

THE AGILITY EFFECT

MAGAZINE

CHIEF RESILIENCE
OFFICER BECOMES
TALK OF TOWN

AGILITY LEADER

GAME-BASED
ECOLOGY

DIGITAL SOBRIETY
NEEDED FOR
TECHNOLOGY

10 SUSTAINABLE EFFICIENCY SOLUTIONS



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Protecting the planet, the climate, biodiversity and natural resources is one of the biggest concerns the world currently needs to deal with. The acute and conscious awareness of this challenge has led individuals, politicians and businesses to start taking concrete action. The recovery plans put in place following the Covid-19 crisis reflect this, all factoring in a "green" focus that seeks to limit climate change.

Our employees, clients and partners, as well as the general public, expect us to undertake serious commitments to work towards this objective while serving a useful purpose and caring for the planet. That is why we have pledged to cut our own CO₂ emissions by 40% by 2030, in line with the VINCI road map. Our role as an accelerator of the energy transition means we must also support our clients to reduce their carbon footprint by imagining and developing innovative environmental solutions together.

This issue of The Agility Effect offers a brief overview of the "green solutions" our companies and brands have put in place across all our business lines. It highlights a great many things we can do, and we now need to focus on the most powerful and virtuous.

I hope you enjoy reading this issue.

Corinne Lanièce
General Counsel of VINCI Energies

AGILITY PICTURE

CUSTOMISATION FOR THE FIRST HYBRID BOAT ON THE SEINE

In Paris, Sodexo Sports & Loisirs is stepping up the energy transition of its Batobus fleet by means of a strategic partnership with VINCI Energies and its Barillec Marine subsidiary, which has specially developed a customised hybrid propulsion technology for the project. The boats, with 50% electric and 50% internal-combustion propulsion, are designed to transport 200 passengers on the Seine on a 15-hour daily schedule. The first hybrid Batobus will begin operating in 2021. The technology will then be rolled out across the entire fleet, with the project set for completion by 2024 in time for the Olympics.



FROM THE “CITY OF LIGHT” TO “CITY LIGHTS”

As an indispensable part of the public space, light creates a hierarchy of urban spaces, and shapes user behaviour. Today it is a focus of the search for ways to reduce local energy consumption.

In the second half of the 17th century, Police Lieutenant Gabriel Nicolas de la Reynie had streetlights installed in Paris to facilitate the work of night watchmen and maintain public order. Historically, the purpose of urban lighting was thus initially to keep citizens safe. Since then, light has become a vital aspect of public space management, a part of the urban heritage, and a crucial contributor to the appeal of cities. At the end of the 1980s, it even became a cultural focus in events such as the Fête des Lumières in Lyon, the Amsterdam Light Festival, and the Montreal High Lights Festival. Climate change has now changed all that. Public lighting accounts for 41% of local authorities' electricity consumption in France. At a time when a large number of studies have pinpointed the harmful impact of light pollution on the environmental ecosystem, the Association nationale pour

la protection du ciel et de l'environnement nocturne (French national association for sky and night environment protection) reports that the amount of light emitted by public lighting systems alone has increased by 94% over the past two decades. "Increasing environmental concerns, growing attention to the convenience and comfort of life in the city, and the need to reduce public spending call on us to re-think the role of light in public spaces," says Nicolas Planteau du Maroussem, Managing Director of VINCI Energies in the Ile-de-France, Nord and Est regions and Director of the Strategy Committee of Citeos, the VINCI Energies lighting and urban equipment brand.

The LED revolution

The expression "city of light", coined to describe Paris when it inaugurated public lighting during the World's Fair in 1878, continues to resonate and public lighting continues to be managed in the singular, but municipal stakeholders have begun to think of lighting and light in the plural, moving from "the city of light" to "city lights".

"Lighting serves a variety of purposes in public spaces, reflecting the major urban policy issues," says Nicolas Planteau du Maroussem. Safety, mobility, social inclusion, environmental and economic sustainability, and aesthetics are just some of its functions. To address all these challenges, city authorities have a powerful ally – LED (light-emitting diode) technology, which, in addition to having a service life of 10 to 15 years, can cut the amount of electricity consumed by municipal lighting systems by 75%. Its many benefits include IoT connectivity, dimmable lighting at the required power level, and

remote management of each light independently of all the others. In short, LED enables urban lighting to migrate to dynamic, sensitive systems that can modulate light intensity according to urban mobility and are geared to continuity of use.

The “right” lighting

The development of sustainable mobility and the encouragement of reduced energy consumption are central aspects of the discussion about future public lighting systems.

For a long time, urban lighting was

designed according to a central criterion – automobile traffic. Streets needed lighting so that cars could use them. Today, attention has shifted towards other types of mobility such as walking, bicycles, bus rapid transit, and tramway systems. For these types of mobility, there needs to be a shift away from a systematic, single lighting to a "right lighting" system – lighting in the right place, at the right time, and at the right intensity.

"Lighting in public spaces serves a variety of purposes, reflecting the major urban policy issues."



And new types of partnership will also be required to improve the performance of the lighting sector. "The energy performance contracts under which we currently make commitments to local authorities can cut consumption by up to 70%," says Nicolas Planteau du Maroussem. The fact remains that the most innovative commercial approaches, which will soon enable local authorities to simply purchase access to light, are only possible with a 100% LED system. With a limited fleet renewal rate of 3% per year, it will probably take many years for cities to complete their migration to LED. In the meantime, "smart" lighting is gaining ground, because the idea is not just to replace equipment but also to re-think the overall role, position, and purpose of lighting in public spaces.

CHIEF RESILIENCE OFFICER, NEW KEY FIGURE FOR CITIES IN THE MAKING

To address the climate emergency, big cities are appointing chief resilience officers – a new key role for cities facing new challenges. Paris and Mexico City are two cases in point.

The recurring heatwaves experienced in Europe during the summer of 2019 serve as a stark reminder that climate change, particularly in terms of the effect it has on the lives of city dwellers, can no longer be tackled on an ad-hoc basis by the authorities. "Exceptional events" have now become a regular occurrence in cities worldwide. And their impact is likely to become more of a problem given the growth of huge cities. Indeed, more than 50% of the world's population lives in urban areas, a figure that will reach 70% by 2050, according to British newspaper The Guardian. This increase is all the more worrying since cities not only have to deal with climate change but also economic instability, social inequality, migration, and resource scarcity. To meet these new challenges, cities are starting to develop a comprehensive strategy that

closely interlinks ecology and resilience, focusing on the capacity to withstand climate-related shocks. And a new role, that of chief resilience officer (CRO), has been created to drive the strategy. It's a position devised by the non-governmental organisation 100 Resilient Cities (100RC), which was launched in 2013 by the Rockefeller Foundation.

The ambition is clear: to help cities deal with increasing urbanisation, globalisation, and climate change, all of which result in "recurring stresses" such as water and air pollution, social inequality, and economic crisis.

Oasis project in Paris

The number of CROs appointed in large cities is today estimated at around 100. Paris is one such city, where resilience is coordinated by Sébastien Maire. In an article in the Le Monde newspaper, he explains his vision for the "general delegation for ecological transition and resilience" that he runs: "Climate policy can no longer be split into separate silos – housing, transportation, food, security, supply, etc."



The "Oasis" project, one of the initiatives launched by Maire, "is about turning school playgrounds into oases, or cool areas, by replacing asphalt with lighter innovative materials that limit solar radiation, and setting up fountains and educational gardens." Sound anecdotal? Not according to Maire who quotes two figures: Paris is set to experience at least 25 days of heatwave by the end of the century and heat events with temperatures of 55°C in the shade between now and 2050. Another initiative in Paris involves the development of "resilient roads", designed with porous

and permeable materials, types of pavement that help combat the heat island effect, and more trees.

Holistic approach

Michael Berkowitz, president of 100RC, addresses another example of a resilient city in a different continent and on a larger urban scale: Mexico City. Since the 1950s, the population of this Central American megacity has shot up from 3 million to 21 million, with around three million people living in informal settlements. "The proliferation

of these informal settlements has greatly exacerbated the risks of shocks, as earthquakes, long-term water shortage and land subsidence impact them at a greater rate."

To build resilience, Mexico City is starting to establish links between the various problems. For instance between informal housing and economic inclusion, and building codes and water aquifers. The goal is not just to "survive a possible disaster but to adapt, grow and thrive," points out Berkowitz. In order to successfully develop then implement a resilience

The skills required to be a chief resilience officer include enterprising spirit, innovative drive, and the ability to get diverse stakeholders to work together.

programme, CROs must work across city departments, stresses the NGO. This applies to all disciplines, whether transportation, energy, healthcare, or education. Indeed, the CRO skills listed by 100RC include enterprising spirit and the ability to innovate and to get diverse stakeholders to work together – not just government officials but also, crucially, the private sector, NGOs, associations, and civil society.

INDOOR AIR QUALITY, A HEALTH ISSUE FOR THE PROPERTY SECTOR

At home and in the workplace, we spend 85% of our lives breathing indoor air that is often vitiated by numerous pollutants. It's a public health issue that the building industry is starting to address.

Mandatory in France in nurseries and primary schools since the start of 2018, and in day camps and secondary schools since 1 January 2020, monitoring indoor air quality (IAQ) will be required in all public buildings as of 1 January 2023. The air we breathe indoors is becoming a real health policy issue. "We spend about 85% of our time inside buildings. This is an unprecedented situation in the history of humankind," says Chloé Voisin Bormuth, director of studies and research at the La Fabrique de la Cité think tank.

Indoor air quality was first monitored in the 1960s. At the time, the health authorities had one single enemy: cigarette smoke. In 1977, a UK study revealed the harmful effects of nitrogen dioxide emissions from gas appliances. In the late 70s and early 80s, analysis shifted towards the detection of radon, which was recognised as

carcinogenic in 1987. Since then, progress has been made in research, with environmental regulations now focusing on particulate matter, volatile organic compounds (VOCs), radon, asbestos, carbon, lead, and ozone. Studies have shown that when buildings are occupied, indoor air can be 5 to 8 times more polluted than outdoor air.

Sick building syndrome

"New building materials and furnishings (floor coverings, adhesives, paint, furniture, etc.) are responsible to a large extent for this indoor pollution, both in residential and commercial buildings," explains Pierre Blanchet, building solutions innovation manager at VINCI Energies. The health effects of the numerous neurotoxic and carcinogenic pollutants and endocrine disruptors concentrated in commercial buildings are well known today: headaches, rashes, irritation of the eyes, nose and throat, nausea, dizziness, fatigue and difficulty concentrating. These symptoms are part of what is now referred to as "sick building syndrome" (SBS). According to the

World Health Organisation (WHO), around one third of the housing stock in industrialised countries could potentially be prone to SBS.

From works phase onwards

Outdoor air pollution, occupant activities, and building management, upkeep and refurbishment are of course key factors when it comes to maintaining good-quality indoor air. But construction professionals have a major role to play in reducing the exposure of future occupants to contaminants. And it starts at the works phase. Supported by the French Agency for the Environment and Energy Management (ADEME) as part of the CORTEA 2015 programme, the ICHAQAI scientific project, bringing together public health researchers (from the EHESP School of Public Health) and construction professionals, illustrated the impact of the works phase on subsequent air quality. "Measurements of chemical contaminants, particulate matter, and mould taken on new construction worksites revealed that the tasks that produce the most emissions in terms of volatile



organic compounds involve the use of what are considered by-products, for example paint and cleaning products which come into play at the end of a project," says Blanchet. Other readings showed that moisture levels shoot up when partition work is carried out.

Material drying, preventive ventilation

The priority objective is to contain moisture – especially since concrete is made up of water – thus preventing the development of mould, which is not only a hotbed of irritants and allergens but which also leads to poorer thermal performance, wood warping and the detachment of finishing coats.

Meeting this objective means complying with drying times for building materials like adhesives

When buildings are occupied, indoor air can be 5 to 8 times more polluted than outdoor air.

and using ventilation or even free cooling systems, on a provisional basis, during key construction periods and before the arrival of building occupants.

Constructors are starting to incorporate certain habits into their projects on site. But looking at the issue of indoor air quality in its entirety, there is still a long way to go from a building construction, refurbishment, and management perspective.

"IAQ still tends to be forgotten in discussions surrounding public health. It's interesting to note that we use the term 'pollution' for outdoor air – to highlight the issue and mobilise public opinion – and 'quality' for indoor air. It still focuses too much on individual responsibility (good practices). But what about more political issues such as industrial policy, spatial justice, and social standards?" points out Chloé Voisin Bormuth at La Fabrique de la Cité.

DIGITAL RENOVATION, AN EMERGING MARKET

When it comes to buildings, there is much talk about energy renovation, but not so much about digital upgrades. As things stand, technology is still too recent and not widespread enough in existing housing stocks. That doesn't mean, however, that digital renovation can't be anticipated.

Energy renovation may have become a commonly used term by property professionals, but digital renovation is a long way from reaching that point. Are digital developments and applications still too recent to have their own renovation process? Or is digital technology itself, by definition, incompatible with the very idea of renovation?

The answer is: perhaps a bit of both. According to Pierre Blanchet, Building solutions innovation manager at VINCI Energies, the expression "digital renovation" is something of an oxymoron.

"The act of upgrading suggests a repair or an adaptation to new standards, but digital technology cannot be upgraded, at least not in the building industry," he states. "The commercial property sector has jumped straight into the era

of data, platforms, and connected objects. However, artificial intelligence can't be upgraded, it self-enhances."

Digital recycling is even less of a market since digital technology doesn't tend to feature in housing stock that is eligible for refurbishment. On a scale of zero to infinity, a zero rate of digitisation is still seen as the norm.

"There are countless oil burners, electric pumps, and old boiler room systems. Digital technology, on the other hand, is much rarer or already obsolete," says Blanchet.

Energy renovation, a springboard for the transition to digital

Building refurbishment represents a huge potential market. The age, if not the obsolescence, of France's housing stock opens the door to a long sequence of new projects to upgrade existing buildings.

The refurbishment of walls and materials will be largely determined by energy efficiency objectives. Since the energy transition is closely linked to the digitisation of infrastructure and tools, there is no doubt that building refurbishment will provide the first opportunity to



integrate digital technology into the existing stock on a very large scale. And although digital is not a common feature in most old buildings, it is set to become the backbone and indeed the nerve centre of their operating system in the future.

"Whether you're looking at it from a refurbishment or a construction perspective," says the Building solutions innovation manager at VINCI Energies, "the role of digital technology is so crucial that you need to 'think digital' right from the design and engineering stages. In fact, digital must be taken into consideration for all works undertaken."

Integrating digital into design phases

Conscious of the shift that is about to take place, the Smart Buildings Alliance for Smart Cities (SBA), Alliance HQE-GBC (professional alliance for a sustainable built environment), and the Cerqual and Certivéa certification bodies have co-developed a framework to help support and encourage building digitisation.

This led to the creation of the R2S label (Ready2Services), a technical reference system for professionals seeking to promote smart buildings. "It's about incorporating digital at a very early stage in every process, and indeed into the actual design of the building. This will give occupants optimum connectivity, ensure the building integrates into the smart city, optimise investments, protect infrastructure from the risk of obsolescence, and add value to the building in a competitive market," explains Blanchet.

Digital technology may not be something that can be upgraded, but it can be anticipated. And the more building professionals anticipate it today, the less they'll have to "upgrade" it tomorrow.

NEW DELHI USES BATTERY STORAGE



In the Indian metropolis, a new 10-MW grid-scale battery storage system is paving the way for wider adoption of the solution to stabilise the grid as it integrates renewables.

India has begun to restructure its electricity grid by integrating renewables and acquiring battery storage systems. Tata Power and AES commissioned a first 10-MW grid-scale battery storage system in early 2019 in the New Delhi suburbs. The innovative storage system will improve grid stability and provide better peak load management, system flexibility, and power quality management, says Praveer Sinha, Tata Power CEO/Managing Director. Tata Power-DDL's two million customers will also have the benefit of better protection of the critical facilities.

Fast, agile ramping

One of the advantages of the storage technology is the relative speed of battery system installation compared to that of conventional pumped hydroelectric energy storage systems. Led by Actemium India – Vasundhara Automation and Engineering Services, a VINCI Energies subsidiary, the New Delhi project was completed in just 14 months thanks to rigorous scheduling. “Engineering skills and project management expertise enabled us to achieve this result,” says Satheesha Hulimane of Actemium India. The Indian Business Unit handles project engineering and balance of plant installations, including transformers, grid, HVAC, lighting, and fire protection systems.

“This project is a first for India,

but Actemium already has substantial experience in this field, with a number of project references, particularly in Europe,” says the Indian manager.

Focus on renewable energies

The New Delhi system is expected to pave the way for battery storage across the entire Indian grid, say the Indian managers. Manish Kumar, Managing Director of Energy Storage for AES, told Power magazine that “By choosing storage over alternatives, India is taking steps to modernise its energy system. We think this will allow for rapid deployment of storage across the country, integrating solar and wind [...] throughout the country.”

“Industry and government are working to develop renewable energy – both solar and wind – in India,” says Satheesha Hulimane of Actemium India. The country has a goal of installing 225 GW of renewable power generation by 2022. This target may well accelerate the rollout of battery storage systems, which can provide the flexibility needed to better integrate intermittent solar and wind energy resources in the country’s electric grid. Battery storage will be invaluable in regions with insufficient grid infrastructure.

COMBINED CYCLE POWER PLANTS, A MORE FLEXIBLE AND LESS POLLUTING SOLUTION

In France’s western region of Brittany, Actemium is to refurbish the GRTgaz interconnection station in Prinquier which will supply natural gas to an innovative power plant in Landivisiau, thus improving the performance of electricity generation facilities.

Gas-fired power plants, one of France’s electricity generation sources (accounting for 8% of EDF’s total output at end 2018), have been equipped for several years now with an innovative technology that limits emissions and enhances production efficiency.

Traditionally, a gas-fired plant operates according to a simple principle: the fossil fuel is burned to create a pressurised gas, which drives a turbine connected to an alternator producing electricity. The exhaust gases from the turbine are released into the atmosphere. In order to limit pollution while at the same time boosting plant performance, new types of facilities have been designed such as combined cycle gas turbines (CCGT). These work on the same principle as simple cycle gas turbines, but recover the heat from the exhaust gases to generate steam. This steam powers a second turbine/alternator unit, producing additional electricity.

Less CO₂

These CCGT plants can achieve efficiencies of 60% or more, compared with 35% for a gas-fired turbine alone, which makes them very attractive. Moreover, they release up to half as much CO₂ into the atmosphere for the same output. Some such plants have already been set up in France, in particular in Dunkirk and Montoir-de-Bretagne. And others are currently under development, like the Landivisiau plant in the Finistère department in Brittany. This 450-MW combined cycle gas turbine will better satisfy local electricity demand and strengthen the network in southern Brittany.

Turnkey contract in Prinquier

In order to contribute to its supply of natural gas, the company GRTgaz is to refurbish the Prinquier interconnection station (in the Loire-Atlantique department) which dates from 1979. A gas pipeline will be built between the Prinquier and Landivisiau plants. Actemium, the VINCI Energies brand specialising in industrial performance, is responsible for the electrical aspects of the refurbishment as well as for instrumentation and control.

“Actemium is handling everything in this turnkey contract, from the detailed design, procurement, prefabrication of electrical cabinets, and execution on site to commissioning, which is due to take place in June 2021,” says Constantin Batereau of Actemium Paris Énergie & Environnement, the business unit in charge of managing the project.

The works are being carried out by Actemium Saint-Nazaire as part of a partnership.

Fine-tuned production

“The GRTgaz interconnection station in Prinquier was not initially intended to supply a plant like Landivisiau,” he points out. “The works across both sites will help improve energy efficiency and reduce air emissions while securing the electricity system.” Furthermore, the Landivisiau combined cycle plant will make it possible to fine-tune electricity production. The project meets a demand for improved flexibility and what is distinctive about CCGT plants is that they can be ramped up very quickly and can be stopped then restarted according to need. Traditional thermal power plants don’t offer this kind of flexibility.

LOGISTICS SYSTEMS GET DATA BOOST

Industry is embracing new collaborative simulation solutions driven by data collection and analysis. Due to its complex nature, the logistics sector is at the forefront of the trend.

Logistics-based simulation tools such as Anylogic, 3D Experience, ProModel, FlexSim, Witness, SimProcess, AutoMod, and Plant Simulation are on the rise, offering industrial operators new opportunities.

They optimise the entire production line by creating a virtual model of an installation, based on real data, in order to analyse efficiency, capacity, throughput, bottlenecks, costs, and so on. "The first benefit of this type of digital platform is better risk management," says Xavier Devolder, branch manager at Actemium, the VINCI Energies brand specialising in industrial processes. "Simulation helps to detect problems before they arise, and this is achieved by carrying out tests in a secure environment."

"By providing a better understanding of the process, the tools play a valuable role in supporting decision making," he adds.

Flexibility and power

Actemium has opted for Plant Simulation, a tool developed by Siemens. "The advantage of this



solution, which we use for our clients, is that it is flexible and powerful enough to incorporate the complex issues involved in the world of logistics," explains Devolder.

In 2019, Actemium performed a simulation for Latexco, a supplier of bedding products. "The pilot phase involved designing an automatic warehouse that had to meet stringent requirements in terms of budget and available space," he explains.

The algorithm developed using Plant Simulation had to include a whole range of characteristics specific to Latexco's business: mattress handling method, varying product sizes, pallet positioning

and speed of movement, time needed for mattresses to be received at the exit area ready for truck transport, etc.

"Prior collection of information and data is key to ensuring this kind of simulation is successful. So we have to be in constant, close contact with the client," says Devolder.

The test conducted for Latexco over a period equivalent to a year of operation showed, among other things, that of the 120 available spaces for pallets in the virtual warehouse, 25 didn't end up being used.

Following the test, Latexco plans to open this next-generation warehouse in 2021.

AGILITY FOCUS

INNOVATION

10 SUSTAINABLE EFFICIENCY SOLUTIONS

The COVID-19 crisis, its economic impact and the measures being taken to respond to it are set to accelerate changes already under way in two key areas:

digital transformation and energy transition. Businesses are in the frontline of these developments and, against the backdrop of the climate emergency, are called on to combine economic efficiency and environmental sustainability.

Isabelle Spiegel, global head of environment at VINCI, states in this issue of The Agility Effect Magazine, that "recovery must be green, on that we are all clear."

The best way to achieve sustainable efficiency is to be agile. Agile in terms of organisational systems, methods and mindsets. VINCI Energies business units meet local needs and leverage the full range of expertise of its global brands, developing solutions that not only make a difference to people around the world but that are also mindful of the planet.

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“SPEEDING UP OUR DRIVE TO PROMOTE MORE ENVIRONMENTAL SOLUTIONS”

Isabelle Spiegel, head of environment at VINCI since August 2019, sets out the Group's goals which include implementing a new environmental roadmap and creating an Environment Award.

In January 2020, VINCI unveiled its environmental roadmap. Is this a continuation of efforts already under way or a marked acceleration in measures?

Isabelle Spiegel. A commitment to “promoting green growth” was incorporated into the VINCI manifesto in 2009. This meant seeking to reduce our greenhouse gas emissions by 30% by 2020, a target we are on track to meet. But if we are to fully play our part in limiting temperature rise to 2°C, then we need to step up our efforts and push the boat out even further. That’s where the new roadmap comes in and its new target to cut CO₂ emissions by 40% by 2030.

To what extent does the SARS-CoV-2 pandemic change the equation?

I.S. The entire VINCI Group executive committee decided to continue our efforts for the

environment despite the pandemic. It's crucial for the planet and it's crucial for the long-term viability of our operations. Our objectives have

especially environmental solutions for growth. Recovery must be “green” – on that we are all clear.

“One of the Group's strengths is knowing how to mobilise its workforce around shared commitments and objectives.”

a 10-year timeframe, so there is no reason to revise them in the light of coronavirus. However, we will have to make adjustments in the short term in order to take account of the overall economic situation. Some actions may be moved back several months. Conversely, we'll probably have to speed up in other areas,

What major levers will the Group pull as it moves forward in implementing its environmental goals?

I.S. One of the Group's strengths is knowing how to mobilise its workforce around shared commitments and objectives. That's already happening with safety, for example. Each of VINCI's 222,000 employees must contribute to the transformation that this new roadmap aims to bring about. This will involve setting up common tools and reference systems, of course, but they'll need to be used as part of a decentralised and agile approach within business lines, markets, regions and with clients. Each level will be responsible for setting its own priorities to meet the 40% reduction in CO₂ emissions goal.



Is 40% an average for the VINCI Group?

I.S. Yes. It's the outcome of consolidated action plans which were drawn up over a period of a few months to reflect each business line. It breaks down as follows: 50% for VINCI Construction and VINCI Airports, 30% for Eurovia and 40% for VINCI Energies.

Have you identified any factors that might hamper the implementation of this new roadmap?

I.S. There's nothing really to hamper it anymore in terms of awareness – that's now a given everywhere. But the business model is not always clear in every

country and in every business line. In North America, for instance, energy prices are much lower than in Europe, and that has a significant impact on return on investment. Furthermore, some of our clients don't formulate clear environmental requirements. That can remain an obstacle in a company like VINCI whose culture is underpinned by execution excellence in strict compliance with client expectations. It's up to us to be proactive, to be bold in addressing the environment with our clients and to put forward solutions!

How do IT and digital technology contribute both to the problem and the solution?

I.S. Digital technologies account for around 4% of CO₂ emissions

in the world. That's a fairly small share, but it's increasing very quickly. Globally, more than 50% of emissions come from construction and transport – sectors that we operate in, so these are our levers. But coming back to IT, the rise in emissions must be curbed, which means implementing robust technological solutions. However, technology alone is not enough, everyone is aware of that. The small everyday actions that each of us can perform also serve as a powerful lever. By using a hybrid excavator on site, I can reduce my emissions by 20 to 25%, and by adopting eco-driving techniques I can add an extra 15 to 20%. And if each of VINCI's 222,000 employees delete 10 emails from their recycle bin every day, 200 days per year, then that will cut the Group's total emissions by 0.2%.

How will you measure your action?

I.S. We've established three areas for action, which involve working to promote climate transition, optimising resources via the circular economy and preserving natural environments. We'll measure this action at two levels: at consolidated Group level, using environmental performance indicators (including greenhouse gas emissions), and at business line level and with clients, using deployment indicators controlled in a decentralised way.

What governance system are you putting in place to manage all of this?

I.S. A 3-tier system is being set up. At VINCI board level, the issue will be taken up by a CSR strategy committee, which will report on progress annually. Plus, executive committee meetings focusing on the environment will be held several times a year. And finally, an environment committee, including each of the sustainable development directors from our business lines (Corinne Lanièce, general counsel, for VINCI Energies), will meet once a month.

VINCI is introducing an Environment Award as part of these new goals. What does it involve and what are your objectives?

I.S. Like the Innovation Award that has been so successful in the Group, the Environment Award is internal to VINCI. The aim is to bring together our movers and shakers. The environment is everyone's business at VINCI. The aim is also to share local initiatives and good practice. Everyone can get involved, apply and vote using an ad hoc digital platform. The Environment Award will launch on 22 September 2020 to coincide



with VINCI's first "Environment Day". Employees then have 5 months to submit their applications. In June 2021, there will be a round of regional award ceremonies (8 regions in France plus international regions: Northern Europe, North America, etc.) before the grand finale in September 2021.

How is VINCI Energies getting on with VINCI's new environmental goals?

I.S. I've been able to check that the various VINCI Energies business lines have taken ownership of the three strands of the VINCI Group's new environmental roadmap. Each employee, at every level of the company, is in a position to adapt the roadmap to their particular challenges and priorities. That doesn't surprise me as the ability to adapt to the situation on the ground and a "client solutions" approach are VINCI Energies characteristics.

In your opinion, what are the key dates in the development of environmental awareness? What triggered the process?

I.S. The first date – and trigger – was without a doubt the UN's Our Common Future report,

also known as the Brundtland Report, published in 1987, which defined sustainable development as ensuring the ability of future generations to meet their own needs. The second key date was December 2015, when the Paris Agreement was adopted at the COP21 climate conference. This was the first time that the topic, till then limited to the worlds of science and government, was taken up by civil society and business. The third date, or rather the third stage, is currently under way. It started in 2019 with increased global public awareness and a sense of urgency.

1987
UN's Our Common Future report
Brundtland Report

2015
Paris Agreement
COP21 climate conference

2019
global public awareness

The Environment Awards



Participate
until 28 February 2021

You have implemented an action to:

act for the climate (reduction in CO₂ emissions, energy efficiency, resilience of structures, etc.)

optimise resources thanks to the circular economy (sorting and recovery of waste, recycled materials, etc.)

preserve natural environments (biodiversity, water, air, soil, etc.)

Submit your initiative on environment.vinci.com



WIRELESS CHARGING MOTORWAY INITIATIVE ON RIGHT TRACK

The COVID-19 crisis is rekindling environmental concerns and legitimising innovation initiatives aimed at limiting greenhouse gas emissions. A wireless charging motorway project, led by major French groups among others, could signal a turning point in the electric vehicle market.

Tension triggered by the SARS-CoV-2 pandemic, health concerns have become indivisible from environmental issues in the eyes of the world. Indeed, many experts warn against complacency in the fight against global warming. Among the initiatives and tests carried out in response to this, the wireless charging road may prove one of the most effective. The project dates back to 2018 when Sweden, which has set itself the goal of achieving independence from fossil fuels in the transport sector by 2030, became the first country in the world to test an electrified road. The 2 km-stretch of road technically replicates the system adopted by some tram systems in France, involving an electrified rail embedded in the central part of the road. Vehicles connect to the rail via a movable arm, which automatically retracts in the event of overtaking or an accident.

Sweden confirmed its status as a pioneer of clean energy at the end of 2019 by opening the world's first wireless charging road on the island

of Gotland. Here, the technology is "contactless", which means that coils installed beneath the road

"By enabling any vehicle to top up in transit, wireless charging will remove the main barriers that have blocked the expansion of electric mobility."

surface communicate with a sensor located under the chassis, thus transferring power to the vehicle. With a budget of €11 million and initially tested on both a truck and a bus on a 1.6 km-stretch of road, this public-private project combines the technology of Israeli start-up Electreon and the expertise of

Omxom (VINCI Energies). So, do wireless charging roads represent the future for electric vehicles? For VINCI Autoroutes, VINCI Energies, and Eurovia, sponsors of an original wireless charging motorway project⁽¹⁾, the answer is yes.

Hybrid industrial model

"By enabling any vehicle, be it a car, truck or bus, to top up in transit, wireless charging will remove the main barriers that have blocked the expansion of electric mobility on an industrial scale," says Didier Deschanel, innovation director at Eurovia.

From a user point of view, these barriers are well known: first, the price of electric cars compared with their internal combustion engine vehicle counterparts acts as a disincentive and second, range is poor (around 300km for Renault's ZOE model, and a charging time of two hours).

"Electric vehicles currently work very well for daily use. But where they struggle, technically speaking,

is in more exceptional cases of long-distance travel. That's why dynamic charging on motorways could serve as a catalyst," adds Pierre Delaigue, director of connected, autonomous & electric mobility projects at VINCI Autoroutes.

In cases of long-distance travel, vehicles would run on their own on-board batteries before joining and after leaving the motorway, and would use the energy transferred

by wireless charging on the motorway segments.

Technical constraints

Embedding coils in the road surface isn't an easy task. The electrical cables can be weakened by the high temperature of the asphalt during their installation or by the pressure and vibration of compactors. Moreover, the distance between

the receiver and the transmitter must be as short as possible (around 20cm) to ensure energy transmission from the ground to the vehicle.

"Externalities" likely to affect the smooth functioning of the wireless charging system also have to be dealt with, since the presence of water and the potential rise in temperature caused by the operation of the coil infrastructure can end up damaging the asphalt.



HOW QUICK SCAN ENERGY CAN REDUCE A FACTORY'S ENERGY BILL



Another issue to be taken into consideration is safety. Deployment of the wireless charging model only makes sense if it doesn't harm the health of people driving or working on motorways. What maximum radiation levels will be authorised by legislators for the coils embedded in the road surface? Will these allow for optimal energy transfer between the road and the vehicles? Upcoming tests should provide answers to these questions but so far initial measurements have been encouraging and solutions exist to prevent electromagnetic field leakage.

A further issue here is whether the grid will be able to meet consumer demand on a large scale. "The French grid operator RTE and Enedis, which manages France's

public electricity distribution network, believe that energy capacity won't be a problem over the next 10 to 20 years. Particularly since all of the energy efficiency initiatives being carried out on all fronts within the OECD will quickly bear fruit," points out Arnaud Banner, technical director at Omexom.

Economies of scale

In terms of economic feasibility, motorway electrification will allow economies of scale to be made, with high levels of traffic guaranteeing an accelerated absorption of the investment. Furthermore, there is no need to electrify the whole motorway. One lane is sufficient and even then it can be electrified

in sections to create a boost charge model.

"The savings generated in fossil fuel consumption and in purchasing vehicles – due to reduced battery size – could be used in part to finance the deployment of this new charging infrastructure," explains Didier Deschanel, innovation director at Eurovia.

So, what is the expected timeframe for being able to drive "for real" using a wireless charging system? Five to ten years, thinks Banner: "The time for R&D has passed; the focus is now on integrating and defining a business model."

(1) Project selected at the end of July 2019 by the European Union as part of its "User centric charging infrastructure" call for proposals.



Quick Scan Energy is an audit tool developed by Actemium that identifies energy-saving measures on industrial sites to help reduce energy spend.

More than one third (36%) of fuel consumption in French industry, or 109.5 TWh, goes up in smoke each year. These figures, published in a study carried out by Ademe (the French Agency for the Environment and Energy Management), highlight the potential offered by waste heat recovery in industry. Residual heat,

generated by a process and not put into use, is central to the Quick Scan Energy solution made available in 2016 by Actemium, the VINCI Energies brand specialising in industrial performance. "Quick Scan Energy is an energy audit, conducted over a short period of time – generally a day – that identifies energy-saving measures on an industrial site to reduce energy spend," explains Alexia Tassin, Industry 4.0 engineer at Actemium. The audit is also a way to provide manufacturers with information about the various subsidies and grants connected to any measures that are adopted, including energy efficiency certificates ("Certificat d'économie d'énergie"), the heat fund ("Fonds Chaleur"), and the "PRO-SMEn" grant for SMEs.

The projects initiated following a Quick Scan Energy audit are essentially thermal and electricity-related. "These savings solutions can involve recovering heat from the fumes of industrial furnaces or from a boiler to heat domestic water, for example," says Alexia Tassin. "Electronic variable speed drives can also be installed to reduce the electricity consumption of pumps that wouldn't be in continuous operation the whole year round," she adds.

A tool that works for all business sectors

The audit process is based on Actemium's in-depth knowledge of industrial processes, built up over many years across all business sectors. Quick Scan Energy has already been used by manufacturers from a variety of industries including food processing, chemicals, metal, steel, automotive, and cosmetics. "We have enough experience to detect sources of energy savings by quantifying waste heat at an industrial site," says Alexia Tassin. Furthermore, Quick Scan Energy is proving to be a valuable tool for identifying opportunities to enter into energy performance contracts (EPC) with clients. "As well as benefitting from grants allocated as part of the energy efficiency certificate scheme when introducing energy efficiency measures, EPCs strengthen the relationship of trust between the client and Actemium, which guarantees that a certain amount of primary energy savings will be achieved over a given period," adds Alexia Tassin.

WIND MY ROOF, ROOF-TOP WIND POWER

In partnership with VINCI Energies, the Wind my Roof startup has developed an original power generation solution involving a compact wind turbine installed on building roof-tops. Antoine Brichot, co-founder of the startup, and Antoine de Broves, technical and innovation manager at Omexom, outline their collaboration which began in 2017.



What makes the Wind my Roof solution original?

Antoine Brichot: We invented a roof-mounted turbine that generates electricity. What makes it original is its horizontal shape, which means it can be placed at the edge of rooftops. The so-called WindBox, patented in the summer of 2019, delivers an excellent generation/compactness ratio.

What other advantages does the technology offer?

A.B. It can be mounted on any flat-roof building. Plus, it doesn't produce any noise pollution and it is

modular. You can install as many boxes as the site will allow, bearing in mind that one module has an output of up to 1500 W, or 1 MWh per year.

Antoine de Broves: The Wind my Roof product is competitive in relation to solar PV installations, which represent an alternative –and in fact complementary – solution.

But it's the environmental benefits that interest us more than anything. The impact of the process in terms of CO₂ emissions per kWh of electricity generated is half that of solar and can be reduced by 78% compared with the average kWh in France.

A.B. Gains are higher still beyond our borders: the impact can be

reduced by 95%, given that the average global energy mix is much more carbon-reliant than that of France. That's why it's important for Wind my Roof to have joined forces with an international group like VINCI Energies.

How did Wind my Roof and VINCI Energies establish contact?

A.B. We first met during the VINCI Innovation Award student challenge which we won in 2017. Straight afterwards, we were hosted for a period of 8 months by the group's incubator, Leonard. That gave us the opportunity to meet the group's various business lines, including VINCI Energies. Following a year of incubation, we took part in the Vivatech conference with VINCI Energies in 2019.

A.de B. Omexom's business, as integrator of turnkey solutions, inspired us to focus on new electricity generation solutions, especially low-carbon ones like Wind my Roof.

How has the relationship between Wind my Roof and VINCI Energies evolved?

A.B. At the start, VINCI Energies coached us to help us better



understand where we wanted to go with our student project. The incubation phase at Leonard was a chance for us to work on our business model, business plan, client base, and so on.

A. de B. The relationship didn't require any particular effort from VINCI Energies. We are used to working with partners, including startups.

A.B. At the moment, there are only two of us – myself and my business partner Yanis Maacha, who is responsible for the technical, R&D, and industrial aspects. That means that discussions with business unit managers at VINCI Energies are simple and direct.

Tell us about the results of your collaboration so far.

A. de B. The first project with Omexom is a demonstrator, which has been installed on the esplanade at La Défense this summer. The Paris La Défense body wants to generate electricity for local use on the esplanade, which doesn't have an integrated electricity system. Initially, the plan will be to power a fleet of electric scooters.

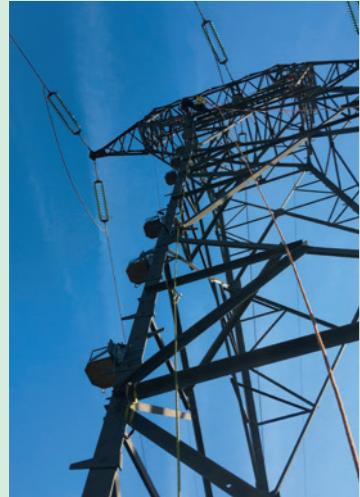
A.B. Two boxes have been installed, one on the Point Info building at La Défense and the other on a lift shaft building. We've calculated that these two modules will have a total output of 25 charges per day or 9,000 per year.

A. de B. A second project involves installing at least two to four WindBoxes on the roofs of two VINCI Energies business units in Viry-Châtillon (SDEL Transport and Citeos). They will be used for self-consumption and for charging electric service vehicles. The project also includes solar canopies and an electric storage system. So, it's a complex project, a prime example of what VINCI Energies can do.

What does the future have in store for the partnership?

A. de B. On 28 February, the VINCI Energies investment fund Inerbiz acquired a stake in Wind my Roof alongside KIC InnoEnergy. We are convinced that this move will bring great benefits.

EVE™, A HIGH-PRECISION ASSESSMENT TOOL



By detecting the slightest anomaly in steel structures and determining their residual service life, the EVE™ vibration analysis method enables Omexom to optimise its management of towers.

Until now, the Val d'Allos ski resort, located in the heart of the Mercantour National Park (in the Alpes-de-Haute-Provence department in south-eastern France), has always changed the core tower of one of its chairlift systems every 7 years.

Further north, the Valmorel resort in the Tarentaise Valley (in the Savoie department in the Alps), recently had the main tower of its iconic Télébourg gondola lift checked, and everything appeared to be in order. That was before the EVE™* method was introduced.

This structure diagnosis technique used by both ski resorts revealed new findings: first that Val d'Allos could afford to change the towers only every 25 years and second that the Valmorel tower was showing an imperceptible non-through welding defect, which had not been detected by traditional inspection techniques and which was weakening the structure.

"The EVE™ method measures the dynamic parameters of a steel structure using sensors that are positioned on it. It then compares the natural frequency of the structure against its theoretical frequency," explains Charles Govin, Omexom sales manager in Albertville (VINCI Energies). The process provides a highly accurate diagnosis of structural ageing or damage and soil-structure interaction, picking up defects in the foundations. "That's how we detected a problem at the base of a tower run by

the operator of the Swiss transmission grid, Swiss Grid. It's a 40m-high structure on which we had installed a few dozen sensors," adds Govin.

A legacy of the Tokachi earthquake

The EVE™ method, which enables a diagnosis to be performed on structures with background noise, is the result of research initiated in the 2000s, inspired by frequency analysis carried out at the time of the Tokachi earthquake in Japan in 1968.

"We are the only ones in France to have been using this technique, validated by STRMTG (French agency for ropeway and guided transport safety), on steel structures since 2015," stresses Charles Govin, who points out that the company has two structural engineers whose job is to interpret the measurements taken. As well as detecting anomalies, the method offers another significant advantage in that it establishes the residual service life of a structure – something that managers of the Val d'Allos ski resort have discovered to their great satisfaction.

* EVE™ stands for Existing Vulnerability Evaluation.

IZEN PROMOTES ENERGY TRADING



IZEN, a VINCI Energies business unit specialising in photovoltaic systems in Belgium and the Netherlands, is set to launch a "smart energy" exchange platform.

Are we seeing the end of a centralised power generation model? The prospect is not all that remote. Indeed, in Belgium, it's already a reality for more than 16,000 homes. Over the past 10 years, Belgian company IZEN has been equipping several thousand families with solar panels. It ensures their installations are profitable by providing them with solutions to store energy, use electric mobility, and trade the electricity they generate. A specialist in renewable energy

system engineering and installation in Belgium and the Netherlands, IZEN, which was acquired by VINCI Energies in September 2019, decided to go further. It joined forces with Zero Emission Solutions, a Belgium renewables company, to build an online platform that links energy producers and consumers, whether homeowners or businesses. This means that a private individual, company, local authority, or shopkeeper that wants to buy or sell local clean energy will be able to do so via this marketplace as of July 2020. The two parties – the seller and the buyer (business or homeowner) – can even enter into a long-term contract.

This may well provide inspiration for other ideas... In 2019, IZEN installed

7,200 solar panels on the roof of the Lidl supermarket in Sint-Niklaas near Antwerp. This gives the store an output of 1,730 MWh per year, which is equivalent to the electricity consumption of more than 600 families over a year. Lidl is committed in 2020 to sourcing 12.5% of its total energy consumption from renewable energies. It would be an innovative concept if the chain also bought electricity back from its own customers, crediting them in the form of vouchers through their loyalty cards.

Employees as electricity producers

In the same spirit, drawing on IZEN's expertise, VINCI Energies Belgium has decided to make its 2,750 employees ambassadors of smart energy technologies by developing a bundled offer of solar panels for their homes. All they need to do is arrange an online appointment and VINCI Energies staff can have a photovoltaic system installed at their home within a day. An IZEN project manager performs the technical analysis and determines the guaranteed kilowatt-hour generation. Thanks to the system, VINCI Energies could power its offices by buying the electricity they don't use from its employees.

HOW STATISTICS AND DYNAMIC THERMAL SIMULATION SUPPORT GREEN BUILDING

Winner of the VINCI Energies challenge at the VivaTech 2019 conference, Helios Exchange aims to be the leading integrated platform for building energy retrofit projects. For owners of commercial buildings, this means substantial time and money savings.

Owners of commercial properties with a surface area equal to or greater than 1,000 m² now have little choice but to take urgent action on energy use in their buildings. In France, for example, a recent decree forming

part of the housing, planning, and digital technology reform law (Elan) requires buildings to cut their final energy consumption by at least 40% by 2030 (compared to 2010 levels), 50% by 2040, and 60% by 2050.

The situation is all the more pressing since the building sector has not been all that prompt so far in taking the necessary steps in this field. "A number of barriers must be removed to enable widespread access to energy retrofit: high transaction costs, a fragmented ecosystem, a lack of standardised processes and indicators, long assessment

times, etc." says Pierre Blanchet, Building solutions innovation manager at VINCI Energies. Take the case of an owner of 10 buildings. To find out how much energy each one of them uses,

the owner needs to commission

an engineering consultancy to audit each site, with a price tag of €10,000 to €20,000 per building. The next step involves waiting three weeks to obtain 10 status reports, returned in PDF format. At this point, the owner has no overall picture of the building portfolio's consumption as a whole, making it difficult to choose the best course of action in terms of strategic priorities and economic constraints.

Change of scale

For a building owner, energy efficiency is first and foremost a

matter of economics. Any retrofit scenario is a business case to which the owner must be able to link performance risk and return on investment.

"If energy retrofit in the commercial sector is to scale up and move to an industrial pace, it requires tools that simplify project administration and delivery, reduce transaction costs, compress execution times, quantify performance risk, and estimate the impact of each measure," explains Pierre Trevet, CEO of Helios Exchange.

Designed around building energy retrofit development, insurance and financing, the Helios Exchange integrated software platform allows property sector players to remotely manage all the links in the energy retrofit chain. Winner of the VINCI Energies



challenge at the VivaTech 2019 conference, Helios Exchange can analyse and manage data relating to energy assessment, retrofit project scenarios and development, works cost estimation, performance risk calculation, and standardised measurement and verification of actions. "It's an original tool that supports decision making," says Blanchet.

Calibrating statistics to actual scenarios

Unlike other dynamic thermal simulation tools, Helios Exchange is built around stochastic simulation. "We wanted to create an agile method that helps reduce uncertainty as you go along," explains Trevet. Using a library of archetypes

derived from statistical data, the tool calculates average indicators based on generic characteristics (type, function, and location of building, etc.). The initial simulation is refined by entering data supplied by the operator and/or held by its operator service-provider: temperature, internal heat gains; thermal characteristics of walls,

windows, and roofing; lighting, cooling, heating, and ventilation, etc. What makes Helios unique is that it can "tweak" the statistical data to calibrate it to actual scenarios. The solution proposes a list of energy efficiency measures (EEM) only after the metrics' reliability has been improved in this way. The measures range from installing LED lighting to optimising the building management system (BMS), servicing the air conditioning or heating system, and carrying out more significant retrofit works

"What makes Helios unique is that it can "tweak" the statistical data to calibrate it to actual scenarios."

(glazing, full insulation of the building). Helios assesses each measure's economics and improvement of energy performance. The algorithm offsets each measure's performance against the other options while taking overall performance into account. "Our simulation tools are designed to create a calibrated model in a few hours instead of a few weeks. Remote energy assessments and audits will help reduce transaction costs and execution times threefold," explains Tretet.



AGILITY FOCUS

ENERGY INNOVATION

GREENFLOOR® REINVENTS HVAC SYSTEMS



Tested in 2012 then approved in 2016 by VINCI Energies, the GREENFLOOR® ventilated concrete slab is a truly innovative heating, ventilation, and air conditioning system.

In late 2018, a new heating, ventilation, and air conditioning (HVAC) system named GREENFLOOR® was installed across 2,000 square metres of ceilings in Actemium Mulhouse buildings. "At the start, people were concerned about the performance of the technique, especially as regards air conditioning. The heatwave in the summer of 2019 was an

opportunity to carry out a life-size test: when it was 42°C outside, the temperature inside the building was 23°C. Some people were asking to sleep at the office!" says Guillaume Rabut, GREENFLOOR® manager at I.C Entreprises, a VINCI Energies business unit specialising in indoor environmental, industrial thermal and sanitation engineering. Developed by VINCI Energies, GREENFLOOR® is a ventilated active slab system based on clean ventilation air. Here, the air is used as a heat-transfer fluid to deliver heating or cooling to the concrete, which acts a radiant ceiling.

"Unlike fan convectors, which blow out air, GREENFLOOR® offers greater comfort by avoiding the cold shower effect. Radiant technology also delivers benefits in terms of heating, giving a higher perceived temperature since the whole ceiling emits heat," explains Rabut. Plus, the new technology is particularly compact: the concrete slabs are no thicker than 22 cm, even with the ductwork, compared with 50 to 70 cm, including the suspended ceiling, for traditional HVAC installations. "This means you can optimise ceiling height, gaining one storey as of the eighth or ninth storey," points out Rabut.

Free cooling

A further benefit is that the solution generates energy savings of 10% compared with a conventional HVAC system. "Concrete has a high heat capacity. By sending fresh air to the slab at night, it cools down and redistributes cool air during the day. It works on the free cooling principle and means that a building requires less air conditioning," says the manager of I.C Entreprises. Guillaume Rabut also draws attention to the maintenance savings delivered, since there is a single filter to be changed for the air handling unit every 6 months. Furthermore, the system results in less damage. This is because 95% of air conditioning problems are due to water (leaks, condensation, etc.), whereas GREENFLOOR® is an air-based system. The process, whose cost per square metre is equivalent to that of convector fans, is highly relevant to medium and large projects. Indeed, one of the buildings in the Archipel complex, the future VINCI head office in Nanterre near Paris, will have its 10,000 m² of premises fitted out with GREENFLOOR® technology.

REDUCING THE CARBON FOOTPRINT OF BUILDINGS

If the building sector is to play its part in the energy transition, then it must take steps to decarbonise. But how is a building's carbon footprint calculated?

Comfortably settled in your office, have you ever wondered if the building you occupy is properly insulated, what materials it was constructed with, where they came from, what type of land – whether natural or agricultural – it was built on, or how much energy it uses? These are all questions that the construction sector, which is one of the main emitters of CO₂ (it alone accounts for 25% to 30% of France's carbon footprint), can no longer shy away from. The enforcement, from 1 January 2021, of France's new RE2020 environmental regulations, which aim to reduce the carbon impact of new buildings and to further improve their energy performance, is set to change the equation. "We are moving from guidelines focusing almost entirely on energy consumption to environmental regulations encompassing building systems, the impact of the actual project, and the building's water and energy use during a theoretical service life of 50 years," says

Pierre Blanchet, Building solutions innovation manager at VINCI Energies. Put briefly, the scope used to measure a building's impact on global warming will now cover its entire life-cycle.

A still-imperfect measurement system

A building's carbon footprint is measured in kg CO₂ eq, in other words quantity expressed in kilograms of carbon dioxide equivalents of the main greenhouse gases (methane, nitrous oxide, etc.), including CO₂, which alone accounts for almost 40% of greenhouse gases. "As the main contractor, VINCI Energies must look at the impact of its suppliers," notes David Merienne, director of Cegelec Tertiaire IDF.

Unlike other building materials, technical installations (plumbing, air conditioning, heating, ventilation, lifts, etc.), which form VINCI Energies' core business, use a standard system to measure their impact, since very few manufacturers publish the carbon footprint of their products.



However, technical systems represent 30% to 40% of a building's carbon footprint and around 3% of total carbon emissions in France. Given that the European Union aims to achieve carbon neutrality by 2050 (Going Climate Neutral in 2050), the environmental impact of buildings is becoming a burning issue.

Using ad-hoc tools to anticipate

"As part of its commitment to overall performance, the VINCI Group has decided to anticipate the new regulations and establish a more accurate method to measure the impact of technical works packages. In any case, their contribution will also be measured in time; it's in the natural course of events," believes Merienne. "We already have labels like BBCA and E+C- (promoting low-carbon, net-zero buildings) but the building engineers devoting an increasing amount of time to these environmental issues want to see effective measurement tools in order to refine the carbon footprint results of their projects," he adds. Several calculation tools have been designed in-house at VINCI Energies or are in the process of being finalised. "The idea is that the emission factors of a particular product or type of energy are entered into a dedicated application according to standard criteria. This makes it possible to assess the various solutions available based on their carbon footprint, while also taking into account their renewal since a building's lifecycle is calculated over a 50-year period," says Blanchet.

According to the Building solutions innovation manager at VINCI Energies, "the environment will emerge as a key new constraint alongside cost, deadline, and quality." And it's a constraint which needs to be anticipated as much as possible.

INTELLIGENT LIGHTING SOLUTION DRIVES SMART CITY DEVELOPMENT IN GERMANY

Tested in Lemgo, the We-Light Open smart lighting solution developed by Omexom provides a permanent power supply for street lighting systems combined with a fine-grained control of city lighting. It also fits into the broader framework of smart city applications.

When it comes to upgrading a city's lighting system, installing LED lamps often tends to be the go-to option. But for savvier local authorities that are keen to leverage digital technology, the benefits of the dense network of lighting columns far outweigh those of LED street lights, even if they are "smart" and cost-effective.

Indeed, columns are ideal for mounting sensors that capture a variety of data and for running digital applications useful to both residents and city councils. With this in mind, the town of Lemgo

in North Rhine-Westphalia (western Germany) set up a life-size test laboratory with the Fraunhofer IOSB research facility, where businesses can trial digital solutions aimed at making street lighting smarter. One such business is Omexom (VINCI Energies), which used this town of 40,000 people to test its We-Light Open solution, a platform for building a smart city based on lighting systems. With the assistance of Lemgo's technical departments, Omexom integrated into the street lamps not just sensors to manage parking, but also gateways to other applications. According to Tobias Hugo, project manager at Omexom and smart city solution specialist, successfully retrofitting existing lighting columns to make them smart by means of the We-Light Open technology, "has laid the foundations for a permanent power supply for smart city components using a street lamp."

Smart City applications supported by existing street lighting system

Omxom's solution powers other smart city components. Once it has been installed, street lighting is managed in the same way as before or adapted to innovative methods. One of the characteristics of We-Light Open is that the solution can be deployed independently in each sub-network of the existing street lighting system. This means that an upgrade can be carried out in stages and that the operator can choose which areas to equip first. Installation is very simple and the system is run in the same way, with no need to configure an additional parallel network to control lighting. Furthermore, it allows for different types of lighting to be installed across the existing network, says Hugo,

for example: "LED lamps or capacitive and inductive luminaire heads."

Interest from several German towns

The solution developed by Omexom is of particular interest to cities and medium-sized towns, which have to finance projects while also taking into account existing lighting networks. In Germany, a number of towns have already expressed interest, points out the Omexom project manager, including Duisburg, Essen, and Mönchengladbach in the state of North Rhine-Westphalia, and Ingolstadt in Bavaria. "No two towns have the same expectations when it comes to smart city features," says Hugo. "The value of the We-Light Open

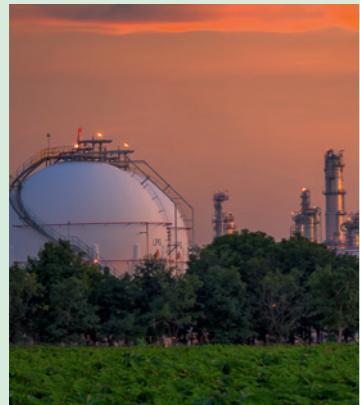
solution is that it can be tailored to individual requirements." Omexom's approach is progressive, recognising a local authority's need to be able to integrate various types of sensors, in several stages and on a street-by-street basis.

"No two towns have the same expectations when it comes to smart city features. The value of the We-Light Open solution is that it can be tailored to individual requirements."



Omxom starts by installing the equipment and components needed to provide the lighting columns with DC voltage. It then carries out the connection, control, and management: networking the columns, controlling the lighting, remote monitoring via a dashboard with open interfaces, preparing the sensors, and setting up the Wi-Fi connection. And finally, once the scalable smart city project has been defined with local authority managers, Omexom installs the sensors and applications for the various features, for example parking, traffic, weather conditions, advertising and mobile phones, Wi-Fi, charging points for electric bikes, etc. "Thanks to its pragmatic approach and staged construction method, We-Light Open is driving smart city development," says Hugo.

PROPANE, THE NEXT BIG THING IN REFRIGERATION



As a result of a new European regulation limiting greenhouse gas emissions, natural gas propane is making a comeback as a refrigerant.

It may have been snubbed of late, but propane is set to return to the forefront of the energy scene, particularly in the field of refrigeration. "Until now, machines haven't used this gas much as it was overshadowed by the vast number of chemical refrigerants. But the new European F-gas regulation, which aims to reduce the use of powerful greenhouse gases by 2030, is reshuffling the cards," explains Michel Lecarpentier,

cooling network development director at VINCI Energies. Unlike competing man-made gases like R404A and other HFCs (hydrofluorocarbons), propane is a natural gas which means that it is not subject to regulatory constraints. "At the moment, 75% of refrigeration facilities run on R404 which generates 3,900 times more pollution than CO₂. Using a single kilogram of R404 is equivalent to travelling around the world by car!" says Lecarpentier.

Conversely, propane, which is easy to source and cost-effective, has a very low GWP (Global Warming Potential). It also delivers excellent thermodynamic performance, and is one of three or four refrigerants offering the highest energy efficiencies. Finally, propane has a very broad range of use in terms of cooling and heating, ranging from -40° to +80°.

An energy efficient and environmentally responsible approach

The only drawback is that it is flammable. "But industrial facilities use a small charge, between 20 and 50 kg in general, and

basic maintenance precautions significantly reduce the risks," believes Xavier Farrugia, manager of the Thermo Réfrigération business unit (VINCI Energies), which recently installed a propane machine for Ferme de la Motte, a company based in the Loir-et-Cher department in central France specialising in the production and packaging of fresh condiments and potatoes.

"This meant the client could avoid using 400 kg of the R407F refrigerant, due to be phased down, while reducing its electricity use and adopting an environmentally responsible approach in keeping with its positioning on the organic product market," says Frédéric Sacher, project manager at Thermo Réfrigération.

It's the same story at CEF Nord (another VINCI Energies business unit), which installed a propane chiller in the JC David smoked fish production plant at Boulogne-sur-Mer in northern France. "The company eliminated the use of HFCs and R404 in favour of propane and CO₂, and at the same time benefitted from financing through an energy efficiency certificate ('certificat CEE')", notes David Facon, CEF Nord manager.

DORIAN TOURIN-LEBRET WANTS YOU TO PLAY A GAME TO SAVE HUMANKIND

After co-founding the startup Smart Impulse, this young engineer and serial entrepreneur embarked on a climate awareness-raising adventure by creating the escape game Gaïactica –combining entertainment, technology, and ecology.

Entrepreneur, consultant, teacher, lecturer, coach... At the age of 31, Dorian Tourin-Lebret has already reinvented himself several times over. "I'm a passionate multipreneur," he states right off the bat. His proudest achievement, however, is being "captain of the Gaïactica ship". For this versatile engineer, the world of childhood and science fiction is never far away. But it's a world in which there is no place for amateurism or approximation. In September 2019, a 50 square-metre spaceship named Gaïactica was installed at Cap Sciences Bordeaux, a centre for scientific, technical and industrial culture located on the banks of the Garonne River. This escape game,



which has already attracted more than 3,000 people, gives visitors the opportunity to make the right decisions in order to "save the Earth and humankind from climate change" by playing an immersive game. It's a fun way to measure the overall impact of our daily activities. "This project, which I initiated in

the summer of 2018 and which took six months of scientific research and scenario development then a further six months of production, brings together three of my passions: technology, environmental issues, and a game-based approach," explains Tourin-Lebret.



Entrepreneurial DNA

It is at École Centrale Paris (a prestigious science and engineering school), from which he graduates in 2011, that he quickly develops a taste for entrepreneurship. A month into his course, he initiates an extra-curricular project with two other students. "A meeting with an engineer from Areva convinces us that energy is a promising sector. After looking into several options, we decide to work on a system that measures a building's overall electricity consumption based on information collected by a single meter," he says.

This process gives rise in 2011 to Smart Impulse and its smart electricity meter, which detects each consumption point and flags up anomalies (lighting left on at night, ventilation of empty rooms, etc.) – an ideal tool for performing an assessment in real time and finding ways to save energy.

Teaching multiple audiences

After a few years of this exciting and promising adventure, Tourin-Lebret starts getting itchy feet... "We were approaching a key moment in the development of the company. We had around 30 employees and international ambitions, but the organisation and management side of it didn't interest me as much."

So, he branches out on his own again in 2018 to focus on teaching.

"In fact, I've always been involved in teaching: I taught secondary school students during my preparatory course for the 'grandes écoles' entrance exams, then preparatory course students when I was at Centrale Paris and finally engineering school students when I was with Smart Impulse.

It's a way for me to share knowledge and experience. And it has helped me train myself in emotional and relational intelligence, which makes it easier to get perspective on your emotions, particularly in a professional context," he says. This fan of mindfulness meditation adds: "You go from being an apprentice boss to a more responsive, agile boss. From being scared to knowing what you want. Ultimately, it's an engineer's approach: how you function as a person."

B2B development

But teaching alone is not enough to satisfy this active young man. His friends introduce him to permaculture, and he fully immerses himself in the subject, as is his way, by reading up about it, doing work placements, and meeting people.

He creates a board game called "Supermaculture", which he self-publishes in 2018 and which sells some 2,000 copies.

"Next, I tried to develop a new project based on agroecology, but I gave up after a year. I couldn't find an idea that delivered enough value."

He then turns his attention to the Gaiactica adventure.

The project, which is part-financed by the Nouvelle-Aquitaine region, is now in the deployment phase. In addition to the Gaiactica experience in Bordeaux where he moved three years ago ("I made a lifestyle choice to split my time between Paris and Bordeaux," says Tourin-Lebret who comes from Antony in the Paris region), he plans to set up the escape room in three or four other cities in France by the end of 2020.

The concept is also being implemented in businesses as part of CSR training programmes and policies.



TACKLING THE CARBON FOOTPRINT OF DIGITAL TRANSFORMATION

At a time when we are seeing a significant increase in the environmental impact of digital technology, businesses must take their share of responsibility, by focusing on green IT practices and adopting a “digital sobriety” approach. Hugues Ferreboeuf, associate director of Virtus Management, who in 2018 led the “Lean ICT: towards digital sobriety” report produced by think tank The Shift Project, and Dominique Tessaro, Chief Information Officer at VINCI Energies, share their views on the subject.

Is the crisis caused by the COVID-19 pandemic likely to change the way in which businesses address the issue of energy restraint?

Dominique Tessaro. I don't think it will change ecological approaches in business since they are built to be long term. We're talking about actions with 10 or 20-year timeframes. The issue will probably receive a little less attention this year, but initiatives are now embedded in strategies.

In its report published in 2018, The Shift Project points to the negative effects that the transition to digital technology is having on the environment. Should we be alarmed?

Hugues Ferreboeuf. Let me start by saying that we are at last achieving more clarity on the issue. In fact, it was a lack of clarity that led the Shift Project to look into it three years ago. At the time, it was difficult to form an opinion between two opposing views. For some, the benefits of energy efficiency offset the negative effects of digital use on the environment. While for others, the explosion of digital data, when compared with the significant but limited technological gains involved, is a portent of serious problems.

We therefore launched a series of studies, hearings, and analyses before publishing the “Towards digital sobriety” report at the end of 2018 – the outcomes of which have since been corroborated by further analyses. Three figures sum up the situation. First, digital carbon emissions are increasing by 8% per year. Second, the digital industry emits 50% more greenhouse gases than the aviation industry. Third, at least 50% of these emissions are directly attributable to the production of electronic equipment. Looking beyond these figures, there is a consensus today that not only is the environmental impact of digital technology growing but also that this trend cannot continue if there is to be any chance of keeping global warming below 2 degrees between now and the end of the century.

D.T. This trend, which is one that I can confirm as CIO, involves a so-called rebound effect: the more tools are developed, the more behaviours are generated and the more people want to use data. Ten years ago, the staff in my IT teams all had a laptop. Today, they have a laptop and up to three additional screens. The reason for this is that production costs have dropped dramatically: a 22-inch screen is currently available for €125. The iPhone was only introduced 13 years ago, but 90% of children going into secondary school now have a smartphone. In short, we've created

behaviours that we should all think twice about as citizens, employees, company managers, and CIOs. Are we on the right path? The answer is clearly no. That being the case, how can we be more careful in our use of technology and how can we move towards digital sobriety?

Speaking of companies, how have Green IT processes worked out for them?

H.F. When companies started adopting Green IT around 15 years ago, it was primarily aimed at optimising infrastructure. Since then, digital technology has become so pervasive that this approach, although still valid, is no longer enough. Businesses must reflect on what generates this "need" for ever more servers, ever more devices.



"Businesses must reflect on what generates this "need" for ever more servers, ever more devices."

Hugues FERREBOEUF

D.T. I agree that Green IT was initially a way to negotiate lower prices and that the real issue was overlooked. It even disappeared off the radar as far as CIOs and digital tenders were concerned. However, I notice that it resurfaced in 2018, with a real change of course taking place in 2019. Perhaps due to the "Greta Thunberg effect"?

Is business as a whole starting to become more aware of the issue?

H.F. Like Dominique, I've noticed a significant increase in awareness over the past year and a half. This was

triggered by the media, which, attuned to the climate crisis, gave considerable coverage to studies published on the subject, including that of the Shift Project which followed on the heels of the Intergovernmental Panel on Climate Change's 1.5 degrees report. Digitally-driven companies have also turned a corner. The recent launch by Cigref* of a working group on digital sobriety is a clear reflection of this. We are also seeing public administrations and politicians starting to become more aware. The circular economy law of 10 February 2020 will, for example, require telecoms providers to add each customer's data usage and the equivalent in greenhouse gas emissions to bills. Lastly, among digital providers, there is a realisation – to a certain extent at least – that they are part of the problem and that consumers may soon choose them on the basis of environmental criteria.

Would you say is France at the forefront or lagging behind?

H.F. France falls within the group of northern European countries where awareness is high. In southern Europe, awareness is much lower, and in China and the US it is almost non-existent. In fact, there are huge disparities in terms of digital use patterns worldwide. It's worth noting that half of the world's population does not have access to the internet. And for the other half, digital use is largely concentrated among the 330 million Americans, 445 million Europeans, 125 million Japanese, and a proportion of the 1.3 billion Chinese. For reference, in American households, the number of digital devices is 13 per person (compared with one or two in countries like Albania). A study carried out by the French Agency for the Environment and Energy Management (ADEME) established that the number of devices in French households stands at 35.

Dominique, what is the status at VINCI Energies?

D.T. Expectations are high in my teams, especially among the youngest members of staff. They want to get involved and are ready to be trained. After a period of 5 years in which we focused heavily on information security, which meant incorporating a "security by design" approach, we are moving into a Green IT phase over the next 10 years. And as was exactly the case with security, which was initially referred to as a high-tech concern, Green IT is set to become an issue taken up by general management. The Chairman and CEO of the VINCI Group, Xavier Huillard, has announced that the Group aims to reduce CO₂ emissions by 40% within the next 10 years. This means that digital sobriety will concern all

employees in the coming decade. At VINCI Energies, we plan to measure, analyse and publish figures, and find areas for improvement.

What actions can be taken as of now?

D.T. The immediate priority is to reduce the number of devices per person. We will be sending all our staff a questionnaire to assess their arrangements in this respect. Moreover, as CIO, I am prepared – going forward – to spend €2,000 on computers instead of the €1,300 we currently spend if I can be assured they will have a lifespan of 8 years. That will force



"Digital sobriety will concern all employees in the coming decade. At VINCI Energies, we plan to measure, analyse and publish figures, and find areas for improvement."

Dominique TESSARO

manufacturers to completely overhaul their production chain, favouring quality over quantity and ensuring publishers move away from planned obsolescence. Incidentally, if we stop changing our equipment every 5 minutes, we'll save ourselves security problems. It's a win-win situation all-round.

H.F. Market forces will inevitably come into play. When half of the CAC 40 companies (the French stock market index) set the same conditions for suppliers, they won't have any option but to meet them.

Is the sobriety approach compatible with the need for efficiency?

H.F. Sobriety is by no means incompatible with efficiency, or indeed security. Quite the opposite! I think we've got to a point where our behaviour is becoming counterproductive in terms of efficiency. A study found that the average attention span, without any interruptions, of a manager in a company is no more than 90 seconds... We must get back to a situation where there is more room for reason and simplicity, and we must be capable of setting limits for ourselves when we use digital devices. Netflix and YouTube videos currently account for 80% of internet traffic. It's not a question of denying the economic benefits of digital technology, but of making choices. Do we want to incorporate artificial intelligence into every single everyday experience? That's the option the Chinese have taken. Do we want Europe to follow the same path? The same question applies to 5G, whose primary function is to provide a solution to the saturation of the 4G network in major cities over the next two years. Will we need to cover the whole country, including the most rural areas?

Should businesses expect a political injunction or regulatory framework to be introduced?

D.T. There must be a political response. A carbon tax has been under discussion for 10 years now: it's time to move forward and take action. There is also an urgent need to tackle the issue of recycling electronic waste that is being dumped illegally in Africa, where it is broken down by children who are exposed to all sorts of toxic elements without anyone batting an eyelid. For a mobile phone worth €1,000, we are only paying a few cents of WEEE (waste electrical and electronic equipment) eco-tax. We must increase it to €100 per electronic device so that we can build recycling plants in France!

H.F. Politicians are starting to get involved, but the measures announced must be clearer, bolder, and more meaningful. We shouldn't kid ourselves: digital sobriety will deprive us of some of our comforts. But the more we wait, the more difficult it will be. If we want future generations in 30 years' time to have even a modest level of comfort, then we must quickly come round to the idea that we can't increase our own levels indefinitely.

*Association representing the largest French companies and public administrations, which supports its members by organising, running and summarising joint discussions on digital issues.

CLIMATE EMERGENCY: INDUSTRY CAN BE PART OF SOLUTION

The COVID-19 pandemic has changed priorities all over the world. The fight against global warming appears to have been put on the back burner and, with it, the European Union goals of reducing greenhouse gas (GHG) emissions by 55% by 2030 and achieving carbon neutrality by 2050.

However, this global crisis, which forced nearly half of the world's population into lockdown for several weeks, has shone a spotlight on the significant environmental impact caused by transport in particular. Looking at the industrial sector one of the worst offenders in terms of GHG emissions. The onus is therefore on this business sector, now more than ever, to accelerate its transformation from within. The health crisis has revealed the importance of new or till now undervalued solutions such as production relocation, remote working and the circular economy. There are three ways in which industry can stop being part of the problem and instead become part of the solution: by cutting its emissions, designing "greener" products and changing its production methods.

1. As far as GHG emissions are concerned, industry can optimise its energy efficiency and turn to renewable energies. It can store and re-use the CO₂ it emits. And it can make its production cycle more environmentally efficient (eco-design, more effective processes, low-carbon materials, alternative production solutions, etc.). This means recovering waste

heat, for example by re-using hot water which, when discharged, can upset the ecosystem. It also means re-using components, tools and technological building blocks for the reconstruction of a new production chain. It's time to move from recycling to re-use, which generates a much smaller carbon footprint. This approach reduces interdependencies between countries, prevents the risk of supply disruptions and ultimately improves the resilience of production systems.

2. In terms of the production of more environmentally friendly goods, there is a wealth of possibilities across all sectors: from the production of building materials that deliver a far superior energy performance, the use in the aviation sector of lighter materials so as to reduce energy consumption and of miniaturised electronics to optimise machine or product operation, to the design of electric vehicles with re-usable parts.

3. In order to change production methods, there are two main paths that industry can take. The first involves developing more flexible, autonomous and localised production units. The carbon footprint impact is immediate on the "transport" segment both for personnel and products. Thanks to automation and artificial intelligence, this relocation is now possible. Remote working, the efficiency of which has been proved by the massive uptake of the practice during the COVID-19 crisis, is also an opportunity for industry.



An opportunity both from the point of view of its necessary organisational adaptation (automation and smart control and monitoring systems will help in this respect) and its contribution towards an improved carbon footprint thanks to a reduction in personnel transport time. The second path involves strengthening industry's ties to its

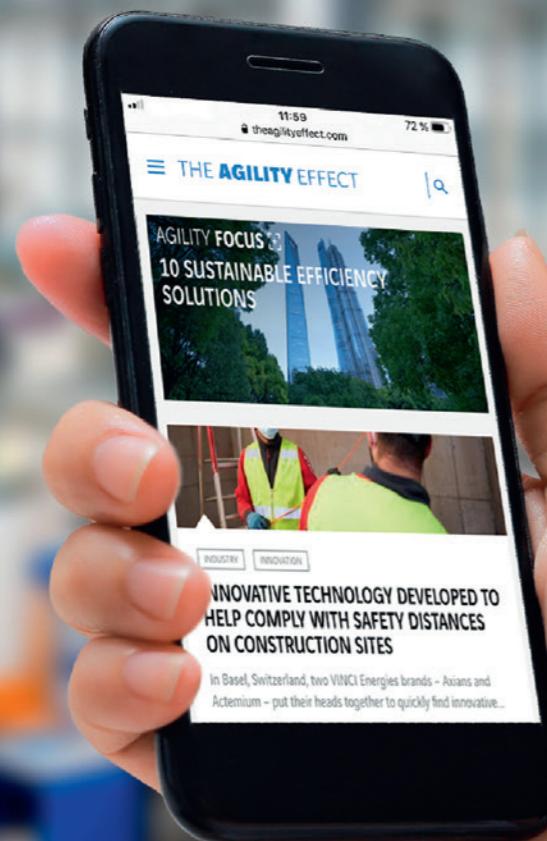
ecosystem by generating positive externalities beyond production alone. This can be achieved by using industrial land for agricultural production, thus promoting shorter circuits – an expectation expressed by the public during the health crisis. Or by using the CO₂ that industry emits to produce algae and spirulina for cosmetics and pharmaceutical applications, or even the paved roads

on industrial sites to generate heat as with the PowerRoad® process developed by Eurovia. Ensuring industry is not simply a problem but part of the solution to relocation as well as to climate change requires thought. But you quickly realise that there are many more solutions than you might have expected, and indeed that they are simpler than expected.



Bruno Nicolas
Director of the Actemium brand

Energy transition,
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STORAGE IS AT THE HEART OF THE ENERGY TRANSITION



Storage to save energy

Network operators are not the only ones who can benefit from energy storage, however. It also helps companies wishing to sharply reduce their energy bill, for example by using their stored reserve during peak tariff periods. Homeowners, meanwhile, could also save money by storing energy generated by solar panels on their roofs. This would allow them to use more of the energy they produce themselves and purchase less electricity from the grid. The shift towards increased use of energy storage techniques has started. It also meets a major ecological goal; TSOs and companies can thus underscore their commitment to sustainable development and individual consumers can reduce their emissions and energy costs.

Lithium-ion batteries could conceivably be used in the short term to store electricity in factories, offices, houses and vehicles. Energy storage would become a key part of a smart flexible and responsible smart grid powered entirely by renewable energy.

Technology has made substantial progress

A major component of smart grids is energy storage. Storage offers both a way to save surplus energy for future use and a source of additional power when demand exceeds production.

In recent years, progress in new technologies, particularly in the field of batteries, compressed air power, power-to-gas and flywheels, is making these solutions increasingly viable.

Omxom, the VINCI Energies brand dedicated to the energy transition, has been key in driving the development and implementation of some of these innovations, especially lithium-ion batteries.

In the Netherlands, for example, Omexom realised the first battery storage in Europe for global energy giant AES. The 10MW lithium-ion battery storage facility, east of Vlissingen, forms a primary reserve for local transmission system operator TenneT, maintaining a constant frequency of 50Hz.



Spencer THOMPSON
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VINCI ENERGIES, ACCELERATOR OF ENERGY AND DIGITAL TRANSFORMATION

In a world undergoing constant change, VINCI Energies focuses on connections, performance, energy efficiency and data to fast-track the rollout of new technologies and support two major changes: digital transformation and the energy transition.

Keeping pace with market change, VINCI Energies integrates customised solutions to help its customers roll out technologies that serve a useful purpose and care for the planet, from design to implementation, operation and maintenance.

VINCI Energies' 1,800 agile and innovative business units build on their strong regional roots to boost the reliability, safety, sustainability and efficiency of buildings, factories, energy, transport and communication infrastructure, and information systems.

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THE AGILITY EFFECT

Publisher
VINCI Energies SA
280, rue du 8 mai 1945
78360 Montesson
France

Printing
Impression & Brochage Snel
rue Fond des Fourches 21
Z.I. des Hauts-Sarts - zone 3
B-4041 Vottem - Liège (Belgium)

Director of publication
Sabrina Thibault

Editor in chief
Roseline Mouillefarine

Design and production
June 21

Date of legal deposit
April 2017

ISSN
2554-019X

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