control the system we need to set up remote access from our offices in Quimper in north-western France,





requiring a high level of cybersecurity," points out Thibault Fauquant.

To sum up, the Dunkirk facility, which represents an investment of around €35 million, contributes

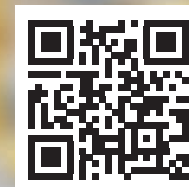
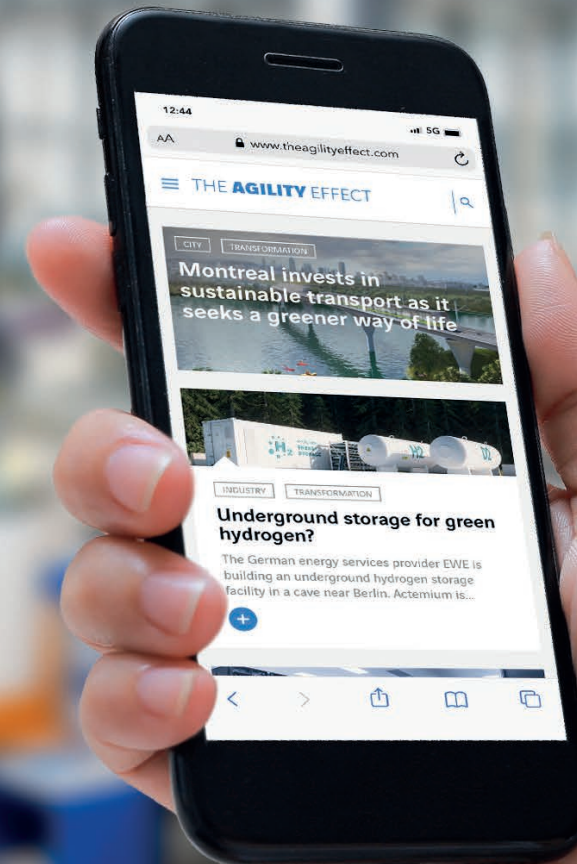
towards regulating electricity grid frequency, supports the grid on the coldest winter days when it is under stress and facilitates the integration of renewable energy sources. Remaining capacity generates additional revenue,

all of which ensures the project's profitability.

(1) Grid Code: a document that sets out the necessary conditions for an electricity producer or user to be able to connect to a power grid.



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## AGILITY FOCUS

ENERGY

ACCELERATION

# HYDROGEN REFUELLING STATION NETWORK EXPANDED IN GREATER PARIS

**A network of hydrogen refuelling stations is to be installed in Greater Paris between now and the 2024 Olympic Games. France Ingénierie Process (VINCI Energies) is carrying out the facility at Porte de Saint-Cloud in Paris, which is set to offer greater capacity than the rest of the network.**

The new hydrogen filling station at Porte de Saint-Cloud in south-west Paris will soon be refuelling Europe's first fleet of hydrogen vehicles. The station's hydrogen will initially be delivered by semi-trailer trucks, but from late March 2022, the facility will produce its own hydrogen thanks to an on-site electrolyser.

This means that the site will be able to generate and dispense up to 1 tonne of green hydrogen per day, increasing to 1.5 tonnes over time, using energy sources guaranteed renewable by utility EDF. This is enough to fill 200 to 300 5kg hydrogen tanks each day (1kg representing around 100km of range).

The station's capacity is far greater than that of the five other refuelling stations installed to date in and around Paris (at Alma, Orly, Roissy, Versailles and Porte de la Chapelle), whose deliveries do not exceed 200kg per day. This hydrogen refuelling infrastructure network was launched on the initiative of HysetCo.

**Around 15 stations to be available in Greater Paris for Olympics**

HysetCo plans to open some 15 stations in Greater Paris by

2024. Supported by the French government and the City of Paris, this new player in the hydrogen mobility market has decided to step up the pace by investing in the construction of the Porte

de Saint-Cloud station, with half of the investment coming from grants. In order to carry out the project, HysetCo approached FIP (France Ingénierie Process). This VINCI Energies business unit, specialising in production, storage and distribution facilities for process industries (oil, gas, chemicals), was entrusted with the concept design phase for the general and piping facilities and for the integration of the various packages and station equipment (electrolyser, compressors, storage bottles, distributors, exchangers, refrigeration units, etc.). As well as undertaking the drawings and 3D model of the station, FIP also helped define the hydrogen process aspect and the utilities for input into the project's P&ID<sup>(1)</sup> and U&ID<sup>(2)</sup>.

### Over 10 trades involved

The VINCI Energies business unit is also responsible for installing, connecting and commissioning the station equipment. "The first challenge to overcome relates to the type of electrolyser selected, in other words a PEM (polymer electrolyte membrane) model,

a new generation of technology that offers higher efficiency than alkaline electrolysis. However, there has been little feedback so far on this kind of equipment. So we need to perform lots of tests, configurations and adjustments to ensure reliability and performance," says Ismaël Soccio, manager of the FIP business unit. Given the complexity of the project, which involves over 10 trades (including electricity, piping, gas, compression, refrigeration, metal works, civil works and industrial IT and automation), FIP favoured a turnkey model for the integration and installation of the facilities. "In order to ensure that all the components (compressors, cooling system at -40°C and storage facility at 1,000 bar) from different equipment manufacturers communicate with each other, it makes sense to integrate everything yourself so that you can better control the process," notes Soccio. Cleanliness poses a further challenge. "With a gas as light and penetrating as this, the stainless steel piping network must not show any dust or impurities. This means putting in place very strict cleaning procedures and using special products," adds the FIP manager.

The scale and unique nature of the project provides a great opportunity for the VINCI Energies engineering company to widen its scope of expertise to the renewable energy sector. Indeed, FIP recently participated in a tender involving the creation of another hydrogen refuelling station in Créteil (in the Val-de-Marne department to the south-east of Paris), this time initiated by Suez and the local energy authority. And in order to expand and step up its ability to respond to turnkey design and build projects related to the hydrogen process, a new business unit called Actemium Paris Solutions Hydrogène has been set up.

(1) P&ID: Piping and Instrumentation Diagram showing all the components of an industrial process.

(2) U&ID: Utilities and Instrumentation Diagram. Similar to the P&ID diagram but relating to utility distribution equipment.





# BATTERIES: HELPING TO CONTROL MANUFACTURING COSTS

**Energy storage is a practical solution that helps manufacturers to manage their renewable energy generation, electricity consumption and quality of supply.**

With the growth in renewable energies and given their intermittent nature, the electricity storage market will become increasingly important over the next few years. The manufacturing sector should take note, even though most manufacturers still consider electricity storage too costly. Rising energy prices, exacerbated by the current international situation, along with the falling cost of storage technologies, could pave the way for new applications in manufacturing.

Take, for example, a manufacturer with a 10 MW photovoltaic installation. Rather than installing a connector rated for the maximum power of their solar farm, they opt for an 8 MW line. This option allows them to save on the cost of the line. But it will only be an efficient choice

if part of the energy generated during the sunniest daylight hours can be stored in a battery for retrieval at peak demand times. "To make the battery cost-effective, other mechanisms will be needed to derive value from the system,"

**"Making a battery cost-effective in a manufacturing context requires multiple ways of optimising value from the system."**

says Edouard Roux, Strategy Director of Smart Grid Energy, a VINCI Energies business unit specialised in optimising energy generation assets and reducing electricity consumption.

## Ways to optimise value

Different methods for optimising value act at different levels, for instance, on managing an industrial site's contract power, i.e. the maximum power it can use. "If a production facility sees large variations in its electricity consumption, it may benefit from installing a battery to optimise management of these disparities and avoid having to pay penalties for exceeding its contract power," explains Edouard Roux.

A battery can also smooth out voltage dips, or ensure supply continuity in the event of a blackout. "Sensitive sites like hospitals, assembly lines or establishments using refrigeration equipment currently operate diesel-powered backup generators. These systems offer a large measure of autonomy and flexibility of supply, but they are polluting and not cost-effective. With a view to increasing their autonomy, batteries could eventually replace generators." Another way to make batteries

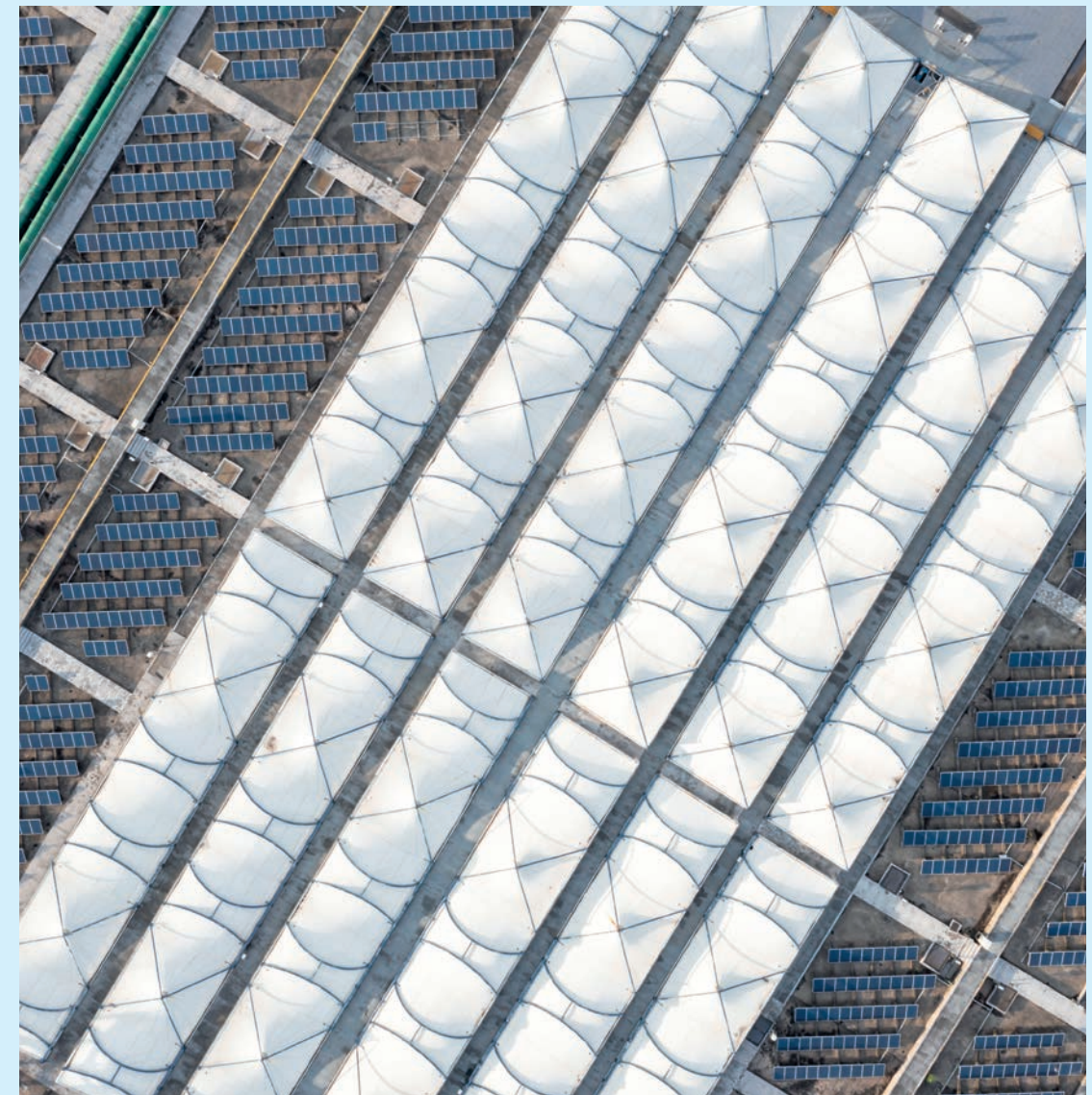
cost-effective in a manufacturing environment is through reactive power management. This acts on the "non-useful" power that passes through the site without being consumed, part of which is lost to the network. "The grid operator charges for this reactive power," says Edouard Roux. "To avoid these losses, a manufacturer can install racks of condensers that reduce these exchanges of electricity. And the condensers can also be replaced with batteries."

## Streamlining processes

Naturally, to make batteries cost-effective means combining all these value-optimisation methods in an industrial setting. Added to which, batteries on a manufacturing site can provide services to the national power supply network. "But that's all highly complex to manage, and requires a high degree of sophistication in the manufacturing processes and from the algorithm that controls

the batteries," says the expert from Smart Grid Energy. This leader in optimising battery use, with 200 of the 300 MW installed in France under its management, has built solid, recognised expertise in this area.

If the cost of storage technologies continues to fall, this market could undergo rapid growth in the manufacturing sector, offering companies new tools for managing their energy costs.





# AUTOMATED CONTROL SYSTEM FOR BIOMASS TRANSPORTATION

**As part of a project to convert a former coal-fired power station in the UK into a sustainable electricity production plant, an Actemium business unit rolled out a solution to optimise transportation of the low-carbon raw material.**

The former coal-fired power station at Lynemouth, on the Northumberland coast in northeast England, has been converted into a low-carbon sustainable electricity production site powered by biomass. Part of the installation is a supply chain based on a biomass fuel handling system. This installation on a Tyneside port site is used to unship biomass in the form of wood pellets. Material arrives by ship and is transhipped via conveyors before being deposited in three storage silos, from where the biomass is transferred (again by conveyor) to a rail loading silo for transportation by train to the electrical plant in Lynemouth.

## Complex system

Actemium Automation Yorkshire (VINCI Energies), based in

Huddersfield, was responsible between 2016 and 2018 for automating the process control system for biomass transfer and storage.

The aim was to help operators ensure correct loading quantities and monitor the biomass moisture content, CO<sub>2</sub> level and temperature in the silos. The control system also allows monitoring of safety features such as the spark arrestor

**“Integrating the efforts of several suppliers and customised equipment was our biggest challenge.”**

and fire prevention systems on each conveyor. Several dozen companies were involved in the project. “Integrating the efforts of several suppliers and customised equipment was our biggest challenge in designing the control system,” says Mark Campbell, Business Unit General Manager at Actemium Automation.

“We had to interface with some systems that we only found out about during implementation of the project.”

## Agile working

The Actemium Automation Yorkshire teams also had to adapt to changes in the ongoing project, in fields other than their own, for example due to inadequate or incompatible components. The result? An outstandingly agile system! “We developed, tested and commissioned a control system composed of Allen Bradley GuardLogix and ControlNet Remote IO automated safety controllers, with Wonderware SCADA software operated from a dedicated control room in the port,” adds Mark Campbell. The system connects to the electrical plant in real time to allow personnel to monitor transport and storage of the biomass wood pellets, and to oversee the process from factory to port. The site can process up to 850 tonnes per hour. It currently generates enough clean energy to power the equivalent of around 450,000 households in this region of England.

# BATTERIES USED TO BALANCE ISLAND GRIDS



**Insular regions are so-called non-interconnected areas. One possible solution to this is to use batteries, as shown by a VINCI Energies project in Corsica.**

Most French islands, including Corsica, Ushant, Martinique, Guadeloupe and Reunion, are not connected (or to a limited extent in Corsica's case) to the mainland power grid. As a result, these “ZNI” or non-interconnected areas require appropriate technological solutions. In order to increase the share of renewable energy sources in these insular regions without jeopardising the stability of their grids, the rollout of storage solutions like batteries or hydrogen chains is needed more urgently than elsewhere. “Studies have shown that beyond the threshold of 30% renewables, storage becomes essential in order to ensure the flexibility of these small-scale grids,” points out

Thibault Fauquant, manager of Omexom Conversion & Storage. This VINCI Energies business unit delivers turnkey offerings which, by including weather forecasts, make it possible to anticipate electricity generation and manage the necessary storage. “Thanks to these applications that integrate renewables, we smooth out power during the day and make sure that batteries are full in the evening,” explains Thibault Fauquant.

## Stabilising the Corsican grid

The Omexom business unit can use the applications for other purposes on islands, for example to help

decision-making with respect to methods of power generation. “In Corsica, when there is surplus solar power, EDF can store the electricity in batteries at a very low cost. This avoids starting up diesel generators when production drops at the end of the day, which would lead to a very high price per kilowatt-hour,” states the business unit manager.

Omexom Conversion & Storage, whose expertise spans the whole chain in this type of operation (civil works, electrical engineering, supply of batteries, conversion and MV delivery substations, plant certification), is thus contributing towards stabilising Corsica's insular grid and smoothing its high levels of solar PV generation.

“We have the capacity to simulate an insular grid and to observe the behaviour of a future solar PV plant in a grid that is more fragile than a mainland network,” says Thibault Fauquant whose business unit works with solar power developer, operator and producer Corsica Sole on behalf of EDF SEI.

“Responsible for island areas, EDF SEI can make a simple request to use our system. The platform reacts in a few seconds and sends the requested output,” explains the head of Omexom Conversion & Storage.



# A SOLUTION TO REDUCE NOISE AND POLLUTION IN PORTS

**Even when berthed, ships continue using their engines. This generates a certain amount of pollution - but that is set to change thanks to the Onshore Power Supply (OPS) solution. Developed by Actemium, the solution supplies electricity to ships at the dock without producing any CO<sub>2</sub> emissions.**

Ships produce a number of emissions, such as sulfur oxide, carbon dioxide, nitrogen oxide and fine particles, that are particularly dangerous for the environment and harmful to our health. According to a study carried out by consultancy organisation CE Delft, if no measures are taken, the maritime industry's emissions could increase by 120% by 2050, representing 10% of global greenhouse gas emissions. This pollution does not just come from voyages at sea, however – the ships engines are activated 24/7, in the dock and at sea alike. Even when a ship is berthed, power is required for lighting, heating, air conditioning and cooling. Moreover, in addition to releasing harmful emissions, the ships' engines also generate noise

pollution. VINCI's brand for industrial processes, Actemium, has worked for around a decade imagining and designing a solution to supply electricity to berthed ships while drastically reducing pollution and noise. That solution, the Onshore Power Supply (OPS), now connects to the ship's power supply systems by cable. Manufactured at the Actemium workshop in Stora Hôga near Gothenburg, Sweden, the system is integrated into a container then shipped to the port, where it is installed and goes into service in just a few days. Another advantage of this equipment is that it can be moved at any time in order to be used in other areas of the port.

## Up to 11,000 volts

The moveable unit contains a switchgear, frequency changers and transformers that, thanks to a 10 m high CMS (cable management system), supplies the ship with electricity. "The power outlet alone weighs 20 kg. We therefore needed a connectivity system making it as easy to use as possible," explained André Olofsson, OPS Project Manager at Actemium.

He added, "Users are using the facility from the ship, with no need for help from anyone on the dock – it's self-service."

A number of technical problems had to be resolved in order to find a solution that fit the bill completely. "The first obstacle was creating equipment that could provide sufficient voltage – up to 11,000 volts – in optimal safety conditions," said André Olofsson. But, by harnessing the latest technologies, Actemium managed to enable high voltage transmission to the ships. "Another difficulty is that the ships are built in different countries. Some of them have a 50 Hz frequency, while others have 60 Hz.

To address that, we designed a solution that could deliver 50 Hz or 60 Hz, using the same equipment.

The right frequency can therefore be chosen for each ship," added André Olofsson.

## Equipping ports all over the world

Using OPS presents considerable advantages, particularly from an environmental point of view. "This solution enables us to drastically decrease greenhouse gas emissions. In total, from 2010 to October 2021, we reduced CO<sub>2</sub>

emissions by some 54 tonnes," revealed Frank Berger, Brand Business Development Director at Actemium.

"It also has a significant impact when it comes to minimize

**"Thanks to this solution, from 2010 to October 2021, we reduced CO<sub>2</sub> emissions by some 54 tonnes."**



the sound disturbances from the ship. These benefits will enable port cities to promote coastal residential developments." Actemium has already delivered to a number of ports with its OPS system, including Gothenburg in Sweden, Kristiansand Harbour in Norway, and Dunkirk and Brest in France. Franck Berger said, "our facility at the port of Ystad in the south of Sweden was the largest in the world when it started operating in 2012." As part of the OPS Club, Actemium communicates with its various offices all over the world using this new technology. "We aim to equip as many ports as possible, such as Hamburg in Germany, Rotterdam in the Netherlands, Antwerp in Belgium and Barcelona in Spain. We have also established contact with countries in Eastern Europe, such as Poland, as well as Great Britain and United Arab Emirates."



# WELCOME TO BATTERY AS A SERVICE

**Swapping electric vehicle batteries is emerging as an alternative to conventional recharging. In January 2022, the Chinese car maker NIO launched its first European battery swap station for electric vehicles. Omexom Norway helped them design the electrical infrastructure with due consideration of the location's unique weather conditions.**

Insufficient numbers of charging points and long charging times are frequently cited barriers to adopting an electric vehicle. According to a recent Ipsos study for VINCI Autoroutes, 56% of French workers want faster charging times. Has NIO found the solution? In mid-January 2022, the Chinese car maker launched its first European battery swap station for electric vehicles near Oslo in Norway. Named NIO Power Swap Station 2.0, this so-called second-generation station is fully automated. The electric car owner simply has to push a button on their vehicle's touchscreen and a mechanism retrieves the battery from under the floor and replaces it with a pre-charged pack of equal or greater range. The process lasts about 5 minutes, considering the time

needed to place the car right. Once the car is put in place, it takes around 3 minutes. With a storage capacity of 13 batteries, "Swap Station 2.0" automatically inspects the battery and electrical system during each swap, reassuring the driver that they have an "up-to-date" battery that will not lose performance over the coming months. This year Omexom will help NIO out with four more stations. This new PSS will have a heating cable underneath the station in the concrete, to help out with snow, ice and regulate the temperature.

## Battery rental

Owners taking up this Battery as a Service (BaaS) offer pay less for their electric vehicle, but are charged a monthly subscription for battery rental. The French manufacturer Zeway offers the same battery swap concept with its electric scooters. The idea was previously considered by Tesla before it decided on its own network of superchargers. But NIO is sure of its ambition. Already a leader in China's niche battery swap market with more than 800 stations across the country, the car maker plans to install 4,000 worldwide, including

1,000 outside China by the end of 2025. To boost sales of its new electric SUV (ES8), the Chinese brand plans to open 20 swap stations in Norway this year, before moving into Sweden, Denmark and Germany.

## Heating cables

For its European debut, NIO called on the expertise of Omexom Norway, which had previously worked on developing direct current (DC) chargers for Tesla and alternating current (AC) chargers

for the city of Oslo. The expert VINCI Energies brand, a leader in energy transition, designed and implemented the electrical infrastructure and installed the station itself. Omexom drew up 3D plans to help NIO design and site the station. Once the site had been chosen, Omexom carried out the studies required for the electrical cabling. It also provided the electrical distribution cabinet, plus foundations and steel plates suitable for power cabinets and superchargers. "We encountered a few problems with the soft clay under the swap

station," recalls project manager Martin Haagensen Strøm. "The ground had to be reinforced." The project also had to take account of Norway's unique weather conditions. "We recommended anti-frost protection plates and special insulation. Heating cables were laid in the ground so that the parking bay markers would not be covered by snow." Omexom also installed a heat pump and fans under the station to help regulate the batteries' temperature. To capitalise on this effort, Omexom is working with NIO to devise a standardised solution for Nordic countries.





# ECOLOGISTS PROMOTE BIODIVERSITY IN PROPERTY PROJECTS

**Wildlife preservation is increasingly being taken into consideration in the property sector, which is seeking to find more ways to add value to assets.**

The main environmental issues being addressed in the property sector today revolve around energy and carbon. Initiatives taken by players in the sector to reduce emissions from the built environment are aimed not just at complying with the orders in the so-called “tertiary decree”, issued in line with the Grenelle II and ELAN laws<sup>(1)</sup>, but also at adding value to assets. There are a whole host of sustainable performance certifications in the property sector today, including HQE, BREEAM and WELL. But the price of success is that the standards no longer have the same power of differentiation for the market.

## Biodiversity and certification

Other standards and labels have recently been introduced,



which validate the compliance of commercial buildings with biodiversity conservation requirements. These include Effinature, a label delivered by the Irice group, and BiodiverCity, issued by the International Biodiversity & Property Council, which brings together urban, property and environmental stakeholders.

While there are very few regulatory constraints relating to biodiversity in property at present, an increasing number of players in the sector are hiring ecologists – engineers specialised in identifying, forecasting and analysing the impact of human activity on the environment and biodiversity.

“We support our clients with

biodiversity conservation at the design, construction and operation stages,” explains Chloé Chary, ecologist at Greenaffair, an engineering consultancy that has been working in the environmental field for 20 years and a pioneer in environmental certification in France.

## Green passages, dark corridors and wall biotopes

Biodiversity concerns are primarily being met in the commercial property sector, whether in construction or refurbishment, through greening initiatives. These might involve installing green areas outside buildings, where plant species can grow

freely and which naturally attract a whole range of insects and birds. Or creating ecological corridors, in other words green passages between two biodiversity reserves. At night, these paths can turn into dark corridors, free from artificial light, in order to protect bats, a protected species.

**“We support our clients with biodiversity conservation at the design, construction and operation stages.”**

Another solution is to “green” terraces, rooftops and walls. The idea is to open buildings up to the external environment, creating areas dedicated to wildlife such as bee hives, bird boxes and welcoming habitats for insects. “We recommend reclaiming certain types of timber from worksites, trunks from felled trees or pallets, to turn them into drilled logs, bundles of sticks or bug hotels,” adds Chloé Chary. This input from ecologists improves resilience in buildings as climate change becomes more of an issue, but it also enhances the sustainability of assets by addressing the increased role that wildlife preservation is playing in decision-making in the urban property sector.

(1) The Grenelle II law is an environmental law and ELAN is a law to reform housing, planning and digital technology



# SECOND-HAND EQUIPMENT MARKETPLACE SET UP TO REDUCE WASTE

**To reduce the amount of waste they generate, VINCI Energies business units can now use a mobile app for buying and selling unused equipment.**

Each year, France’s construction and engineering sector produces 42 million tonnes of waste. The circular economy, which is one way for the sector to play its part in using resources more sparingly, is seeing very limited uptake, particularly in terms of equipment reuse. So to meet the challenges around waste reduction in the building industry, VINCI Energies has launched a mobile platform called Reyuz that provides second-hand technical equipment.

“At one point or another, businesses have to manage the end of contracts, moves, order errors and dead stock. To help with this, we designed a mobile app that enables each VINCI Energies business unit to make a wide range of equipment available to others, including office furniture and consumables, site furniture (fridges, microwaves, lockers, etc.), power tools and

technical equipment,” explains Stéphane Bretin, maintenance & services building solutions manager.

## Overcoming the barriers to the adoption of the service

Rather than being based on a system with centralised stock and integrated logistics, the idea is to connect needs, linking buyers and sellers of succinctly described equipment. It’s up to the various parties to discuss purchase terms and conditions, including the price. The designers of the marketplace purposely opted for a simple and transparent offering. “It’s probably trickier to launch and above all maintain a circular economy app in the business world than in a consumer environment. There are a lot of barriers to the adoption of a professional marketplace. In fact, that explains why there are so few initiatives of this type,” stresses Stéphane Bretin.

The first challenge is to achieve critical mass. Platforms like this require a big enough community of users to make the benefits

outweigh the risks. This condition is all the more critical since the model needs to operate locally or at the most regionally if it is to meet its environmental objectives.

Another barrier is that for buyers who are used to working with well-established framework contracts (suppliers, products, prices, delivery times), equipment reuse appears to be more restrictive than new product purchasing. Moreover, there can be doubts as to the guarantees offered for the logistical aspects (delivery, packaging). The selection and coordination of partners across the value chain requires an assurance of transparency.

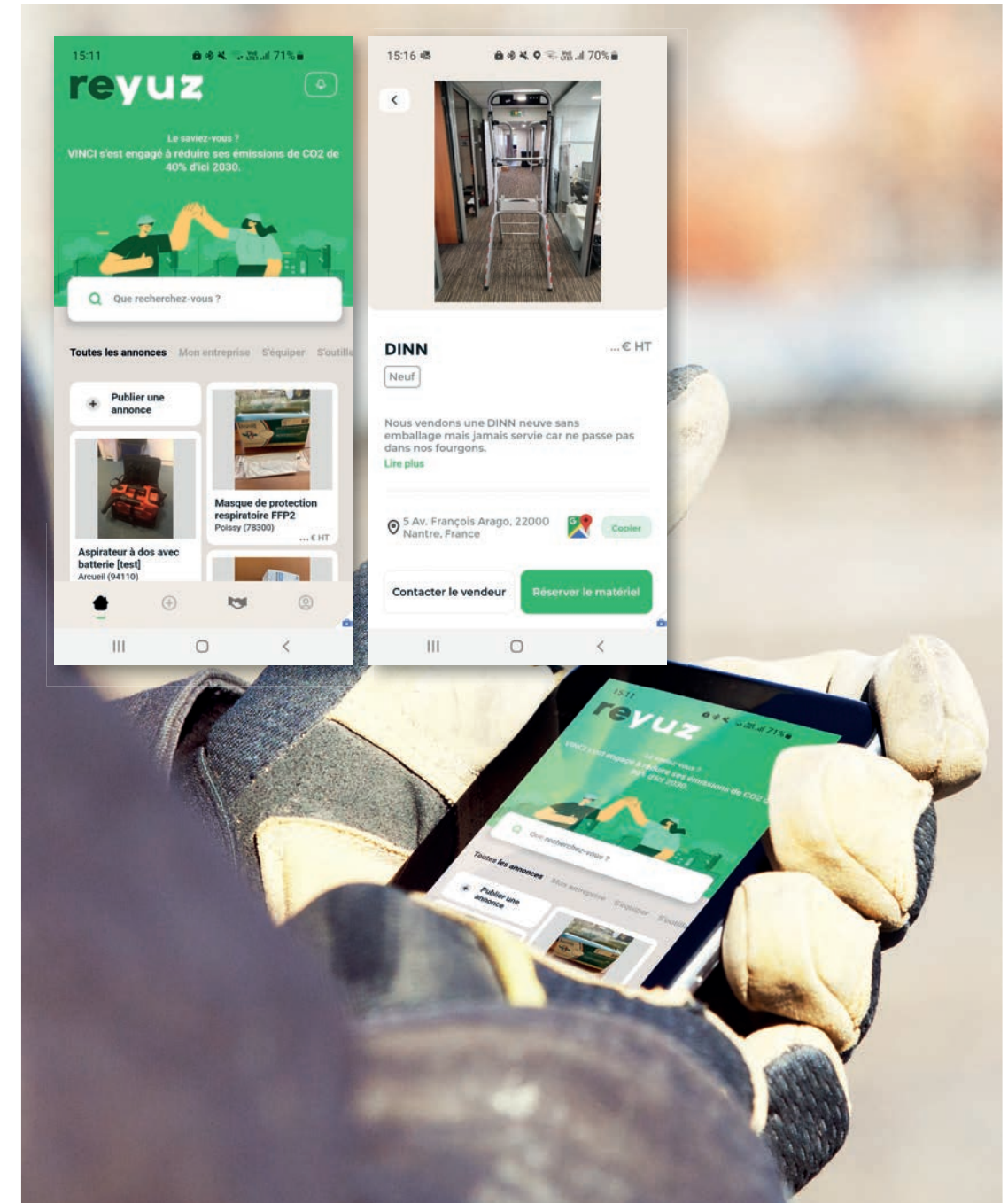
## Second-hand products aren’t necessarily less expensive

Lastly and indeed paradoxically, second-hand doesn’t always mean lower cost. Products intended for reuse can require steps involving labour such as removal, cleaning, repackaging, transport and storage, and because they’re not registered in a pricing guide they can reach a price that is equivalent to that

of new products. “The main purpose of our marketplace is to promote a socially and environmentally responsible approach that keeps waste generation to a minimum. We want to contribute towards

the expansion of the circular economy and to be in line with current developments.” Designed and developed in-house, the solution should be rolled out within VINCI Energies at the end

of February 2022. In the longer term, it could be used to define the carbon impact of transactions performed and this could then be incorporated into the group’s overall carbon footprint.





# MONTREAL INVESTS IN SUSTAINABLE TRANSPORT AS IT SEEKS A GREENER WAY OF LIFE

**The heavily congested city of Montreal in Quebec is in the process of building a 67km fully electric metro line. The project, which represents a substantial investment, is primarily aimed at addressing environmental concerns.**

The REM (Réseau express métropolitain) is the biggest public transport project to be undertaken in Quebec in half a century. By the end of 2022, this 100% automated electric light rail metro will supplement Montreal's metro network, inaugurated in 1966, serving a wider area of the Canadian city. The new line, with its 26 stations, will span the Greater Montreal area across 67km. It will run below ground, at ground level and above ground at an average speed in motion of 51km/h, reaching a maximum speed of 100km/h on some stretches. The first trains are expected to start operating in December 2022 (the project is six months behind) and the rest of the network will gradually be put into service in

2023 and 2024. More than 200 cars will be launched, with four-car trains running at peak hours (offering capacity for 600 people in total) and two-car trains at off-peak hours. The Quebec authorities opted for a light rail transit system based on the Alstom Metropolis, which is already in use in Paris, Shanghai, São Paulo, Dubai and Sydney. But in a city like Montreal, which experiences snowfall and extremely low temperatures every winter, operating a predominantly outdoor transportation system poses an additional challenge.

As a result, the car pantographs have been equipped with scrapers to clear accumulations of ice off the catenary, and locomotives have been fitted with snowploughs.

## A huge electrical engineering project

This large-scale project involves a number of logistical, operational and technical challenges. "In many places, we're working right in the middle of an urban environment. So we need to ensure the safety and comfort of residents and enable them to continue with their daily lives," says Wassim Gamaoun, Construction Lead – Track & Systems at NouvLR, the consortium of five companies (SNC-Lavalin, Dragados Canada, Groupe Aecon Québec Itée, Pomerleau and EBC) set up to manage the engineering and construction for REM. A further challenge involved coordinating the large number of players and operators coming

together each day at the numerous work sites. "We need to plan carefully and clearly define our working areas and needs on the tracks so as to avoid time losses and minimise the risk of accidents," notes Denis Vaugeois, transport manager at Transelec Common Inc. This VINCI Energies business unit was appointed by the NouvLR consortium to carry out a package of services including the installation and handling of 116,430m of cable conduits in ballast; the supply and installation on raised concrete structures and in substation service spaces of 4,091m of tray systems for the 25kV medium voltage cables; and the laying and installation of cables alongside the track, on catenary poles and within supply stations, rectifier







substations, train stations, etc. "Since we started working on the project in November 2019, we've signed 14 contracts worth a total of over Can\$100 million. And there are a lot more contracts to come," says Denis Vaugeois.

#### Traffic congestion

For the local authorities, the \$6.5 billion investment in the REM meets environmental, economic and social needs. Montreal, the main city in a country that saw the number of registered cars increase by around 50,000 in 2020 compared with 2019, is known for its high levels of traffic congestion. A Montrealer driver is said to spend an average of more than 145 hours per year stuck in traffic jams. This road congestion has significant economic implications. Annual financial losses caused by absenteeism and traffic-related delivery delays amount to more

than \$4 billion for Greater Montreal alone. Moreover, the Quebec government had to allocate \$3.2 billion in 2020 to refurbish road infrastructure that had been severely impacted

**"The electric metro will reduce greenhouse gas emissions by 680,000 tonnes over 25 years of operation."**

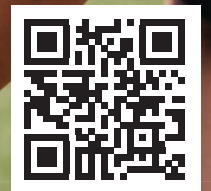
by soaring traffic levels. And finally, road congestion is a real headache for employers at a time when there's a major shortage of staff in Quebec. However, the REM seeks primarily to address environmental

concerns. All-electric, it should help reduce greenhouse gas (GHG) emissions by 680,000 tonnes over 25 years of operation. To add value to and revitalise the agricultural land located around the Rive-Sud terminal station, an agricultural land trust will be set up in partnership with the "Union des producteurs agricoles", a professional farmers' union, and the "Communauté métropolitaine de Montréal", the Montreal Metropolitan Community. And in order to offset the GHG emissions produced during construction, a partnership has been put in place with the Earth Day organisation and the 375,000 trees programme with the aim of planting 250,000 trees. Lastly, agreements have been forged with sustainable mobility partners (car-sharing, carpooling, electric taxi services, bikes) to diversify travel options between home and the station or between the station and the workplace.

# MAKE A DIFFERENCE WITH VINCI ENERGIES!

Go to Solidarity Effect to learn more about what VINCI Energies and its employees are doing to bring about a more considerate and benevolent world.

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TRANSFORMATION

# HOW FRANCE'S ARMED FORCES ARE RIDING THE WAVES OF INNOVATION AND DIGITAL

**Having long been at the cutting edge of innovation, the defence sector has been roughly shaken by the rise of digital. But in recent years, the Ministry of Armed Forces has taken the initiative by opening up more to civilian technologies.**

"We are in the age of new technologies and digital, and our armed forces are not exempt," said Prime Minister Jean Castex at the signing of the contract to develop Caesar NG, a new generation of connected artillery systems, which took place on 19 February 2022 at the Nexter plant in Roanne (Rhône). During his visit, the Prime Minister also officiated at the launch of the fourth phase of the Scorpion programme, which aims to modernise the army's combat capabilities with new armoured vehicles (Griffon, Jaguar and Serval) and a unique combat information system. Like the army, all of France's armed forces are several years into a digital transformation on a massive scale. The aim is to optimise their internal operations and offer cutting-edge digital services to all their personnel.

This movement began in earnest in 2018, with the establishment of the Directorate General for digital, information and communication systems (DGNum), reporting directly to the armed forces minister, Florence Parly. It is tasked with ensuring global consistency across the ministry's information and communication systems, and improving the conditions under which projects are carried out.

## Controlling data

According to the roadmap published by the ministry, as new threats emerge, the challenge of digital technology is to "ensure operational superiority and the control of information in theatres of operations, make support more efficient, make everyday life easier for military personnel, improve

civilian relations and make the ministry more attractive." The three challenges identified are: "Controlling and processing data; rebuilding secure, high-performance digital foundations; and the possibility for everyone to learn and take ownership of new uses in their roles." Their sights are set on improving the daily life of soldiers by making their communications more fluid, better organisation of data circulation between hierarchical levels and between the different services, and in the longer term, operational superiority through better control of data. "In ten years, the major forces will be those that control the data: the army wants to be one of them," said Colonel Olivier, lead officer of the French Army's Programme Planning Division, back in 2018. The renovation of the ministry's

intranet, "Intradef", installation of a technical framework common to all information systems (project Defence Platform) and the creation of an environment that encourages armed forces personnel to develop their skills were the first steps toward that goal. The Definvest fund and the Defence Innovation Agency (AID) provided the finishing touches to the scheme: the former to support the development of SMEs strategic to defence, and the latter to revitalise the unwieldy structure of the

Directorate General of Armaments (DGA) by turning more toward innovations from the civilian world. Destined to become "the ministry's flagship for innovation, open to the outside world, [the AID] will give our entrepreneurs a chance," Parly said.

## Cooperation with the civilian world

To undertake this transformation, the ministry focused on cooperation with the civilian world: universities,

the French National Centre for Scientific Research (CNRS), SMEs and startups. In fact, the days when the defence sector controlled most of the country's innovation potential are long gone. The increased power of civilian research over the last 20 years has been game-changing and accelerated innovation processes considerably. True cooperation therefore became necessary in order to tap into innovations and disruptive technologies, which are evolving more and more rapidly. The aim?







To develop an innovation ecosystem to facilitate access to emerging technologies to the advantage of military systems and applications. New technologies such as big data, cloud, blockchain, 5G, IoT, 3D

**“To undertake this transformation, the Ministry of Armed Forces focused on cooperation with the civilian world.”**

printing, robotics, and augmented and virtual reality offer numerous possibilities for different military applications, as the institution's early initiatives have shown. The 3D printing blockchain FIBR<sup>2</sup>EO, governed by SIMMT (Integrated structure for maintaining land materiel in operational condition) in collaboration with the SME Vistory and the manufacturers Nexter

and Arqus, aims to provide the maintenance chain with 3D printing facilities to allow production of spare parts for land army materiel, whether domestically or in a theatre of operations. But the armed forces' digital revolution also extends to the seabed, as illustrated by Florence Parly's announcement on 14 February 2022 that by 2025 the navy would be equipped with a pair of robot drones capable of diving to a depth of 6,000 metres. The ocean's depths have become strategically crucial due to the proliferation of undersea digital cables connecting the continents.

**From administration to the battlefield**

In a completely different vein, the Milistore project is an application store designed to meet the day-to-day needs of military personnel. Via a smartphone, they can directly access useful everyday digital services: cybersecurity, information on life in their unit, army news, services for their daily

interactions, job-related skills, etc. Another digital tool, this one aimed at section chiefs and unit commanders, the Senior Officer Intradef Terminal (TIC) is a military-standard touchscreen tablet suitable for use in the field that provides access to data about their subordinates at any time.

Other strictly military operational applications should follow in due course. AI will be used to control aircraft systems supported by drones interconnected via an ad hoc cloud, similar to the future air combat systems (SCAF) that have been under development in Europe for the past decade.

Data analysis using big data techniques, ultrafast always-on access to operational data via the cloud, autonomous robots performing tasks dangerous to human beings, such as mine clearance, and storage of sensitive data with full traceability using blockchain are just some examples of applications destined to radically transform the soldier's day-to-day experience in the near future.

**A SUSTAINABLE ENERGY FUTURE REQUIRES A LOCAL APPROACH**



protection solutions and balancing economic, environmental and social considerations at international level. That is the key to meeting the energy challenge of tomorrow. If this new global model is to be embedded, there must be a shift towards renewable energy generation systems, new storage technologies and smart grids based on decentralised energy models. New local renewable energy generation systems can help supply remote communities and provide a source of energy generation close to where the electricity is used, thus reducing the carbon footprint. These communities take the form of legal entities that aim to generate environmental and economic benefits for local people, while achieving a balance, albeit a difficult one, between reducing energy costs, improving energy efficiency and increasing energy generation to meet growing global demand. The system enables communities to act independently when it comes to taking decisions about issues that go beyond economic gain alone. And it opens up a whole range of opportunities that can be exploited by today's society.

**Renewable energy communities must be built and developed at local level in order to meet the world's growing demand for electricity in a fair manner.**

Looking around, we can see how easy it is for us to interact with the complex electricity generation, transformation, transmission and distribution systems that support us on a daily basis. But that is not the reality for all parts of the world. Developing countries are a case in point. Indeed, these countries face a new challenge as the world population experiences excessive growth. It is believed that in less than 30 years the world population will have increased by 3 billion people, leading to a rise in energy demand in countries already equipped with a reliable, high-quality energy

generation and distribution network. This population growth will also present a challenge for developing communities with as yet precarious infrastructure and equipment, since it means developing their energy systems. As both energy sector operators and society as a whole transition towards a sustainable, responsible energy model, bodies like the World Energy Council ensure that the rising demand for electricity is met fairly, reliably and sustainably throughout the world, in line with this model.

**Decentralised models**

Improving access to energy should not be achieved at any price but by guaranteeing supply through innovative grid maintenance, operation and



**Tamara Yagüe**  
Director VINCI Energies in Spain



## AGILITY **PICTURE**

# WHAT'S NEW IN RENEWABLES? AGRIVOLTAICS!

The old quarrels between farmers and proponents of renewable energies are a thing of the past. Increasing numbers of arable farmers, wine growers, and livestock breeders are installing solar panels on their land as a useful additional source of income. Making agricultural land available is now one of the most promising avenues for expanding the renewable energy sector, known as agrivoltaics. Multiple initiatives are springing up, like in Bioule, a rural community in southwestern France where Omexom RE Solar has installed more than 30,000 solar panels over 17 hectares. The eventual aim is to supply 13,45 MWp of power.





## AGILITY **PROFILE**

# VINCI ENERGIES, ACCELERATOR OF ENERGY AND DIGITAL TRANSFORMATION

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With their strong regional roots and agile and innovative structure, VINCI Energies' 1,800 business units have positioned themselves at the heart of the energy choices their clients make, boosting the reliability, efficiency and sustainability of their infrastructure and processes.

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