THE **AGILITY** EFFECT
MAGAZINE

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SUMMARY

EDITORIAL

Many of you regularly log on to the www.theagilityeffect.com digital platform and read the new content posted every month. This may be because you are interested in topics that deal with the transition to renewable energies or with digital transformation, or because you are curious about developments in our markets and services.

This second issue of the magazine features a selection of topics recently covered on the platform. It takes you on a world tour of initiatives and innovations that have been developed to help bring about these energy and digital-related transformations.

We wanted to use this issue to shed special light on Africa, a continent experiencing rapid population growth and offering enormous potential for development but which faces a major challenge: access to electricity.

In order to supply power to and connect nearly half of Africa's population – which wants access to electricity – major projects have been initiated, propelling Africa into the future thanks to renewable energies. Because of its energy infrastructure and the speed with which digital services are being deployed, Africa will be able to benefit from favourable conditions for economic and societal development.

I hope you find the magazine interesting.
Enjoy the ride!

Arnaud Grison
General Manager of VINCI Energies International & Systems

CONVERTING CO_2 INTO BIOFUEL

That carbon dioxide in the atmosphere could be considered a new resource has been the focus of research for several years. Finnish and German researchers have developed a device capable of producing high-quality biofuel by converting CO_2 via a compact solar reactor called Soletair. Their goal is to demonstrate that renewables can help the energy industry to break free from fossil fuels. A demo version of the system is scheduled to be set up this year at Lappeenranta University of Technology in Finland.

CITY TRANSFORMATION

THE PORT HOUSE, A DIAMOND FOR ANTWERP

The port authority has centralised its staff in a new architectural complex designed to reassert the city's international reputation.

Since September 2016, the determination, imagination, and talent mobilised to create the Antwerp port authority's new headquarters, known as "The Port House," have given the famed Belgian city a new lease of life. The project has capitalised on a number of elements. First, Antwerp's international renown as the city of diamonds, which inspired the immense sparkling glass façade that changes appearance according to shifting weather conditions. Second, the historic fire station, which serves as the foundation for the new headquarters.
The project also relies on underground energy, which remains at 10°C year-round, using geothermal techniques to heat the building in winter and cool it in summer.
"It definitely captures the eye!" says Patrick Enghien, who was in charge of the heating, ventilation, and air conditioning portion for Cegelec (VINCI Energies), on the front line of the renovation site. "From now on," he adds, "whenever you mention the port of Antwerp, you know that people will be thinking about the top structure of the Port House."

Visual identity

"The port authority's decision goes back to 2008," states Annik Dirkx, press officer for the port of Antwerp. "The site had become too small, and it was imperative to have a place to bring together all 500 staff members who were working in different departments in buildings around the city. We also wanted to come up with a visual identity, to make it more attractive."
In an era where management and collaboration methods are both

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complex by nature and more flexible thanks to new technologies, the internal organisation had to adapt. "We now work differently," Annik Dirkx asserts, "because many employees move around a lot more within the offices, carrying their laptops. The port authority employs 1,500 people in all, but the staff here primarily work in the areas of administration, accounting, and finance."
The marriage of modern architectural design with a classic and elegant structure should guarantee the site's longevity.

Technical feats

It was a complex technical feat for Cegelec, which had to install and unify the energy networks of two very different buildings – one rectilinear and dating back to the previous century, and the other, entirely new, with triangular forms. "There were almost no right angles in the entire new complex!" says Patrick Enghien, laughing.

"In addition, everything had to be assembled in very tight spaces, above the ceilings. That said, we knew what to expect, and everything was perfectly well-planned ahead of time."

One of the technical feats was the drilling, which reached a depth of 82 metres. Plastic pipes were inserted to achieve an energy storage volume of 12 cubic metres. By doing so, the port authority hopes to achieve a "very good" rating for BREEAM (Building Research Establishment Environmental Assessment Method) certification.

> "From now on, whenever you mention the port of Antwerp, you know that people will be thinking about the top structure of the Port House."

"Construction of the drilling system is part of the port authority's ambition to make this new headquarters an example of sustainable development," states Annik Dirkx.

No room for error

"We worked on all "Aeraulic" and electrical elements," says Patrick Enghien. "The hydraulic part, including the components related to the heating system, was done by our consortium partners. Total construction time for the project was four years. The part assigned to Cegelec took two and a half years."
The specific nature of the construction, with two buildings of very different types and ages, led Cegelec to begin reserving the building materials and components before arriving on site, under real conditions, thereby leaving no room for error.
Among these new installations were components as varied as three boilers (710 kilowatts each), 260 beams, a 300-kilowatt heat pump, a gigantic refrigerating machine, and hundreds of square metres of plinths for heating the ground.
In the end, the project of architect Zaha Hadid – who died a few months before the site's inauguration – has enabled Europe's second-largest port after Rotterdam (and ahead of Hamburg since 2015) to attract tourists and become a conference centre. The Port House, financed entirely by the port authority, is open Wednesdays and Thursdays for 90-minute guided tours.

CITY PERFORMANCE

TRAM SERVICE CONTINUES AS USUAL DURING WORKS

In Rotterdam, Omexom teams have relocated an electrical substation used to power a tram line without disrupting service or residents' lives.

In Rotterdam (Netherlands), teams from Omexom, the VINCI Energies Power & Grid brand, were selected by the city's public transport company RET to move the power supply system of tram line 7 in order to free up space in the city – a scarce commodity! – and to enable student accommodation to be built.

"The city had to find space for a new student residence near Excelsior Stadium, home to a First Division football club," explains Rini Kouwenberg, mobility client manager at Omexom. "It was important for Rotterdam to redevelop the area and to make it more attractive for residents. But a tram substation was located right in the selected area, so a solution had to be found."

There was one strict requirement he stresses, which was that: "The substation had to remain in operation until the last minute, otherwise no trams would be able to run and it would mean penalties. The transport company had to keep the whole system in service."

Station moved to stadium

So what was the best way to overcome a problem like the presence of a stadium? By turning it into an opportunity! "It was decided to build a new substation for the tram system in the area and to integrate it into the football stadium under the main stand," says Rini Kouwenberg.

The decision required planning since the stand and stadium were being refurbished at the same time as relocation of the power station.

To ensure the energy transfer could take place within a few hours, part of the new equipment of the approximately 50 m² substation was pre-assembled so that it could be directly installed without wasting valuable time building it on site. This meant that there was no disruption for tram passengers.

CITY TRANSFORMATION

ALL-ELECTRIC BUSES SET TO CONQUER THE WORLD

Except in China, all-electric buses are still far from being the norm in urban fleets. But the market is expected to grow rapidly in the coming years, especially in Europe.

1.2%: That was the share of European city buses that were 100% electric in 2013. A tiny portion, but one that is expected to grow rapidly. According to market research firm TechSci Research, the global market for electric buses should grow 17% each year from now until 2021.

> Leading the way in all categories, China currently holds 98.3% of the global fleet, with 170,000 electric buses in operation.

The market potential opening up to vehicle manufacturers and electrical service operators is most certainly colossal. The European Union aims to reduce greenhouse gas emissions by at least 80% by 2050. Yet nearly half of all buses in Europe are still of Euro III standard or older, that is, in operation since 1999 or before. It is therefore time for renewal, with priority going to clean vehicles.

Less than 1,000 vehicles in Europe

Where do European cities stand in their investment plans?
In January 2017, the ZeEUS project (Zero Emission Urban Bus System) published an extensive overview of electric buses in operation today, with a look at 61 cities around Europe that are either operating or testing all-electric buses with a capacity of 55 passengers or more.

The European fleet—as counted in the area surveyed by ZeEUS—contains 956 purely electric vehicles, either in circulation or on order. With 18% of this total, the United Kingdom is the country in the lead for adopting all-electric fleets, ahead of the Netherlands, Sweden, Poland and Germany, which each account for around 10% of this market. In France, the percentage of 100% electric vehicles is even more modest, but in 2025, all buses in major urban

centres are expected to be "clean." In Argenteuil (France), starting in April 2017, the city's public transportation fleet will include four 100% rechargeable electric buses, for a total of ten by 2018.

In terms of renewing their fleets, the report shows that 19 public transport operators and authorities, covering about 25 cities, have published a strategy for the introduction of electric buses by 2020. By that date, there should be more than 2,500 electric buses operating in the cities concerned, representing 6% of their total fleet of 40,000. Another 13 public transport operators and authorities in some 18 cities have a strategy with a 2025 horizon; by then, they are expected to have more than 6,100 electric buses in service, representing 43% of their total fleet of 14,000.

And elsewhere in the world?
In 2016, about 200 electric buses were ordered in the United States, with the state of California making the most purchases. In Russia, India and Latin America, public transport operators are still at the experimentation stage. In Australia, the city of Adelaide is studying the suitability of a solar-powered bus system. If there is one economic fact that characterizes the global market for electric buses, it is the overwhelming predominance of China, which currently holds 98.3% of the global fleet, with 170,000 electric buses in operation (six times more than the previous year). And it will not stop there. For example, Shenzhen City alone (10 million inhabitants) plans to electrify its entire fleet of 16,500 vehicles by the end of 2017.

Significant growth potential

It is true that China is home to a large number of manufacturers, including the world leader, BYD, which is now tackling the European market with a model adapted to usage habits on the Old Continent.

Around the world, and notably in Europe, the growth potential for a full-fledged electric bus market is considerable. According to ZeEUS, a European series production of electric buses should reach full maturity by 2018-2020. What remains is to remove the primary economic constraint: the upfront cost of electric buses and their charging infrastructure can be inhibitive when compared to "conventional" systems. However, the higher purchase cost is later offset by a lower usage cost.

ZeEUS, Europe's electric bus project

Launched in November 2013, under the International Association of Public Transport (UITP), ZeEUS (Zero Emission Urban Bus System) brings together over forty partners and is supported by the European Commission, which provides 13.5 million euros in financing (out of a total budget of 22.5 million euros).
The project aims to validate, through demonstration projects and well-documented studies, the economic, environmental and societal viability of electric buses in urban settings.

CITY PERFORMANCE

THE DASHBOARD: A KEY INSTRUMENT FOR SMART CITIES

Capturing data is essential but not sufficient: you need to make data easily readable on a shared interface to enable informed decision-making.

Dashboards are interactive platforms that provide communities, businesses, and citizens with an in-depth and ongoing view of urban development. They can also be used as a tool for budget-friendly data analysis. As a result, dashboards are now a key feature of smart-city performance.
In Dublin, for example, this feature is freely accessible to decision-makers and residents, enabling them to use and participate in the data flow generated by their communities. Singapore, which is regularly cited as an example of a smart city, carries out real-time studies on commuter satisfaction with public transport, thereby allowing it to correct minor deficiencies on a consistent basis.

Indicators and benchmarks

Dashboards are not exclusive to world-class capitals and metropolises. Smaller cities such as Gütersloh, Bochum, Essen, and Aachen in Germany, with which Axians Infoma (VINCI Energies) has been working closely, have also opted for the "smart city dashboard."
"Using thousands of key performance indicators, cities can build their own configuration and create a benchmark encompassing their objectives and results from other cities. They can take into account variables such as city size and location for more accurate comparisons," states Oliver Couvigny, Managing Director, Business Area Public at Axians Infoma.
The key is to persuade public authorities and operators to provide access to their digital data. In Paris, the RATP Group (a state-owned public transport operator) evaluated the risks and opportunities associated with open data before deciding to make public transport data in Paris available in real time. "Citizen participation is crucial for smart cities," notes Oliver Couvigny, who believes that intra-urban data is "no longer a black box."

ICT PERFORMANCE

GETTING DATA TO "SPEAK" IS A KEY JOB

Collecting data is one thing; interpreting them is another. Here is how Axians helps businesses read their data more effectively so as to boost their performance.

The Internet of Things, augmented reality, self-driving vehicles, smart cities… in the years ahead, we will see an exponential growth in data volume. Every person, every robot, and every location will receive and send digital signals. The era of big data is only just getting under way – along with related specialities including, first and foremost, data analytics.

According to Arno Hordijk, Chief Technology Officer (CTO) and analytics expert at Axians Netherlands (VINCI Energies), "Data resources are nearly unlimited. The only limit is us – we humans. So we have to make sure that our imagination will continue to come up with new solutions. Data have a specific function, but it's up to us to find creative ways to use them to our advantage."

Both quantitative and qualitative

All sectors are undergoing a transformation. Business, politics, marketing, and sports are only beginning to gauge the multiple revolutions currently under way.

Some of these revolutions are cause for concern, while others provide hope. Data analytics generate quantitative results, but they also bring about qualitative consequences.

> "Due to ageing of the population and more unhealthy lifestyles, focus in healthcare changes towards prevention."

"In the healthcare sector, we work with university-affiliated hospitals, for example, to create an analytics environment that enables the hospital to process and analyse patient and medical data to improve diagnostics, patient care and medical results. It's a matter of using data to optimise the performance of hospital services," says Arno Hordijk.
"In the case of disability care, we analyse information on the recurrence and likelihood of incidents depending on the context in which they occur."

Another focus area cited by the Axians Netherlands CTO: "Due to the ageing of the population and the more unhealthy lifestyles, as the focus in healthcare changes towards prevention, data analytics will play an important role in this process."

Knowledge and learning

Discounting human intuition is a mistake; failing to use data as an aid for problem-solving is also a mistake. We need to enhance knowledge by cultivating learning, and creating a balance between subjectivity and a new form of objectivity. Top-down thinking must be partially reversed.
"Organisations," states Arno Hordijk, "now believe that data will play an important role, but they don't know exactly what role. We're here to help." In concrete terms, "The search for a solution to a specific business problem starts at our Datalab. Together with the organisation, data scientists examine the focus area and the available data. In addition to knowledge of analytics and IT skills, these scientists also provide a dose of creativity and inquisitive thinking. This combination quickly gives rise to a specific idea and working prototype." says the Axians Netherlands CTO.

ICT INNOVATION

PUTTING THE APPROACH BEFORE THE METHOD

For Belgian “net entrepreneur” Jo Caudron, agility is less about methods or processes than about an attitude, driven by a vision and an approach.

In business, today’s failure is often tomorrow’s success. Jo Caudron, a Belgian entrepreneur who operates in the digital environment, is a perfect illustration of this. “My first company was involved in the fashion industry,” explains the founding partner of consulting firm Duval Union Consulting. “We had a computer programme aimed at professionalising operations. It didn’t work but it was that setback that led me to the digital world,” he adds.
It’s a world that he has stayed with since and one in which he is considered a guru in Belgium. But as well as being a respected digital expert, Jo Caudron is above all a “serial entrepreneur”. “Technology itself isn’t important; it’s what we do with it that counts,” he says.
Since he started out in the early 1990s, he has set up a total of 25 companies, including Social Seeder (online communication), TV Agency (TV production), ONE Agency (interactive services), Dear Media (digital transformation) and Duval Union. “I invest in a new company every year, or I create one. It’s much easier to build a company than to incorporate a new business activity into an existing company.”
The main focus of the Ghentbased entrepreneur’s vision is on identifying ways to achieve flexibility, dynamism and speed. In a word: agility. In a constantly changing and unstable environment, agility is a strength.”It correlates closely with the concept of entrepreneurship. And it’s characteristic of a new generation that wants to break free from traditional structures and models.

If you're stuck in an outdated mindset, you'll find it hard to learn new methods."

The ability to think small

The size of companies and organisations frequently slows down decision-making processes, curbs initiatives and stifles talent. But there's no reason why large businesses should get stuck in a rut. Having the ability to think small despite being big can deliver growth. And it can provide meaning. "Facebook, Google and so on have grown into massive companies but they've kept things agile by forming small teams," he stresses.
So is agility bit of a cliché?
"The term has become popular in the information and communication technologies environment, but many companies are starting to use it specifically for developing new ideas," he notes. The trick is to avoid falling into the trap of thinking that a method, technique, tool or software programme is enough to create sustainable momentum.
"Being agile is first and foremost a way of thinking. It means being open to doing things in a different way, in a way that's more compact and nimble than in the past. Sadly, for a lot of companies, it's the methods that count. But if the mindset isn't there, agility will never follow. It's never a question of tools! Tools always come at the end," he adds.

> "If employees are on board, there's no longer any point in learning the method as that happens on its own!"

Spreading an agile mindset

Jo Caudron goes on to say: "Too often, many big companies work in silos or they're too focused on optimising processes. That's the biggest obstacle to business agility. Especially as it is not uncommon to find that new methods, once they've been developed, aren't really applied and the whole thing becomes a costly investment that doesn't produce results".

He considers that, ultimately, staff engagement remains the most important factor. "If employees are on board, there's no longer any point in learning the method as that happens on its own!" The key is to make change an opportunity rather than a threat, and to see it as part of a vision, he adds.
"Companies can spread an agile mindset by creating a very clear vision of a future in which senior executives, employees and partners do things differently.
If everyone believes in it, it gathers momentum by itself. People are then convinced that agility, flexibility and responsiveness are the way forward. And history writes itself."
The bottom line? Approach is more important than method.

AFRICA: NEW-GENERATION ENERGY

Africa lags in **access to electricity** but is fast catching up, especially in West Africa where a large number of projects are under way (p.20)... To achieve economic take-off, Africa **needs an ambitious** energy policy, says Khaled Igué, President of the Club 2030 Afrique think tank (p.23)... VINCI Energies now **exports its expertise** to West Africa from Morocco, where it has operated for 70 years (p.26)... The Zagtouli photovoltaic plant in Burkina Faso exemplifies **the spread of solar** energy in Africa (p.28)... Once refurbished, the Mavuzi and Chicamba **hydroelectric** plants in Mozambique will notably supply the country's second-largest seaport (p.30)...

ENERGY | TRANSFORMATION

AN ELECTRIFYING CONTINENT

Africa remains the least developed continent in terms of electrification. However, this situation is changing with the launch of many projects.

Whenever the International Space Station passes over Africa at night, French astronaut Thomas Pesquet sees blinking lights at the top and bottom of the continent, with the countries in between in the dark. According to the United Nations Development Programme (UNDP), Africa, home to 15% of the world's population, accounts for only 5% of the end consumption of electricity, leaving around 580 million people on the continent with no access to electricity. Only a few countries have electrification rates higher than 50% and these are mainly in North Africa (99%) and Southern Africa (77%).

Other figures point to this disparity: on average, Africans (excluding South Africans) consume only 162 kilowatt-hours (kWh) a year per person compared with 7,000 kWh for people living elsewhere in the world. Even worse, Africans pay an exorbitant price for this scarce resource.

For the International Energy Agency (IEA), this situation is due to "a glaring lack of electrical infrastructure." The electrification rate in Sub-Saharan Africa, for example, is only 32%, and it drops as low as 14% in rural areas. These energy shortages and recurring power cuts cost the continent 2% of its GDP, according to the African Development Bank (ADB).

A colossal effort

Improving access to electricity is a key issue of Africa's sustainable economic development, facilitating access to education and healthcare services and, more generally, improving the quality of life throughout the continent. From this perspective, the net demand for electricity in Africa is projected to triple between 2010 and 2030, according to the International Renewable Energy Agency (IRENA). As a result of this growing need,

electricity production capacity must be boosted from 140 to 250 or even 480 GW.
VINCI Energies' efforts are set against this backdrop of access to energy and development for the African continent.

> Thanks to the know-how of its Omexom brand, VINCI Energies is leading electrification projects in Africa from its base in Morocco.

"VINCI Energies has undertaken an initiative both to reinforce and diversify activities in the existing subsidiaries, to create new subsidiaries in a handful of pivotal countries on the continent and actively position itself on major electrical infrastructure projects such as inter-connection between power grids and energy production. Essentially, we can do this thanks to our proximity with our main partners, operators, and energy infrastructure developers.
VINCI Energies, through its Omexom brand, a key Power & Grid player, is providing know-how and skills in production, transport, and energy distribution," states Abdellah Sabri, Deputy Managing Director of VINCI Energies in Morocco.

Diversifying energy sources

Reaching the development objectives of the continent requires energy diversification. In fact, fossil energy still dominates electricity generation in many countries, such as Ivory Coast or Senegal. But other petroleum and gas-producing countries have trouble exploiting this great potential. Nigeria and its bordering countries can count on gas plants, whose cost of construction is low and which can deliver high performance thanks to the West Africa Gas Pipeline.

But Africa can also count on renewable energy sources with major development potential on a continent where wind, sunshine, and water are abundant: wind power in the north-east of the continent, plentiful sunlight in the Sahel favourable to solar energy, geothermal energy in the east of the continent, and hydroelectric power in Central Africa. States are aware of this natural abundance because around half of all African countries have initiated studies to assess natural resources that may be exploited for energy production according to IRENA. Hydroelectricity is a major resource, but less than 10% of its potential is exploited due to high costs and time-consuming implementation efforts.

Interconnecting networks

Pooled energy-development efforts among African countries as part of network-connection projects, will result in more effective use of resources. The Organisation for the Development of the Gambia River connects Gambia, Senegal, Guinea-Bissau, and Guinea with Mali, Mauritania, and Senegal, using 225-kV networks.
The Organisation for the Development of the Senegal River and the CLSG project involving Ivory Coast, Liberia, and Guinea are leading similar efforts. "Apart from these paranational organisations, other bilateral interconnection network development plans have been put in place, this is particularly the choice made by certain East African countries such as Djibouti and Ethiopia," adds Abdellah Sabri.

Improving governance in the sector

The African continent's energy revolution is under way. It could not have happened without large-scale mobilisation of all players at both regional and international levels. National governments, project developers, funders, and builders must deploy all of their know-how as well as their technical, human, and financial resources.
National governments in Africa that are active in the energy sector are aware of this potential; consequently, they are increasing initiatives, particularly those headed by the African Union, to put in place regional structures – "Power Pools." At present, there are five (COMELEC: Comité Maghrébin de l'Électricité; EAPP: Eastern African Power Pool; PEAC: Pool Énergétique de l'Afrique Centrale; WAPP: West African Power Pool; SAPP: Southern African Power Pool). The purpose of these pools is to take advantage of economies of scale made possible by the sharing of electricity reserves.

All these projects will allow millions of people to have access to electricity so that a part of Africa is no longer plunged in darkness.

KEY FIGURES

Population: 1,200 million in 2014; 2,400 million in 2050; 4,000 million in 2100.
46% of the world's population with no access to electricity lives in Africa.
Between 260 and 400 million people will still have no access to electricity in 2050.
32% of the population in Sub-Saharan Africa has access to electricity; that figure is 99% in North Africa.

Source: "Energy in Africa in 2050," Association for the Development of Energy in Africa and Eurogroup Consulting.

ENERGY ACCELERATION

"NO DEVELOPMENT WITHOUT ENERGY"

Educated in his native Benin and in Ghana, France, and the United States, Khaled Igué is Head of Public and Institutional Partnerships at OCP Africa, a subsidiary of Moroccan world phosphate leader OCP. He is also President of the Club 2030 Afrique think tank. As an active participant in, and observer of, African development, he believes that the continent needs an ambitious energy policy if it is to achieve economic take-off.

Could you describe the access to energy situation in Africa?

Across the continent, more than half the 54 African countries have an electrification rate of less than 20%. Geographically, North Africa has a 99% electrification rate but Sub-Saharan Africa has only 32% overall (South Africa being the exception at 85%) and only 14% in rural areas. Only 42% of the population has access to electricity in Africa, compared to 75% in developed countries. In addition, the electricity generated in Africa is very expensive: the kWh can cost an African household up to €4, compared to €0.15 for a European household. This explains why biomass, which is available free of charge, makes up 80% of the energy consumed in Sub-Saharan Africa (mainly firewood and charcoal). Although it causes pollution and is harmful to health, coal, mainly used in cooking and heating, represents about 60% of energy consumption in Sub-Saharan Africa.

Which types of energy production do you think should be given priority?

The use of firewood cannot be eliminated in the short term since it is often the only source of energy available to rural households. It is therefore urgent to massively distribute improved woodstoves – a simple and inexpensive measure that is rarely applied. To foster rural electrification, one solution would be distributed generation and off-grid and mini-grid distribution solutions using technologies such as photovoltaic solar, micro-hydro and methanisation. But substantial difficulties – technical, policy and financing issues – remain to be overcome.

What role do governments play in implementing these projects and what role should private sector initiative play?

More and more African governments are encouraging the private sector to become involved in helping to implement a comprehensive energy infrastructure development policy. This cooperation generally takes place within the framework of public-private partnerships (PPPs). The term covers a wide variety of arrangements involving cooperation between the public and the private sectors, but it should not be confused with privatisation. Under a PPP, the public sector retains

responsibility for providing a public service, whereas privatisation effectively transfers responsibility to the private-sector partner. PPPs have several advantages. They make it possible to raise private sector financing to make up for any shortfall in public funding. But PPPs also offer other benefits. The partners share the long-term risks, fostering more rational use of the resources involved; and the existence of performance penalties if requirements are not met when the property is transferred at the end of the project period, which give the private-sector partner an incentive to properly maintain and manage the property with which it is entrusted.

Are French and/or European countries particularly involved in the process?

A number of French companies such as VINCI Energies have been quick to grasp the importance of supporting African customers, based on a long-term African strategy. But there is considerable scope for further development, since French companies have the advantage of sharing a language with the countries of French-speaking Africa, which represent a market of nearly 300 million people. Companies should shift their focus from risks to opportunities. Contrary to what many companies think, the market is solvent since a lot of Africans are using costly and outdated energy solutions.

How does electrification fit into a broader managed development programme in Africa?

The African equation is not easy to solve. With the exception of South Africa, the continent currently emits a very low level of greenhouse gases (less than 3.8% of total global emissions) yet at the same time it is highly vulnerable to climate change. To achieve economic take-off, Africa needs to implement an ambitious energy policy. There can be no agricultural, industrial or technological development without energy. Access to electricity is a prerequisite for overcoming poverty in Africa and enabling the continent to improve its health and education infrastructure.

> "Access to electricity is a prerequisite for overcoming poverty in Africa."

How can Africa avoid massive consumption of fossil energy in achieving economic take-off?

There are several initiatives that African countries can take to increase their clean energy portfolio while reducing poverty. One is to improve access to electricity by means of pre-paid meters to improve access to electricity. The meters encourage efficient use of electricity and facilitate payment collection. Other initiatives include providing government guarantees to banks that offer loans to companies wishing to invest in the production of clean, renewable energy; eliminating import duties and production levies on renewable energy; increasing the availability of funding, such as microcredit programmes to enable the poor to purchase solar panels and solar lanterns; and ensuring worldwide availability of green climate funding for clean energy projects that reduce fuel poverty in Africa.

> "Companies should shift their focus from risks to opportunities."

ENERGY | PERFORMANCE

ELECTRIFICATION: FROM MOROCCO TO WEST AFRICA

VINCI Energies Morocco, which has been active in that country for 70 years, is now exporting its know-how to West Africa.

"Until the early 1990s, Morocco was really behind in rural electrification. In 1996, when the country's electrical-power and drinking-water authority was launched, only 18% of villages were connected to the grid. Twenty years later, we're practically at 100%," says Ahmed Rahmani, General Manager, VINCI Energies Morocco.

Our market share was carved out against competitors from aroundthe world: Spanish, Canadian, Turkish, Portuguese, French, and Moroccan. "Every week, there were several calls for tenders. To come out ahead, we had to provide the best service offer and the best price," recalls Lahoucine Fardadi, who heads up Omexom Distribution Morocco and is in charge of export and distribution.

The Group, a major player in this electrification program, has connected 9,000 villages to the power grid, that is, 25% of the total. "We absolutely had to be competitive, especially after the first few years when locations in the plains were electrified and we had to turn our attention to villages in the mountains," adds Ahmed Rahmani.

Since then, the Group has bolstered its industrial capacity. In addition to its full-service offer, it manufactures the concrete posts and pylons that support power lines. "We took advantage of this program to increase our capacity and improve our production quality. Then, we started to think about the next step, well before the end of the program. That is why we are naturally turning toward neighbouring countries in West Africa, where the rural electrification situation is similar to what it was in Morocco when it launched its program. Most countries in the region need development in this regard," states Ahmed Rahmani. "We're deploying our offer under the Omexom banner, which is the Group's Power & Grid expert brand, enabling us to consolidate our strengths beyond our country."

"In Ivory Coast, for example, as part of the president's emergency program, VINCI Energies began with a two-million-euro project to electrify four villages, followed by an electrification project for one hundred locations (a value of twenty million euros), which was completed in 2015. We then created VINCI Energies Ivory Coast, a subsidiary that is currently carrying out high-voltage line and substation projects. Our subsidiary now employs about sixty people, who, on their own, can address various markets and respond to calls for tenders in Ivory Coast," adds Lahoucine Fardadi.
In Mauritania, thanks to its Omexom brand's expertise, VINCI Energies was awarded power-distribution projects in the capital Nouakchott and, later, two other large cities, along with high-voltage line and substation projects that are under way. Mauritania, Senegal, and Guinea have considerable electrification potential; accordingly, local VINCI Energies subsidiaries have been launched in all three countries to contribute to their development.

> "In 2017, we plan to provide more than 15,000 hours of training at the VINCI Energies Academy in Africa, based in Casablanca."

Identifying local talent

When the project was at its peak, our company (formerly Cegelec Morocco) connected three or four villages, with 50 to 200 homes each, every day to the power grid. That's roughly a hundred villages a month. The most difficult part was bringing power lines from high-voltage substations to villages,sometimes located more than 100 kilometres away.

"We can now implement this process in West African countries," says Ahmed Rahmani. For example, as part of major projects to interconnect national electric power systems in the region, such as the project involving Senegal, Guinea-Bissau, and Gambia, we have won several 225-KV works packages in perfect synergy with our French colleagues at VINCI Energies TTE.

To be able to export its know-how, VINCI Energies Morocco has started a major training initiative for local staff. "In 2017, we plan to provide more than 15,000 hours of training at the VINCI Energies Academy in Africa, based in Casablanca, which we modelled on the VINCI Energies Academy located in Montesson in Yvelines," states Ahmed Rahmani. The goal is to identify local talent to train to ensure effective knowledge transfer.

A strong renewable energy component

In Morocco, the Group is involved in activities other than rural electrification. It is the leader in the development of high-voltage and very high-voltage energy production, transport, transformation, and distribution infrastructure.

And the future is promising: "Morocco has decided to implement an energy mix with a strong renewable energy component. Its goal is to achieve a 42% renewable energy share by 2020, including one-third each for hydroelectric, solar, and wind power. Following COP 22, a goal was also set for 2030: to raise the renewable energy share to 52%. We're positioning ourselves to seize these opportunities. In Morocco, our strength is due to our well-established local presence and VINCI Energies' global network," says Ahmed Rahmani in closing.

ENERGY | INNOVATION

SOLAR ENERGY SHINES ON BURKINA FASO

The Zagtouli solar photovoltaic power plant in Burkina Faso will begin operating in August 2017. VINCI Energies is one of the companies implementing this large-scale project.

If there's one abundant resource in Africa, it's the sun. The International Energy Agency (IEA) expects solar energy to represent 14% of installed power capacity in Africa by 2030. The Zagtouli photovoltaic power plant, located in a suburb of Ouagadougou in Burkina Faso and scheduled to begin operating in August 2017, is one of the projects contributing to this rise in solar power on the continent.

Thanks to the expertise of Omexom, its dedicated Power & Grid brand, VINCI Energies is building the 33.7-megawatt (MW) plant for Sonabel, Burkina Faso's national electric utility. Solarworld is supplying the PV panels.
The project is financed by a grant from the European Development Fund and a loan from the French Development Agency (AFD).
This funding requires the beneficiaries to use supplies from either the European Union or the African, Caribbean and Pacific Group of States (ACP).

130,000 solar panels

Zagtouli represents a €37-million contract. "The distinctive feature of the project is that, in addition to building the solar plant as a turnkey deliverable, there is a two-year operation and maintenance component," states Alexandre Haueisen, a director at VINCI Energies.

The solar plant is made up of 130,000 polycrystalline silicon panels with a peak unit power (maximum sunshine) of 260 watts, 1,800 structures of 72 modules inclined at 15 degrees, and 32 one-MW inverters. These inverters are used to transform direct current into 33-kV (kilovolt) alternating current. The solar plant is then hooked up to the Zagtouli substation.

"This substation was built in 2009 with the goal of connecting Bobo-Dioulasso, the country's second-largest city, to the capital, Ouagadougou. Moreover, since Bobo-Dioulasso is already connected to Ferkessédougou in Ivory Coast, it improved interconnections between the countries," adds Alexandre Haueisen.

Increasing electricity production while lowering the cost

With this solar power plant, Sonabel hopes to increase its production while lowering the cost of distribution, which is heavily subsidised by Burkina Faso.
"The solar plant will be connected to a reliable substation, because solar power plants work when the network is energised, unlike thermal power plants, which can be stopped and started according to demand," explains Alexandre Haueisen.
A 17-MW expansion is also planned for this site, financed by the European Investment Bank. Once it is in service, Zagtouli will be the largest photovoltaic power station in West Africa.
With 2,200 KWh per square metre per year, Zagtouli's sunshine is significant, but the Harmattan (a wind from the northeast, often dry and dust-laden) and low precipitation in this region will require the panels to be cleaned frequently, as opposed to once every five years in France.
"But aside from this inconvenience, with solar power, there's not a lot to do, except change a few fuses now and then," says Alexandre Haueisen, for whom the second phase of solar energy development in Burkina Faso will involve the introduction of local off-grid solar plant.

Once in service, Zagtouli will be the largest photovoltaic power plant in West Africa.

ENERGY | TRANSFORMATION

MOZAMBIQUE BANKS ON HYDROELECTRIC DEVELOPMENT

Omexom (VINCI Energies) is restoring two hydroelectric power plants in Mozambique.

With approximately 10% of the world's hydroelectric potential, Africa has promising development prospects. Only 5% of its potential, however, is used according to the Africa Energy Forum.

There are two obstacles to further development and use of this resource. First, hydroelectric facilities cost more to build – on average 50% more than thermal, gas or coal plants – and their construction takes longer: an average of ten years versus four for a thermal power plant. Second, facility maintenance is the first area where budget cuts are implemented by national companies in Africa.
In Mozambique, Omexom (VINCI Energies) is rehabilitating two power plants in Mavuzi and Chicamba, near Chimoio, the country's second-largest city, near the border with Zimbabwe on behalf of Électricité du Mozambique (EDM).

"These were old facilities, dating back to the 1950s and 60s, which absolutely needed upgrading," says Fabien Buytet, Project Director at Omexom Hydro. As the lead contractor and coordinator of a consortium of companies that also includes Norway's Rainpower and France's Hydrokarst, Omexom is restoring alternators and overseeing the general site installation process known as the "balance of plant" (distribution of power production, electrical and mechanical auxiliary systems, and control systems).

€95 M for 100 MW

This €95-million project, which will be completed this year, will deliver an installed capacity of 100 MW: 50 MW in Chicamba with two production groups, and 50 MW in Mavuzi with five groups.
"The purpose of this project is to ensure the facilities' reliability," points out Fabien Buytet.

Located in the heart of a node in the power distribution grid, the two power plants will supply the cities of Chimoio and Beira, the country's second-largest seaport. According to Agence Française de Développement, this project will allow EDM to reduce its dependency on imports and obtain electricity at the lowest cost.

INDUSTRY | INNOVATION

ROBOT TO BE DEPLOYED IN REACTOR CORE

Robot to carry out fully automated inspection and maintenance within the reactor core without human intervention.

VINCI Energies is to build, together with Airbus Safran Launchers and Nuvia Limited, the robotics equipment which will be deployed in the ITER programme's thermonuclear prototype reactor.

Cegelec CEM (a business unit of the VINCI Energies nuclear business line), Nuvia Limited (a VINCI subsidiary), and Airbus Safran Launchers have just signed a global framework contract, worth approximately €100 million, with the European agency Fusion for Energy (F4E).
These three cutting edge companies will be responsible, during a 7 year period, for the robotics of the international ITER programme (International Thermonuclear Experimental Reactor), which aims to prove the feasibility of nuclear fusion as a new viable and sustainable energy source for future generations.

Automated system

Human intervention being prohibited within the reactor core a sophisticated robotics system is set to take over.
In Cadarache near Marseille (France), where the thermonuclear prototype reactor is being built, Cegelec CEM will use its expertise in mechanical engineering to develop, install and test a Cask and Plug Remote Handling System (CPRHS).
This automated system will transport components from the reactor chamber to the hot cells, to be tested then either repaired or disposed of. It will also carry remote handling equipment to the reactor core, to perform inspection and maintenance without human intervention.
"This project is a unique opportunity for Cegelec CEM to demonstrate its ability to develop and build remote handling equipment for a nuclear application in as complex an environment as this," says Pascal Champ, Cegelec CEM sales director.

INDUSTRY | PERFORMANCE

MAINTENANCE: A COMPETITIVENESS FACTOR FOR OIL PLATFORMS

The oil industry is looking to optimise platform operating costs. Revisiting its maintenance methods will help drive performance.

The recession has forced the oil industry to address an important issue: that of optimising barrel production costs and consequently, platform operating costs. Revisiting its maintenance methods gives it the leverage needed to meet this objective.

Achieving a significant impact on operating costs means innovating on an organisational level rather than on a technical one: "Encouraged by our clients, we changed our approach to maintenance, moving from a system where crews are based offshore 100 per cent of the time, towards a system of resource pooling, where workers are based onshore.
We form client-dedicated crews that can operate across several sites in a given area,"
explains Jimmy Neron, Commercial Director at VINCI Energies Oil & Gas.

Advance scheduling and engineering

Offshore maintenance is performed over shorter periods, in campaigns, with much of the scheduling and engineering work completed in advance. "By preparing preventive or corrective maintenance tasks onshore, we optimise the amount of time spent on operations offshore and the presence of mobile crews on site," he adds.

In Angola, for example, VINCI Energies is responsible for maintaining two FPSOs (Floating Production, Storage and Offloading units), Girassol and Dalia, on Block 17 for Total E&P Angola. "Together with Total, we revamped the organisation of the ad hoc crews who operate on the two vessels. So if there is a need for an HVAC specialist on Dalia and another on Girassol, then the tasks are planned accordingly and the worker operates on both FPSOs," says Jimmy Neron.

This resource pooling and reorganisation method has generated "maintenance savings of 25 to 30 per cent for the client. In terms of personnel, there has been a 30 per cent reduction in the number of permanent workers on board Girassol. Instead of 92 people, there are now 49, with 15 working on rotation throughout the year," points out Jimmy Neron.

This new way of organising work to make it more efficient involves many changes: it means reorganising jobs, having more method & operation teams onshore, and monitoring indicators and tasks.
A virtual operational room, replicating the offshore control room, was therefore created. Dubbed the "smart room" at Total, this facility makes it possible to share the same information in real-time and to monitor all indicators and tasks.

"Our methods and performance in terms of multi-technical maintenance and services rendered have proved their worth, to the extent that clients who don't normally operate this way are now showing an interest in the model. We hope to extend the expertise we have gained in Angola – and the other countries in which we operate like Nigeria, Congo and Cameroon – to new clients in the coming months," concludes Jimmy Neron.

"Our methods and performance in terms of multi-technical maintenance and services rendered have proved their worth."

ENERGY ACCELERATION

SODIUM VERSUS LITHIUM

Whatever technology powers them, tomorrow's batteries are set to speed up the deployment of smart grids and electric mobility.

With electric vehicles (EVs) struggling to take off due to the limitations of their batteries, solar energy generation development being hampered by storage issues, and smartphones sporadically hitting the headlines when their batteries explode, tomorrow's batteries can't come soon enough. By overcoming such drawbacks, new technology will free up battery uses and help accelerate the transition to renewable energy. But what will tomorrow's batteries look like?

"The expected boom in electric mobility in the coming years will be a decisive factor in the development of battery performance and the reduction in battery costs," says Caroline Chapuis, project manager at Citeos (the VINCI Energies brand which works to transform urban space).
Tesla, the electric vehicle manufacturer which has just opened a Gigafactory meant to produce more than 500,000 batteries in 2018, is looking to drive down prices and increasingly refine the lithium-ion batteries that are now fitted in most EVs and in homes that store renewable energy.

But researchers, such as the Americans from the Joint Center for Energy Storage Research, believe that the Holy Grail lies "beyond lithium-ion" and are trying to make batteries five times more energy-dense at one-fifth of the cost. In France, the CNRS (French National Centre for Scientific Research) and the CEA (French Alternative Energies and Atomic Energy Commission) have developed a prototype based on sodium-ion technology.
Less expensive than lithium and around a thousand times more abundant, sodium is a promising avenue.

"Sodium technology is still at the R&D stage," says Arnaud Banner, technical director at the VINCI Energies Power & Grid brand Omexom, who does not believe in the battery "Big Bang". He rather sees the development of energy storage-related uses as a gradual evolution of batteries rather than the effect of a technological leap.

"The cost factor will be key. Due to the drop in battery prices and the foreseeable rise in grid tariffs, grid parity (when the cost of producing self-generated energy becomes equal to the average price of buying power from the electricity grid) should be reached in France within the next two years. This will mark a shift in battery-related uses.
In Germany, which has already achieved grid parity with a kWh price of 29 cents, sales of home batteries have soared," he adds.

> "Grid parity should be reached in France within the next two years, marking a shift in battery-related uses."

"Self-consumption of energy, through a mix of batteries and solar PV, is a reality in Germany and the south of France," points out Arnaud Banner. And improvements in power storage will make it possible to initiate collective self-consumption schemes: in a neighbourhood fitted out with accumulators, residents who sign up to the service will have access to stored electricity, sourced from solar PV or from the grid.

"All that remains is to find solutions for recycling the increasing stock of batteries," notes Arnaud Banner. Indeed these could go on to have a second life in the building sector.

BUILDINGS | TRANSFORMATION

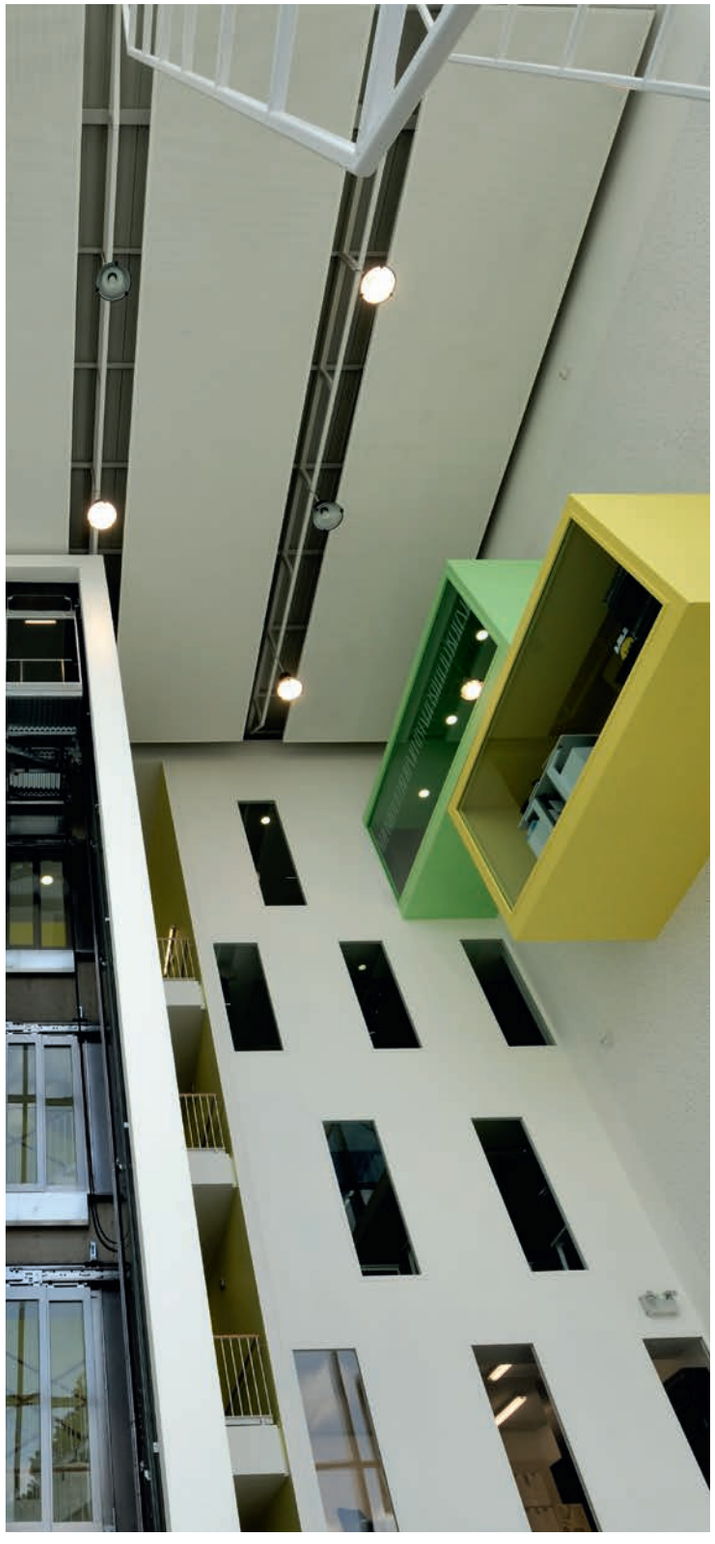
LE MIRAIL, A "TEXTBOOK" RENOVATION

In the spirit of Candilis, the original designer of the campus in Toulouse, VINCI has rebuilt the site and injected new life into it.

Mission accomplished! The Mirail campus at Université de Toulouse-Jean Jaurès has undergone a makeover without losing its soul. Its buildings, run-down after only 20 years of operation and no longer spacious enough to accommodate the growing number of students, were designed by architect Georges Candilis. Previous work on these buildings dates back to the early 1990s. The newly renovated campus was inaugurated in late 2016.
In accordance with the project's objectives, a busy site covering more than 130,000 square metres was rebuilt without betraying the spirit of the campus's original designer, a renowned figure who made a significant contribution to the field of architecture.

Staggered relocations

The final phase of this major project, which was entrusted to Miralis, a project company that brought together VINCI Construction and VINCI Facilities, may be regarded as a textbook case in many respects. "Since the university had to stay in operation during the project, we designed a staggered relocation operation. It was truly a challenge, but we were successful," states Stéphane Coppin, project manager at Tunzini (VINCI Energies).
This was also a remarkable operation from a contractual standpoint since the project is part of a 30-year public-private partnership agreement that encompasses design, construction, restructuring, demolition, routine and major maintenance, technical operations, and funding for the Mirail campus.
This is a textbook example of assessing and delivering on client needs for a refurbished and efficient university campus, while preserving the design principles deployed by the architectural firm Candilis, Josic & Woods in the 1960s and 70s, namely, the use of right angles, patios, and relatively low-rise buildings.
To meet the university's energy-efficiency objectives and the set-budget requirements in its 26-year maintenance contract, Miralis demolished the existing structures in order to implement appropriate materials and techniques.



BUILDINGS | CUSTOMIZATION

IOT, THE KEY TO UNLOCKING ENERGY EFFICIENCY IN BUILDINGS

Thanks to the Internet of Things, it is now possible to continuously monitor building management, with both comfort and energy efficiency in mind.

As with any innovation that is set to disrupt business models and daily practices, smart buildings bring their share of questions.
How do they work?
Just how smart are they?
Why do we need them?

"According to our definition, smart buildings must be comfortable, usable, energy efficient and connected to the outside world," outlines Pierre Blanchet, innovations manager for the tertiary network at VINCI Energies France.

A smart building is first and foremost achieved by balancing a number of parameters, which is where "connected things" come into play. IoT is used to design and ensure compliance with all the prerequisite criteria via intelligent and non-intrusive systems, which collect and analyse data relating to occupancy and motion, temperature, humidity, sound levels, and air quality.

Sensor cube

VINCI Facilities is working in this field with the French start-up GreenMe and its sensor cube – whose aesthetic design will facilitate adoption in offices – which continuously measures 5 comfort and health parameters.
"Placed on desks, in meeting rooms or in corridors, the cubes, which are independent from the building information systems, record data via the LoRa network and transmit it to the Cloud," explains Bertrand Beauchesne, IT Tools Director at VINCI Facilities.

This opens up a whole range of prospects. If temperature levels are considered unnecessarily high, a technician is alerted. If there is too much time between two sound recordings, this means that a meeting room is under-used (and also that it doesn't need cleaning). On a larger scale, it will at last be possible to tackle the "phantom bookings" phenomenon.

One of the most promising initiatives is the "Digital Ceiling" project, a prototype of a smart building, created on the campus of CESI training body in Nanterre in cooperation with Axians, Cisco and Philips. Used under real-life conditions, measured and continuously monitored, the building should very soon generate valuable information that will help guide future choices in terms of smart building design, production and operation.

Implicitly, it's the overall optimisation of space that is driving thinking. The economic implications are considerable given the price per square metre for rentals.
"The market for IoT-based energy optimisation in buildings is still being developed. But an increasing number of trials are being undertaken because the economic stakes are so high," maintains Pierre Blanchet.

BUILDINGS | CUSTOMIZATION

DISTRIBUTED WORKING SEEKS HYBRID BUILDINGS

The digital revolution is giving rise to new forms of work and employment. For those who design and operate tertiary property, this means rethinking space.

"Tomorrow people will work anywhere but the office". This statement is perhaps less surprising than it may seem. Current projections of future working patterns challenge the notion that the office is the only place where tertiary activities can be carried out.

In an age where the digital boom has made it possible for everyone to be connected any time and any place, "distributed working", in other words working across different locations (at home, in cafés, on the train, in co-working spaces or public gardens, etc.) and in segmented timeframes, is no longer limited to intellectual and creative professions alone.

The business itself becomes an ideal hub for multiple activities. "So far, work spaces have been designed around two central and static components: the office and the meeting room. The system now needs to be rebuilt around the concept of tasks and encounters, with a particular focus on modularity," explains David Ernest, Innovation and Energy Director at VINCI Facilities.

> Anything that encourages an exchange of ideas or collective intelligence is being explored.

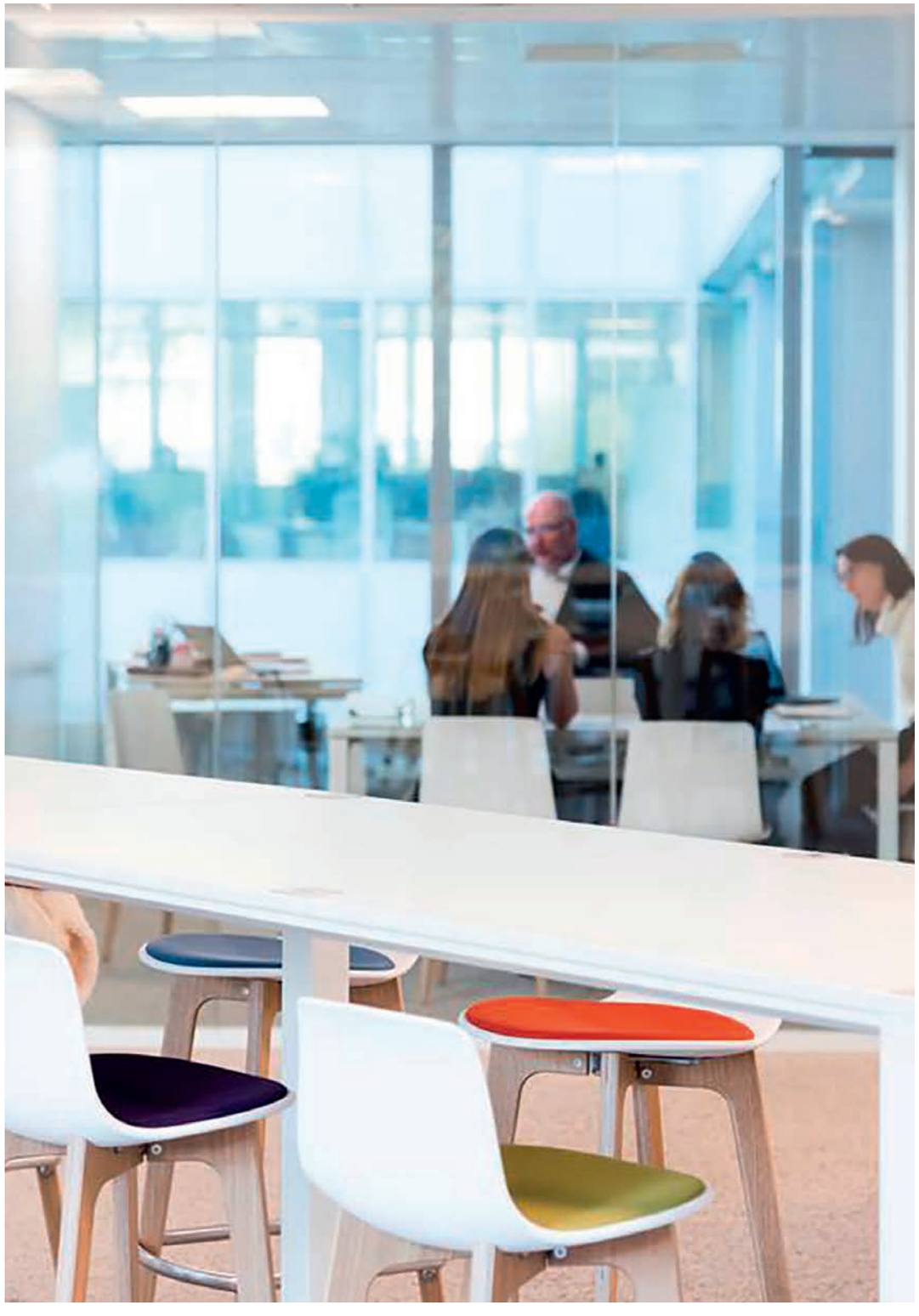
Brainstorming rooms, break-out areas, project spaces, videoconferencing rooms, rapid prototyping workshops, active-learning style training rooms, and chill-out areas in which to relax: anything that encourages an exchange of ideas or collective intelligence and that promotes the emergence of chance projects – so-called serendipity – is being explored by designers and managers of tertiary buildings.

"Offices are constantly evolving to adapt to new practices. Space will inevitably be freed up. Companies, for which rent is the second largest cost after payroll, will have to use this resource one way or another, for example by opening it up to external users, whether they are professionals or not," believes David Ernest.

New forms of employment

The emergence of new forms of employment could accelerate the trend. Indeed, the practice of "distributed working" is now starting to go hand in hand with that of "distributed employment", which refers to self-employed workers, interim managers, employee-entrepreneurs, open contributors, "slashers" (people who have multiple roles or who work for multiple companies), and so on.

Beyond individual situations and motivations, these new forms of employment are all moving in the same direction: towards a hybridisation of activities, types of status and contracts. And the tertiary property sector will have to do something about it very quickly.



ICT INNOVATION

ARE SMART GRIDS THE PERFECT SOLUTION FOR ENERGY TRANSITION?

Olivier MONIÉ

Radek LUCKÝ

Faced with rising world demand for electricity, the need to control consumption, the depletion of fossil energy sources, and the growing call for renewable energy, power grids will have to adapt. Olivier Monié, Managing Director of Omexom, part of VINCI Energies, discusses the environmentally-friendly opportunities offered by smart grids to consumers and agile companies, with Radek Lucký, Managing Director of E.ON Czech Republic.

Power grids have to adapt. One way to upgrade them is to make them smarter. How do you think this could be done?

Radek LUCKÝ. Efficient network operation is essential for well-functioning energy markets. Distribution System Operators (DSO) have an important role to play, as a neutral market facilitator, to ensure that system operation is secure. For example, they should make sure that all energy retailers can sell energy to consumers with no discrimination. In the coming years, there will be new opportunities for DSOs to deliver benefits to energy consumers and the energy sector in general. New technology allows the consumer to interact with the market, amongst others, which means that the role and culture of DSOs might change. DSOs will be more and more responsible for keeping balance in the grid, especially at a local level.

Olivier MONIÉ. A major challenge will be to move beyond historical schemes and to elaborate understandable and fair value sharing rules for all parties. As it is already the case, rules will depend on the country and on the historical players that are in place. This is strongly related to the energy policy in the country and to the way this country manages access to electricity for everyone. Even within Europe, we can see different situations. When you compare French and German regulation systems, they are significantly different, leading to large price gaps, also the ways to make grids smarter are quite different in both countries. Moreover, technological choices and situations can be different. Consequently, DSOs' answers will be specific to each country, despite similar constraints regarding neutrality and quality.

Radek LUCKÝ. As you state, each market and each country is different and the approach of the regulatory body varies a lot, mainly for historical reasons. We have identified four overriding principles which should apply to all DSOs: they must run their businesses in a way which reflects reasonable expectations of network users and other stakeholders, including new entrants and new business models; they must act as neutral market facilitators in undertaking core functions; they must do all of this in the interest of the public, taking account of the costs and benefits of different activities; and they must ensure that consumers own their data. DSOs need to be more and more innovative and explore smart solutions when managing networks.

It is thought that progress in photovoltaics and energy storage will accelerate the trend towards self-consumption, and microgrids. This could reduce grid operators' revenues and impact their business model. How can they offset the loss of revenues and turn this challenge into an opportunity?

Radek LUCKÝ. I think that it is self-understanding, that everyone connected to the grid should participate fairly to the costs of the grid. The discussion about the tariffs and fair payments could be open in the near future. But this is only one side. The other side is – as you mentioned – our entrepreneurial approach to a changing environment. And there - E.ON is very active in this area. We are currently running pilots with both small and big batteries for various commercial purposes. We expect a dramatic decrease of battery prices that will speed up their implementation, which is already supported with subsidies.

Olivier MONIÉ. Usually, people think that the main distribution networks and local microgrids are antagonist solutions, but they are not. In the future, they will have to co-exist and solutions to share the value between them be set up. Complementarities must be explained and enhanced. If I refer to the situation observed in some markets, like Germany, microgrids and sharing local energy within small communities are frequent. More than 1,000 communities exchange the electricity they produce locally. In France, this way of consuming local electricity production is also well expected by many local authorities. Local stakeholders and local authorities would appreciate the development of such solutions and of course, as they are our clients, we aim to bring them customised answers to their expectations. Technological and economical improvements will make these solutions more and more efficient and acceptable by people. For us, microgrids can provide services to the main grids, such as investment deferral and voltage control.

What changes will smart grids bring about to industrial and residential consumers?

Radek LUCKÝ. Distribution System Operators have a role to play in keeping future balance in the grids, especially at a local level. Specifically, a smart grid must be capable of providing power from multiple and widely distributed sources, for instance wind turbines, concentrated solar power systems, photovoltaic panels and, perhaps, plug-in hybrid electric vehicles. Moreover, since all renewable energy sources invented so far are intermittent, a smart grid must be able to flexibly store electric power for later use, for example in batteries, flywheels, super-capacitors, or even in plug-in hybrid electric vehicles. Last, but not least, in order to improve power reliability, a smart grid must make use of new and highly sophisticated adaptive generation and distribution control algorithms.

"New technology allows the consumer to interact with the market, among others, which means that the role and culture of distribution system operators might change." Radek LUCKÝ

Olivier MONIÉ. Electricity produced by local means such as solar panels, windfarms, or biogas technology is obviously a good solution for the environment. Some consumers want to produce, by themselves, a share of the electricity they consume. Distribution networks were not designed to accept these energies and need to be adapted. Making grids smarter is not only to implement technology; it also includes solutions for interaction between networks and consumers. Typically, Demand-Response is one of these solutions. More and more frequently used for transmission networks balancing, this solution will progressively penetrate power distribution networks. At the end the consumer, be they industrial or individual, will see their electricity bill decrease.

Radek LUCKÝ. Consumers are aware about the possibilities of smart grids and smart meters, but the question is still the added value compared to cost. But in the end the question about the implementation of smart technologies is not "yes or no" but rather "when".

Cities currently cover less than 2% of the earth's surface but contain 50% of the world population, consume 75% of the energy produced, and account for 80% of global CO_2 emissions. What are cities doing to achieve greater energy efficiency?

Radek LUCKÝ. In accordance with E.ON know-how, the aim of our "Smart City" project is to support cities in reducing emissions through energy efficiency. It means implementation of energy-saving measures. In order to achieve this, cities replace old public lighting for new effective LED technology and push clean mobility by adapting their transport fleets. Compressed natural gas and electric vehicles are playing a stronger role. Buildings are also built according to stricter energy standards, as well as old buildings, which are being renovated to achieve required norms in the Czech Republic. It's important to do this. With the planned EU targets of eMobility deployment in cities, a grid has to be adapted definitively, because charging infrastructure requires additional power capacity that system operators will have to deliver in following years.

Olivier MONIÉ. Through its brand Citeos, the group has been offering committing solutions to cities for thirty years to save electricity for street lighting while improving quality of service. At first, it was using technology and high-level operation management. Now, we are introducing smart technologies to deliver the right quantity of light, depending on time and affluence. In some cities, we combine street lighting with power generation via PV panels and hydro on the local river. Electricity storage with batteries is now a solution we can use to optimise this generation and consumption set, including e-mobility, in a virtual grid. We aim to dramatically decrease cities' electricity consumption.

What about smart cities' development in the Czech Republic?

Radek LUCKÝ. In the Czech Republic, this topic is very important. We have scaled up projects for smart cities and corporations in more than 20 cities of between 10,000 and 50,000 citizens. Smart cities' projects are critical for their development, which has been based on historical developments: in some cities, power generators are in the middle of the city; in other urban areas, they are out of town. The Smart City concept is still in its first stage in the Czech Republic. The most advanced cities where we are participating are Pisek, Kyjov, Trebic, and Brno.

"People think that the main distribution networks and local microgrids are antagonist solutions, but they are not." Olivier MONIÉ

Olivier MONIÉ. We've worked together in Pisek. We have developed solutions for street lighting, for eMobility, and for energy storage. We also know perfectly how to manage traffic, car parking, thus contributing to better living in the city. We offer all these experiments to our clients, provide customised offers, and mobilise our teams and partners (universities, startups, associations etc.) to build solutions for the cities of tomorrow. Right now, we have about 20 ongoing projects in France alone and these reflect the diversity of issues we address by our transversal approach to smart cities: sustainable mobility, energy autonomy, citizen participation, new business models and more.

Radek LUCKÝ. Based on successful cooperation in Pisek, we've worked with you and other partners or universities to create what we called the «Czech Smart City Cluster». The basic goal is marketing the smart city concept across the Czech Republic and cooperation with state administration, which is sometimes difficult for cities. This cluster was set-up to improve citizens' quality of life, energy savings, renewables, energy support, and the environment.

One of the main features of the smart city is the large volume of data exchanged among various stakeholders. This data will have to be interpreted at an ever-faster pace and will also have to be secure. Do you see your role shifting to that of data supplier, and if so, for what services?

Radek LUCKÝ. Smart metering will be the door opener. There is an opportunity for system operators to utilise their existing passive infrastructure and participate in the data market. Current data grids in cities do not fulfil the requirements of the Internet of Things, which has just started to be deployed, and therefore data grids have to be strengthened. This is basically a chance for the system operators to be much more effective in each city in the future.

Olivier MONIÉ. Consumers are becoming prosumers, and need data to balance their own electric system. A major stake is to combine data and to deliver an interface adapted for each specific usage. If people have to think about how they consume electricity, it will not work, but if it becomes natural, they will be smart consumers as they will interact with the grid. Cities are becoming active prosumers that we can jointly help to become smart cities. New technologies such as blockchains will probably penetrate cities and create conditions for more interaction between inhabitants and their cities. We have to open our minds to different worlds such as startup companies, universities, and clusters, in order to set up customised solutions. We have some examples of what we do with all this data, like the digitisation of control systems in substations, or by using information we haven't used before, such as weather conditions. E.ON and we have a lot to share to help cities to become smarter!

IF IT'S TO REMAIN ATTRACTIVE, THE CITY OF THE FUTURE WILL NEED TO BE EFFICIENT

In a context of global competition, budget constraints and environmental concern, cities must adapt and enhance their communities in order to boost economic development, improve quality of life and increase their perceived value. Technological developments go a long way towards addressing these constraints. But although technology helps meet most expectations in cities, it must not be an end in itself. Instead, it must remain a tool that supports collective projects.

It makes good sense to collect data, but it makes even better sense to exploit it.
In Place de la Nation, Paris, sensors have been installed to analyse traffic (pedestrian, cycle and motor), noise and pollution. The data generated by the sensors have proved very useful in the redevelopment of the square. Similarly in Eindhoven, in the Netherlands, local government has set up dozens of sensors to measure pollution in real time. This means that residents can access a live report of the pollution level in their neighbourhoods. The city has revamped its urban planning scheme so as to reduce congestion in the most polluted areas and redistribute urban traffic more effectively.

To collect the data, various technologies can be implemented that support the use of connected devices. A user-friendly interface must then be produced for professionals and private individuals in order to utilise the data in question. Once the data has been gathered, it has to be organised in a structured way so that it can be analysed in real time or non-real time. It's the role of Big Data experts to extract relevant information from it.

Collective intelligence

But local authorities do not always have all the capabilities needed to exploit the data, which is why it should be opened up to a wider group of stakeholders. Each stakeholder can find value in the data, and as a result cities inspire emulation and create new services.

Smart city schemes will deploy technology, that's for sure, but the key aspect is to take account of local authorities' needs and constraints. By placing municipal services, residents, shops, businesses and tourists at the heart of thinking, and by focusing on efficiency, habits and new services, we bring collective intelligence to all city stakeholders.

Guillaume GARRIC
Smart Cities development director at VINCI Energies France

Edouard HENRY-BIABAUD
Smart Cities development manager at Axians

AN INDUSTRIAL REVOLUTION IN ELECTRICITY STORAGE

We have all heard now that electricity storage is critical to the future sustainability of the UK's energy supply. It offers vast potential for grid stabilisation and black start capacity. It can combine with renewable assets, enable smart cities and factories and work within integrated industrial micro-grids. The question now facing us is this: who will take delivery of a storage revolution from promise to reality? UK industry is primed to capture the benefits of electricity storage, and the time to move is now, says VINCI Energies' Chris Hutchinson.

Interest in storage tends to lie in grid management, home packs and renewables integration. However, at VINCI Energies we believe it is industry that could be at the forefront of storage uptake, innovation and roll-out. From our day-to-day operations, we see that the highest economic value of electricity storage is currently where commercial and industrial consumers can use behind-the-meter solutions and deliver energy efficiency and flexibility. Industry is already in the position to gain from electricity storage rapidly and easily.

Towards an industrial revolution in energy storage

There are many incentives for industry to invest in electricity storage now and relatively few regulatory concerns. Many large manufacturers have already invested in renewables and energy management technologies for reasons of cost control and sustainability. Discussions of demand-side response have increased awareness of the arbitrage opportunities from reducing power purchasing at peak times.

Storage offers the opportunity to increase returns from these existing investments – and profit is a great motivator. There is also the fact that industry likes secure, affordable and clean energy, all of which is enhanced by electricity storage capacity. Conversely for the grid, there is a fast evolving regulatory environment and many more external variables over long-term pay back over any investment.

Going forward, moves towards half-hourly energy pricing will only increase the focus on costs and opportunities for avoiding peak pricing. We're also going to see an increasing appetite for energy efficiency and extra power capacity in our commercial sectors. And that's on top of the trend towards industrial micro grids, uptake of ever more cost efficient renewable assets and demand-side response.

Chris Hutchinson
Director, Actemium UK

STRASBOURG CATHEDRAL DISPLAYED IN ALL ITS GLORY

A new illumination system has been in place at Strasbourg Cathedral since 29 October 2016, revealing the beauty of its architecture and promoting the city's heritage. The building's 660 lighting points are fully LED-based, generating energy savings of 25% on the previous system and combining aesthetics with energy efficiency. The lighting scheme was designed to showcase all of the architectural details of the cathedral, which is celebrating the 1000th anniversary of its foundation, in different ways depending on the time of day, from dusk to dawn.

AGILITY **PROFILE**

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: the digital transformation and the energy transition.

Keeping pace with market change, VINCI Energies supports its customers by offering increasingly innovative solutions and services, from design to implementation, operation and maintenance.

With their strong regional roots and agile organizational structure, VINCI Energies' 1,600 business units boost the reliability, safety and efficiency of energy, transport and communication infrastructure, factories and buildings.

The Group's business units are organized around five international brands – Omexom, Citeos, Actemium, VINCI Facilities and Axians – in addition to brands with a more regional identity.

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