VEOLIA

ENERGY SERVICES FOR BUILDINGS

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INTRODUCTION

HUMANITY HAS NEVER FACED AS **MANY CHALLENGES** AS IT DOES IN THE **21ST CENTURY**

We live on a planet we have not cared for properly.

And now we are paying the price. If the extreme weather events battering every continent are the most visible scars, other equally fearsome challenges need tackling during the coming two decades. And with the clock now running on the climate emergency, decarbonizing and improving the energy of buildings plays an essential role, whether in terms of cutting greenhouse gas emissions, managing non-renewable resources, or boosting regional resilience.

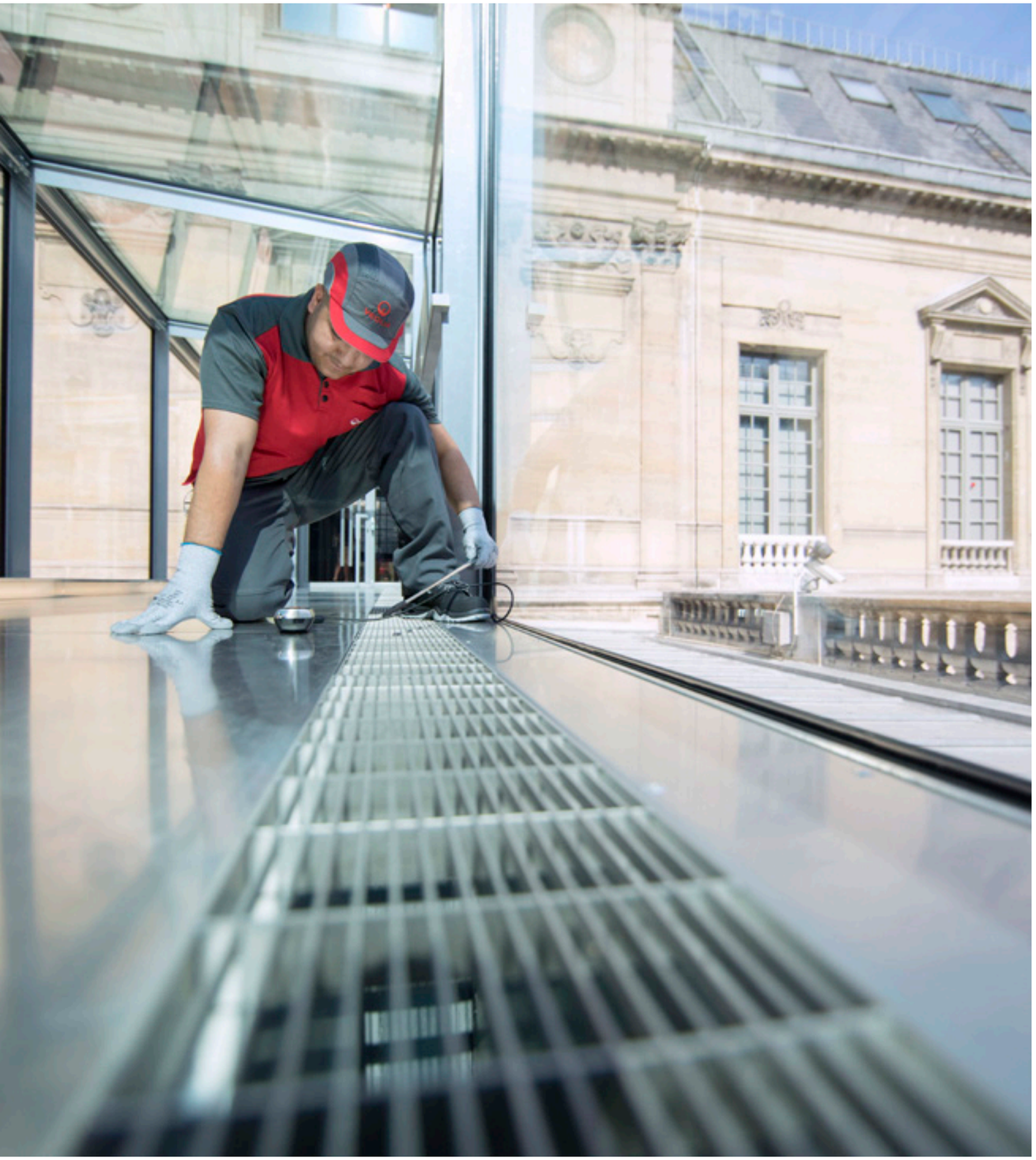
01 — Introduction

From a strictly practical viewpoint, in 20 years' time there will be 9 billion people on earth, all of them needing homes and food; the rise of the global middle-class and of digital technologies will increase energy needs by 30%; rampant urban spread will continue to swallow farmlands that are already heavily degraded; proximity between untamed natural environments and urban spaces will increase the risk of new viruses being transmitted to humans; rising temperatures and pollution will make life ever harder in megacities where population densities will continue to increase; resource scarcity, foremost of all freshwater, "blue gold", will be the cause of major conflicts between users, destabilizing entire regions across the planet, and so on. These are just a few of the planetary challenges that Veolia seeks to offer solutions for.

In 20 years' time ***there will be nine billion people on earth.***

Tackling these challenges is critical: they have shown us that our lifestyles are under threat and that we need to change them right now, humanity cannot go on living in the same way. There is no turning back. Our world is different now, and we must adapt. Unless we act immediately, circumstances that seem exceptional today will become the norm tomorrow. We have to take stock and act collectively.

The rise of the global middle-class and digital technologies ***will increase energy demand by 30%.***



BECAUSE **ALTERNATIVE SOLUTIONS** EXIST

Veolia's resolute commitment to ecological transformation means that it can respond to the highly complex equations that condition tomorrow's world.

Veolia has adapted its business activities — in water, energy and waste management — so it can better support its stakeholders in their own transformations. Veolia seeks always to combine strengths because nobody, in isolation, can tackle all these challenges while also preserving natural resources and combating the climate emergency.

Against this worrying background, the ecological transformation of buildings is an issue of critical importance. Worldwide, the energy used by buildings accounts for 35 to 40% of total CO_2 emissions. So, the Energy Services for Buildings business line is central to the ecological transformation that is vital if we are to decarbonize our day-to-day lives and enjoy a better quality of life.

The following pages show how this business line actively contributes to building a more sustainable world, and how Veolia leverages innovations to roll out new solutions for tomorrow.

In today's world, working on the ecological transformation of buildings is vital. Making sure that the spaces we spend our time in are of high quality and comfortable, reducing their energy consumption and increasing the use of decarbonized renewable energy sources are all priorities.

Energy services for buildings from Veolia leverage the full potential of our experts' unrivalled expertise, combined with our digital tools, to deliver solutions for the future of us all — and our planet.

FRANCISCO SILVERIO MARQUES

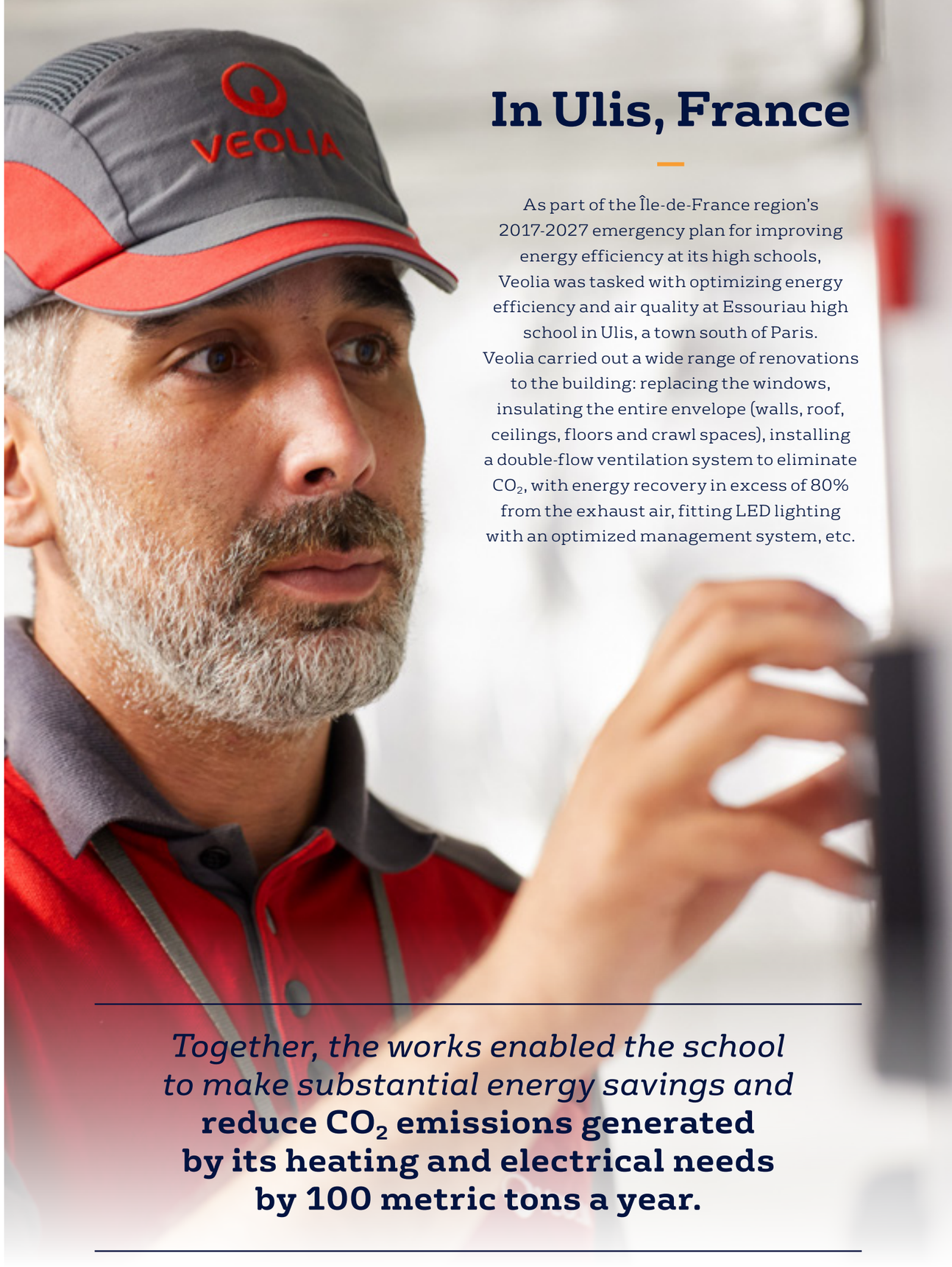
Director, Energy Services for Buildings

VEOLIA SERVING THE PLANET

BUILDING REFURBISHMENTS **TO REDUCE** GREENHOUSE GAS EMISSIONS

Most buildings in use today require fossil fuels to function, providing heat, ventilation, air conditioning, lighting and hot water. And because of their design, the materials used and the equipment installed, most of these buildings are not energy efficient. The European Commission estimates that three in four buildings in Europe are not energy efficient.

In this context, Veolia advises and supports building owners and managers to carry out works to improve energy efficiency and reduce emission of the greenhouse gases that cause global warming. The buildings covered by these refurbishment works are hospitals, teaching establishments, commercial properties, transport facilities, sports facilities and hotels as well as residential apartment buildings.



In Ulis, France

As part of the Île-de-France region's 2017-2027 emergency plan for improving energy efficiency at its high schools, Veolia was tasked with optimizing energy efficiency and air quality at Essouriau high school in Ulis, a town south of Paris. Veolia carried out a wide range of renovations to the building: replacing the windows, insulating the entire envelope (walls, roof, ceilings, floors and crawl spaces), installing a double-flow ventilation system to eliminate CO_2, with energy recovery in excess of 80% from the exhaust air, fitting LED lighting with an optimized management system, etc.

Together, the works enabled the school to make substantial energy savings and **reduce CO_2 emissions generated by its heating and electrical needs by 100 metric tons a year.**

MONITORING AND MAINTENANCE **TO OPTIMIZE** THE USAGE OF ENERGY RESOURCES

If delivering a significant cut in a building's environmental footprint often involves upgrading its intrinsic characteristics, optimized management of equipment during the operating phase generates additional energy savings and guarantees them over time. An energy performance contract involves a set of transparent undertakings, setting clear and easily understood targets for cutting energy use via a program of refurbishment works and improvements to the way a building is managed and run. Veolia supplies a vast range of maintenance services as well as the client reporting tools and mechanisms needed to measure a building's operational and environmental excellence. Building operators are provided with dynamic real-time information on energy consumption that they can use to decide on any corrective or preventive measures to take.

In Spain

Veolia signed an energy performance contract with Indra that included full guarantees for a set of defined objectives and covered energy management at 73 sites. Thanks to the reporting system and 162 separate energy-saving measures put in place, electricity consumption fell 14% and CO_2 emissions were reduced by 2,500 metric tons a year. Indra's buildings are now ISO 14000 certified, rewarding the success of this environmental management program.

ALTERING BEHAVIORS **TO REDUCE** BUILDINGS' ENVIRONMENTAL FOOTPRINTS

User behavior is another determining factor in reducing the environmental footprint of buildings.

Altering people's behavior and getting them to adopt habits that are more environmentally aware can also have a significant impact on a business' environmental performance. But behavioral changes often need support. With Awareness, part of its Hubgrade smart monitoring solution, Veolia provides a communication program designed to make users of buildings more aware of the environmental impact of their behavior.

In Brussels, Belgium

Veolia is responsible for energy performance at buildings occupied by the national pensions office. In addition to modernizing energy installations, Veolia also raised awareness of the performance-led approach among the 1,700-strong workforce. Taken together, these actions delivered a 31% fall in energy use across the organization's seven office buildings.

DECARBONIZING
THE ECONOMY, DECARBONIZING BUILDINGS

Setting aside any fall in the consumption of fossil energies, the ideal scenario is a complete decarbonization of the economy. In France, the High Council on Climate noted in its 2020 annual report that “attaining carbon neutrality implies that the building sector is fully decarbonized by 2050. Structural long-term action in this sector presents unique opportunities for responding to the threefold imperatives of economic recovery, reducing inequalities, and combatting the climate emergency.”

*Veolia has developed the **expertise** needed to produce energy **that is decarbonized and renewable.***

In Queensland, Australia

Veolia has developed a water battery project on the University of the Sunshine Coast campus in Queensland. Photovoltaic panels have been fitted to rooftops and sunshades on campus car parks and the energy produced is used in a thermal process to cool water stored in a reservoir, acting like a battery. The water is then released into the buildings’ cooling circuits at the desired time to provide air conditioning. When correctly managed, these techniques should deliver savings of over 92,000 metric tons of CO_2 emissions over 25 years, equivalent to the carbon emissions of 525 Australian homes over the same period. USC plans to achieve carbon neutrality by 2025.

05

VEOLIA SERVING REGIONS AND BUSINESSES

RECONCILING
ENERGY PERFORMANCE WITH ECONOMIC PERFORMANCE

The amount of investment required for improving the energy efficiency of buildings and reducing their environmental impact is not a hindrance to economic efficiency.

Quite the opposite, because not only do the solutions for cutting buildings' energy use and environmental footprints actually exist, but rolling them out can generate substantial savings, even additional earnings, for operators and regions alike. Investments targeted at reducing energy usage can cut energy bills by 15 to 40%, offering a return on investment within 5 to 10 years. It is also important to remember that in today's market, the more energy efficient a building is the more it is attractive to occupiers, and therefore the higher its value as an asset.

In Dubai, United Arab Emirates

In 2015, Enova, a joint venture between Veolia and Majid Al Futtaim, signed an energy performance contract with Etihad ESCO to deliver energy performance services to the Dubai Electricity and Water Authority (DEWA). The contract, which is based on the use of a Hubgrade energy management center, delivered a 30% fall in water and electricity use in seven DEWA-owned buildings, helping Dubai to deliver its Vision 2030 plan for sustainable development.

SECURING
BUILDING ENERGY SUPPLIES

In certain buildings, hospitals for example, an interruption to the energy supply can have serious or even fatal consequences for safety and continuity of care. And the extreme weather events seen in recent years are testing the resilience of buildings and city energy systems. Against this background, some building operators are looking for ways to guard against the risk of power outages, motivated by the search for greater energy autonomy and better control over running costs.

Veolia responds to these demands with solutions built around microgrids, which are small smart energy networks able to operate with, or independently from, local power grids. Microgrids are innovative, cost-effective and environmentally friendly solutions for producing heat and electricity, primarily from renewable sources (solar, wind, biomass, etc.), storing then distributing the energy locally.

In New York, United States

Thanks to support from Veolia, all the energy needs at the TWA Hotel at New York's John F. Kennedy airport are met by a standalone energy microgrid that operates independently from the New York City central grid. The hotel produces its own energy, stores it in batteries, and meets its own needs for heating, air conditioning and electricity.

SUPPLYING BUILDINGS WITH RENEWABLE ENERGY FROM WASTE RECOVERY

To combat resource scarcity and limit the use of fossil fuels, buildings can be powered by renewable resources, using energy recovered from waste sources such as wastewater and household garbage. Veolia has patented a solution called Energido, which makes it possible to divert a portion of municipal wastewater through a heat exchanger, transferring the thermal energy to a heat transfer fluid. The calories recovered are routed through a reversible heat pump and the energy then used in a building's heating or cooling network.

In Marseille, France

Energido is used at the Cercle des Nageurs de Marseille swimming complex to keep the Olympic-length pools at an all-year constant 27°C and to preheat hot water for the changing rooms. As well as providing a 35% saving on annual energy bills, the heating system also avoids annual emission of 230 metric tons of CO_2.

UNDERSTANDING HOW TO MEET
COMPLEX AND VARIED NEEDS

Veolia has developed a range of offers suited to a number of different business models, backed by different levels of performance commitments.

- **Expertise:** Veolia guarantees an initial level of energy savings thanks to access to its Hubgrade solution coupled with advice and reports on energy usage. This service incorporates additional environmental performance criteria as well as energy.
- **Comfort:** Veolia commits to meeting comfort and quality thresholds in buildings, such as indoor temperature and humidity, with guaranteed response times in the event of a breakdown. Technical equipment is managed and optimized for the long term.
- **Efficiency:** Veolia designs, installs and operates energy plants for buildings, giving operational and yield guarantees.
- **Performance:** actions to improve energy efficiency are rolled out after an audit process, allowing clients to benefit from Veolia's comprehensive guarantee from that performance thresholds will be met. Monitoring and optimization of consumption are provided via the Hubgrade solution.

04

INVENTING TOMORROW: CENTRAL TO EVERY VEOLIA INNOVATION

In France

The telephone and internet provider Orange uses the Flexcity platform to monetize its back-up energy storage batteries by aggregating its installations and running them using the solution's algorithms. The platform uses capacity from thousands of batteries at Orange's sites across the country to mitigate the effects of high demand peaks and power surges. Over 8,000 sites can be called on in just a few minutes.

USING ELECTRICAL FLEXIBILITY TO MANAGE ENERGY NEEDS

At a time when electricity systems are undergoing far-reaching structural changes, achieving balance between production and demand is a major preoccupation for grid operators in their work to support the energy transition. The need to use more energy from renewable sources adds further difficulties: production is intermittent and bears no relation to peaks in demand.

To support its clients, Veolia has created Flexcity, a solution for leveraging electrical flexibility. By modulating and adjusting certain production processes, this smartgrid technology adapts electricity consumption and production to match demand in real time. It makes it possible to optimize assets that consume, produce and store distributed electricity. There are numerous client benefits: they can benefit from payments from power grid managers, take advantage of price fluctuations to optimize their electricity bills, assure their energy independence thanks to microgrids, and support integration of renewable energy sources into the grid.

CAPTURING
RESIDUAL ENERGY AND
PRODUCING
ELECTRICITY FROM COGENERATION

Veolia is currently developed a new generation of more flexible microgrids that provide real-time remote management, optimized to reflect variations in production and demand. These use cogeneration technology: the heat generated by the production of electricity, usually not used, is recovered and used to heat the building. As part of an energy optimization process, surplus energy not used in buildings can be sold to energy companies. In this way, Veolia creates a virtuous loop that connects utility grid managers with industrial managers: residual energy in a region is captured then transmitted via Veolia-managed networks to buildings also managed by Veolia.

In Brunswick, Germany

Veolia is implementing a concept called ReUseHeat in a new high energy efficiency district. Waste heat from a data center is recovered and stored for use in district heating (for a building or even an entire neighborhood). Heat is injected into a decentralized heating network connected to the existing district heating network. Waste heat from the data center can reach temperatures of 18°C to 25°C. A pump then sends it to the district heating network.
A heat pump is then used to raise the temperature to 70°C so that it can provide the city's buildings with heating and hot water. This is an environmentally friendly solution — even the electricity needed for the heat pump is from a renewable source.

ASSESSING
THE IMPACTS OF BUILDINGS ON THE ENVIRONMENT AND **IMPROVING** THEIR RESILIENCE

Veolia offers innovative decision-support with 6THEMIC®, a special methodology developed by Seureca, the Veolia group's consulting engineering division, to help building owners and operators to assess the total impact of their buildings on the environment and human health.

In New Orleans, United States

In 2005, hurricane Katrina caused 1,800 deaths, with 80% of the city flooded and massive damage to property. Following this disaster, the city council was keen to measure its exposure to risk and to transform its urban systems to make them more resistant to shocks. Working alongside the city authorities and reinsurance specialists Swiss Re, Veolia applied its 6THEMIC® methodology as part of the world's first ever public-private partnership for creating a regional resilience strategy.

IMPACTFUL SOLUTION

05

HOSPITALS:
ENERGY EFFICIENCY FOR HEALTH

BACKGROUND

Hospitals have to deal with many critical health-related issues in the course of delivering their public service missions. To make sure that patient care is provided under the best possible conditions they have to ensure continuity of care and services, no matter what the conditions. The tradeoff is that hospitals have very high energy bills because they have to meet patients' needs and comply with regulatory standards in terms of performance guarantees. A hospital uses twice the amount of energy per square meter than a conventional building.

In France, according to the EHESP School of Public Health, this can amount to as much as 5% of total hospital budgets. In the USA, healthcare establishments are the nation's number two energy consumers, spending close to $8.5 billion every year. Safety and reliability factors lead them to seek almost total independence from energy suppliers, for example by fitting their own plant to generate electricity and heat.

SOLUTION

At a time when hospital budgets are under strain, Veolia has conceived and developed reliable solutions that enable healthcare establishments to deliver high energy, economic and environmental performance standards.

As part of providing these energy services, the Veolia group innovates and commits to supporting healthcare establishments through the use of energy performance contracts. These contracts are designed to deliver guaranteed energy savings, with a portion of contract payments dependent on the results obtained. Energy production installations are designed, built, operated and maintained by Veolia, supported by real-time performance monitoring delivered via Hubgrade.

As partner to over 2,200 hospitals around the world, Veolia helps to secure their energy supplies and optimize their energy use. Erasme in Brussels and Westmead in Sydney, Australia, are both hospitals that saw 18% falls in their energy bills.

IMPACTFUL EXAMPLE

In Italy, Veolia signed a contract with the health agency in Trieste for the country's first-ever public-private partnership for energy services. Signed in August 2019, the nine-year contract tasks Veolia with improving efficiency at two hospitals, Cattinara, (730 beds, the city's largest) and Maggiore (200 beds). It is anticipated that the associated works will cost 10 million euros, financed via energy savings and 2.5 million euros in funding from the European Regional Development Fund's regional operational program. The contract covers re-engineering the heating and cooling installations, construction of cogeneration plants and work on the electrical systems and wastewater treatment plant. The combined works are scheduled to achieve a 27% fall in CO_2 emissions by the end of the contract period.

10 million euros
of investments financed via energy savings.

IMPACTFUL SOLUTION

HUBGRADE:
SMART MONITORING FOR ENERGY

06

BACKGROUND

Digital technologies make it possible to combine operational, environmental and financial performance. Digital makes it possible to imagine new solutions to improve how a building's energy performance is monitored and controlled so that abnormalities can be detected, areas for improvement identified, and the appropriate actions be put in place. These solutions also make it possible to spot signs of ageing in installations, helping to prolong total working lifetimes. Veolia has been developing digital tools to help with this process and deploying them all over the world for over a decade.

SOLUTION

In 2018, Veolia decided to speed up its digital transformation and make Hubgrade its single brand that embodies digitalization across all its business lines, helping to improve the quality of services delivered to its municipal, industrial and commercial clients.

Today, Hubgrade represents a set of solutions that combine human and digital expertise: it leverages the advantages of digital to collect data that are then compiled and examined by our experts. The solution provides energy performance assessments for buildings, so that actions can be taken as indicated by the results obtained. Hubgrade pairs human expertise with the power of algorithms and digital technologies.

In 2020, Veolia operated 64 Hubgrade monitoring centers in 22 countries worldwide. Although each center has specific local features, they are all increasingly converging toward a unified single vision, which facilitates the implementation of new digital solutions that can be shared. Hubgrade centers make it possible to achieve energy savings of up to 40% on bills. For the Veolia group, which manages over 100 million square meters at building complexes around the world (offices, hospitals, schools, shopping malls, etc.), the potential impacts are highly significant.

IMPACTFUL EXAMPLE

The Mall of the Emirates in the United Arab Emirates is one of the world's most popular shopping malls, welcoming over 45 million visitors every year. The mall is not connected to a district cooling system and relies on its own cooling plant to produce all the chilled water needed to maintain comfortable conditions all year round.

To achieve this, Veolia, working through its Enova subsidiary, developed a solution known as BEES - Performance (building energy efficiency services). Enova has been supporting Mall of the Emirates since its pre-opening, first as a consultant for the implementation of operation and maintenance, then as the service provider for its facilities energy management operations.

Since the mall opened in 2005, Enova has been in charge of operating and maintaining the entire heating and cooling system, from ventilation to air conditioning and including the chiller plant, mechanical refrigeration equipment, along with the electrical and water distribution systems.

Thanks to Hubgrade, Enova can now monitor the mall's performance and implement energy saving measures.

For the mall, this realistic digitally-led approach to facilities energy management delivers:

- improved profitability
- increased competitiveness
- reduced risk profile
- enhanced sustainability for services assets
- enhanced image

KEY ACTIVITY DATA

GLOBAL GEOGRAPHICAL FOOTPRINT

Services supplied in
33 countries

OUR CLIENTS

2,200
hospitals

7,900
office buildings

1,100
shopping malls
and major stores

122
airports

2,600
university campuses
and school buildings

300,000
apartment building
residential equivalent units

REVENUE (2020): €2 BILLION

OUR ENERGY PERFORMANCE CONTRACTS (2020)

35,500 MWh
of heat and cold saved

77,000 MWh
of electricity saved

Veolia Communications Department
October 2021

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Resourcing the world

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