

# THE **AGILITY** EFFECT

MAGAZINE

MACHINE LEARNING  
EASES TRAFFIC  
IN URBAN AREAS

GLOBAL PERFORMANCE  
CONTRACTS  
DRIVE EFFICIENCY

WELCOME TO  
THE MODULAR  
FACTORY

NETWORKS

## PRIVATE NETWORKS SUPPORT CRITICAL COMMUNICATIONS



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## EDITORIAL

We use our smartphones all the time. They are part of our lives and provide us with invaluable services every day. But we've all encountered situations where we've lost signal in an area with poor coverage or experienced bad reception due to network congestion. These problems mean that public mobile networks are not ideal for supporting critical or safety communications that need to operate 24/7 with a high level of performance, availability and security.

However, these standards can be met by Private Mobile Networks (PMN). VINCI Energies, through Axians in particular, has long-standing experience in the field, having carried out numerous projects in emergency service security networks, information management for offshore wind farms, and high-speed, uninterrupted data transmission in large public spaces like stadiums.

The special report of this issue of The Agility Effect features several applications developed by VINCI Energies in connection with Private Mobile Networks.

The magazine also includes an article on the use of machine learning to improve traffic flow and an interview with Aurélie Jean, an entrepreneur with a PhD in science who specialises in artificial intelligence and algorithms.

I hope you find this issue interesting.

François Lemaistre  
Director of Axians brand



## AGILITY **PICTURE**

# CONNECTED HIVES COME TO THE RESCUE OF BEES

A world without bees? Throughout the world, engineers and ecologists are putting their imagination to work to stem a decline that is posing a serious threat to our ecosystems. In New Caledonia, Axians ICT Nouméa is conducting an experiment based on "connected hives" in partnership with the start-up Label Abeille. A smart box placed under the hive collects data (mass, temperature, light), populating a bee "health check" in real time that can be accessed from a mobile application. And if an event occurs that requires human intervention, an alert is sent to the beekeeper.

# MACHINE LEARNING IMPROVES TRAFFIC FLOW IN DENSE AREAS

**The Hauts-de-Seine department is trialling innovative software to forecast road traffic on the ring road around La Défense, Europe's leading business district. The solution is then set to be rolled out elsewhere.**

Every day, around 30,000 drivers use a 4 km artery located west of Paris – officially named the RD993, but commonly known as the La Défense ring road – where traffic jams are a common occurrence. In 2019, the local council for the Hauts-de-Seine department decided to innovate here in order to boost the appeal of Europe's leading business district.

A call for projects was launched in partnership with the Paris La Défense local authority and the Centre for Studies and Expertise on Risks, Environment, Mobility, and Urban and Country Planning (CEREMA). The aim was to design, implement and prove the real-time success of innovative solutions to make traffic smoother and safer – not only around La Défense but also through duplication at any other mobility infrastructure.

The departmental council selected four applications, including the AGIT system for smart traffic analysis and management designed by Citeos Solutions Digitales, a VINCI Energies business unit that focuses on smart

parking solutions. Currently at the trial phase, the model developed by Citeos and its partner Qucit produces highly precise traffic forecasts 15 minutes ahead of time.

**The solution designed by Citeos produces highly precise traffic forecasts 15 minutes ahead of time using machine learning.**

To do so, the solution harnesses machine learning technology connected to the traffic management centre for the interdepartmental public authority (EPI) for the Yvelines and Hauts-de-Seine departments, which uses regional traffic data (speed, flow, journey times, etc.) as well as various external data (schedules, bank holidays, school holidays, the weather and road network data).

## Hybrid forecast models

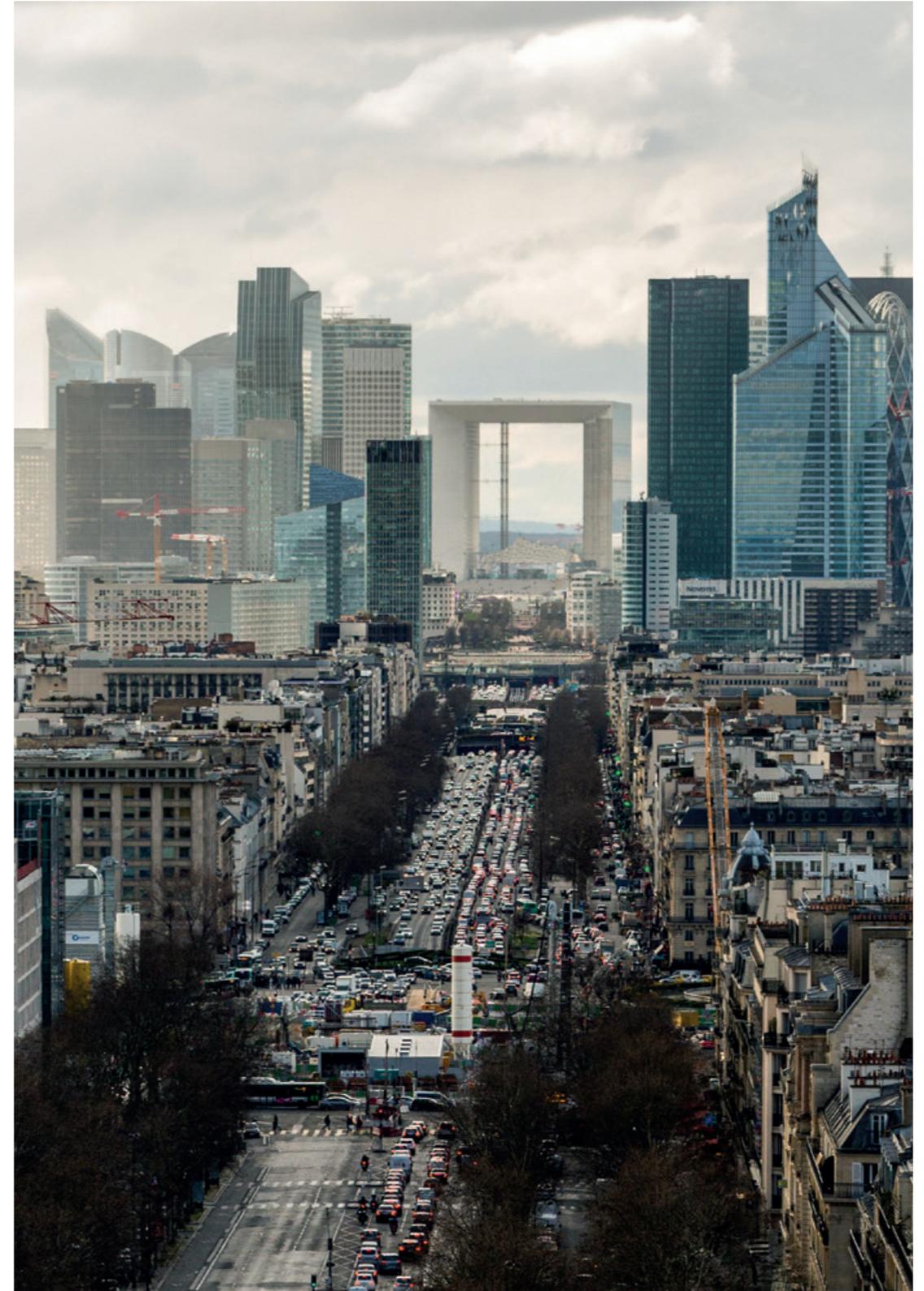
The first attempts to formulate a mathematical theory for road

traffic date back to the 1920s. But even now, a century later, no one scientific theory has managed to truly understand the real factors that influence road traffic. Current forecast models therefore harness a combination of empirical and theoretical techniques.

We know that traffic behaves in a complex and non-linear manner. Due to how individual drivers react, vehicles do not simply interact in accordance with mechanical laws; rather, they tend to form clusters which, depending on their density, produce shock waves of varying sizes.

Project manager at Citeos Solutions Digitales, Alexane Gondel, said, "standard forecasting tools, like statistical analysis based on physically measuring vehicle flows, are still not suitable for precisely analysing dynamic traffic in a dense and complex environment like the Paris La Défense ring road. As far as we know, there is currently no model fully based on machine learning that can be used in real time".

The decision to carry out trials at La Défense is also beneficial in that the solution designed by Citeos can incorporate rapid changes to traffic flows, as well as more long-term trends created by drivers' evolving habits.





For example, the recent lockdowns and subsequent lifting periods in particular have led to drastic changes to existing behaviour.

#### **An open and easily replicable solution**

In addition to analysing traffic and forecasting congestion incidents, the software solution rolled out at La Défense could, over time, offer a wider range of services such as alarm configuration for operators,

decision-making assistance, scenarios for adjusted traffic signal programmes and speed limits, and communication with drivers using variable message signs. Citeos provides clients with software that summarises analyses via an online interface where they can visualise the results of the trials. The aim is to roll out the demonstrator project currently underway at La Défense across the entire department, supporting the regional low carbon mobility strategy. AGIT was therefore

designed with easy replication in mind. "The system can be reproduced in other places and environments for the assessment and regulation of traffic at different types of infrastructure, such as environmentally friendly transport routes. It's also an open solution that can be applied to different forms of mobility. AGIT can therefore provide forecasts for MaaS or cycling route planners, so they can adapt recommendations for users in real time," pointed out Alexane Gondel.

# MAKE A DIFFERENCE WITH VINCI ENERGIES!

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

[solidarity-effect.vinci-energies.com](https://solidarity-effect.vinci-energies.com)



# AN ENVIRONMENTALLY AND SOCIALLY CONSCIOUS NEIGHBOURHOOD

**The “Bon Air Ecoquartier Caribéen” eco-neighbourhood project, for which Getelec Collectivités is to deliver the dry utilities and street lighting, is built around two aims: to take into account environmental concerns and meet social inclusion needs. It will serve as a laboratory for sustainable urban renewal, set in the centre of Martinique’s capital, Fort-de-France.**

The Bon Air project, Martinique’s first eco-neighbourhood in the making, which includes around 500 new housing units in a development offering multiple activities (green spaces, walkways, communal gardens) as well as a dedicated early childhood area, a toy library and cultural centre, seeks to fulfil both a social and an environmental ambition. The aim is to provide rented accommodation for predominantly low and very low-income households while minimising the project’s environmental footprint. The Bon Air mixed use zone project in Fort-de-France involves rebuilding an estate which dates from the mid-1960s and which was made part of a preservation plan in 2005. The three buildings that form the commonhold property (formerly council housing) have not only fallen into a state of serious disrepair but the whole site

is exposed to a known and non-rectifiable seismic risk. It was therefore decided, for the safety of residents, that the buildings would be demolished and that a new mixed-use neighbourhood would be built as part of a sustainable urban renewal initiative. What this means is that the project will have a low-environmental impact and will feature solar PV panels, the buildings will be oriented in such a way as to maximise solar gain and optimise insulation and ventilation, and rain water will be collected and stored, among other things.

## Energy performance and social support

The project’s innovation lies in the combination of two objectives: energy performance and social support. “Of course, the eco-

neighbourhood is about delivering sustainable construction, replanting the immediate environment, reducing energy use – especially carbon-based energy – and promoting self-generated electricity. But the original specifications are based, first and foremost, on providing access to high-quality social housing that supports age diversity and that creates building-integrated activities and services,” says Yannis Baflast, CEO of the Bon Air simplified public limited company, the concession holder of the mixed use zone.

## €50 million over 10 years

The overall project, set to cover a 10-year period, is worth a total

of €50 million. Initial refurbishment works started in the first half of 2021. VINCI Energies business unit

**“This first eco-neighbourhood in Martinique serves as a laboratory for future replications.”**

Getelec Collectivités was selected to carry out the dry utilities and street lighting, including the installation and removal of electrical and telecoms ducting, the installation of transformer

substations, electric vehicle charge points and retractable power bollards, and the deployment of 155 lighting points. The project is to be performed in three phases and programmed over three years. “In its current configuration, the contract involving VINCI Energies Martinique and its business unit Getelec Collectivités is worth €1.5 million. It was important to play a part in the construction of Martinique’s first eco-neighbourhood, which will serve as a laboratory for future replications,” points out David Liénard, director of VINCI Energies Martinique. “What’s more, further packages should be opened up for bidding, particularly the PV aspect and building infrastructure,” he adds.



# MOVE OVER 15-MINUTE CITIES, IT'S TIME FOR THE ONE-MINUTE CITY

**Dan Hill, an urban planner at Swedish innovation agency Vinnova, runs the Street Moves initiative in Sweden. He tells The Agility Effect how he aims to transform cities at hyperlocal level, street by street, making residents co-architects of the change.**



**Why do you support the idea of a one-minute city rather than that of the 15-minute city promoted by Paris for example?**

**Dan Hill.** It's not that I support one idea "rather than" the other: in fact, the 15-minute city comprises several one-minute cities! Just as the city comprises hundreds of 15-minute cities. Based on the premise that all your daily needs can be met within a 15-minute walk or cycle ride, the 15-minute city covers a large area. As such, it doesn't always give you the opportunity to have

a meaningful relationship with your immediate neighbourhood. Yet each neighbourhood has its own specific characteristics.

**So that's where the one-minute city comes in...**

**D.H.** Yes, the one-minute city refers to the space you have that closer relationship with – the one right on your doorstep. There's a risk that the 15-minute city simply becomes a feature of urban planning. To create a truly participatory movement, you need to establish a more immediate relationship and that starts at street level. That's where you can engage with people about what specific spaces can be developed.

**Residents are at the heart of the change ownership process.**

**D.H.** That's right. They can talk to each other, their neighbours

or other street users about what the city means for them and about their role in it. This helps develop a shared approach to managing the environment and a real ownership of the space. Indeed, this form of engagement is key to reinventing our cities and securing the top spot on the "ladder of citizen participation" devised by Sherry R. Arnstein\*. It's then possible to tackle issues like shared gardens or pooled infrastructure for energy, water, waste management, housing, cooperative structures, shops and independent work spaces. We've had enough of top-down

technocratic urban planning!

**Might this type of approach lack coherence from the point of view of an entire neighbourhood or more widely a city?**

**D.H.** Not at all. The real issue is ascertaining what should be coherent and what isn't. There are cities in which some of the basics are ineffective or incoherent. All the engineering (plumbing, wiring, networks, etc.) should be coherent, but that's not a

city's ultimate goal. A city, first and foremost, is about a culture, interactions, communities, shops and so on. Of course, some services like trains, underground systems, buses, payment systems, etc. should be developed coherently on a large scale.

But this isn't difficult, we know how to do it. What's more complicated is having diverse places, cultures and decision-making structures at hyperlocal level and adding all of it together to create something that is greater than the sum of its parts. In other words a city.





ENERGY

TRANSFORMATION

# QUEBEC BASES ITS ENERGY TRANSITION ON MICROGRIDS



**Would you say that's the whole point of the one-minute city?**

**D.H.** Absolutely. The one-minute city approach raises these kinds of questions. A more advanced form of technology – distributed, decentralised, adaptive, modular and straightforward – can help make smaller parts coherent, piecing them together in an agile way. We don't need cumbersome, centralised systems. It's time for a new generation of infrastructure to emerge.

One that is inspired by a "more human" concept and based on cooperative systems and contemporary network practice.

It's a way to achieve recognisably different, fully participatory public places, while at the same time having coherent systems on a larger scale as needed.

**"The one-minute city refers to the space you have that closer relationship with – the one right on your doorstep."**

**What are the Street Moves project's most symbolic achievements to date?**

**D.H.** It's easy to describe a prototype of street transformation that starts locally at single street level and aims to transform all the streets in the country. But moving the project forward and indeed seeing it through is less easy! This type of initiative tends to use

a tactical urbanism approach, which is almost activist in nature! Here in Sweden, Street Moves is supported by the government with the assistance of several local authorities and businesses like Volvo and Voi [shared scooter service]. To give an example, we've shown that school children could reinvent a street, receiving a 70% approval rate from residents to remove parking spaces and replace them with modular and adaptable wooden units that feature sandpits, greenery and social spaces. Getting the government to work in that way is already a step forward. Even if it's a small step, it serves as an example and demonstrates that more is possible. It creates optimism, and that in itself is a great achievement.

\* American consultant Sherry R. Arnstein in 1969 set out 8 levels of participation by citizens in projects that concern them in "A Ladder of Citizen Participation".

**Quebec's first local power grid is now in operation in the small town of Lac-Mégantic. This pilot scheme aimed at decarbonising isolated sites was led by the Canadian federal government and public energy utility with the support of VINCI Energies.**

An electric microgrid designed to meet the needs of Lac-Mégantic, a town home to 6,000 people located at the eastern tip of the Estrie administrative region, has been installed – a first in Quebec. The scheme has been up and running since November 2020,

and what makes it original, in a country that sees more periods of snow than sunny spells, is that it relies among other things on solar power. A microgrid is a local, community-centred electricity network that can operate independently (in "islanded" mode) while remaining connected to the public grid and drawing power from it if necessary. In Lac-Mégantic, just over 1,800 solar panels were mounted on the rooftops of the municipal sports complex and of four other buildings and a multi-purpose structure intended for educational use. In time, the microgrid should

include 2,200 panels, delivering a total installed capacity of 800kW. In the summer, during sunny weather, the equipment should be able to supply almost double the amount of electricity used by the neighbourhood it serves. The initiative is being jointly carried out by the local municipal team and Hydro-Québec, the public utility responsible for the generation and distribution of electricity in Quebec. By cofinancing this initial microgrid in Lac-Mégantic (with a total budget of \$10.2 million), the Canadian federal authorities plan to make it a symbolic part of Quebec's energy transition plan.



### Disaster at the origin of the project

The fact that Lac-Mégantic made this choice is no coincidence. On 6 July 2013, its downtown area was destroyed in one of North America's worst rail disasters. That day, a train loaded with hydrocarbons derailed, killing 47 people and razing around 40 buildings in the explosion. The town wanted to rebuild itself sustainably, breaking free from the fossil fuels that caused the disaster and turning instead to green energy sources. Environmental conversation initiatives have been under way in the municipality for several years, including the introduction of three-way waste collection in 1997, the opening of the International Dark Sky Reserve in 2007 and the promotion of active transportation in 2016. Furthermore, Lac-Mégantic is a well-known tourist site in Quebec, reason enough for Hydro-Québec and the government to launch a pilot project there. "Lac-Mégantic serves as a technology showcase which will help us decarbonise the 22 remote, off-grid systems that Hydro-Québec owns elsewhere in Quebec," said Canada's Minister of Energy and National Resources, Jonatan Julien.

### Community of practitioners

"Thanks to the expertise acquired in Lac Mégantic, the microgrid technologies can be transposed to sites that are currently highly dependent on fossil fuels. The users and owners of the buildings will act as a community of practitioners, getting to grips with the technologies, discussing the issues involved in applying them and deciding on the best behaviours to adopt in terms of energy consumption," confirms Anne Sabatié, vice-president of renewable energies and special

projects at Transelec Common Inc. Leading provider of energy and telecoms infrastructure services in Quebec, this VINCI Energies subsidiary was selected by Hydro-Québec to manage the project. "It's a major job, which we carried out in partnership with Stace for the solar panels and CIMA+ for the engineering. In total, around 50 people worked on the project over a two-year period, plus another 20 or so on site," explains Sabatié.

**"Thanks to the expertise acquired in Lac Mégantic, the technologies can be transposed to sites that are currently highly dependent on fossil fuels."**

In addition to the Stace solar modules, the grid comprises batteries with a capacity of 700kW developed by EVLO, the Hydro-Québec subsidiary specialising in energy storage. When the supply of electricity from the microgrid exceeds neighbourhood demand, surplus power will be stored in these batteries. It can then either be used during cloudy periods and after sunset or fed back into Hydro-Québec's main grid. Energy consumption in buildings and electricity generation will be managed by a centralised control system which also ensures the transition between connected mode and islanded mode.

# GERMANY SOON TO BE SELF-SUFFICIENT IN GREEN HYDROGEN

**A floating photovoltaic system located in a lake in North Rhine-Westphalia is set to generate green electricity and hydrogen. The challenge is to ensure all the system components communicate with each other in real time and maximise self-consumption of the energy generated on site.**

By 2023, Hüdderath gravel pit in North Rhine-Westphalia (western Germany) will house a floating photovoltaic system spanning a surface area of 9 hectares. The project, which is advantageous in that it does not take up valuable agricultural land, is based on a closed system covering aspects from electricity generation to the regional marketing of green hydrogen. Some of the electricity produced on site will be used to operate the gravel plant, which has set itself the target of achieving carbon neutrality, and some will be converted into green hydrogen by means of electrolysis. The energy generated will be stored and made available to other local businesses such as food wholesaler Chefs Culinar which has shown interest in the project with a view to eventually powering its truck fleet using hydrogen.

## From design to implementation

Named "WasserstoffImpuls Niederrhein" (WIN), this ambitious

programme is being led by three companies from the Bas-Rhin department in eastern France: the Teunesen group, an expert in sand and gravel extraction; Omexom Smart Technologies, a VINCI Energies business unit specialising in complex production and control processes for alternative energies, water, the food industry and bulk products; and Wystrach, a systems supplier for the whole supply chain of electrolysis-based hydrogen. Omexom is operating as technical integrator for the project, which involves a total investment of around €11 million. "Not only are we active in the fields of communication, network technology and system control, but we also provide support from design at the early stages of the project through to implementation (advice on system components, choice of suppliers, definition of interfaces with the industrial site, etc.)," explains Thomas Willems, manager at Omexom Smart Technologies in Uedem, Germany.

## Wider application of the concept

While the technology has been tried and tested – specifically the interconnection of the photovoltaic systems, electrolyzers and storage capacity – the challenge for Omexom and its partners is to maximise self-consumption of the electricity generated on site and the degree of self-sufficiency. "To achieve this, all of the system components must constantly communicate with each other in real time and must be able to react accordingly to changes, especially

those relating to the electricity generated by the PV installation. So the challenge will be to get the best results out of each individual system in accordance with the overall concept," stresses Timon Mund, IoT & Smart Grid project manager at Omexom Smart Technologies. This innovative process involves a research component, in which scientific partners such as the Duisburg hydrogen and fuel cell centre (Zentrum für BrennstoffzellenTechnik) and Osnabrück University of Applied Sciences are participating. The ultimate goal is to make

the concept available on other sites. "The project should serve as a benchmark for the whole region and industry. With a few adjustments, the system could be applied more widely," points out Thomas Willems. "The renewable energy source does not necessarily need to be a floating photovoltaic system." "Wind and solar farms for example, which over time will stop receiving subsidies under Germany's renewable energy act (EEG), will need to find solutions if they are to avoid being dismantled," adds the Omexom Smart Technologies manager. Producing green hydrogen could be an advantageous solution for them.



# "ALGORITHMS ARE NEITHER GOOD NOR BAD, THEY'RE WHAT WE MAKE THEM"

**Entrepreneur Aurélie Jean, who holds a PhD in science, specialises in artificial intelligence and algorithms – a subject she covers in her latest essay *Les Algorithmes font-ils la Loi ?* ("Are algorithms calling the shots?" published by Editions de l'Observatoire in October 2021). She believes that data and AI are a major step in organisational digital transformation.**

## Why are we scared of algorithms?

**Aurélié Jean.** Faced with the unknown, we can develop several possible reactions, including fantasy and fear. Algorithms trigger fear for a number of reasons. Firstly because they are both intangible and everywhere at the same time; we interact on a daily basis with these mathematical and digital concepts, sometimes without even realising. They play a part in important decisions in our lives,



for example in disease diagnosis, credit line assignment (in the US) or choice of a romantic partner. Over the past few years, we've seen several algorithm scandals relating to gender or racial discrimination. When misconstrued in the media, by politicians or in discussions with friends, all of these things can further mystify algorithmics to the extent that the discipline is rejected, with deep-seated fear building up around it. But as I often say, algorithms are not a black-and-white issue. They are neither good nor bad, they are what we make them. We need to remember that behind each algorithm is a human being.

## How can they help accelerate digital transformation and/or the energy transition in businesses?

**A.J.** A few years ago, digital transformation enabled businesses to reach their clients or consumers. Today, algorithms help businesses understand their clients thanks to data collection and analysis. The arrival of data and algorithmics is just as important as digital transformation, and in some ways accelerates transformation as without digital technology there can be no algorithmic calculations. As far as the energy transition is concerned, algorithms can help measure water or energy consumption in goods production and transport in near real time. You can only develop that which you can evaluate over time. And data and algorithms are a smart way of doing that.

## We are not seeing an increase in numbers of women in tech jobs and engineering. What can be done to change that?

**A.J.** Things are changing, but you're right numbers aren't really going up. Action needs to be taken on various

levels. At school (from preschool onwards), we need to develop an analytical mindset in children and in students so that they become problem solvers. At home, we need to encourage girls differently to boys in science and engineering. And in society, we need to get rid of all the prejudices and stereotypes about women in these sectors. We also need to talk to men in these communities – they're the greatest allies for us women scientists and engineers! We're going in the right direction but we have to speed up the process by having an honest conversation. When I speak to girls studying in their last years at school and at university, I tell them that by choosing scientific and engineering disciplines, they'll be intellectually stimulated all their life. They'll solve large-scale problems with far-reaching influence on society and they'll earn a good living. Intellectual and financial independence: a winning combination!

## What will the next technological breakthroughs be? In which sectors is innovation accelerating the most?

**A.J.** That's hard to say. As the Metaverse develops, there are bound to be technological breakthroughs in computer vision. I'm a firm believer in advances in sectors like medicine, where algorithms are paving the way for a different paradigm. By that I mean predicting disease risk, and personalising, refining medicine. Great things can be done in this area.

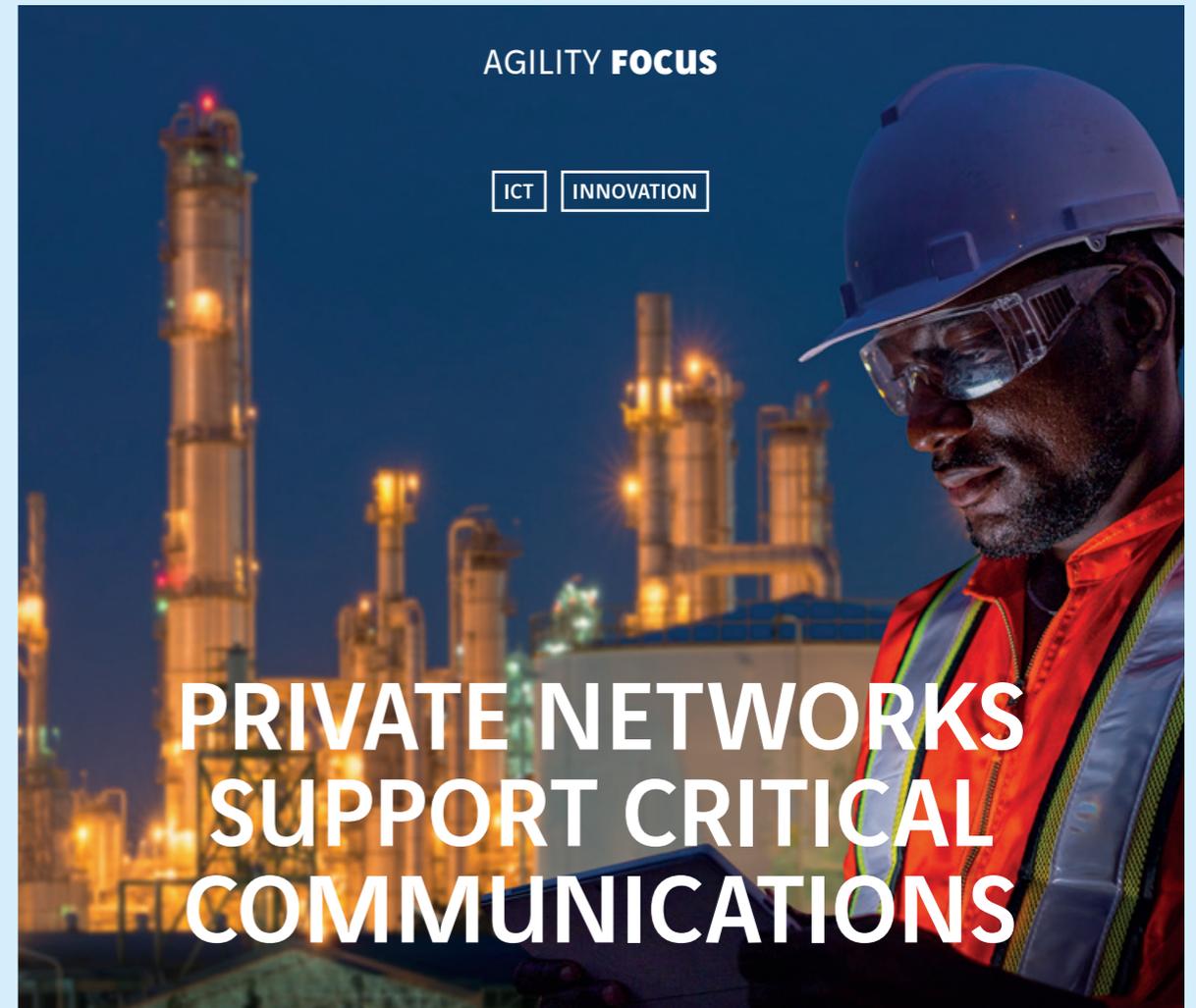
## Who or what inspires you?

**A.J.** I still find Steve Jobs really inspiring 11 years after his death. His creativity and genius were extraordinary. Professor Richard Feynman, whom I regularly quote

in my books, and his brilliant teaching technique and infectious passion also inspire me. In terms of technology, I can't not mention internet communication, which enables me to speak to my friends and family on both sides of the Atlantic whenever I like and without any effort. In 2004, when I went to the US for the first time, Skype was in its infancy and I was still using phone cards to call my grandparents. It might sound naive, but that changed my life.



Energy transition,  
digital transformation, more on  
[theagilityeffect.com](http://theagilityeffect.com)



AGILITY FOCUS

ICT INNOVATION

# PRIVATE NETWORKS SUPPORT CRITICAL COMMUNICATIONS

In January 2022, the French and German governments announced joint support for private 5G network projects in sectors such as manufacturing and healthcare. The two countries have pledged €17.7 million in support of four cross-border collaborative projects to demonstrate the benefits of 5G technology in specific private-network use cases.

France's Minister of the Economy Bruno Le Maire says that "building a Franco-German sovereign ecosystem for 5G and future telecom network technology will play a key role in placing Europe at the forefront of innovation in these fields," while his German counterpart Robert Habeck spoke of "a big step forward in terms of digital sovereignty for 5G."

This cross-border initiative forms part of a wider movement currently underway in France and across the rest of the globe. Manufacturers, local authorities and governments are showing greater levels of interest in 4G and 5G private mobile radio (PMR) networks, as they need to ensure their critical communications are secure. Here is an overview.

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## AGILITY FOCUS

ICT INNOVATION

# PMN: NEW STANDARDS, IMPROVED PERFORMANCE

**Private Mobile Networks (PMN) have long been reserved for voice communications, but they are currently experiencing rapid expansion with 4G and shortly 5G. Indeed, they can now be used to send complex data, a feature that is attracting growing interest from industry, utilities, transportation, government and local authorities.**

Attacks, natural disasters, accidents and police interventions are all events that require a communications system that is operational and resilient everywhere and at all times. This is where Private Mobile Network-based critical communication systems, with 24/7 availability, come into play.

These systems started off as analogue before turning digital

with the introduction of TETRA (Terrestrial Trunked Radio) standards in the 1990s then the DMR (Digital Mobile Radio) standard in 2005. Thanks to 4G/LTE (Long Term Evolution) technology, they now serve new use cases for professional organisations.

**“The market has a huge potential, even more with the arrival of 5G.”**

“The critical communications market is booming. In the last one or two years, we’ve been seeing a transformation in applications

supported by LTE technology, in other words 4G and soon 5G, incorporating data as well as voice,” explains Fouad El Mernissi, international business development manager at Axians, the VINCI Energies specialist ICT brand. Baggage handlers, ramp agents and turnaround coordinators working on the apron at airports, for example, will in time be equipped with smartphones, enabling them to continue communicating in the same way as with their current TETRA devices (using a Mission-Critical Push-To-Talk application) and also to stream high-definition video to the airport’s air traffic control centre.

### The frequency prerequisite

The first installation projects of private 4G networks are fairly recent. A prerequisite for any installation is the allocation of private frequencies by regulation

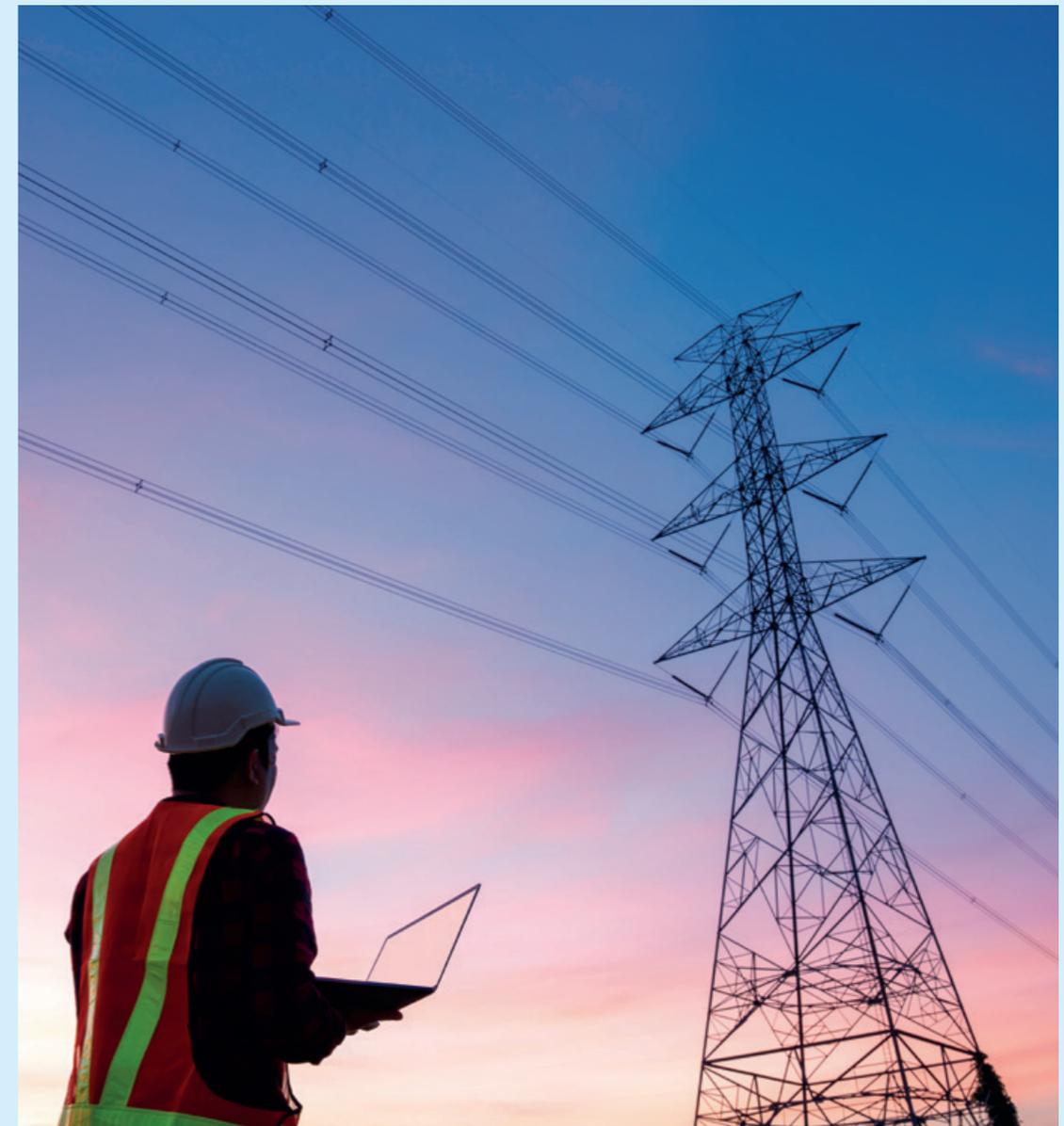
authorities. In this respect, the situation is quite heterogeneous across Europe for the moment. In France, the French telecommunications regulatory authority (ARCEP) has reserved 40MHz on the 2.6GHz frequency band for private networks. The Netherlands and Germany have also set aside spectrum, but Portugal, Belgium and Sweden have yet to do so.

Mobile operators with spectrum are also committed to delivering services for professionals on the basis of their national mobile networks. With the arrival of 5G, operators firmly intend to position themselves in the market by offering solutions to professional organisations. “The market has huge potential, all the more so with 5G, which is not profitable for operators

in the consumer segment alone. In fact, 5G will also have a bearing on B2B,” says the Axians business development manager.

### Dedicated networks for improved reliability and availability

Since they are dedicated to the professional organisation





that deploys them, Private Mobile Networks deliver high quality of service in a reliable, continuous and secure way. They consequently offer an optimum alternative to mobile operator networks which can face capacity problems and can even be overwhelmed by a surge in calls during exceptional events like natural disasters and attacks. Private Mobile Networks are also designed to meet specific coverage needs, for example in industrial facilities. This contrasts with mobile network coverage which can be inadequate in certain strategic areas on site.

#### Axians takes proactive approach to growing market

A systems integrator with a strong R&D culture, Axians operates in this market which is undergoing rapid technological change. The VINCI Energies group in 2019 acquired two companies positioned in this segment: Sysoco in France (rebranded Axians Réseaux Mobiles Privés) and Koning & Hartman in the Netherlands. "Axians has long-standing expertise in integrating

and managing Private Mobile Networks. We're ready to support the technological leap towards private 4G and subsequently 5G networks, which is already under way," adds Fouad El Mernissi, for whom next-generation Private Mobile Networks are delineating the scope of the public and Industry 4.0-oriented high-speed critical communications networks of tomorrow.

## AGILITY FOCUS

ICT INNOVATION

# SAFER SCHOOLS WITH VIGIALERT

**Integrated at the deployment stage of a private mobile network, this easy-to-use technological solution developed by Axians is designed to meet the need to secure public access buildings against hostile intruders.**

The attacks that took place in Paris on 13 November 2015 led the French public authorities to review the "Plans Particuliers de Mise en Sécurité" (PPMS), specific plans for safeguarding the population, particularly in schools. The circular of 25 November 2015 set the framework for the security measures to be put in place in educational establishments. The primary objective of these instructions is to ensure pupil safety in case of threats and to raise an alert as quickly and securely as possible. The circular states that it is the responsibility of schools to implement the required equipment, a process that is gradually being put into practice by local authorities managing nursery and primary schools.

What schools need is a fast, simple and reliable connection between any part of the building and the police station, which will receive urgent notification of an intentional threat against children and their teachers.

Technically speaking, part of the answer to this need lies in Private Mobile Networks (PMN). These have the advantage of being independent from operator networks like Orange or Bouygues, which can be jammed or neutralised by attackers. Connected to a Private Mobile Network, the VigiAlert technological solution is specifically designed by the VINCI Energies ICT brand Axians to meet the PPMS safeguarding specifications for school communities.

#### From Toulon to Belfort

This is an issue that several municipalities in the Var department in south-eastern France, among others, have been working on. The Toulon urban area authority was keen to build on the Private Mobile

Network already in place for the municipal police and public transportation in order to establish links with schools. To do this, the business unit that deployed the network, Axians Réseaux Mobiles Privés, devised an innovative alert solution. It was initially tested by means of a proof of concept, which convinced the elected officials. Developed under the name VigiAlert, the solution is currently rolled out across half of the municipalities in the Toulon area, as well as Belfort town hall and schools in several other towns including Périgueux, Hyères, Villard de Lans and Saint-Mandrier. The system comprises a series of boxes installed in classrooms, featuring a button to trigger an alert in the event of intrusion or malicious acts. The fixed components also include a remote control, making it possible to raise the alert from anywhere in the school. Each of the boxes is linked to a central cabinet mounted in the school, which transmits the alert to loud speakers throughout the premises and

simultaneously sends an emergency signal to the municipal police station.

### Two secure networks

The solution delivers fully secure transmission links. Its various components are connected, within the school, by a short-range local area radio network similar in style to LoRa (operating in the 800MHz frequency band). All the school's systems interact with each other within this "tactical radio bubble". A second type of network is implemented using a long-range radio link like DMR or TETRA between the school's transmission cabinet and the police station. "The benefit of this end-to-end wireless solution is that it keeps works in schools to a minimum and provides a means to bring the alert function right into classrooms locked from the inside," stresses Christophe Blanc, VigiAlert expert at Axians Réseaux Mobiles Privés. The combination of these two technically secure and reliable radio technologies along with the frequencies used, ensure the robustness of a solution that is designed to operate in a very specific way. The system must be easy to use, without any need for detailed training or instructions since teaching staff change from one year to the next and are not experts.

### Customised maintenance

In order to take account of this context and ensure the solution is fail-proof, VigiAlert includes a system of customised maintenance. It performs self-diagnosis to identify technical problems, then notifies the relevant department of them. Automatic cyclical monitoring of all the points also forms part of the solution. "And if no status report is provided," adds

Blanc, "a technical fault alert gets triggered." Similarly, VigiAlert offers an emergency power system in the event of a hostage-taking scenario involving a power cut. Back-up batteries and cells ensure continuity of the alert system.

**"The benefit of this end-to-end wireless solution is that it keeps works in schools to a minimum and provides a means to bring the alert function right into classrooms locked from the inside."**

Schools are the main establishments to fall within the scope of VigiAlert, but they are by no means the only ones. The intruder alert system is potentially of interest to all public access buildings, for example museums, libraries and municipal services like register offices. Toulon is a forerunner in the field since the administrative buildings in the area are set to be equipped with the VigiAlert solution.



# A KEY ASSET FOR PUBLIC SAFETY

**Public institutions like the police, the fire service, civil defence and the army need robust, secure communications networks. To deliver this, the French public authorities have set in motion a proactive modernisation plan.**

The way in which public services (police, gendarmerie, fire, ambulance, etc.) communicate in the field is evolving, as is the array of equipment and accessories available to them in their day-to-day operations. Existing communications infrastructure (including INPT and RUBIS in France, Astrid in Belgium, BOSNet in Germany and Airwave in the UK) is designed primarily for voice services, a critical requirement but increasingly inadequate. "Until now, with Private Mobile Networks, the main 'data' to be exchanged has been voice. But circumstances have changed and there is now a need to share actual data.

Over the last few years, we've seen people looking to migrate to private or dedicated 4G/5G networks in order to ensure fully secure mission-critical communications and limit the risk of interception," explains Nicolas Le Jean, project manager at Axians Ingénierie Radio Île-de-France.

## Increasing the pace of modernisation

Operations carried out as a result of recent terrorist acts have made the various public security services aware of the importance of speeding up the pace of network modernisation. After the 2015 attacks in Paris, the French Ministry of the Interior launched an initiative at the end of 2016 to address the issue. Its "Réseau Radio du Futur" or "RRF" (radio network of the future) will be based on 4G/5G network performance. The first step in the new network was initiated with PCSTORM (which stands for converged platform for resilient

and mobile operational broadband services), a programme aimed at ensuring the transition from field communications to 4G and increasing bandwidth to facilitate the use of applications such as real-time video. As an integrator of telecoms solutions, Axians is involved in the project. Its role is to establish all of the operational and integration testing for the new equipment. The VINCI Energies ICT brand is working, in particular, with French Special Forces units like RAID, BRI and GIGN to complete field tests on the new systems, referred to as "tactical bubbles".

"What we're talking about is a large battery-powered backpack containing a compact antenna, an autonomous core network, capable of creating an ad-hoc 4G radio network," states Le Jean. These tactical bubbles provide response units with access to a fully independent, secure 4G network that can be used at all times and in all places, including areas without existing coverage.

Axians is also training elite police officers and gendarmes in the use of this new equipment.

## Hybrid network

In order to keep to the ambitious network upgrade timetable (the first operational phase is scheduled for the 2024 Olympic Games) while taking account of economic considerations, the Ministry of the Interior opted for a hybrid model.

"The network uses both the national coverage provided by multiple commercial 4G/5G mobile networks, a dedicated and secured

packet core, and high-resilience solutions involving tactical bubbles.

## Elite police units in France like RAID, BRI and GIGN now have special equipment at their disposal during operations.

Work is carried out in close cooperation with commercial

mobile operators so that they can implement functionalities and services for the police, thus ensuring high levels of security and availability for their mission-critical communications," points out Nicolas Le Jean.

Network modernisation programmes are also under way in most European Union countries (Emergency Services Network in the UK, Blue Light Mobile in Belgium, etc.), which will help harmonise communications systems between the public security forces of neighbouring countries.



# MOVING TOWARDS INDUSTRY 4.0

**Superfast Private Mobile Networks are as yet little used in industry. But private 4G/5G technology, which supports voice, data, photo and video transfer, can considerably facilitate and improve the reliability of operations on sites and in factories.**

The final assembly line for Airbus A380 (whose production has been discontinued) at the Toulouse-Blagnac site covers 200 hectares, including 200,000m<sup>2</sup> of halls, more than 20 hectares of outdoor areas and offices. To the south-east of Lyon, the 1,000-hectare Chesnes business park is the biggest logistics platform in France and one of the largest in Europe.

Like these industrial and logistics sites, large-scale facilities can use Private Mobile Networks (PMN) to optimise communications through new technologies such as 4G/LTE (Long Term Evolution) and, in the near future, 5G, which enable voice, data, photo and video content to be sent and received securely.

"You need a lot of Wi-Fi hotspots to cover areas of several square kilometres. With a few private 4G/5G base stations, you can equip the whole site and achieve much greater reliability," says Arthur Rabaté, manager of private 4G/5G services at Axians RMP.

Especially since existing wireless networks are not really suited to the critical nature of communications at some sensitive sites. Manufacturers need to protect themselves from espionage, as it's relatively easy

to intercept cellular or Wi-Fi communications for example by using IMSI-catchers, devices that simulate a fake cell tower by acting as the "man-in-the-middle" between the mobile operator network and the equipment being monitored.

**Private 4G/5G mobile networks improve connectivity on large industrial sites.**

This vulnerability doesn't exist with superfast Private Mobile Networks, which offer significantly higher levels of security than conventional networks, for instance by preventing devices from connecting to older networks. What's more, these private networks are not connected to the internet, unlike telecoms operator networks, which stops potential malicious hackers from intercepting traffic.

### Robots controlled by 5G

"In a refinery, private mobile radio networks are used to coordinate communications between control room staff and engineers carrying out tasks, like opening or closing a valve. Thanks to superfast technology, a real-time image can be added to voice, giving the control room a better understanding of the situation. These Private Mobile Networks also help protect lone workers thanks to tilt sensors and accelerometers which send a distress call if an abnormal situation is detected in an employee, like a fall," explains Yann Bertrand, business developer at Axians. PMNs also use geolocation services, with indoor and outdoor capabilities, to identify where to send emergency services in the event of an incident. Private 4G/5G, with its fast speeds and low latency, supports the creation of real-time videos. "You can film the scene of an accident, which helps emergency teams to better prepare their response," points out Arthur Rabaté. Moreover, private 4G/5G offers more seamless and effective remote support. Engineers wearing connected headsets can be

guided remotely as they perform tasks anywhere in the factory, or can instantly access useful data via an augmented reality app. AGV (Automatic Guided Vehicle) robots, used in logistics facilities and previously wire-guided, are gradually becoming autonomous. So-called Automotive Mobile Robots (AMRs) can be equipped with a robotic arm and controlled remotely. "With 5G, it will ultimately be possible to export all of the robot's intelligence to a centralised system in the factory so as to coordinate its actions more effectively," sums up Rabaté.

### Technology with high growth potential

"This means you can cover the whole site, both inside and out. By adding an arm to the robot, you facilitate goods loading and

unloading operations, physically demanding jobs that were previously performed by humans," adds Frédéric Boulvert, innovation commercial manager at Actemium Rennes. The arrival of 5G will be beneficial in managing diverse fleets of robots of different brands. The port of Rotterdam, one of the largest in the world, uses a private 4G network installed by Axians Netherlands instead of Wi-Fi to manage its fleet of AGVs. This has significantly improved reliability, which in turn has led to productivity gains since AGV movement is not hampered by a loss of radio communication. Ubiquitous connectivity on site helps drive efficiency among port employees. In France, where a dedicated frequency band has been allocated for PMN, very few industrial sites have so far adopted these new Private Mobile Networks even

though the potential for use is considerable. "The technology is as yet little known and manufacturers still view 4G and 5G through the lens of mobile operator offerings," reckons Frédéric Boulvert.

The situation should change in the coming months as private 4G/5G networks are rolled out for the first time in the industrial sector. In Germany, substantial ranges of radio frequencies have been set aside in the 3.5GHz and 26GHz bands for private 5G mobile networks in order to support the development of Industry 4.0. Axians provides a private 5G platform to test industrial use cases with its clients at "Digitalschmiede" in Frankfurt, VINCI Energies' digital innovation centre in Germany, which brings together Axians, Actemium and Omexom areas of expertise.



# FACILITATING MORE SEAMLESS, SECURE AND RELIABLE COMMUNICATION IN HOSPITALS

## Hospitals and healthcare facilities in general use Private Mobile Networks (PMN) to facilitate communication between professionals and ensure greater security for enhanced patient care.

The Covid-19 pandemic has highlighted the importance of efficient healthcare systems. Cyberattacks on establishments in France and elsewhere in Europe exposed weak spots in IT systems, many of which were old and obsolete. Private Mobile Networks (PMN) can enhance and ensure greater security for communication within hospitals.

"There are different PMN solutions possible like analogue radio networks, digital mobile radio (DMR) and Terrestrial Trunked Radio (TETRA) technology, which is primarily used by police forces and other public safety agencies.

They are mainly used for voice communication. Data is transferred via Long-Term Evolution (4G/LTE) networks or 5G," said Otto van den Wijngaard, Manager Business Development & Innovation at Axians NL.

These networks are capable of transferring all types of voice, text, image and video data including mission and critical applications, such as sensing & Push-to-Talk (PTT)," added Otto van den Wijngaard.

### Keeping systems for professionals and visitors separate

Push-to-Talk is a method of having conversations over a data network like mobile operators, private mobile network or Wi-Fi Caregivers can also create separate user groups specifically for doctors, nurses, nursing assistants, etc.

"One of our clients uses a private LTE (4G) network to keep professional communication separate from hospital visitors. Visitors are directed to the Wi-Fi network and professionals to the private LTE network to ensure none of the data mixes," explained the Manager Business Development & Innovation at Axians NL.

Doctors and other caregivers who use the LTE network have their own SIM card in their smartphone or tablet, which is what controls who uses the network and keeps the data streams separate to prevent data breaches. Furthermore, the LTE network guarantees 99.99% availability, which means the likelihood of downtime is practically nil – quite a contrast to networks managed by telecom operators, which are regularly affected by incidents and downtime. "It guarantees the connection and

availability these establishments need, particularly during operations," said Otto van den Wijngaard.

### Waiting on 5G

To top it all off, these private networks are stand alone systems, which means they are better secured for viruses or malware – threats that can cost healthcare establishments financially and put people's lives at risk. The auction for 5G frequencies in the Netherlands is due to take place this year. This technology should further enhance the services

provided by PMN. "Hospitals are evolving at a rapid pace. They need greater flexibility when it comes to

**"Hospitals are evolving at a rapid pace. They need greater flexibility."**

making changes such as moving medical equipment between rooms or quickly opening up emergency

care facilities. Cable-free, high-speed 5G networks can accelerate and facilitate these changes," said Otto van den Wijngaard. This is particularly true considering these networks are more secure than those that interfered with medical equipment 10 years ago. The Business Development & Innovation Manager at Axians NL concluded by saying that "once 5G coverage is available, these networks will be able to connect to apps – including artificial intelligence-based ones – in real time, which will require a reliable, stable connection that offers very low latency times and high speeds."



# SOON TO TOP THE BILL AT FESTIVALS

**Equipped with LTE technology, Private Mobile Networks (PMN) are an effective alternative to Wi-Fi and the public 4G services offered by mobile operators at major cultural festivals. The tests that have been conducted so far are promising.**

The Vieilles Charrues festival didn't take place this year due to coronavirus. But the small 7,000-strong town of Carhaix in Brittany normally sees an influx of around 300,000 music fans on the third weekend in July for four days of open-air concerts. This also means an influx of nearly as many smartphones, making it a logistical headache to ensure phone coverage. In order to enable spectators to use their smartphones and more importantly staff and public security services (Civil Defence, fire brigade, etc.) to communicate in the event of an incident, Wi-Fi networks need to be installed. However, these are not fully reliable, especially in terms of voice services. And neither are mobile operator-run public 4G networks. Interference and congestion can complicate communications, something

that can prove detrimental in an emergency. The arrival of private 4G LTE networks, a technology which facilitates data and voice communications, is perhaps changing the equation. "At big events of this kind, operator networks get bogged down by the heavy use of smartphones

*Private 4G/LTE networks are easier to deploy than Wi-Fi, which involves installing multiple hotspots, and offer new uses thanks to their reliability.*

by spectators, particularly in rural areas. This can disrupt confidential and critical communications. At the Vieilles Charrues festival, for example, we set up a private

4G network enabling the organisers to communicate with each other and maintain a reliable link with the Prefecture\*," explains Arthur Rabaté, who is in charge of developing private 4G services at Axians Réseaux Mobiles Privés. Specialist VINCI Energies ICT brand Axians also tested a secure push-to-talk communication channel, based on special terminals, during the 2019 festival. Private 4G/LTE networks are easier to deploy than Wi-Fi, which involves installing multiple hotspots. Three eNodeB base stations, serving as a gateway between the mobile terminals, radio antennas and core network, are enough to cover very big sites. Axians supplies SIM cards for the private network which provide encryption and work with the most recent smartphones.

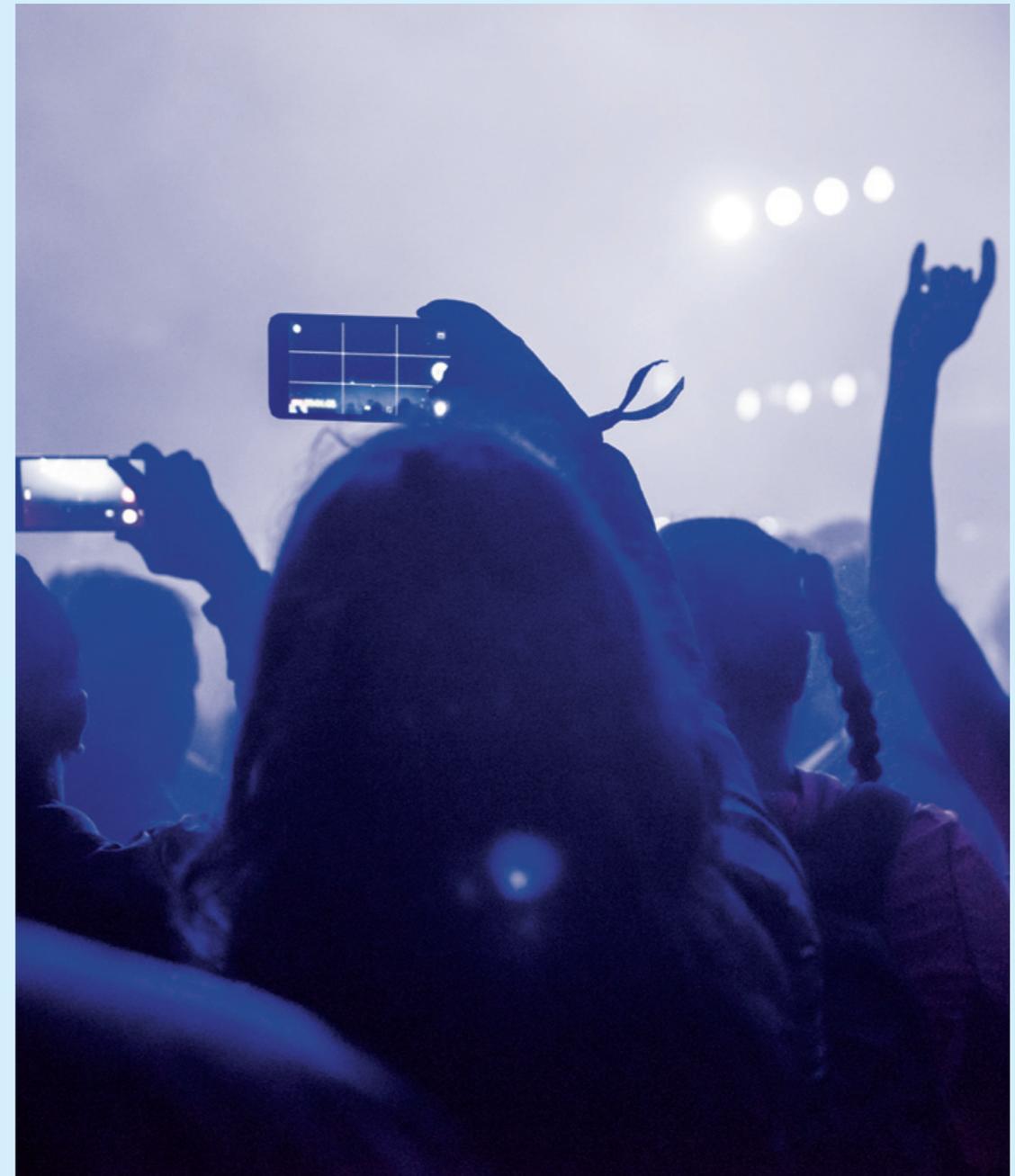
## Tests and partnerships

Private Mobile Networks for events remain at the test stage for the time being. Under current legislation, frequencies cannot be obtained for this type of short-lived event. "We're essentially carrying out tests, so the service can't be marketed yet. So far, we've forged

partnerships," says Rabaté, who has volunteered at the Vieilles Charrues festival for several years. It was thanks to this connection that he was able to propose that the organisers test out these private 4G/LTE networks. The technology may also be of interest to companies

like Weezevent, which offers ticketing and cashless payment solutions. While the cultural events market still represents a niche for high-speed PMN networks, it could rapidly expand in a country that hosts several thousand such events each year, including a dozen or

so large-scale gatherings. But this will depend on frequencies becoming more accessible in terms of cost, since the price tag is currently prohibitive for organisers of cultural festivals, who often struggle to balance the books.



# REVERSIBLE BUILDING DESIGN, AN AGILE RESPONSE TO CLIMATE CHALLENGES?

**Property developers have started developing a small number of reversible buildings. However, if production is to be scaled up, there are technical, financial and regulatory obstacles that need to be overcome.**

During the 2024 Paris Olympic Games, some 6,000 athletes will be housed in the "Universeine" development which forms part of the Olympic Village. Not only will the four buildings be constructed with a timber and ultra-low concrete structure or façade for environmental performance, the project will also implement reversible building design at scale. What this means is that at the end of the Games, the buildings will be transformed into a new mixed-used neighbourhood, featuring 64,000m<sup>2</sup> of housing, 57,000m<sup>2</sup> of offices and 4,000m<sup>2</sup> of shops. "This will be a first in the history of athletes' villages," says Vincent Louvot, deputy director of the commercial property department at VINCI Immobilier, the developer for the project. He points out that the main innovation of this reversible design

project is the Maxwell Hall which will be repurposed as offices after the event.

"Right from the outset, the structure was designed as an office building. We realised that the technical barriers could be overcome by building large floor areas which we partitioned into bedrooms on the façade side, with the plumbing and bathroom system in the middle," explains Louvot. The initiative anticipates the provisions of the Climate and resilience bill, passed in France by the National Assembly in May 2021, which requires that a "study into the potential for reversibility and future alteration" be carried out for

some buildings submitting a planning application from 1 January 2023.

## Constraints and solutions

However, Vincent Louvot recognises that the "Universeine" model used for the Olympic Games in the Saint-Denis district is mainly replicable for use cases based more on student housing or hotels than on family apartments. "A real reversible building, serving an initial use case for a certain duration then another in the long term, involves meeting more complex technical challenges," he stresses.

For example, reconciling various standard ceiling heights (3.6m for offices, 2.7m for housing units), providing balconies for each apartment when office buildings tend to focus more on large collective terraces, reconvertng the generous lobbies of commercial buildings into the more private entrance areas found in residential buildings, and adapting the number of fire escapes – another feature that tends to differ according to the intended use of the building. Solutions do exist though. Such as installing external galleries in an office building which will then become balconies when the structure is converted into





# GLOBAL PERFORMANCE CONTRACTS, A NEW TOOL FOR DRIVING ENERGY EFFICIENCY

By combining design-build with operation-maintenance services, global performance contracts involve meeting real energy performance commitments at every stage of a property project.

housing. Or using innovations such as the Habitat Colonne product from VINCI Construction which, thanks to a system of posts and slabs without beamdrop, provides large, open floor areas in which partitions can easily be installed or removed. The non-load-bearing façades made from timber or masonry with external wall insulation allow for all types of facing. This technique forms part of VINCI Construction's Conjugo concept aimed at constructing office buildings that can be turned into housing units or vice versa.

## Reversibility or flexibility?

Just as technical barriers can be overcome, so too can legal and regulatory constraints be met... in time. "The creation of a dual-status building permit, which brings together the two successive statuses of a future structure in a single planning permission process, is a step in the right direction. But for the time being it is still experimental in the context of

the Olympic Games," states Cécile Lamon, strategy and business development director at ADIM (VINCI Construction's property development subsidiary).

**"Use patterns are increasingly hybrid in nature and change all the time. These changes will not necessarily have been anticipated by a predefined reversibility system."**

Lamon also draws attention to the recent introduction of "VEFI" (vente en état futur d'inachèvement), a form of off-plan purchase contract that offers greater flexibility with regard to

the end purpose of certain spaces. Similarly, the new provisions of the "ESSOC" law (a French law for a state at the service of a trust-based society) allow for exemptions from fire safety and accessibility rules, provided similar results are achieved.

"Even in terms of the promotion of these reversible design buildings, a key aspect, things seem to be changing a little with the arrival of investors interested in the concept," points out Lamon, who notes however that the only way to truly change the equation is through new restrictions on the carbon cost of buildings. She believes it's more about "finding the right level of flexibility" than about reversibility. "Use patterns are increasingly hybrid in nature and change all the time," she says. "So it's best to make interim choices early on in the process that enable you to adapt to changes that a predefined reversibility system would not necessarily have anticipated."

Provided for in article 34 of order number 2015-899 of 23 July 2015 on public procurement contracts, France's "marché global de performance" (MGP), a global performance contract, follows on from the design-build-operate-maintain (DBOM) and build-operate-maintain contracts previously covered by the French Public Procurement Code.

The energy version of the contract, known as MGPE in France for "marché global de performance énergétique", is as yet little used. However, this kind of integrated contract could become a key component in building refurbishment. It's an innovative contractual tool that can help support the energy transition of a sector responsible for a large share of greenhouse gas emissions. The "tertiary decree" (decree number 2019-771 of 23 July 2019), applicable since 2019, obliges businesses operating commercial buildings with a surface area equal to or greater than 1,000 sq m to undertake the necessary works to contribute towards an overall target of 60% reduction in consumption by 2050. The challenge is all the more ambitious since, for owners and

operators, energy renovation is not profitable – at least not within a 15 to 20-year time frame – and grants in the commercial sector have largely been absent.

"To meet the target set out in the decree, the volume of refurbishment projects, which currently account annually for less than 2% of the total, needs to be multiplied by a factor of 2.5. Furthermore, targeting operation systems alone will not be enough. We also need to work on building packages, such as façades, insulation, roofing and external woodwork," explains Aymeric Tissandier, who in May 2021 became the head of a new global performance contract department within the VINCI Facilities North-West France and Greater Paris division.

## Formalising energy commitments throughout the project

Linking design-build services with operation services is precisely what this type of integrated contract aims to do. In the property sector, the contractual division of services, whether chronological (project

management, then works contract, then maintenance) or functional (split by works package), inevitably leads to a blurring of responsibilities that makes it difficult to monitor commitments and indeed penalties for non-compliance.

"These integrated contracts will properly formalise energy commitments throughout the value chain from the project planning stage to maintenance, and from building works to networks and systems," adds Tissandier. Services are awarded conventionally in the form of a competitive dialogue procedure aimed at tailoring the project to the owner's needs. The only prerequisite for the implementation of such a contract is that quantified and measurable performance objectives are included. These will serve, among other things, as a remuneration benchmark for service providers. "The energy version of the global performance contract is still in its infancy but we have no doubt that the benefits it offers in terms of property-related energy transformation will ultimately make it indispensable not just for public buildings but for the whole property sector," comments Tissandier.

# COOPERATION BETWEEN MANUFACTURERS AND DEEP TECH SECTOR CAN STIMULATE RECOVERY

**Creating pathways between big businesses and “game-changing” start-ups can help revive industrial processes. An ad hoc collaborative ecosystem is emerging in France, spurred on by the public authorities.**

One of the strands of the French government’s strategy to revitalise industrial activity involves bringing together two very different ecosystems – on the one hand, big industrial businesses and on the other, breakthrough innovation players led by a new generation of deep tech start-ups, of which the government believes there are around 500 in France. Public authorities are seeking to meet three goals here: to boost the country’s attractiveness, reindustrialise its regions and decarbonise its economy. Not an easy task. Indeed, laying the basis for a common language for two categories of business with such different organisational, operating and governance models is a massive challenge. In order to meet this challenge, public investment bank Bpifrance launched a “Generation deep tech” plan in 2019 which has supported some 600 start-ups so far.

As a result of its success, the programme has been extended and its budget increased by €700 million. This means that by 2023 the budget will stand at €2 billion.

**“The ecosystem that has been emerging around start-ups over the past few years is conducive to innovative applications.”**

## Contact portal

In keeping with the plan, Bpifrance signed an agreement in 2021 with France Industrie, a professional organisation comprising 71 members from various industrial sectors, aimed at building bridges between large industrial groups and deep tech start-ups. A highlight of the initiative was the launch in April

2021 of the Tech in Fab platform, an information and contact portal for start-ups and small, medium-sized and larger enterprises in the manufacturing industry. “For manufacturers, transformation may appear complex.

And as for start-ups, many of them don’t have the keys to enter the manufacturing environment,” says Nicolas Dufourcq, CEO of Bpifrance. “In order to address this, we must create cross-over and encourage players to work together by promoting cooperation that will support growth.” Tech in Fab provides free access to educational and explanatory innovation-related content tailored to manufacturers, including less mature companies, as well as to a directory of technology solutions providers and case studies of successful collaborations. The platform enables tech players to update the data that concerns them and to take note of calls for projects published by the various industries.

The agreement between Bpifrance and France Industrie also provides for a memorandum of cooperation, developed in partnership with the National Institute of Industrial

Property (INPI). Its purpose will be to guide negotiations between the two parties with a view to formalising their commitments.

## Pre-industrial demonstrators

While involvement on the part of the public authorities and major professional organisations can only speed up the linkage process between industrial businesses and tech start-ups, the need to build collaboration is not new. In 2016, VINCI Energies set up FactoryLab, an industrial and academic consortium that seeks to integrate technology solutions in very short time frames so that pre-industrial demonstrators can be

produced to meet members’ needs. “We need to think about innovation in terms of application needs rather than in terms of breakthrough technologies. IoT and artificial intelligence, for example, aren’t all that new as technologies. However, the ecosystem that has been emerging around start-ups over the past few years is conducive to innovative applications,” states Thomas Leseigneur, innovation manager at VINCI Energies. FactoryLab brings together four manufacturing companies (Stellantis, Safran, Technip, Naval Group), academic players (the French Alternative Energies and Atomic Energy Commission – CEA, the French Technical Centre for Mechanical Industries – Cetim,

ENSAM engineering school), 20 or so technology providers and an integrator (Actemium, the VINCI Energies industry brand). It includes around 30 players altogether, all of whom have agreed to pool industrial needs and technological capabilities as part of an open innovation approach in order to design and implement projects then put them into production in four main categories: flexible digital factory, advanced control, physical support systems for operators and cognitive support systems for operators. In 6 years, the consortium has given rise to some 30 projects, a third of which have been rolled out and brought to market on an industrial scale.



# WELCOME TO THE MODULAR FACTORY

**The latest Hannover Messe trade fair shone a spotlight on several innovations aimed at making production plant more flexible and modular. In the factory of the future with its digitised floors, machine tools and robots can be reconfigured as required.**

The Covid 19 crisis has shown that resilience is a major requirement in industry. And the key to resilience is, among other things, agility. Some manufacturers have been able to diversify, changing their production lines from one day to the next. For example, in the clothing and the chemical industry, factories started producing masks, visors and hydro alcoholic gel. Flexibility was the central theme of the 2021 Hannover Messe held from 12th to 16th April 2021. Several exhibitors at the trade fair promoted the modular factory concept. By using new technologies, such as IoT, artificial intelligence, additive manufacturing and 5G, they maintain that manufacturers will in future be able to assemble then dismantle production units on an as-needed basis, a bit like Lego.

## Smart factory

A European network of more than 45 mostly German manufacturers called Smart Factory KL presented its PL4 demonstrator. Placed in blocks of glass and mounted on wheels, a 3D printer, a quality control station (operated

by a computer vision system) and an assembly station communicate with each other as part of an automated production line. Set back from the equipment, a technician supervises the operations from a control desk.

**In the future, manufacturers will be able to assemble then dismantle production units as required.**

By enabling machines from different manufacturers to communicate on a plug and play basis, Smart Factory KL should serve as a test bed for GAIA-X. As a reminder, GAIA-X is a European initiative that aims to build a secure cloud by bringing together existing service providers and guaranteeing the interoperability of their services based on common standards.

## Choreography of autonomous and versatile robots

Karlsruhe Institute of Technology has come up with an army of autonomous and versatile robots in place of current robotic systems, which are generally fixed installations and assigned to a single task. Working together, vertical robotic arms perform various processes, based on a clever choreography, such as assembly, cutting, machining and quality assurance. Reconfigurable, they can be given other tasks as required.

These robotic “kinematics” should considerably reduce assembly and planning times. Karlsruhe Institute of Technology and its industrial partners, automation specialist Siemens and machine tool manufacturer Grob-Werke, are only at the prototype stage however.

## Digitised floor

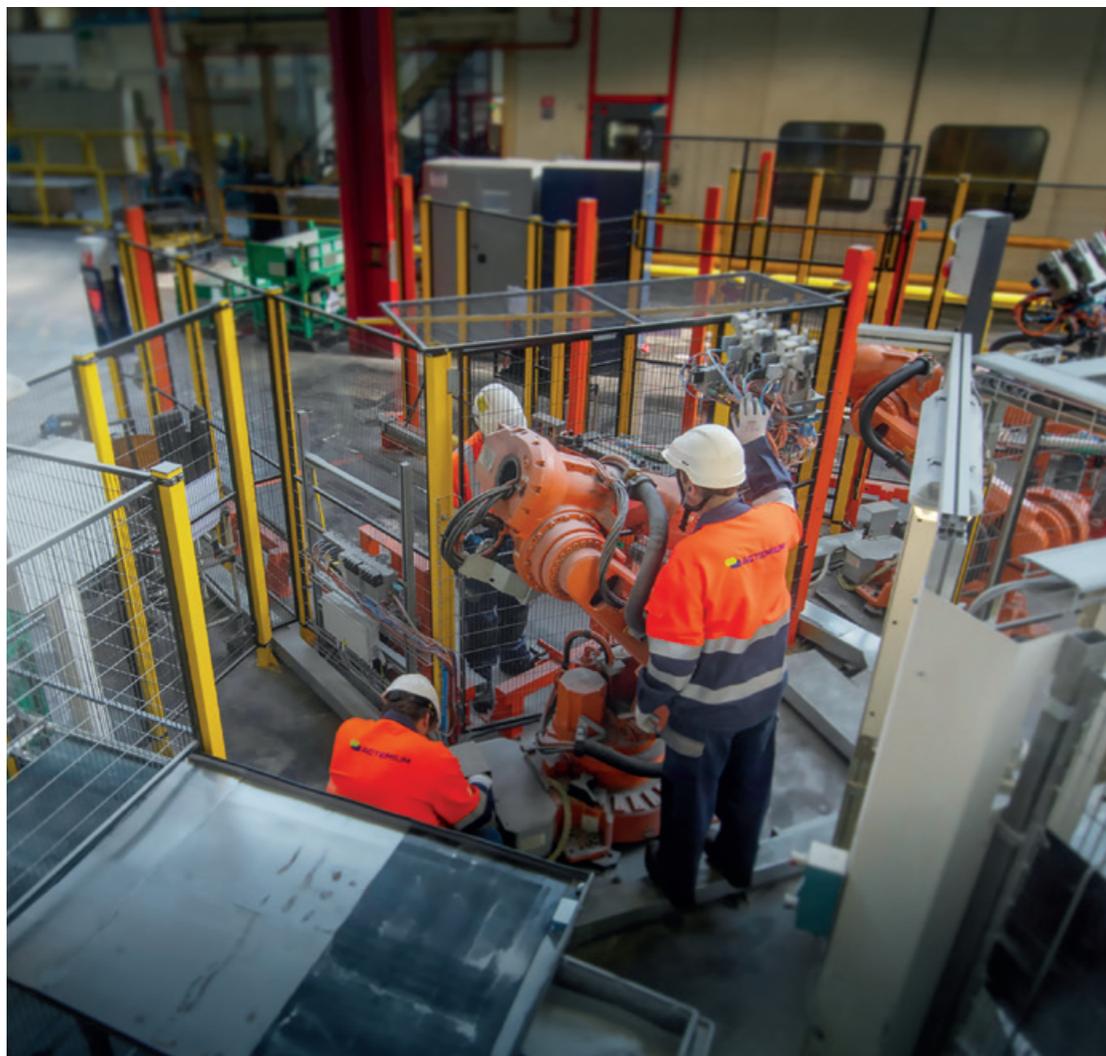
Finally, Bosch Rexroth has devised an intelligent floor, which is set to become the backbone of the factory

of the future. The digitised floor identifies devices, manages them, exchanges data with them and even supplies them with electricity wirelessly. Production machines move to the areas assigned to them. There’s no longer any need for complex localisation systems, since AGVs (automatic guided vehicles) follow slabs as they light up, with LEDs to guide the way.

The German automation company uses 5G to interconnect the various components.



# RETROFITTING OR THE ART OF COMBINING DURABILITY AND PERFORMANCE



**Retrofitting involves refurbishing all the internal components of a machine in order to increase its reliability and bring it up to date. In the current economic and environmental climate,**

**this upgrading approach has huge potential for development.**

In manufacturing, heavy demands are placed on machines. The intensive use that is made of them accelerates wear and tear.

And indeed the obsolescence of their software features and the requirement for them to comply with the latest regulations are further issues to be taken into consideration. An alternative to purchasing new machinery, retrofitting is increasingly seen

as an attractive solution. The method goes beyond simply repairing equipment. It's more a question of reconditioning a machine by replacing some components with more advanced technologies. The parts most often concerned are generally related to the mechanics, software or control systems. So it's not only a process of rehabilitation, but also and above all of modernisation and enhancement. Retrofitting is an opportunity to bring new life to a machine. The technique isn't a new one in the manufacturing sector, particularly in heavy industry which relies extensively on equipment requiring substantial investment. But in the current crisis, where people are looking to achieve cost reductions now more than ever, retrofitting is an option that is regaining popularity among all industrial sectors. The solution, in keeping with the broader circular economy approach, also offers the advantage of meeting greenhouse gas emission reduction requirements by cutting down on material wastage and the consumption of new resources.

### Savings of 20 to 40%

The system improves machine performance while reducing costs. It can even provide a competitive advantage thanks to a secure supply of spare parts and the possibility to reduce product prices and thus meet client expectations. According to the European Remanufacturing Network, remanufactured products are

between 60 and 80% of the cost of a new product due to the savings made from the recovery of the materials. As far as energy savings are concerned, it's necessary however to look at the machine's entire life cycle in order to assess the benefit of a retrofitting solution.

**Retrofitting is an opportunity to bring new life to a machine.**

The right balance must also be struck between the necessary investment and the generally shorter service life of a reconditioned machine in relation to a new one. Finally, the system may find its limits in the case of some equipment such as electrical safety components, which are subject to often rigorous specifications.

### An as yet underused solution

The first recommendation before initiating a retrofit is therefore to perform an in-depth analysis

of machinery reconditioning needs. It's also important not to overlook the testing phase so as to comply with the product's specifications. This requires the expertise of highly skilled professionals. And lastly, it's vital to ensure that the reconditioned machine is accompanied by a warranty covering all the equipment. Today, retrofitting is a conceivable option in multiple sectors, but despite offering clear financial and environmental benefits, it unfortunately remains an underused solution in industry. Indeed, the technique makes it possible to operate more modern and more efficient machines without having to change equipment – the upshot being boosted productivity.



**Marcos Salido**  
Project manager at Actemium

## URBAN CABLE CARS TAKE OFF

The fact that cable cars - traditionally found in ski resorts - don't generate CO<sub>2</sub> emissions, have a low land take impact, produce limited noise pollution and can be completed at a reasonable cost means that they are attracting increasing interest from urban areas, which see them as a relevant part of a renewed mobility mix. France is one of the most dynamic markets in the world, with projects in Brest, the pioneer in 2016, Toulouse, where a line is due to open this year, and Saint-Denis on Réunion Island, where a cable car was commissioned at the end of December 2021 with the support of several VINCI Energies business units and VINCI Construction.



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