

Innovation Journal #4



OCTOBER 2021

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WHISTLE-STOP TOUR

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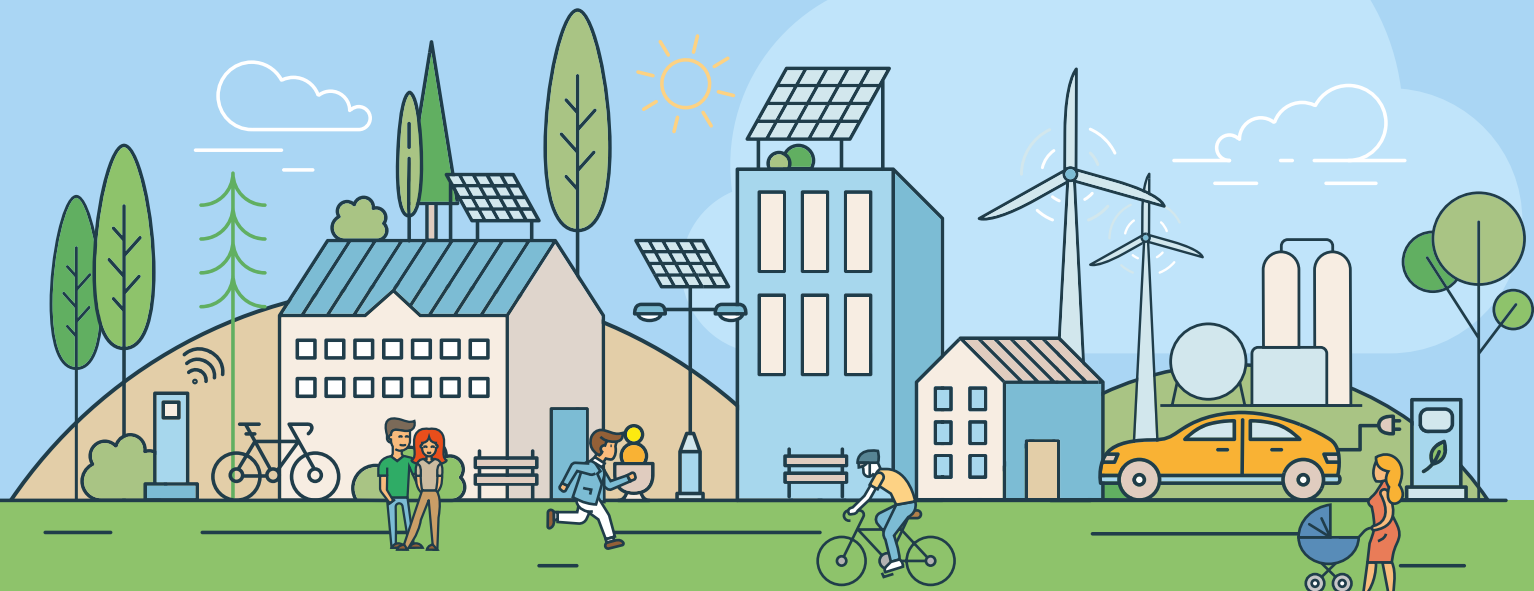
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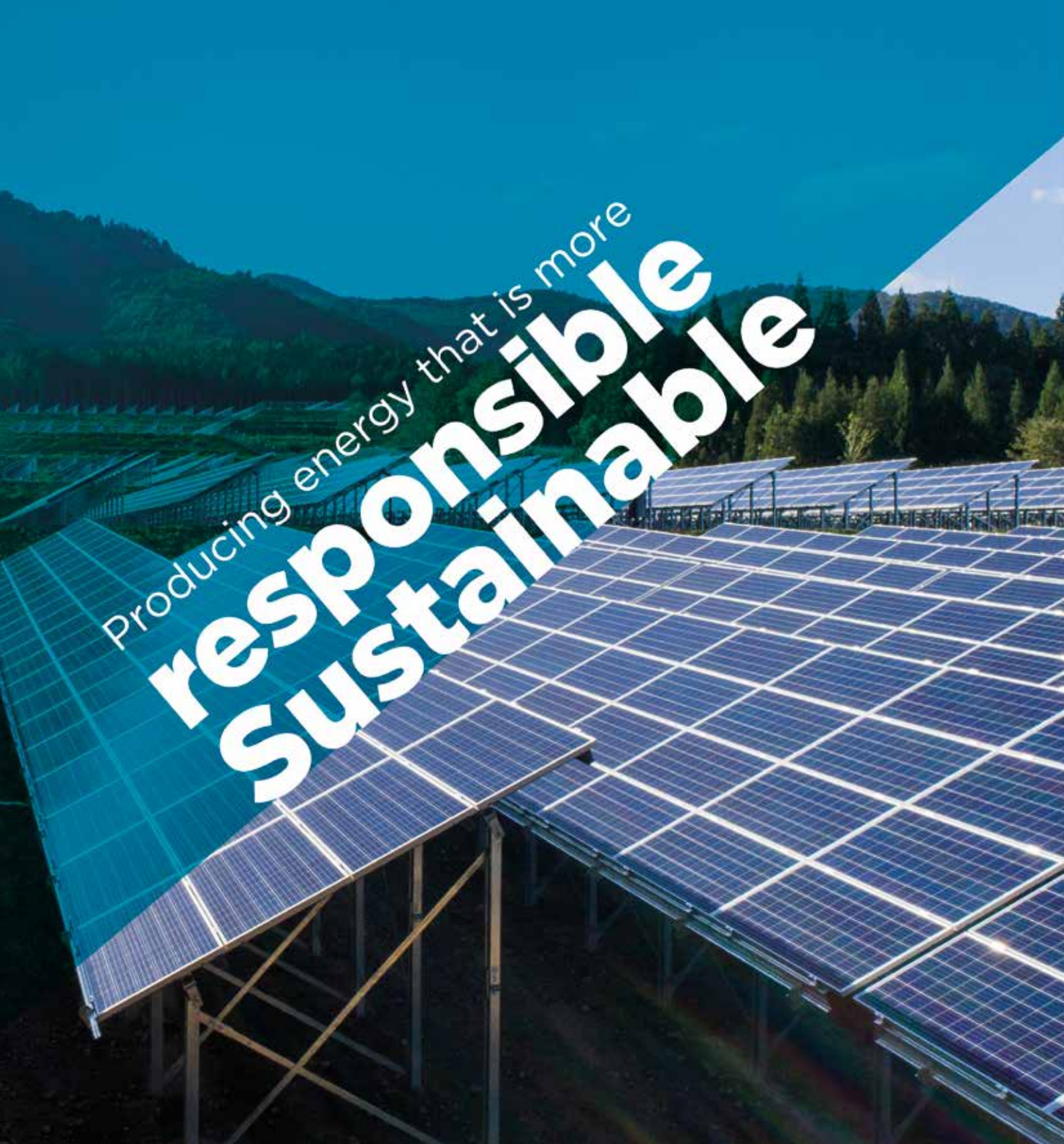
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SPECIAL REPORT DECARBONISATION

TOGETHER
FURTHER
FOR

Climate





Producing energy that is more
responsible
Sustainable

Because we live in a world that is changing to meet environmental challenges, we are acting to accelerate the energy transition. All over the world, we offer you innovative, tailor-made and turnkey solutions to produce a reliable and sustainable source of renewable energy worldwide, including in isolated sites, that are more respectful of the environment.

www.bouygues-es.com



DIVISION OF



Shared innovation

AIMING FOR DECARBONISATION

After more than a year of crisis, there are reasons to hope given the COVID vaccination campaigns as well as the easing of health measures and the partial return to the work place. However, the covid crisis combined with the climate emergency have marked a turning point and started a significant transformation of our societies.

This summer we were able to host our seminar with the Swiss, German and French innovation communities and via Microsoft Teams for our British and Canadian colleagues. Although a hybrid format is not always ideal, all our staff were still deeply involved in this annual event and I thank them heartily for it. The quality of their work can be seen throughout this paper.

The crisis is bound to have affected our mindsets and working methods by catapulting us several years ahead in the development of remote work, both for our clients and for ourselves. We must now take these societal changes with us within the business and in our services: less office space used by companies, increased demand for flexibility, new services for our FM teams, etc.



The pendulum will probably swing back some of the way, but we can be sure that a good share of these changes will be permanent.

Cutting down on travel, a social phenomenon triggered by COVID, has shown it is possible to reduce CO2 emissions. Decarbonisation and the climate emergency are

becoming defining features of our economies, and sources of continuous innovation. We have shifted from grandstanding on climate to actually taking action: the European Commission's Green Deal, development of renewable energies, electric vehicles, hydrogen, all of which were already on our community's radar, are now being scaled up.

●● *Decarbonisation and the climate emergency are becoming defining features of our economies, and sources of continuous innovation.* ●●

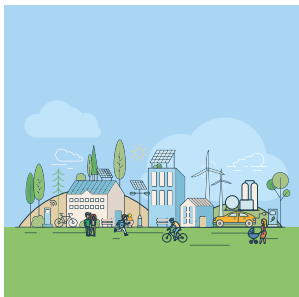
Companies and local authorities themselves are moving away from green washing and taking practical steps both internally (carbon footprint calculation, electrification of the vehicle fleet, staff awareness raising) and externally, with regard to their suppliers. The movement to decarbonize our economies is real, albeit still slow. The transformation is underway and the companies in the Energy and Services division are at the vanguard of this movement.

As was the case last year, we have dedicated our central feature to decarbonisation and brought in renowned outside experts to gain perspective and insight into this subject. This is illustrated by practical examples of solutions introduced to the market by various units in our division.

Decarbonisation is the keystone of this innovation paper. That said, it is just one of the four pillars of our division's Together Further strategy. Throughout these pages, you will find innovation projects that address the other three related pillars: Digital, Services and People.

I hope you enjoy the read.

Servan Lacire
Director of Research, Development and Innovation for the Division



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& **Servan Lacire**



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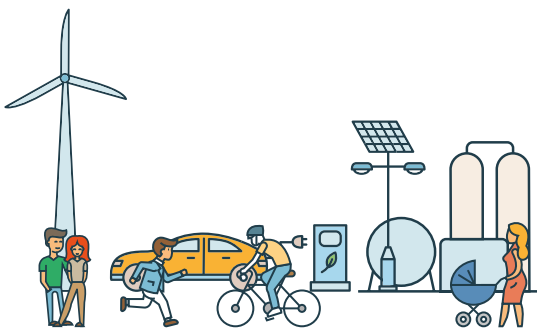
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INNOVATION EFFORTS
will focus on
decarbonisation



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What's New?

A VIRTUAL DEMONSTRATOR FOR SMART CITIES & REGIONS AT CHALLENGER



You can visit the Smart Cities & Regions demonstrator at Challenger, the headquarters of Bouygues Construction. You can even visit remotely via your smartphone, thanks to the «Challenger Discovery» application: urban hypervisor, i-Girouette, intelligent street lighting, electric vehicle charging stations, etc. This application allows you to discover all the Bouygues Energies & Services innovations presented in the «demonstrator» at Challenger, either from home or in conjunction with an on-site visit. Get the new version of the app in early 2022!

Download the app on the App Store or Google Play!

UNITED AND INSPIRED INNOLEADERS

To encourage exchange and foster new innovative projects Bouygues Construction's Energy & Services division organises an annual seminar with some sixty innovation ambassadors from around the world. They come from France, Switzerland, Germany, Great Britain and Canada and participate in inspiring conferences, discussions with management on the company's ambitions and strategy, workshops, etc. The aim of this seminar is to enable the creation of innovative solutions that better meet the needs of employees, customers and users! See P.35 for the 2022 projects initiated at the last seminar.



3 FAVOURITES FOR THE INNO' CUP JURY



The Inno'Cup competition is an annual opportunity for all Bouygues Construction employees to highlight their innovations. Each edition highlights the human commitment, professional excellence, sustainable development, and organisational transformation through innovation projects. This year, three projects linked to our strategic challenges won the jury's favourites: a «low tech» approach to avoid waste in projects and favour local sourcing; «Kalm solution», a decarbonisation solution by storing energy from power stations and finally «By-Bot Legal», a chatbot that instantly answers simple and recurrent legal or administrative questions. See you at next year's event!

All makers in the UK!

MAKERS

In Great Britain, the «Makers programme» enables all employees, whatever their job or function, to develop an innovative project in keeping with the company's development strategy. The primary aim is to highlight all initiatives, good practices and ideas that promote professional excellence. The next step is to enhance, develop and share them so that they can be disseminated on a wider scale. Almost 200 projects have been generated through this programme, half of which have been approved and disseminated. It has proved to be a powerful tool for responding effectively to the Covid crisis.

TRENDS, NEWS, PROJECTS... OUR INNOVATIONS ON THE WEB!!



Intelligent and sustainable territories, smart buildings, industry 4.0, renewable and decarbonized energies... Energies & Services as well as our clients and partners can express their views on a shared web space dedicated to innovation. Making shared innovation more than just a slogan, but rather a fully-fledged approach.

<https://shared-innovation.bouygues-es.com/en/home/>

FANCY AN INNOCAFÉ?

In Germany, Kraftanlagen hosts an innovacafé every two months across its 8 branches. These internal meetings dedicated to innovation and networking are accessible to all employees in both face-to-face and virtual formats. The first session was on the European Green Deal and the next on process digitalisation.



Become an entrepreneur

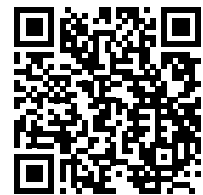
Bouygues Innovation has just launched a new intrapreneurship programme involving Energy & Services division employees. The theme of this first season is «new solutions: simplifying daily life and contributing to community well-being». An opportunity for employees - whatever their job and speciality - to become entrepreneurs with the support and expertise of the Group's business lines.



Zoom on VIVATECH

Every year our experts speak at this international innovation fair. Watch our speeches at the 2021 event on the Bouygues Construction YouTube channel:

- Innovation for climate policy**
- Innovation for responsible mobility**
- Innovating for better city living**



DRAGON'S DEN TV SHOW

Dragons' Den is a reality television program format in which entrepreneurs pitch their business ideas to a panel of venture capitalists in the hope of securing investment finance from them.

Plan Group has created their own version of this TV show allowing employees to pitch their ideas to senior leaders.

This event will be and streamed live for all to watch, learn and enjoy.

Events and exhibitions... meet our experts

Throughout the year, find out about our innovations that can support your digital transformation and your energy transition at various events that we attend:



VIRTUAL AND AUGMENTED REALITY: WELCOME TO THE BOUYGUES CONSTRUCTION DESIGN LAB!

At Bouygues Construction, innovation is key to tackling the challenges faced by the Group and its customers. It plays a dual role: feeding the strategy by acting as a pathfinder, and turning it into reality by providing rapidly tested and deployed solutions, accelerated by digital technology. The «design lab», a place for experimenting with virtual and augmented reality, was created to support the Group's digital transformation and the digitalisation of its businesses and processes. Find out more about this new space, which is now open to the Group's customers and prospects.

Integrating emerging trends and new uses, stepping up responses to environmental challenges, and increasing operational efficiency are Bouygues Construction's innovation priorities.

Digital transformation is at once a requirement, a means and a catalyst of innovation. With the «Design Lab», Bouygues Construction aims to support this change both internally with its employees and externally with its customers.

Designed as a place to experiment and demonstrate innovative digital solutions applied to construction, this room is a place to explore the uses of virtual reality and augmented reality through [5 customer journeys](#):

1 Using the 3D model, interact with the developer, the architect and the end customer to **approve proposed layout options or finishes** projected in a virtual space.

2 **Monitoring the location of reservations**, assisting with the layout, marking out: Superimpose the EXE model onto the real environment (in situ) and note any discrepancies; Feed the information into the BIM tools.

3 **Training the company's associates** in the correct gestures, via a visual and tactile process using a simulator made up of a virtual reality helmet, a robotic platform and movement acquisition sensors to **monitor and evaluate the associate's posture**.

4 Help an employee prepare for real work on **complex operating procedures** in virtual or augmented reality to anticipate and better understand the tasks to be carried out.

5 **Automating compliance checks** via image processing, machine learning, and AI.



2021 Paris-Saclay Innovation tour.



"We want innovation to be as visionary as it is practical, to reconcile the pursuit of big dreams with their actual application on the ground. Innovation is a commitment for everyone. Driven by a team spirit, we draw on the initiatives and best practices of our teams, the skills of our partners, and the needs voiced by our customers and end-users around the world," says **Marie-Luce Godinot**, Deputy General Manager in charge of digital transformation, innovation and sustainable development at Bouygues Construction.

To support this commitment, Bouygues Construction is unlocking synergies between the expertise of each of its business lines and 3 main cross-functional approaches: forecasting to anticipate, Research and Development (R&D) to overcome technological obstacles and strategic marketing to formalise.

"Our strength lies in an entire international ecosystem, both in-house and external, that innovates for the benefit of society and sustainable regions" concludes Marie-Luce Godinot.

WHEN INNOVATION *lights the way*

Interview between
Pierre VANSTOFLEGATTE
and Servan LACIRE

HOW CAN WE MEET OUR CUSTOMERS' NEED FOR RAPID TRANSFORMATION?

PVF: I am convinced that in a changing world, our future and development depend on our ability to help our clients harness essential resources: energy, data, services and human capital. We must make our energy cleaner and support the digital transformation of businesses and processes, by offering more sustained local services with teams committed to a trusting relationship with their customers. Our clients want us to oversee the performance of their assets: regional infrastructure, industrial equipment, and commercial buildings. They need to adapt to new uses, be able to weather a crisis, and reduce their carbon footprint. This involves trained teams in the field who are constantly upgrading their skills and expertise. Lastly, we ourselves must embrace the digital transformation and decarbonisation that we are selling to our clients: this symmetry strengthens our credibility and therefore our appeal.

WHICH ARE THE PRIORITY REGIONS AND HOW CAN THEIR EXPECTATIONS BE MET?

Mature countries where we are well established: France, the UK, Germany, Italy, Canada and Switzerland. All these

countries have ambitious climate roadmaps, encouraging reindustrialisation and are transforming their regions to improve the living and working environment. Our strategy is to act locally, adapting to the different regulatory situations, particularly in the energy sector and regional or industrial infrastructures. Our strength is our ability to spread our expertise between regions, as with Axione's development of fibre networks in the UK, T&D's involvement in Germany with Kraftanlagen, and supporting our data centre customers in Italy. This also applies to developing solutions based on renewable hydrogen, or Industry 4.0.

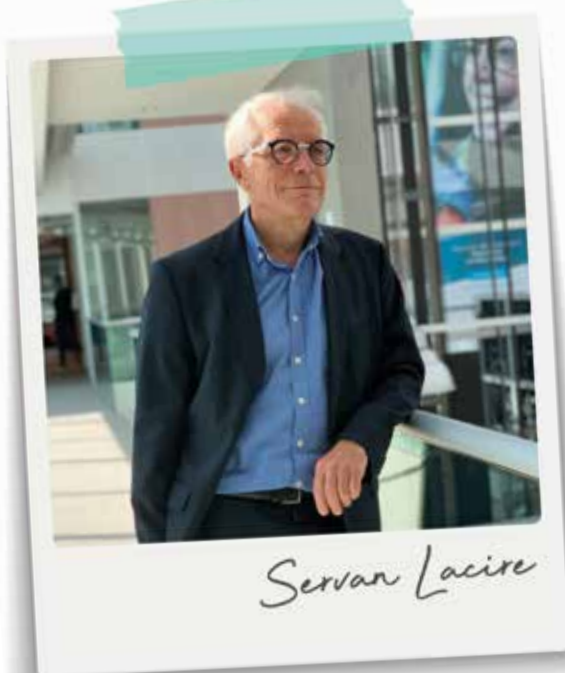
●● *We must embrace the digital transformation and decarbonisation that we are selling to our clients: this symmetry strengthens our credibility and therefore our appeal.* ●●

WHAT ABOUT INNOVATION IN THIS NEW CONTEXT?

PVF: We have developed a new corporate strategy, Together Further, with 4 strategic axes: Decarbonize, Digitise, Develop

services, Develop human capital. Innovation plays a key role in each of these areas. The innovation community must be committed and supportive of this strategy. I see it as having four missions: lighting the way, unlocking synergies, providing methods and incubating strategic projects.

*"IN A CHANGING WORLD,
LET'S KEEP MOVING!"*



Pierre Vanstoflegatte, Managing Director of the Energy & Services Division and Chairman of Bouygues Energies & Services and **Servan Lacire**, Director of Research, Development and Innovation for the Division, share their vision of an actionable innovation.



WHAT DOES LIGHTING THE WAY MEAN?

PVF: In a rapidly evolving market, the innovation community must identify, select and support drivers of innovation for future markets, businesses or offers. Let us take Artificial Intelligence (AI) for example. The question is not whether the subject is intellectually stimulating, but how it will help transform our customer offering, enhance its appeal and help us create value. And finally, how AI can help us to become more efficient and therefore more competitive, as is the case with BIM. Drop the «nice to have» and keep the «nice to pay» for our customers. Make the choice of initiatives dependent on economic performance and ensuring long-term customer preference. We must look ahead to the changes and developments that will affect our businesses.

SLC: Each year we identify projects related to these potential game changers through our innovation seminars, to identify the importance of a technology, forthcoming trends, and whether it is a fad or an underlying trend. For example, we have been working on hydrogen or Artificial Intelligence for several years now. With Bouygues Construction, we are working on the building operating system (BOS); we are also working with a sociologist on societal changes linked to the post-covid era in office buildings. This forward-looking approach is part of our DNA. In the coming years, we must give it a better structure: increase the involvement of our employees in external think tanks, improve the feedback and exchange of information between ourselves and Bouygues Construction and focus more on the sociological and behavioural aspects. Because understanding the customer experience is just as important as working on the technology!

●● *When you have a sound methodology, you can focus on the core of the issue without wasting time on «how to move forward»* ●●

HOW DO YOU INTEND TO BOOST SYNERGIES?

PVF: The Innovation Community's role is to share the initiatives, knowledge and good practices that emerge in each of the countries in which we operate. Rapidly identifying and learning about a new idea saves a lot of time, money and energy. The aim is not to be the first but to create a reference base of experiments and practical projects carried out with clients. This is the trust capital that must be built up as a new market develops in order to become its leader. Synergies are intended to share this capital to create more opportunities.

SLC: Many projects are already managed synergistically between several entities. Nevertheless, we have to make a special effort to get to know each other and learn to work together. Our annual innovation seminar is a driver. It is a hub between our different entities! This is a continuous effort because the network changes as the Energy & Services division evolves. It is a community on the move. The advantage of large groups is that they can benefit from each other's expertise. Interactions must be organised through internal conferences, cross-disciplinary projects and the emergence of a shared culture of innovation, on an international scale, to encourage synergies. Our challenge is to ensure that this ability to work together grows along with the company.

To create this shared culture of innovation, we set up business committees like the BIM community. Our role is to offer these communities our facilitation experience and to pass on the working methods that we have tried and tested.

Another symbol of this synergy is our innovation website, which allows us to share and publicise our projects externally, to our clients and partners and to generate new opportunities. All the division's units contribute!

WHAT METHODS ARE YOU PASSING ON?

PVF: Innovation is not just digital in the form of a new application or a new platform. It is primarily about shared tools and methods. These are principles of organisation and accelerated project development. The «Smart Melody» support programme is a good example. We need more of the 'Smart Melody' approach to all our businesses.

SLC: When you have a sound methodology, you can focus on the core of the issue without wasting time on «how to move forward». Implementing and applying our Smart Melody methodology is key. Originating from an innovation seminar, this method provides a framework to support project leaders and help them achieve their ambitions.

We have also set up accelerators in the second half of 2021. It is always challenging to move from the proof of concept (POC) to an actual commercial project. Methodology is essential to achieve this: an approach that encompasses the marketing and business plans so that entities can take pick up subjects started by others. The shift from a technical result to a product that has a price and a market positioning requires meticulous work. These accelerators will ensure that this happens.

HOW DO YOU INCUBATE STRATEGIC PROJECTS?

PVF: By using our methods and partnerships! For hydrogen, we invested in innovative suppliers, leveraging their knowledge, image and market recognition to achieve even more. In energy, as well as other areas, many companies of all sizes, from very small businesses to large groups, work with Bouygues Construction on innovation projects and development of customised solutions. These solutions can be replicated for other clients and other contexts, thereby transforming our markets. Our methods must help us to

●● *Your role is to guide us through the innovations you develop and lead by example as a community.* ●●

identify innovations and replicable solutions. The innovation component is not simply a new technology, it is sometimes an innovative combination of existing elements that multiplies value creation. Incubating a project is really about deploying its full potential, «transforming the experiment» with a method that also galvanises our partners.

SLC: It is about identifying and developing key themes, then bringing them to market using existing tools (intrapreneurship, think tanks, etc.). Incubation must be within the business units (BUs) for it to work because deciding to use a solution is made at the BU management level. While several of our key projects were incubated by the innovation community before being integrated into our BUs, such as the infrastructure for recharging electric vehicles (IRVE) project or the Citybox, it took a few years to get them up and running. Development is always much quicker and the chances of commercial success much greater when operational departments have taken ownership of the project and supported it from the start.

Incubation means working from the idea stage until the project is able to stand up on its own with a launch plan. Here too, methods and support are essential for the BUs. A project is strategic when it can have a significant impact on the business. Often its complexity requires support from the entire company, not just the innovation department.

ANY LAST MESSAGE TO THE INNOVATION COMMUNITY?

PVF: you are our oldest cross-disciplinary community. You must inspire others, such as the French BIM community, which we launched this year and which is intended to become international. Inspiring in the way you work with your diversity, your involvement and your commitment to all. Your role is to guide us through the innovations you develop and lead by example as a community.



INNOVATION AND DIGITAL TRANSFORMATION OF

our business lines

Is innovation driven by digital technology, or is the broad societal trend towards digitalisation at the root of most innovations today? Either way, digital technology and innovation are closely intertwined. While digital technology can be used to update the way projects are developed, and therefore alter how projects are managed, we also know that companies that are poorly digitised will find it increasingly difficult to innovate. Innovation and digital technology must be combined now if we are to exist in the future!

Focus on 7 projects that demonstrate the digitalisation of our businesses, solutions and processes, both for our customers and internally.



BIM

DIGITALISATION: TACKLING THE MAJOR ISSUES OF OUR CLIENTS

Profitability, efficiency and productivity are the main concerns of our customers and field teams. By constantly reinventing ourselves with technological innovation, we can offer customers a completely new experience that matches their uses and expectations as closely as possible. In construction, digital innovation happens through collaborative construction processes - Building Information Modelling (BIM). This innovation is now core to the sector's digitalisation strategies. Optimising project planning has the potential to transform working methods, resulting in cost savings and productivity gains.



DIGITAL TWINS of industrial structures

Gastier uses digital twins of industrial structures to prepare and improve the management of its worksites. Using a 3D model developed in partnership with a Montreal start-up, Gastier was able to anticipate the manufacture of all the parts that needed to be installed at a world leader in the food industry to protect the production line. Prefabricated to the millimetre, the work was able to be completed in just one week. For another of its clients, a mining start-up, Gastier used the building's digital twin to coordinate the work of the 25 people who worked on the project for two months. Whether it is a matter of time or coordination, the 3D model is a digital tool used by Gastier to improve performance for its customers.

CENTRALE SUPELEC: BIM for building maintenance / operation

As part of the maintenance and running of the Francis Bouygues building, a 25 000 m² complex located at the heart of the Ecole Centrale-Supélec campus, Bouygues Energies & Services adapted the 3D BIM model to the actual building as it was completed.

This model was initially designed for the construction of the building, but is now used to prepare for on-site interventions, to access documents in the construction file or intervention and safety procedures, to visualise equipment that cannot be seen or that is high up thanks to augmented reality, to identify discrepancies between reality and the virtual, to record additional work carried out.

This allows the safety of users and employees to be guaranteed at the centre of the site's operating projects, but also improves user satisfaction by minimising the time taken to repair or replace equipment. It also enhances management of the facilities to better control the building's energy consumption.

This project was awarded the Silver BIM at the BIM d'Or 2021 competition, demonstrating the importance of digital for maintenance interventions.



Every day, the operations of Bouygues Energies et Services France prompt our teams to design and implement digital solutions that help transform and secure our customers' information systems. To become the benchmark integrator of digital solutions, we must always be leading the way, particularly through our involvement in technical, service and organisational innovation.

Serge Laurence,
technical director Bouygues Energies & Services France



UPTOWN BASEL: digitalisation of our manufacturing processes

Thanks to the combined use of BIM and Hilti's semi-automatic drilling robot, Bouygues Energies & Services is further digitising its site management: the robot carries out pre-planned work on the building site using the digital twin of the building, which was created using BIM. Thanks to robotics and meticulous advance planning, the drilling plan is followed to the millimetre.

Using this technology, Bouygues Energies & Services was involved in the construction of the innovative Uptown Basel Industry 4.0 skills centre, which is modular in design (individual modules to be assembled on site).

As well as improved respect of deadlines and cost optimisation, this approach reduces the error rate, makes more efficient use of human and financial resources and significantly increases safety at work - especially when working at height.

Our Swiss business is extremely diversified: from major corporations to small communities, we cater to the requirements of a broad spectrum of clients and need to master a wide range of technologies. We focus on technology advancements and continuously test emerging tech with our clients, to ensure that we continuously deliver value to our stakeholders and to our communities.

Thomas Stadler,
Chief Digital Officer BYES InTec

VIRTUAL REALITY AND ARTIFICIAL INTELLIGENCE: OPTIMISING THE PERFORMANCE OF OUR TEAMS AND OUR SOLUTIONS



AUGMENTED REALITY helps Plan Group 'Bring Ideas to Life'

Plan Group has tested Trimble XR10, the only HoloLens 2 solution compatible with an industry standard hardhat and certified for use in safety controlled environments, on a new build in Toronto. The team's goal during this particular pilot was to verify the physical locations of "turn-ups and turn-downs", the conduit that electrical cables are run through the concrete walls. During their HoloLens 2 pilot on site, the joint team:

- Created 3D holograms for all the architectural, structural, mechanical backgrounds and the electrical and compartment rooms that can be reviewed at any time, and in any place, by our in-house designers.
- Added the ability for users to view these four models all at the same time.
- Used the HoloLens 2 to measure and analyse the electrical installations completed in the high voltage room onsite, to see how the installation compared to the virtual design model.
- Used the HoloLens 2 to measure the space between different pieces of equipment, to help verify the accuracy of the installations done.

●● *Plan Group leads the Canadian market for the build and maintenance of smart hospitals. How have we acquired and defended this position? Simply by partnering with our clients, understanding their strategy and processes in great detail and translating their digitalisation and efficiency needs into technology and integration choices which deliver performance in the short term as well as over time.* ●●

John Slattery,
Chief Digital Officer Plan Group





BAR CODES to geolocate tools on construction sites

Managing equipment stock requires a lot of organisation for construction companies. A barcode system to track entries and returns is an effective solution to this organisational challenge.

For instance, all tools at the pilot site in Burghausen have been tagged with barcodes. The tools are tracked using a dashboard that identifies which employee has taken which tool, who has or hasn't brought it back to the warehouse, etc.

In this way, the site is managed more efficiently and equipment losses are limited. Another pilot site in Canada, which is experiencing the same problem, is considering testing this solution.



●● *In Germany, we are working with IT, technical experts and digitalisation specialists to make large amounts of data, which cannot be processed manually due to their quantity and speed, available to all customers, management, employees, technical departments and all other stakeholders, regardless of location and time. Only if we manage to use these huge amounts of data withing projects in a systematic way we will be able to implement the requirements of our customers in the future.* ●●

Christian Weberpals,
Head of digital transformation



SOLAR FARMS AND ARTIFICIAL INTELLIGENCE

In Vietnamese and Thai solar farms, energy performance data is collected via sensors. Thanks to a digital dashboard, the theoretical performance data (expected production of the installations) is then compared to external factors that limit the actual performance (weather, government limits on grids, etc.).

This gives the customer an accurate performance picture, i.e. the energy that the panels could have produced versus the energy actually produced. Performance and transparency increase customer satisfaction.

For the teams in France, Great Britain and Japan, as well as for the local managers in Vietnam and Thailand, this dashboard has become a valuable tool for their daily work.



●● *Beyond improving our productivity, we focus our digitalisation efforts on supporting our customers' own digital transformation by working with hand in hand with our tech partners. Among our key topics are the building operating system and the digital twin.* ●●

Aurélie Marais,
Director of digital transformation & innovation,
marketing & communication - Bouygues Energies & Services (UK)



BOUYGUES ENERGY & SERVICES DIVISION DIGITISES ITS CUSTOMER EXPERIENCE

«The aim of the BYES 360 project is to put the customer at the heart of the company and our way of working», explains Christophe Carlier, Digital Officer of the Bouygues Construction Energy & Services division. This project aims to digitalise the entire customer relationship chain, from the first contact with a customer or prospect to invoicing, including costing, work acceptance and satisfaction surveys. This «digitalised and seamless customer journey» will save time and smooth interactions between employees and customers. Interview with Christophe Carlier.



- Our customer culture is being transformed to adapt to market expectations and to provide greater simplicity, greater responsiveness and greater transparency ●●

explains **Christophe Carlier**

WHY DID THE BYES 360 PROJECT COME ABOUT?

Today we represent almost € 4bn of the Bouygues Construction group's € 13bn sales, but what really sets us apart is our volume! Each year, around 200,000 orders are placed. Every day, several thousand employees in the Energy & Services division use between 10 and 20 IT tools to process customer requests! While most of these orders concern medium-sized or even small sites, we currently use the Bouygues Construction group's IT system, which is designed for managing large projects. We therefore felt we needed to overhaul our IT system to better adapt it to our daily needs, with a modernised «front office», i.e. a shared interface with our customers, and a redesigned «back office» to automate many manual tasks, such as registering an order or triggering an invoice. In this way, we will become more efficient, customers will see faster processing and employees will have better access to information so that they can work together more effectively.

WHAT ARE THE MAIN AIMS OF BYES 360? WHAT IS IT ABOUT?

Let's look at 3 related aims, which we call the pillars of the project: optimising the customer and employee experience, improving productivity and strengthening cash flow. To achieve them, we must work from the source by equipping our field teams. We are going to create a full-scale customer relations portal and take special care to make it fully accessible on the move. This future tool will automate all the time-consuming - or redundant - manual tasks at each stage of our process, starting with the processing of customer requests, the establishment of quotes, the order taking, then the acceptance of the site or work, and then immediately automating the invoicing. The BYES 360 project to transform our customer chain is the first major project that addresses all our countries and businesses.

HOW WILL IT WORK IN PRACTICAL TERMS?

We chose the Salesforce platform to achieve these goals. It will become our technological backbone to unite our existing applications, set the pace and properly sequence our actions.

This project is based on workshops attended by more than 150 employees from four countries to produce a solution that is as close as possible to the players in the field. Between July 2021 and July 2022, the solution will be deployed and then gradually enhanced.

- We are looking forward to BYES 360, which will help us put ourselves in our customers' shoes. This will be a game changer for the company, for us in Canada, but also for the whole of the Energy & Services division» ●●

Paul Sheridan, *Plan Group.*



Because each job is a promise to the customer that must be kept from start to finish, Bouygues Energies & Services has come up with a unique, easy-to-use and adaptable operational tool for a seamless employee experience: Underpinned by our human values, BYES 360 will define the quality of our customer relations!

REVIEW OF THE PROJECTS 2020-2021



**GENERATE MORE RESPONSIBLE
AND LASTING POWER**



Green Power on Demand

The idea is to provide industrial customers with flexible green power without any investment, thanks to third party partners who are willing to invest in green power assets, while closing the return on investment gap. Each project starts by analysing energy consumption and designing a solution to improve the client's key performance indicators (carbon footprint, energy costs, etc.). This service reduces risks for the company by decarbonizing the power supply. This solution is starting to be sold, with the first customers in Germany.



**INVENTING INFRASTRUCTURES THAT
OFFER MORE MOBILITY AND FLUIDITY**

Augmented Supervision

Augmented Supervision uses artificial intelligence to help the maintenance teams of electric vehicle charging stations by prioritising and pre-qualifying incidents. Augmented supervision uses a Machine Learning algorithm that feeds on our business data and is enhanced by our expertise. It is learning from our maintenance teams now so that it can take the most tedious tasks of their hands in the future. This will allow them to focus on their real task: improving and securing the quality of the charging service on our networks. This solution is now deployed on all charging stations operated by Bouygues Energies & Services in France.



**DESIGNING AND BUILDING A MORE
EFFICIENT AND FLEXIBLE INDUSTRY**

A SHOWROOM AND A 5G EXPERT GROUP FOR INDUSTRY 4.0

Robotics, automation, connectivity, augmented reality... The deep-seated transformation of industries is affecting all businesses and processes. To make our more traditional offerings more attractive, we need to think cross-functionally about our solutions. To help us collectively address our customers' challenges, we are working on a joint showroom of our innovative 4G/5G solutions and establishing a cross-functional group of experts to build the best solution for our customers.



DESIGNING BETTER SERVICED AND CONNECTED BUILDINGS



RetroBIM



Using BIM for the maintenance and operation of existing sites rather than construction can reduce the time an engineer spends on site identifying and completing tasks by around 30%. Retro-BIM provides centralized hosting to manage site information, a virtual 3D geometric representation of physical assets and tools to improve communication and technical decision-making. Saving time, sharing the correct versions of documents, securing and providing digital access to old paper documentation, going paperless, viewing, controlling and approving subcontractors' work in batches... all of which create a faster, more effective and efficient environment for employees, the basic supply chain and the customer. RetroBIM is already used by more than 6 clients and can be customised to suit the client's needs.

Agile Office



When making decisions about office space, Canadian employers rank safety, employee productivity, culture and collaboration higher than operational savings. With the rise of a hybrid corporate working model, spurred on by the health crisis, Agile Office brings value to landlords, tenants and end-users by optimising the workspace for both flexibility and safety. Focusing on collaborative space design results in better use of shared space and a reduction in portfolio size of up to 40%. The proof of concept has been deployed at a client site.



Space Intelligence



Space Intelligence is a solution that tracks the actual occupancy of workspaces in office buildings to enable users to book and access spaces more easily. In turn, managers have a full view of how their property assets are used. Bouygues Energies & Services acts as the customer's single point of contact: it installs presence and people counting sensors, develops dashboards and applications for viewing and analysing data, advises managers and occupiers on how to improve layouts. This solution includes the management of user feedback: requests for improvement, satisfaction, etc. The proof of concept has already been deployed at a customer site



SHARING INNOVATION FOR A SIMPLER AND MORE FULFILLING LIFE

VIRTUAL REALITY FOR TRAINING

Immersion, quick and easy deployment, infinitely customisable scenarios, real-life situations without any risk or danger... There are many advantages to using virtual reality to train operational staff. To immerse the trainee in an interactive simulation, we have developed a virtual reality (VR) device to support the theoretical training. The user can interact in real time with their environment. Their learning is enhanced through practice. A first module has already been developed on electrical accreditation.. The deployment of this solution started at the end of 2021 and could see potentially 2,000 employees gaining electrical accreditation each year. This solution improves the quality of training with a view to reducing workplace accidents.

SPECIAL REPORT:

The challenges and opportunities on our way to net zero

FOREWORD, by Lord Redesdale

Lord Redesdale is the founding Chairman and CEO of the Carbon Management Association and the Energy Managers Association. He was the Liberal Democrats Energy Spokesman for the House of Lords in 2000-2008 and has spoken on various issues on behalf of the Liberal Democrats Parliamentary Party, such as the environment, international development, science and technology. In November 2013, he founded Heelec, which launched the Energy Management Exhibition (EMEX). The show attracts over 4500 professionals from the Energy Managers Association's community.





In December of 2020 the Climate Change Committee set out a route map to the UK becoming net zero in a landmark report. Since its publication, the idea of net zero has started to filter into the public consciousness. 'Net zero' means we need to take out as much carbon from the atmosphere as we're putting in, until we get to a zero position. While we don't have the technology yet to undertake massive carbon storage and capture, we need to look at the amount of carbon we are using and at ways to reduce it. The difficulty of course is the carbon economy enables us to do anything we want; we can go and fly to the other side of the world on a whim if we choose.

The first steps are within our grasp: decarbonizing power generation by looking at renewables such as wind and solar, which are coming on at a pace. We are seeing that the grid mix has gone down in carbon intensity, mostly because there has been a reduction in coal. We haven't built a coal power station in the UK since the 80s. There's a huge amount of green money going into renewable energy. We have moved from 50% of our fuel being coal, to 50% being gas now, with the rest made up by renewables and nuclear.

Without as many gas power stations, we will end up with a much less stable grid. Where will we get power from if one of the big assets goes off? How will we back it up? Although the new generation mix will be heavily based on renewables, batteries will also be part of the mix in order to tackle this issue. In the future any building in operation will probably have a battery in it which will be charged up at peak power times and then used off-peak.

Data will be key. We need to look at where the power comes from and how we can reduce it so we can massively cut down the amount of energy we use. How much energy an office block uses is dependent on how it is used. In many buildings if something breaks it is replaced without much consideration of the energy used to do this. Over the next few months and years there will be a transition towards understanding how those assets can be put on a net zero path through energy-focussed maintenance; how they are managed and maintained, retro-fitted and replaced.

We need to be aware that everything has a carbon cost. Many companies are starting to understand the emissions they

are directly responsible for (scope one) and the emissions they're indirectly responsible for (scope two). The big one coming down the line is scope three; the carbon emissions of their supply chain. Up until now companies have handed this over to energy brokers or third-party intermediaries to deal with. Now they will need to record at a granular level what electricity, gas and other fuels they are using and categorize them to each and every site on a year-on-year basis.

There's going to be a massive move to electric fleet and electric transport but the issues around this need to be addressed. A single electric vehicle uses the same amount of power as a domestic household. The grid is going to find it very difficult powering millions of vehicles. So how we charge electric fleet needs to change. In addition, there is no electrical solution for trucking and this is an area in need of innovation.

As individuals, we all need to start making assessments of how much carbon we are using on a more granular level. If you stream an album on a constant basis as we do now, it actually uses more energy than getting a physical CD, as we used to do. If you have an online conference call with the video function switched on, it is 95% more carbon intensive than just using audio. Video conferencing has a far lower cost than if we all got on a train and sat in a room but it's not small on the global standard. In a couple of years' time around 25% of the emissions on the planet will be due to computing.

It's becoming very clear that the effects of climate change are going to be catastrophic and that we passed the tipping point some time ago. As society comes to terms with this and looks for ways to reduce the damage further, we will see a change in society and societal values. The focus will move away from the financial cost and towards how many kilogrammes of carbon are being used. Less households will own a car. The green brand will become a major selling point for a company's image and society will frown upon those businesses and individuals who are not doing the right thing. Importantly, as low and zero carbon solutions start to become readily available and easy to use, more people will take them up. We can see this in the amount of people choosing to become vegetarians and vegans, as the range as the range of options increases and the quality improves.

●● *In terms of innovation, net zero means we have to become much more integrated in all aspects of technology. However, a cultural shift in society will be the biggest innovation we see.* ●●

Lord Redesdale

INNOVATIONS IN ENERGY

Innovation within the energy industry is focussed on developing or improving technologies that can increase the efficiency of energy production and reduce the economic, environmental, social, or political costs associated with energy supply and use. 2020 saw the largest absolute decline in global CO₂ emissions in history, with emissions falling by 5.8% (IEA, 2021). Additionally, low-carbon fuels and technologies made up 20% of the global energy mix, the highest ever annual share achieved (IEA, 2021). Although the pandemic had a significant contribution to this decline in global emissions, innovation has also made the rise of renewable energy generation possible. However, a rapid increase in energy demand has been projected to accompany the economic recovery from the pandemic. This means there is a risk that emissions will rebound to past levels. Innovation is therefore key to ensure there is no rebound in emissions, requiring rapid changes in how we use and produce energy. Here are a few innovations that have taken off across the globe, helping to drive the transition to a sustainable, zero-carbon energy industry.

EPFL'S THERMAL INFRASTRUCTURE: *RENEWAL OF THE HEATING AND COOLING SYSTEM*



Problem: EPFL and the University of Lausanne's existing heating and cooling infrastructure was outdated, inefficient and carbon intensive. The university campus was heated through a thermal power station and the Pierettes pumping station, consisting of two heat pumps powered by two turbines fuelled by oil.

Solution: To help the university switch to 100% renewable energy to power the heating and cooling system, Bouygues Energies & Services re-designed and upgraded the university's thermal infrastructure to reuse as much energy and water as possible. The Pierettes pumping station's capacity was doubled with the installation of a strengthened network of pipes, whilst the thermal power station was extended with four new heat pumps and the removal of the two oil-fired turbines. Additionally, the thermal power station was also raised to house a data centre, covered in solar photovoltaic panels.

How it works: Water from Lake Geneva is pumped through the Pierettes pumping station. A proportion of the water goes immediately into the campus' cooling network, whilst the rest goes into the thermal power station. Here, the heat pumps extract energy from the water and convert it into heat that can be used to warm the campus buildings. This process cools the water, which can then be re-injected into the campus' cooling network. Simultaneously, warm water is produced from the cooling network, which can be re-injected into the heat pumps to be used in the heating network. Additionally, the data centre will be cooled by the cold-water discharges from the thermal power station and will warm the water through heat released by the data servers.

Added Benefit: This recovery and reuse of thermal waste reduces the amount of lake water initially pumped. «The water in the lake feeds the heat pumps, but it has many other uses,» says Vicent Pelejero, project manager. «It makes it possible to cool the buildings, to serve the industrial water network or to cool the data centre.» As the heat pumps are no longer fuelled by oil turbines, the new thermal infrastructure has eliminated 1800 tons of CO₂ per year.



SWAFFHAM PRIOR: *RENEWABLE HEAT NETWORK*



Problem: Swaffham Prior is a historic, rural village based in Cambridgeshire. The village is not connected to the gas grid and 70% of homes burn oil for heating and hot water production, the rest are mainly on electric for heat. This reliance on fossil fuels produces large amounts of CO₂ and is financially draining for the members of the village.

Solution: To help Cambridgeshire County Council become more energy efficient and reach their target of becoming net zero by 2050, Bouygues Energies & Services have designed a renewable heat network. Installation is planned to begin in the second half of the year.

How it works: A combination of air source and ground source heat pumps extract heat from the air and beneath the earth's surface. At the energy centre, heat from the pumps is used to produce thermal energy. This is then transferred to the village's buildings through an insulated pipe network. Renewable electricity from a private network will be used power the energy centre.

Added benefit: The renewable heat network will reduce fuel poverty, reduce the dependence on oil and reduce the villages' carbon emissions. Simulation models predict that the network will deliver 95% emissions avoidance in year 1, rising to 96% by 2030 and 99% by 2050.

ELECTROCHAEA: *POWER TO GAS SYSTEM*

Problem: The intermittency of mainstream renewable sources is one of the biggest problems facing the energy industry. Solar power relies on the weather being sunny and without clouds, whilst wind power is only generated when the wind is strong enough to turn the wind turbines. This means that energy is wasted, as it is impossible to balance production continuously and consistently with grid demand; this causes around 20-30% of renewable energy to go to waste.

Solution: Utilise this excess energy from renewable sources to power the conversion of water and carbon dioxide into grid-quality renewable methane, which can be injected into existing natural gas pipelines for storage and distribution.

How it works: Renewable energy is used to power an electrolyser to split water in hydrogen and oxygen. The hydrogen and CO₂ undergo a biocatalytic reaction in single celled microbes called archaea. The result of this reaction is the production of biomethane, which is injected into the gas grid.

Added benefit: This process of biomethane production has lower capital and operating costs than conventional thermochemical methanation processes. The reaction is also a form of decarbonisation, helping to remove carbon dioxide that would otherwise be released into the atmosphere and contribute to global warming.

See page 24 for a more detailed look at this solution.

THE GREEN HEAT MODULE: *GREEN HEAT FOR INDUSTRIAL USE*

Problem: Industrial processes come with high pressures and temperatures and tend to occur in a complex system with massive cost pressure. The International Energy Agency estimate that globally, around half of all energy consumption is used for providing heat to homes and industry. In the UK, heating for industrial processes accounts for 37% of total UK carbon emissions.

Solution: Kraftanlagen have developed their own Green Heat Module (GHM) to produce industrial scale green heat. The GHM consists of an electric heater, storage system and heat exchanger and is powered by electricity that comes from a renewable source.

How it works: High-performance electric heaters convert renewable electricity into temperatures of up to 1000°C. The heat is then stored in high temperature thermal storage systems and distributed for industrial processes.

Added benefit: Powering the heater with green electricity means 100% reduction in CO₂, with no emissions produced. Furthermore, the module is very flexible and can be used in high temperatures of +1000°C and pressures of 350 bars.

See page 26 for a closer look.

FLOATING SOLAR PV FARMS

Problem: In many areas, land suitable for ground mount solar is scarce. Land tends to be prioritised for other purposes, such as farming or construction. Additionally, solar panel performance tends to decline as temperatures rise, becoming less efficient in hot climates.

Solution: Floating Solar PV farm

How it works: Solar photovoltaic panels are attached to a buoyant platform, which sits on the surface of a body of water, such as a reservoir, lake or even the ocean. These platforms are moored on calmer bodies of water that have little use, such as hydroelectric dam reservoirs, wastewater treatment ponds, lakes, or agricultural reservoirs. Bouygues Energies & Services delivered the first floating solar power plant in France and the largest in Europe. Near the commune of Piolenc, the farm consists of 50,000 photovoltaic panels on a quarry converted into an artificial lake.

Added benefit: Floating Solar PV farms decrease evaporation and improve water quality, serving as an energy source of pumping and irrigation. The bodies of water exert a cooling effect, which improves the performance of solar photovoltaic panels by 5-10%. The farm provided enough power for 4,700 homes in the Piolenc commune.



A CLOSER LOOK AT ELECTROCHAEA

Small microbes – big impact: Electrochaea’s technology for renewable gas generation

THE BIOMETHANATION TECHNOLOGY:

Electrochaea is a dynamic growth stage company with headquarters in Munich, Germany. The multi-national and interdisciplinary teams make sure that we take good care of our biocatalyst, provide a productive environment (bioreactor) and enough food (CO₂ and H₂) so that it can generate large quantities of renewable methane (RNG). Interest comes from around the world from CO₂ emitting industries, gas grid operations, as well as renewable electricity providers in need of large-scale and long-term energy storage technologies. The list of international project opportunities for commercial grid-scale solutions is long. Our proprietary power-to-gas (P2G) process provides multiple upsides: it converts renewable energy and carbon dioxide into grid-quality renewable methane for storage and distribution. It recycles CO₂ in large quantities and ensures that our existing gas grids worldwide are utilized for distribution and storage of renewable methane gas. The technology has been extensively tested in our pilot plants in Switzerland (Store&Go), Denmark (BioCat) and the USA (NREL/SoCalGas). We have injected renewable methane into commercial gas grids in Switzerland and Denmark, and we qualified the product gas for the French gas grid and California’s rule 30.

Using our process, renewable methane is synthesized from CO₂ and H₂ by our patented biocatalyst, a selectively evolved microorganism – from the family of methanogenic archaea.

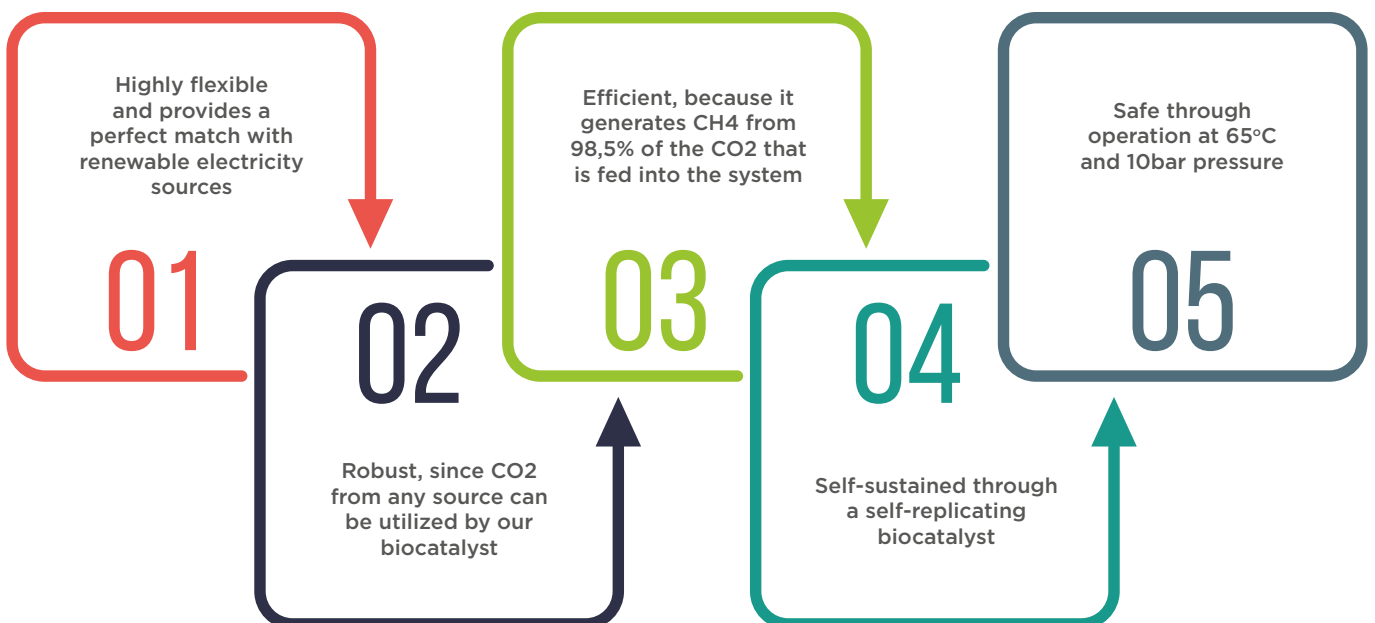
The high efficiency and robust nature of our biocatalyst enables our methanation technology to operate at lower capital and operating costs and with greater flexibility than conventional thermochemical methanation processes. The biocatalyst is compatible with variable duty cycles and common impurities in CO₂ sources.



Besides the patented biocatalyst, Electrochaea owns the patents and know-how for the biomethanation system, the controls, feeding strategies for the biocatalyst, various critical design features and technologies, techno-economic analyses, and integration into existing CO₂ generating infrastructure.

CO₂ can be recycled from any source such as anaerobic digestors, landfills, dairies, fermentation facilities or industrial processes like cement and lime production or steel industry. We have demonstrated the use of raw biogas in industrial scale at the wastewater treatment plant in Avedore, Denmark, and we have utilized raw geothermal gas, CO₂ from bioethanol generation, from wine and beer fermentation processes.

ELECTROCHAEA’S TECHNOLOGY IS



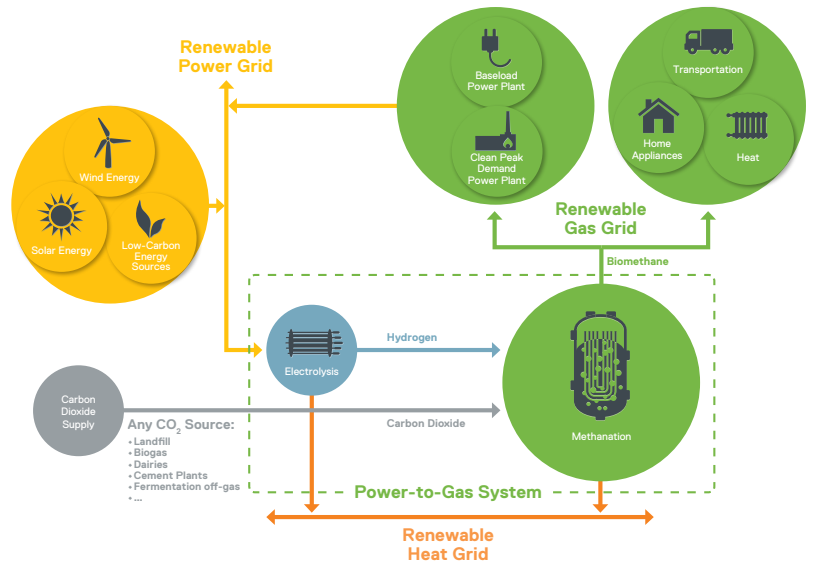
SCALING FROM INDUSTRIAL PILOT TO COMMERCIAL APPLICATIONS - THE ARCHETYPE PROJECT

Electrochaea is currently completing design work for the 10MWe Archetype Project. The project includes Kraftanlagen as the selected partner for scale-up work. The commercial, scalable biological methanation plant design project is partially supported by a grant from the European Innovation Council Accelerator program.



The project is at an advanced stage and is expected to deliver the engineering documentation for this scaling step.

The design incorporates learnings from previous industrial pilot projects to mitigate relevant scaling and project risks.



The project is conceived as a grassroot project, while the main drivers for it are a high degree of modularization, a footprint reduction and a standalone design which is easily transferrable to different project sites with minimum integration effort.

Simultaneously, it contributes to Capex and Opex reduction and includes a digitized engineering workflow through all project phases, namely concept, basic engineering, detail engineering.

We expect this project to be finalized in October/November 2021, resulting in a FID (Finals Investment Decision) including a decision on the final project location taken soon thereafter. With the Archetype design Electrochaea will provide standard biomethanation plant design to realize commercial plants at reduced timelines and attractive cost.



The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No. 101010276.

A CLOSER LOOK AT GREEN HEAT MODULE

The Green Heat Module (GHM) will transform Industrial Heat

MAKING OUR INDUSTRY CO₂-FREE IS IMPERATIVE FOR THE EUROPEAN UNION.

The EU goal of net zero carbon by 2050 is considered very ambitious but fortunately, it is possible. However, the challenge is immense. Greenhouse gas emissions in the EU were only reduced by 23% between 1990 and 2018, which means we need to reduce by a further 77% over the next 30 years. This will affect all businesses, stakeholders and individual lifestyles. At a global scale roughly 10% of global greenhouse gas (GHG) emissions are due to industrial heat production alone, equal to the GHG of cars and planes combined. As a rule of thumb in the EU, 3 out of 4 energy units in the industrial sector are used for industrial heating or cooling (208.8 Mtoe). Only about 1 of the 4 energy units is used for electricity to drive machines or lighting (73.3 Mtoe).

Therefore, the success of the industrial decarbonisation will inevitably depend on innovative green heat solutions at an industrial scale.

INDUSTRIAL AND RENEWABLE GREEN HEAT

Renewable energy sources (RES) for electricity generation have game-changing potential and are good value. But the supply is low in a number of cases. This problem is addressed directly by the GHM: it is the missing link between the volatile but cheap RES on the generation side and a specific heat-load profile on the industrial-demand side. The GHM consists of three key components: the modular electric heaters; the modular storage of Kraftanlagen; and a heat exchanger to be connected to an existing industrial plant. The electric heaters fed by the RES electricity, charge the thermal energy storage with a hot air for several Megawatt-hours up to Gigawatt-hours in the future. On demand the heat is then discharged directly into the industrial process via a hot air gas flow or indirectly via a heat exchanger:

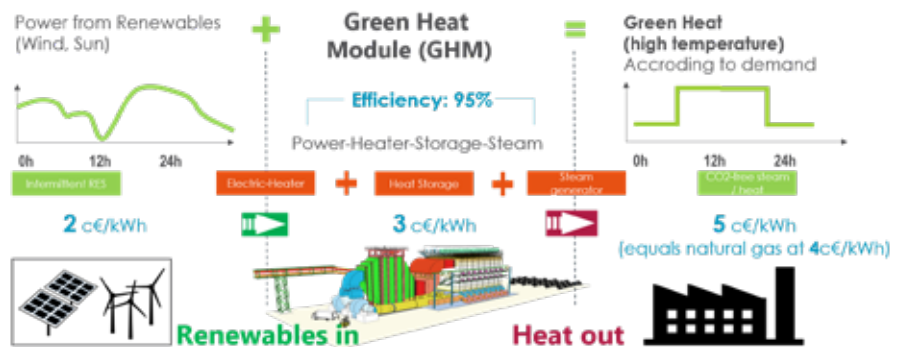
- for any type of heat transfer fluid in the existing plant: steam, thermal oil, air etc.
- temperatures exceeding levels of large-scale heat pumps (~150°C) up to 1000°C today
- pressure levels up to 350 bar

A MARKET-READY INNOVATION

The GHM of Kraftanlagen shows the perfect fit between the supply of low-cost RES and the specific demand of industrial clients seeking decarbonisation solutions for heat. The GHM sees a high initial market interest from several industries than run 24/7, such as chemicals, basic and construction materials, food & beverage, car manufacturers and power in the EU, the USA and the Middle East. In the EU such innovations could be supported by governments or by the EU, in a format similar to the new EU Green Deal Innovation Fund's supporting investment (CAPEX) and 10 years of operational expenditures (OPEX). This is especially true in the South of Europe with photovoltaic, both on its own and in combination with offshore wind, where the GHM provides a high potential to decarbonize industrial heat applications. Due to its high conversion and storage efficiency of approximately 95% (RES-to-stored, heat-to-steam) the heat is produced at a large-scale at only a fraction of the cost of green hydrogen. In contrast hydrogen can complement the GHM when it comes to temperatures greater than 1000°C or to back-up the system for when redundant.

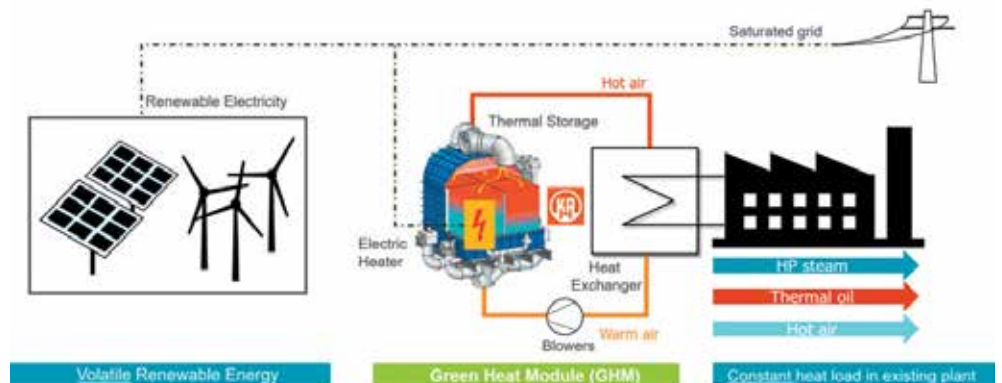
GHM fits very well to the Energy System of today

Green Power + GHM = Green High Temperature Heat up to 1000°C



Looking to the main market, there are barriers such as a lack of information on the clients' side, electricity market regulation and not enough commitment for CO₂-reduction in the industry. Kraftanlagen is trying to overcome these barriers by educating clients, assessing country market regulation changes and public funding pots to find the right market spots for a smooth market introduction.

Finally, the GHM is a great fit for both Bouygues E&S' decarbonisation portfolio and its country markets with both our existing and new clients.



3 QUESTIONS WITH DR RALF UTERMÖHLEN



Dr Ralf Utermöhlen has been advising industrial and commercial companies on environmental issues and sustainable development for 30 years.

He specialises in: environmental audits; energy efficiency in companies; and companies' sustainable development.

We put three questions to him about what businesses should all be focusing on to get to the sustainable world we need.

WHAT KEY ROLE DO COMPANIES PLAY IN A MODERN, RESOURCE EFFICIENT AND COMPETITIVE ECONOMY?

Despite the negative association of big companies and the environment, corporate sustainability will change the markets much more drastically than many executives believe today, and it is essential to undergo environmental change. These companies do not only carry a share of the responsibility for a successful sustainable development of our society, they play a crucial role.

As an example, imagine that you and your family have to be more sustainable and you have two choices of how you can do this. Firstly, you could buy and live on a small piece of land, in a wooden hut, eating self-grown food and dressing in rags. Alternatively, you live warm and comfortably, but you rely on companies to provide you with highly sustainable products such as climate-neutral food. Which option would you take? In every conference I have done, everybody has had the same answer and has understood that we need companies. We must make the entire architecture of our society sustainable; how we eat, how we heat, how we dress, how we earn, and companies are key to helping us achieve this. Companies align their entire corporate strategy to a sustainable market environment and develop sustainable products and services, launching them with high availability and credibility. ●●

●● *In a sustainable world, the energy sector, industry, the building sector and transport must make the greatest contributions to emission reductions in the coming decade* ●●

WHAT WOULD A SUSTAINABLE WORLD LOOK LIKE AND HOW WOULD VARIOUS SECTORS CHANGE?

●● In a sustainable world, the energy sector, industry, the building sector and transport must make the greatest contributions to emission reductions in the coming decade. This is not possible through only pure efficiency measures; technology changes are required as we cannot continue to combust gas, oil, etc., in our production.

Fast forward to a sustainable world and many sectors will have drastically changed. For example, the energy sector. It will need to completely regenerate, a process we should have started in the 1970s / early 1980s. There will be changes in the landscape such as the addition of wind turbines and cables; houses will have energy storage; heating will be with heat pumps; and there will be a focus on thermal insulation and scalable H2 solutions. We also need energy services that balance the generation consumption-gap. Although we have recyclable energy, it is not sufficient for the rate we consume.

The mobility sector will also experience significant changes. For example, individual mobility will be completely electric, greater use of hydrogen fuel cells, carbon neutral air traffic, and innovations in charging services and storage technology.

Consumers and manufacturers must adjust to tighter regulations for product design and after-sales service. We need products which are longer lasting, have reusable packaging, follow eco-design guidelines and are expandable through updates. The new 'cool' will be to consume less and use products longer. From this we will see the introduction of reuse, repair and take-back services. The problem today is not just that we need to repair something, but that we can't find someone to repair it for us. ●●

WHAT IS THE EUROPEAN GREEN DEAL AND WHAT DOES IT MEAN FOR BOUYGUES ENERGIES & SERVICES?

●● The European Green Deal is Europe's new growth strategy that enables the transition to a modern, resource efficient and competitive economy. It will be the driving force for successful companies. Its aims are to have no more greenhouse gas emissions by 2050, uncouple economic growth from resource use, and promote the conservation of nature, food production and energy.

The Deal and its aims present numerous opportunities for Bouygues E&S. A zero pollution Europe with access to affordable, clean energy needs scalable storage for buildings and industry; power-to-heat solutions; sustainable, charging infrastructure for climate neutral transport; and clean energy such as gas turbines, electrode boilers, electrolyzers and pipeline construction. These services already exist in Bouygues' portfolio, highlighting how their business model is a contribution to sustainability and how it will have access to the financial market, presenting numerous opportunities. ●●

HOW WE ARE INNOVATING TO TACKLE THE CLIMATE EMERGENCY

Our climate strategy is clear and ambitious and we want to lead by example. In order to meet our commitments globally, we are looking to:

- Reduce fuel consumption and optimise transport and mobility management
- Reduce energy consumption at our sites and construction sites
- Ensure the involvement of our providers in the low-carbon value chain and the supply of less carbon-intensive products
- Increase low-carbon offers by activity and provide dedicated calculation and eco-design tools to support low-carbon design
- Educate all our internal staff and stakeholders.

MOBILITY AND TRAVEL - VEHICLE FLEET:

Our objective is to obtain an inventory of the entire fleet of vehicles and equipment and to monitor all the consumption in litres by type of fuel using a reliable data recovery system. Every country will define a «greening» plan to reach the objective of 90% of low emission vehicles by 2030 and to reduce fuel consumption.

Solutions to achieve this include:

- Renewable hydrogen stations at Bouygues and customer sites
- Alternatives to professional car with the Mobility credit
- Low-carbon vehicles in France, the hybrid electric pack in Switzerland, and fleet management in Canada.

LOW-CARBON PROCUREMENT:

We want to reduce the carbon emissions of our purchases in the main families identified: Cables, Equipment, Fittings & Lighting, Sheathing & Tubes, Concrete. Partnering with our suppliers in order to improve production practices and transparency across our supply chain will be key to diminishing our carbon footprint.

Solutions include:

- Encouraging suppliers to produce materials, products and equipment with recycled materials or innovate based on new production models (e.g. circular economy approach)
- Reducing emissions related to the transport of materials products and equipment

EMPLOYEE TRAINING:

Ensure our employees have a good understanding of climate issues and how they can help us achieve our objectives.

We will do this by:

- Rolling out an e-learning module on climate issues to all employees
- Provide additional modules dedicated to specific activities in all our countries in 2022.
- Provide training on our carbon reporting tool
- Establish a Carbon Helpdesk to support operational teams in carrying out carbon assessments of projects.

ENERGY MANAGEMENT IN BUILDINGS:

We want to monitor the electricity consumption of eligible sites and worksites in order to identify the main sources of energy savings and to provide regular monitoring integrated into each country's environmental management system.

Solutions to address this include:

- Hydrogen for generators
- Photovoltaic panels for the needs of the site
- Premium bungalow
- Green contracts



CUSTOMER SOLUTIONS:

We are developing and promoting low-carbon solutions, as well as integrating carbon calculations from the very beginning of the process: from commercial conversations on to design and development.

It is also a question of calculating the carbon emissions of projects and estimating the potential savings thanks to alternative solutions (in design, construction and maintenance and operation).

Solutions to address this include:

- Energy efficiency (replacement of older equipment with more efficient options, recovery of waste heat with thermal recovery, cogeneration using waste gas),
- Alternative input materials (recycling, retrofitting, material efficiency, alternative raw materials, use of recycled material, etc.)
- Electrification (switch to electric heat pumps, replacement of coal by electrification, installation of electric vehicle recharging, tram ...)
- Renewable energies (PV, Hydrogen)
- CO2 capture/sequestration

INTERVIEW WITH INGRID JOUVE



WHAT WILL BE THE KEY TO SUCCESS IN DEPLOYING OUR CLIMATE STRATEGY?

To succeed in deploying our climate strategy, we need commitment and transparency and want to lead by example.

The involvement, desire and support of employees is key to achieving our challenging objectives within both our internal activities and our client offerings. The climate is everyone's business, and therefore relevant to all our company's processes (purchasing, finance, materials, HR, sales, etc.). We need to work as a team to succeed in honoring our commitments.

Transparency of figures and clear communication of these figures is also essential to understand our balance sheet, the impact of actions and the savings generated by the potential drivers. It is essential to become familiar with carbon figures to understand our impacts, compare ourselves and measure performance towards our 2030 objectives.

WHAT TOOLS, PROCESSES AND RESSOURCES WILL HELP US MEET OUR OBJECTIVES?

Data recovery, consolidation and processing still need to be improved in order to properly integrate all the adjustment variables (turnover, emission factors, workforce, price of certain materials e.g. copper, office space, number of registrations) and to specify the missing data (such as energy consumption of establishments and construction sites). It is therefore necessary to mobilise all the company's key processes to achieve this.

A country deployment index for the climate strategy has been developed to support our countries. It includes the five major axes completed by the key elements of governance (strategy, tools, deployment) and an R&D axis. During monthly meetings with the countries' CSR contacts, the key resources we have or need to deploy for the strategy are identified (e.g. carrying out an inventory of vehicle fleets, sites and establishments, supporting the purchasing departments, etc.).

●● *We need to deploy climate communities of employees who want to get involved in their jobs and personally too.* ●●

The deployment index is a qualitative measurement tool that will be completed at the end of the year by a climate scorecard, also carried out as part of the non-financial reporting. This exercise highlights the contribution of the various processes (Purchasing, Finance, Materials, HR, Commerce, etc.).

Key expertise is required from climate data specialists. Carbon ambassadors are also essential. We need to deploy climate communities of employees who want to get involved in their jobs and personally too. This is one of the challenges ahead.

Among the tools, those that allow us to carry out the carbon assessment of projects and suggest ways to reduce our clients' carbon footprint have yet to be developed. A map is currently being drawn up based on tests carried out jointly by our CSR and Innovation departments.

WHAT DO YOU THINK ARE OUR STRENGTHS?

The climate strategy is an opportunity to carry out the activities of the Energy and Services division: solar energy, green hydrogen, public lighting performance, soft mobility, energy performance of buildings, etc.

All our clients share the same objectives: to reduce their consumption of fossil fuels, to digitalise their processes in order to be more efficient, and to maintain and enhance the value of their strategic assets by entrusting them over the long term to a trusted player.



Ingrid Jouve

Director of Quality & Environmental Policy,
Sustainable Development and Corporate Social Responsibility

Our conviction is embodied in «Together Further for Climate», one of the four action plans of Together Further, with one principle: to search for symmetry between the solutions suggested to our clients and our own action methods.

Our purpose/raison d'être is: "We take care of our world by making the essentials of tomorrow go further."

The finance sector is climate-oriented and promotes green projects. Many development perspectives are therefore possible in favour of the energy and environmental transition of buildings and industries (such as energy storage, production of electricity and decarbonized heat), infrastructures (like sustainable mobility and transport) and territories (for example, development of local renewable energies).

WHAT IS OUR MAIN CHALLENGE?

In-house, our main challenge is prioritising our actions and areas of activity in order to address critical physical flows and to participate in the joint effort of reducing the various scopes aligned to the SBTi approach.

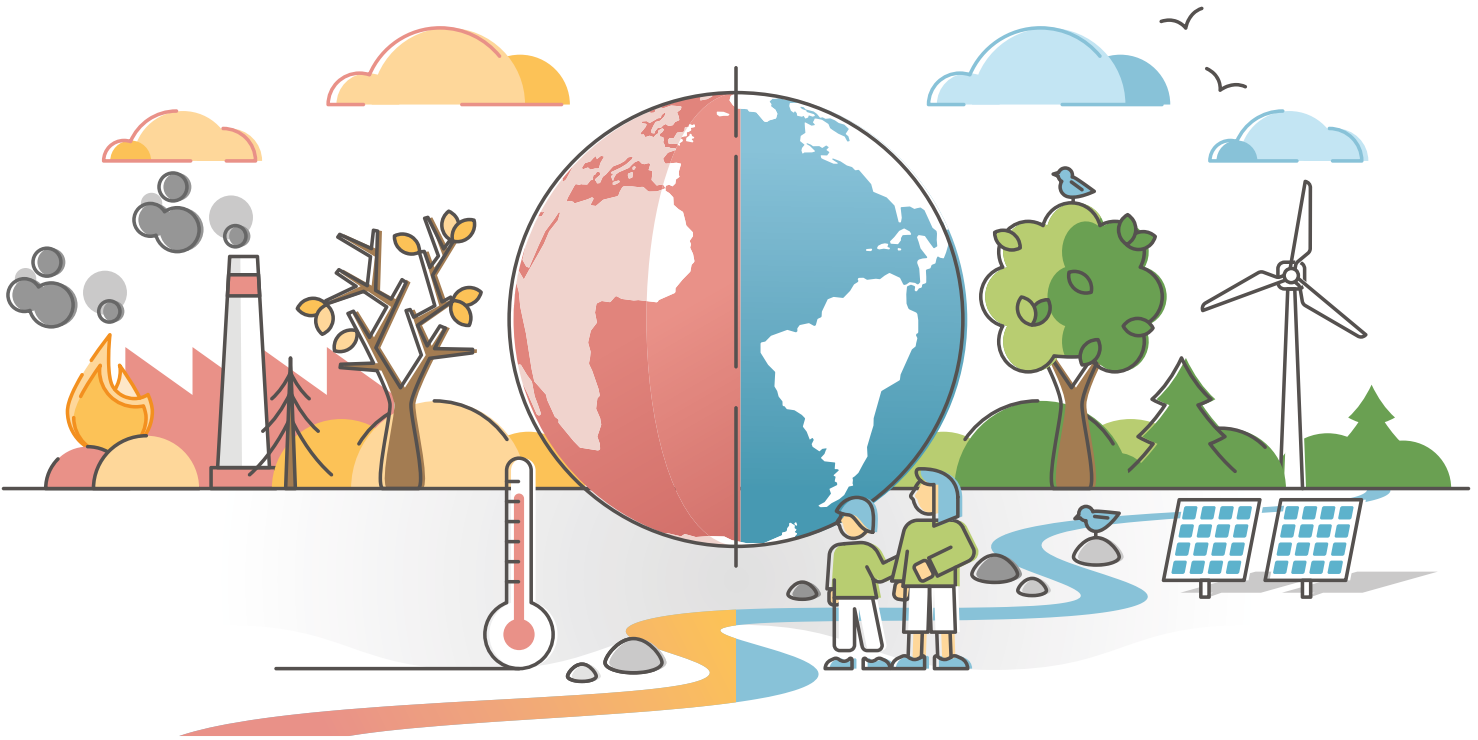
The first actions to be carried out include:

- the deployment of the «greening» of the fleet - improving carbon accounting (especially purchasing) and making reporting more reliable
- identifying low-carbon projects (in line with the European carbon taxonomy)
- the deployment and expansion of training courses and the acculturation of all stakeholders.

●● *The main challenge is to succeed in saving carbon emissions from the design stage of client projects and across the whole life cycle* ●●

Externally, we must support our clients in promoting their projects through virtuous commercial offers (energy efficiency equipment, vehicle charging facilities, energy regulation and control tools, renewable energy technologies, etc.). In conjunction with the sales teams, our organisation should enable us to map virtuous projects in their design or use and strengthen the sales pitch.

The main challenge is to succeed in saving carbon emissions from the design stage of client projects and across the whole life cycle (less material, new construction methods, re-use of equipment, low-carbon energy mix, renewables, etc.) by changing our practices and by involving our providers too.



HOW IMPORTANT IS INNOVATION IN HELPING US TO ACHIEVE OUR GOALS?

Innovation and R&D has an important role to play in emulating and creating ideas and practices to design and realise projects in a different way. They contribute to the catalogue of solutions from countries and suppliers that could be included in the topics addressed by the group's climate strategy (decarbonisation of the country's activities or participation in decarbonized offers).

The various actions suggested at our July 2021 Innovation Seminar are aligned with our climate strategy and reflect the commitment shared by the teams to lead the way for new ideas with strong added value.

WHAT'S UP

in the world ?



CLIMATE COLLAGE, GETTING EVERYONE INVOLVED!



Could games be the best way to raise awareness of the climate crisis? The Bouygues Group has decided to find out by teaming up with Fresque du Climat, an association that offers fun workshops to explain the mechanisms of climate change. At its annual conference, the innovation community of Bouygues Construction's Energy & Services division took part in a «Climate Collage» workshop to find motivation and inspiration to create innovative solutions to help decarbonize the world.



For Bouygues, the aim is to have 100% of employees take part in this awareness-raising workshop to enable everyone to understand why the Group is deploying a climate strategy. *“This initiative is part of a transformational challenge that requires us to rethink our business models in order to mitigate our greenhouse gas emissions. As part of defining Bouygues Group’s climate strategy, this event gives each employee, regardless of where they stand in the hierarchy, the opportunity to understand the major climate mechanisms and the importance of deploying these new strategic directions for the Group,”* explains **Virginie Savina**, Bouygues Group’s sustainable development and operational excellence coordinator.

Since the beginning of 2020, all Bouygues group entities have been holding these workshops with their staff. To date, more than 1,400 people in 10 countries have already been informed or trained through the Climate Fresco tool.

A GAME TO RAISE AWARENESS

In a context of climate emergency, the Climate Collage aims to raise awareness, particularly within large companies, of the impact of human activities on the environment and the socio-economic consequences of climate change.

“The Climate Collage is a tool for spreading knowledge about climate change. It is difficult to grasp all the mechanisms explained in the reports by the UN Intergovernmental Panel on Climate Change (IPCC). We created the Fresque du Climat organisation to make them more accessible, fun and tangible. Aim: 1 million people will have awareness raised of the issue by 2021” explains **Cédric Ringenbach**, creator of the tool and founding chairman of La Fresque du Climat.

The collective intelligence workshop dedicated to the innovation community last July was led by Virginie Savina, and Izaskun Laucirica, Head of CSR, Quality & Lean Management, Bouygues Bâtiment International, who has already deployed this method in his company.

“To see that human beings are the cause of all the consequences going hand in hand with the climate change was as interesting as terrifying. It was a very intensive reminder that we have to do something, better yesterday than tomorrow. Otherwise we will cause the end of life as we know it.”

Julia Federl,
Project developer for digitalization projects - Kraftanlagen in Germany

“The game shows how complex this topic is and that there are so many factors and dependencies which are playing along. There isn’t the one answer that solves the problem but referring to the complexity even small actions can help to improve the situation.”

Damian Flück,
Automation/Systems Engineer at Bouygues E&S InTec Switzerland in Building Automation

“The climate Collage is a very good tool to raise awareness of the causes and impacts of climate change and in particular to raise awareness of the chain reaction that is taking place right now as we watch. It is now up to us to find or implement solutions that will reduce this disruption as soon as possible! I would like to have gone even further by presenting these solutions and giving more details about the causes of this disruption, and then discussing the joint actions that we can take now”

Simon Giraud,
Head of BIM Management at the Industry division.

“For two hours we joined all the links in this infernal chain that is causing climate change to accelerate. In a collective game where there are no wrong answers... there is only one possible strategy: to open our eyes to the reality of the multiple crisis that surround us and that we often prefer not to face! A real wake-up call!”

Matthieu Pringalle,
Chief Of Operations - Solar & Renewable Energy



1. Measure your carbon impact: <https://nosgestesclimat.fr/>
2. Follow the climate action news with newsletters such as Novethic, podcasts like Time to Shift or blogs like Enterprise Contributive
3. See the interactive map of expected flooding by 2050 : <https://coastal.climatecentral.org/>
4. Watch the latest documentaries: Seaspiracy (consequences of overfishing) and Breaking Boundaries on planetary limits.

6-8
JUILLET
2021
ST CYR/MER



LA FRESQUE DU CLIMAT

THE CLIMATE COLLAGE

GLOBAL
innovation
Semindr
2021



YOU'RE
HOLDING ALL
THE CARDS!



@become-studio

GOOGLE'S FOUR PLEDGES TO REDUCE ITS CARBON FOOTPRINT



In 2020, Google set an ambitious goal of running on carbon-free energy 24/7 everywhere, by the end of the decade. At the same time, AI systems based on machine learning are becoming increasingly powerful and therefore more widely used. What will be the environmental impact of these systems and how does Google plan to offset this impact in the future?

Jacqueline Pynadath, Director, Sustainability & Innovation EMEA South at Google Cloud shares the four pledges Google has made to reduce its carbon footprint.



ELIMINATING OUR CARBON LEGACY

Google's net carbon footprint has been zero since 2007. By purchasing high quality carbon offsets, we have eliminated Google's entire carbon footprint, which covers all of our operational emissions.



1

RUNNING ON CARBON-FREE ENERGY 24/7 BY 2030

We have been using 100% renewable energy to cover our entire annual electricity consumption since 2017. By 2030, Google aims to be running on carbon-free energy, everywhere and at all times, in all our data centres and campuses around the world. Our data centres power the products and services you use every day. So every email you send through Gmail, every question you ask in Google Search, every YouTube video you watch and every route you take using Google Maps will be powered by clean energy, every hour of every day.

We will achieve this by solutions such as combining wind and solar energy sources and increasing our use of battery storage. We also work with Artificial Intelligence to optimise our electricity requirements and projections.



2



3

HELPING TO ACHIEVE 5 GW OF CARBON-FREE ENERGY INVESTMENT

We shall continue to invest to support the development of 5 GW of new carbon-free energy in our main generating regions by 2030. We expect this to stimulate more than \$5 billion in clean energy investment, prevent emissions equivalent to taking more than a million cars off the road each year, and create more than 8,000 clean energy jobs.



4

HELP MORE THAN 500 CITIES REDUCE THEIR CARBON EMISSIONS BY 1 GIGATONNE PER YEAR BY 2030

Cities are responsible for 70% of global emissions. Google's Environmental Insights Explorer helps more than 100 cities track and reduce carbon emissions from their buildings and transport, and maximise their use of renewable energy.

We have also been working with the International Council for Local Environmental Initiatives (ICLEI), financing a fund to help non-profit and grassroots organisations use data to promote environmental action. Beneficiaries of ICLEI include Berlin's Deutsche Umwelthilfe, which is using car traffic data from the Explorer, as well as other tools, to develop mobility infrastructure, such as cycle lanes, according to street patterns, to expedite the city's progress towards air quality and carbon neutrality in transport.

To find out more: g.co/carbonfree-fr



2022 PROJECT

Pipeline

Improving the evaluation of our carbon footprint and that of our customers, generating decarbonized energy, developing modular prefabrication, mapping, storing, sharing and exploiting data, and providing even better support in order to share innovation across the Energy & Services division... Find out more about our innovative projects for 2022.



INNOVATION RESEARCH & DEVELOPMENT @BYES



IN 2022, INNOVATION EFFORTS WILL FOCUS ON DECARBONISATION

Each year, we decide where to focus our innovation efforts based on the company’s strategy, the results of the Inno’Cup internal call for projects and the innovation seminar.

Our new Together Further corporate strategy for 2021-2025 outlines the four key themes which we will systematically build on over the next five years: together further for climate, for digital, for services and for people.

We combine these strategic development objectives with our business themes, which cover both our businesses and the needs of our customers: smart buildings and regions, sustainable mobility, customer experience, productivity and methods, health and safety, the smart grid and energy.

Management has also given our innovation community four main tasks, which act as a guide to determine the angle from which we will approach innovation: lighting the way, boosting synergies, providing methods and incubating key projects (see pages 8-9).

Finally, we are completing our approach with two cross-functional toolboxes: artificial intelligence and methodology, with our Smart Melody programme as well as new accelerators and coaching that we will be setting up in autumn 2021.

Experience has taught us to break down complex projects into work packages that are easier to understand and complete.

This year, energy transition is having an even greater impact on the innovation projects we have identified than in previous years. The innovations proposed for 2021 mainly concern the digitalisation of our businesses, our processes and our offers. This year, we are seeing a real shift towards projects that promote the energy transition.

More than individual projects, it is essential that we create formal or informal communities on our strategic themes. These provide powerful leverage to acquire and share knowledge and thus avoid duplication. Moreover, each theme has several aspects that need to be explored through several projects and points of view.

●● Our teams’ interactions will enrich the shared experience and maximise the chances of success for each of our projects. ●●

Servan Lacire





Coaching



Green Solutions Accelerator



Client Advocacy Accelerator



Energies



SOLAR PV AS OFFSET:



Install solar panels on BYUK-managed sites, with energy used for own consumption and excess sold on the market to offset carbon emissions.

GRAVIT'EAU JUNGLE:



Validation and market launch of a joint solution between BYES and Elan for greening urban spaces, including the use of rainwater and biodiversity solutions.

GREEN CONSTRUCTION SERVICES:



Establish a range of green construction services within a centralised portfolio to be launched as an alternative on the market starting in 2022.

MYCARBONECO:



Providing an option for individual carbon footprint calculation via third party applications embedded in our decarbonised Facility Management offers.

CARBON CALCULATOR:

A global partnership driven by Switzerland and France to build a user-friendly digital tool in order to calculate the carbon footprint of our interventions, including Scope 3 materials.



ECOSYSTEM BUILDING :

Explore partnerships for green energy production and distribution with major players to complement our installation and maintenance services. Our T&D, Smart Energy and Helion teams will partner to identify and test new business models for a greener and smarter energy future in France and Switzerland.



Data



BYES PREDICT 4.0:

Extending our predictive maintenance solutions across the entire spectrum of activities, including facility management and industry, with a dual focus: building an internal ecosystem of experts and partnering with clients for POCs. Driven by France and expected to expand internationally.



DATA MARKETPLACE:

The creation of a digital tool to inventory existing data sets and acquire new ones, with a powerful search engine enabling full transparency and building synergies between data teams across all our business units. Driven by BYCN IT with support from BYES data teams in France and abroad.



DATA ACCULTURATION:

An extensive outreach program to build awareness of data analysis capabilities and the business advantages brought by an analytics approach. Driven by BYCN IT with support from BYES data teams in France and abroad.





Data

ROBOTICS FOR INDUSTRY:

The development, validation and launch of a new market offering for our robotics services in the Industry sector.

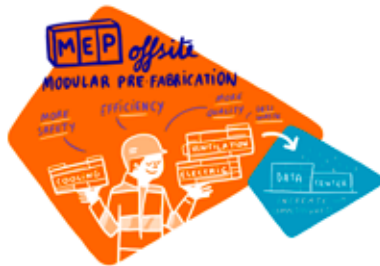


DIGITAL TWIN BUSINESS MODELS:

Explore the potential of digital twin modelling within our Smart Regions activities and identify new data-based business models.



Services



CITYBOX REDESIGN AND MARKET LAUNCH:

Solution redesign, validation and market relaunch for one of our most successful products: the Citybox.



SUBSCRIPTION-BASED MODEL FOR FACILITY MANAGEMENT CLIENTS:

Driven by France and applicable to all countries, this new business model matches the development of hybrid ways of work and the evolving requirements of our clients



PARCOURS FM:

The launch of an already-successful client partnership model for high-margin, customised FM services in France. The model is applicable to all other geographies and will initially be extended to the entire French market.



OPTIMISE THE COLLECTION AND ANALYSIS OF GEO-REFERENCED DATA:

Offer development & launch for photometric services and light pollution management within the scope of our Smart Regions activities. The development, validation and market launch of our existing services.



People



WEDNESDAYS FOR R&D:

Collaboration between Switzerland and France to establish a series of events dedicated to R&D and innovation across the entire BYES ecosystem. To broaden our internal ecosystem of innovators, and support synergies, a series of communications and events is to be established over the upcoming months.



INNOVATION DEVELOPMENT Pathway

I have an innovation to share!
Brilliant! Is it ...



Aligned to our strategic imperatives?

Aligned to our strategic imperatives?

Energy, Data, Services & People

Energy, Data, Services & People

Is there a client interested in a collaboration?

Is there a client interested in a collaboration?

Please, share the details via this form



Contact us directly to discuss coaching options.

Contact us directly to discuss coaching options.

Need help to refine the value proposition?

Need help to develop the technical solution?

Is technical feasibility confirmed?

Need help to develop the technical solution?

Our themed accelerators might be a good option for you!

Smart Melody might be what your innovation needs!

Need help to refine the value proposition?
Our themed accelerators might be a good option for you!

Smart Melody might be what your innovation needs!

OR

OR

Bouygues Energy & Services, a partner in your digital and energy transformation



Producing energy that is:

**+ responsible
sustainable**



Transporting, transforming and storing:

**+ energy
data**



Inventing infrastructures that offer:

**+ mobility
fluidity**



Developing regions
and communities that are:

**+ smart
attractive**



Designing and integrating industrial
processes that are:

**+ high performance
flexible**



Designing buildings to be:

**+ service-oriented
connected**



Sharing innovation to create a world that's:

**+ simple
beautiful**

The purpose of the Energy & Services division of Bouygues Construction is to protect and look after the essential resources to our future, such as energy, data, services and people. On the ground, the men and women of the division, together with our customers and partners, contribute to making the world around us more efficient and resilient. How do we do this? By decarbonising energy to take concrete action for the climate. By developing digital technology in business processes and in our daily lives, to be more efficient. By offering more local services, over the long term, in the heart of the regions. By mobilising responsible and committed teams everywhere. What is important for our clients is also important for us. That is why we commit to delivering low-carbon solutions and accelerating digital transformation on all fronts in our activities.

Together, we are the guardians of the flow, together, we make tomorrow go further.

Contact us via [LinkedIn](#)