

TRANSATLANTIC PERSPECTIVES:
COMPANIES INNOVATE TO FIGHT CLIMATE CHANGE





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SUMMARY FOR POLICYMAKERS

If we fail to take action against global warming, the global average temperature is likely to increase by 3.5 °C (and could exceed 4.5 °C) by the year 2100. The consequences of this would be disastrous: entailing an increase in the frequency and magnitude of natural disasters, the disappearance of a large number of animal and plant species, soil degradation, and so on.

It is imperative that both state and non-state actors (companies, NGOs, citizens) mobilize and contribute to a common effort to mitigate climate change. It is crucial to limit a rise in temperature and to adapt our practices to improve society's ability to cope with rising temperatures.

The fight against climate change requires a significant modification in production and consumption patterns and more generally a transformation of current development models. To implement these important changes, innovation must play key role to shift modes of production and consumption in order to:

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- Replace old practices with more contemporary and eco-friendly ones;
 - Implement actions to offset CO2 emissions;
 - Adapt and improve our resilience to climate change.

The AmCham France Climate and Innovation Working Group has identified five major paths in the field of innovation to bolster the fight against climate change:

- Reducing the impact of business operations and production processes;
- Developing and deploying new products with lower carbon impact;
- New ways of organizing businesses to limit the impact on climate;
- The use of digital technology as an asset for reducing emissions;
- Innovative financial tools used to promote low-carbon solutions.

Throughout the report, a dozen case studies illustrate these five themes, all of which feature the innovations developed by AmCham France's member companies. These innovations - at different stages of maturity, from basic research to commercial deployment - highlight reflections on

innovative solutions to reduce CO2 emissions in all sectors of the economy. They also showcase new business models (like corporate PPAs and models supporting the circular economy), or new ways of organizing companies.

Gathering corporate feedback allowed for the identification of conditions for climate innovation in France. Three main areas for improvement emerged:

1. DEFINE A FAVOURABLE BUSINESS ENVIRONMENT FOR INNOVATION AND EXPERIMENTATION OF LOW-CARBON SOLUTIONS:

- I. Accelerate the development of experimental projects **by introducing a regime that derogates from the regulation applicable to experimental projects** in order to allow companies to quickly test their innovations on a small scale («quick test» concept).
- II. Develop experiments **by stimulating local ecosystems** mixing local communities, universities, and companies and by simplifying their access to funding for the implementation of concrete decentralized projects (smart grids, hydrogen mobility, etc.).

2. ACCELERATE THE DEPLOYMENT OF SOLUTIONS BY STRENGTHENING THE COMPETITIVENESS OF LOW-CARBON SOLUTIONS AND BY LOOSENING THE CONDITIONS FOR PROJECT IMPLEMENTATION:

- III. **Develop the awareness around climate change and push innovation in the procurement process** of companies and the state (green procurement), based on the ISO 20400 standard.
- IV. **Encourage the convergence of technical standards (ranging from building equipment to the definitions necessary for the implementation of the circular economy) between economic zones** via international standardization.
- V. **Stress the ambition of lower energy consumption in heavy industry, building industry, and transport, combined with incentives and support for the deployment of key solutions in these sectors.**

3. ENABLE ACCESS TO FUNDING FOR ALL INNOVATIONS LEADING TO A LOW-CARBON PATH:

- VI. **Quick roll out of proven low-carbon solutions by giving them easier access to private equity and / or debt financing.** In order to quickly modernize equipment (urban transport fleet, street lighting, etc.), it is necessary to mobilize, for example, sovereign guarantee instruments to enable medium and small sized communities to access private financing.
- VII. **Promote SMEs' access to green financing** (Green Bonds and Positive Incentive Loans) **by harmonizing the taxonomy applicable to the necessary criteria to access financing based on these instruments**, thus making them accessible to a wider range of companies.

Following the withdrawal of the United States from the Paris Agreement in June 2017, many companies, both American and multinational, have taken a stand in favour of the climate. With the One Planet Summit in December 2017, French climate diplomacy focused on the role of the private sector in the fight against climate change. The concrete innovations and recommendations in this white paper illustrate and confirm the determination of American and French companies to work and innovate towards a low-carbon economy, alongside states and civil society.

The report presented to you today is the first that AmCham France member companies have decided to dedicate to the idea that innovation should be placed at the centre of the fight against global warming.

The urgency for the fight against climate change is increasingly prevalent among citizens and public decision-makers. However, the implementation of concrete actions is still met with reluctance, underpinned by the desire to minimize the impact of environmental policies on the economy. The idea that only a decline in growth would reduce our carbon footprint must be contradicted: there are clear ways to reduce greenhouse gas emissions that would have a positive impact on the economy. Rather than being a constraint, climate action can and must be integrated into growth policies. **Thoughts on the status and respective role of actors, whether they are public or private are more than ever necessary. This would insure that growth, social progress, and climate action are made complementary.**

In 2015, the Paris COP 21 allowed an awakening in the international community around climate change and triggered an unprecedented mobilization of companies. On the eve of COP 24 in Poland, we wish to recall and renew the commitment of our companies on this crucial topic.

In this perspective, we have gathered over twenty companies from AmCham France, long-standing investors in France, to form a working group on the theme «Climate and Innovation.» Rather than assessing the merits of current policies, the goal is to identify the sources of progress that have yet to be put forward by companies to serve the environment.

The main objective of this publication is therefore to **share and promote good climate innovation practices implemented by American groups present in France, in collaboration with French and European companies.**

Our approach is part of a commitment to transparency and exchanges with all economic actors, public and private, to enable them to better understand the issues and opportunities that the climate challenge represents in our sectors of activity.

This report is based on the initiatives implemented by companies in various sectors and identifies concrete actions to establish a positive green innovation framework in France. It is in this proactive context that the strategy of our companies must be set. Thus, the aim is to offer the greatest number of solutions that respect the environment.

Although the innovative approaches taken by companies in favour of the climate are essential for progress, their development takes time and requires the establishment of an appropriate framework. It is only through collective, rapid, and thoughtful action by economic actors, and with the support of governments, that we can win the fight against global warming.

It is our strong belief that in the near future we will have to answer a growing demand for solutions that are affordable but also respectful of the environment. We will have to address the challenges of mobility, continue developing renewable solutions, and adapt our organizations to reflect the reality of our commitment.

We are convinced that business strategy and climate responsibility must be rolled into one.

This report is the first step of a reflection that we wish to continue, but it is also a very concrete testimony of the actions undertaken by our companies.

We thank you for your interest.



Corinne de Bilbao

General Electric
President & CEO France



Jean-Pierre Letartre

EY President France -
Western Europe & Maghreb,
Managing Partner

A handwritten signature in black ink, appearing to be 'cd' with a flourish.

A handwritten signature in black ink, appearing to be 'JPL'.



**II COMPANIES:
KEY PLAYERS IN INNOVATION FOR
THE CLIMATE**



The Paris Agreement calls a full mobilization of stakeholders

In 2015, at the end of the COP21, 195 countries adopted the Paris Agreement on Climate Change. The main objective of this United Nations conference on climate change was to reach an agreement between states to fight against global warming.

Among the various commitments resulting from the adoption of this historic treaty are included:

- Limit rising temperatures well below 2° C (35.6° F) compared to pre-industrial levels;
- Continue efforts to limit this increase to 1.5 ° C (34,7° F);
- Strengthen the capacity to cope with the consequences of climate change.

The Paris Agreement emphasizes the importance of the role of governments, but also the involvement of various non-state actors to achieve these goals (cities, local authorities, civil society, private sector). Article 6 states that «These approaches shall aim to: [...] enhance public and private sectors participation in the implementation of nationally determined contributions¹.»

Non-state actors have already established a large number of initiatives. Amongst them international organizations, financial institutions, and companies, including:

- **One Planet Summit / One Planet Coalition:** A United Nations, World Bank and French government initiative to mobilize private and public actors to accelerate the implementation of the Paris Agreement. The One Planet coalition members met in December 2017 and agreed on a set of 12 commitments to support the implementation of the Paris Agreement. A second edition of the One Planet Summit was held in September 2018 in New York.
- **RE100:** Global and collaborative initiative of large companies committed to using 100% renewable electricity. The objective of RE100 is to bring together leading industry groups from around the world to share their renewable energy experience and accelerate the energy transition.

1 Accord de Paris 2015

- **Financial institutions' action for climate:**

As part of the "Common Principles for Climate Change Adaptation Finance Tracking" initiative, major financial institutions such as the six major Multilateral Development Banks (MDBs) or the International Development Finance Club

(IDFC) have agreed on a set of common principles that aims to monitor funding designed to support companies in their fight against climate change.

The strong involvement of companies

"CLIMATE CHANGE IS REAL. INDUSTRY MUST NOW LEAD AND NOT DEPEND ON GOVERNMENT."

Jeff Immelt, ex-CEO of General Electric

"CLIMATE CHANGE IS REAL AND WE ALL SHARE A RESPONSIBILITY TO FIGHT IT. I WANT TO REASSURE YOU THAT TODAY'S DEVELOPMENTS WILL HAVE NO IMPACT ON APPLE'S EFFORTS TO PROTECT THE ENVIRONMENT. WE POWER NEARLY ALL OF OUR OPERATIONS WITH RENEWABLE ENERGY, WHICH WE BELIEVE IS AN EXAMPLE OF SOMETHING THAT'S GOOD FOR OUR PLANET AND MAKES GOOD BUSINESS SENSE AS WELL."

Tim Cook, CEO of Apple

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Following the United States' withdrawal from the Paris Agreement in 2017, many American companies have nevertheless declared their intention to maintain their actions and climate change commitments. This is the case for Dell Technologies, HPE, GE, Apple, Google, Facebook, and Microsoft - members of AmCham France, but also other major French groups such as Schneider Electric. These companies have published a column in the New York Times and the Wall Street Journal following the announcement of the US withdrawal from the Paris Agreement², calling for a stable political framework in order to concentrate efforts in fighting this vital issue. It is not only the demand of the public but also the concept of operational savings and the prospect of opening new markets that dictate this involvement of companies.

At the same time, the «We are still in» initiative, which brings together around 2,700 actors (states, cities, universities, businesses,

university campuses and other local actors throughout the US) implement the US commitment in place of the United States, a reduction of 26% to 28% of greenhouse gas emissions by 2025, compared to 2005. The latest IPCC (Intergovernmental Panel on Climate Change) report, presented in October 2018, reflects that it is still possible to limit global warming to 1.5 ° C, provided

2 Business support for the Paris Agreement, C2ES, <https://www.c2es.org/content/business-support-for-the-paris-agreement/>

that «rapid and far-reaching transitions in land, energy, industry, buildings, transport and cities»³ are made. The IPCC highlights in particular the role that needs to be played

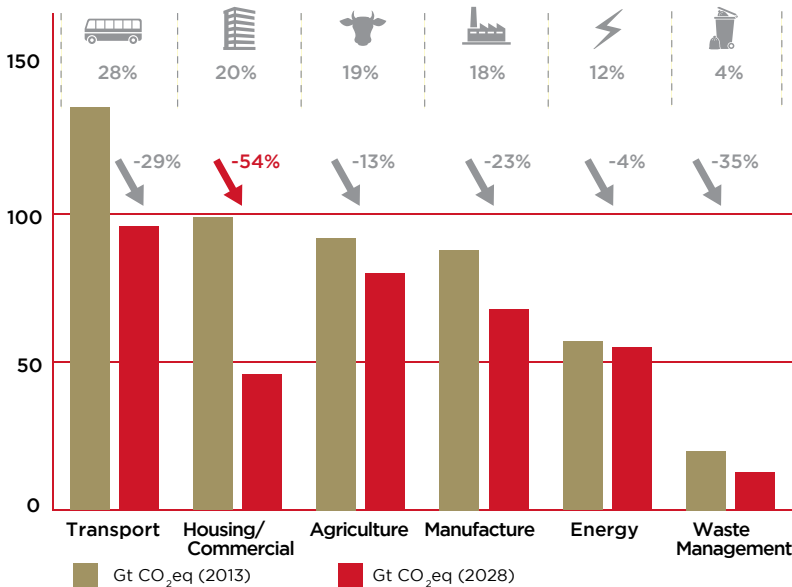
by innovation and therefore stresses the importance of the private sector' involvement.

France is part of the international mobilization

The European Union ratified the Paris Agreement on the 5th of October 2016, allowing its entry into force on the 4th of November 2016. In its action plan, the EU specifies in particular that its Member States consent to reduce their emissions by Greenhouse Gas (GHG) by 40% by 2030 compared to 1990 (year of reference).

At the French level, the National Low Carbon Strategy, adopted in 2015 and a revised version of which will be published by the end of 2018, plans to divide by four the CO₂ emissions by 2050 compared to 2013. This reduction effort must be divided between the different polluting sectors:

Forecast of greenhouse gas emissions by sector in France 2013-2028



Source: SNBC 2015

3 Intergovernmental Panel on Climate Change. Global Warming of 1.5 °C. Summary for Policymakers. Octobre 2018.

If France wishes to achieve these ambitious objectives by 2028 it will have insure that significant CO2 reduction efforts are made. As the graphs shows, the residen-

«THE TRANSPORT SECTOR AIMS TO PROMOTE CLEAN MOBILITY, TO IMPROVE THE ENERGY EFFICIENCY OF VEHICLES AND TO DEVELOP MODES OF TRANSPORT OR VEHICLES THAT EMIT FEW OR NO GREENHOUSE GASES.»⁴

tial and tertiary buildings sector (-54% CO2 emissions), the transport sector (- 29%) and the industry (-23%) will be at the centre of these changes in business practices.

«MANY ACTIONS ARE CARRIED OUT IN THE BUILDING INDUSTRY TO IMPROVE THE ENERGY PERFORMANCE OF NEW BUILDINGS AND BOOST ENERGY RENOVATION.»⁵

In addition to these specific aspects, the National Low Carbon Strategy introduces recommendations related to research and innovation.

The 2017 French “Climate Plan” seeks for carbon neutrality by 2050. .

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Innovate in order to achieve the Paris Agreement objectives

Achieving the Paris Agreement’ ambitious objectives represents a considerable challenge not only in France but also for the rest of the world. Innovation is therefore to play a crucial role in order to achieve this radical transformation. All sectors of the economy, as well as all the stakeholders concerned, should contribute to the overall effort to reduce GHG emissions.

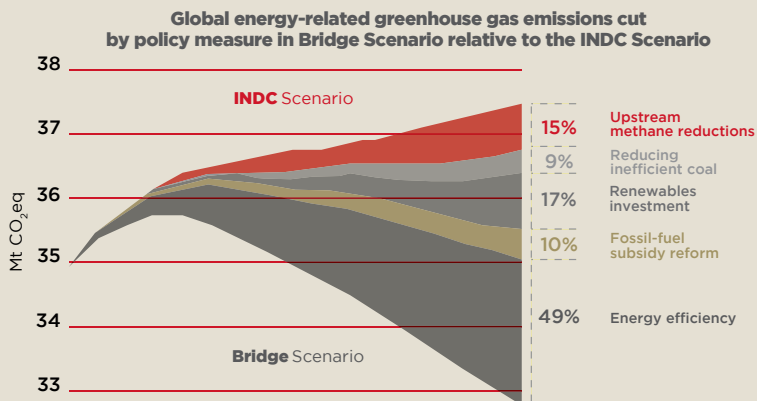
Companies will have to develop new business models, new practices that are less polluting and new actions to compensate for the polluting activities. Hence innovation’s role is imperative as this process will require introducing solutions both to reduce GHG emissions and to capture carbon in order to limit impacts on climate and to seize the opportunities that it can offer.⁶

4 <https://www.ecologique-solidaire.gouv.fr/strategie-nationale-bas-carbone-snbc>

5 Ibid.

6 Innover face au changement climatique, INRA, UMR Innovation Montpellier, 2017

Introducing low-carbon solutions is illustrated by the International Energy Agency model that identifies the difference between the emissions resulting from the commitments of the States (Intended Nationally Determined Contributions (INDCs) and a Scenario to stay on a 2 ° C trajectory (Bridge) (IAE)⁷:



Among the various leverage points identified by the IEA, some relate to actions already well mastered and in use such as energy efficiency, which represents 49% of the capacity to reduce CO₂ emissions. However, other leverage points are less advanced, with fewer effective solutions currently developed and requiring significant innovation efforts.

These innovations can be technological, organizational, institutional, or social and can be applied to all business sectors and at all stages of maturity (from basic research to commercial deployment). Companies can innovate at each stage of their value chain in order to establish less GHG-emitting processes. It can for instance concern raw material supply, production process, sales or the way to use the product or the service.

A recent AmCham France survey of member companies⁸ reveals that climate innovation is among the strategic priorities of 69% of companies, a majority of which have already set concrete targets to reduce their CO₂ emissions. Also, 75% of these companies intend to invest in climate innovation in

France in the next 5 years. However, 59% believe that the current conditions (economic and regulatory) do not meet the challenges of climate innovation.

In order to encourage these initiatives, AmCham France offers recommendations aimed at fostering innovation related to climate issues for policy makers, economic actors, and stakeholders. This contribution to the public debate is unique, as it presents the point of view of American companies who wish to share best practices, and presents a dialogue with French AmCham member companies around their reflections on climate issues.

⁷ AIE. World Energy Outlook Special Report: Energy and Climate Change. 2015. P. 74.

⁸ Survey conducted online and by telephone with AmCham member company executives in October and November 2018 (102 responding companies, representative of all sectors of the economy). The sectors most represented are energy and transport, as well as the technology sector, which each account for more than 20% of respondents. The financial, pharmaceutical, agri-food, consulting and luxury sectors are also represented. Finally, the sample is representative of the diversity of geographical locations in the region, in Ile-de-France and in the regions.

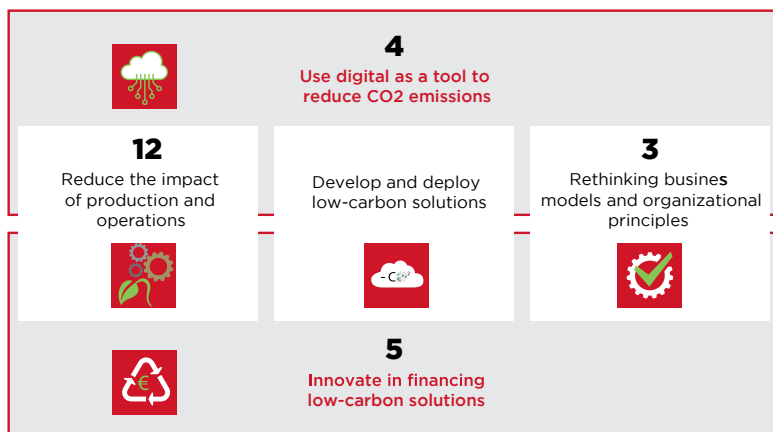


**II | INNOVATING IN
FRANCE TO FIGHT
CLIMATE CHANGE:
OBSTACLES AND
LEVERAGE POINTS FOR
COMPANIES**



The AmCham France Climate and Innovation Working Group has identified five main areas of business innovation in favour of climate:

- Three axes related to the value chain of companies, focusing respectively: 1) on reducing the impact of production and operations, 2) on introducing product innovation and 3) on exploring solutions regarding companies' organizational modes and business models to work towards a low-carbon economy.
- These three areas are supplemented by two transversal dimensions, whose action impacts all links in the value chain, concerning 4) the role of digital in climate innovation and 5) innovation in financing models for deploying low-carbon existing solutions.





1| Reduce the impact of production and operations

Green procurements (including renewable electricity), energy efficiency, and change in energy carriers are the main means used by companies to reduce the climate impact of their operations. More and more companies are seeking similar commitments from their supply chain.

Industry and buildings (including residential buildings) account for 22% (13% related to energy use, 9% related to industrial processes) and 16% of French greenhouse gas emissions¹. To reduce these emissions, companies have several means of action:

- **Energy efficiency**, with programs to improve the efficiency of old production processes and buildings (offices, logistics warehouses, etc.). Due to the digitization of industrial processes the technologies of the industry of the future (for example 3D printing, advanced modelling of the production process to reduce waste) allow to innovate in favour of a lower environmental impact of production (energy, water, materials).
- **The supply of renewable energy**, either through green electricity supply contracts, self-consumption operations or even long-term renewable power purchase contracts (corporate PPAs). If corporate PPAs are still less developed in France, signals indicate that they should constitute a significant part of the market in the coming years.
- **Emissions reduction programs related to industrial processes**, such as reducing upstream flaring (burning of natural gas discharges during oil and gas exploitation), and the capture of, storage and recovery of CO₂ (Carbon Capture, Utilization and Storage, CCUS).
- **Efforts to reduce water consumption and waste** in order to adapt to the effects of climate change and the preservation of resources.

Often, companies seek similar commitments (lower emissions, reduced energy consumption, etc.) from their suppliers, with responsible purchasing policies.

¹ Ministère de l'Environnement, de l'Énergie et de la Mer. Chiffres clés du climat France et Monde. Édition 2017.

Reduction of the climate impact of industrial operations (example of the Tilloy-lez-Cambrai site)

DESCRIPTION OF THE SOLUTION / DIFFICULTIES ENCOUNTERED

Since 1975, 3M has implemented a global program (Pollution Prevention Pays, or PPP) that has prevented the emission of 2.3 million tonnes of pollutants through more than 10,000 projects. 3M has therefore reduced its greenhouse gas emissions by 69% in 2017 compared to 2002.

By 2025, 3M is working at the same time to improve its operations but also those of its customers, and works on the development of new solutions. In the current context where companies set global objectives and continue to increase growth, 3M has set goals, measured and driven, and broken down into green roadmaps:

- 30% improvement in the energy efficiency of operations;
- 25% increase in renewable electricity consumed;
- 50% reduction in greenhouse gases;
- Additional 10% reduction of waste.

This approach is particularly illustrated in France on the site of Tilloy-lez-Cambrai (North). Established since 1975 near Cambrai, this production site is globally recognized for the production of structural adhesives, retro-reflective road marking strips, glass microbeads for road signs and hollow glass microspheres for lightening and insulating materials, particularly in the aeronautics and the automobile industry. These lightening capacities play a key role in reducing energy consumption. New solutions for electric vehicles are also industrialized (heat dissipation materials around batteries). For instance 80% of the site's production is for export. Certified ISO 14001 since 1999, the Tilloy site has obtained the ISO 50001 label. This label certifies that the site's energy management is insuring a continuous improvement of energy performance. In order to achieve this level, several manufacturing processes have been optimized for better energy efficiency.

KEY FACTORS FOR SUCCESS

- In accordance with 3M's global objectives the production site follows a clear plan to meet with climate policies and meet ISO requirements.

OPPORTUNITIES

- A project to recover the heat required for production for heating buildings has reduced energy consumption by 1,000 MWh / year.
- In 2018, the site invested in the optimization of glass microsphere manufacturing processes that will reduce its gas consumption by 6000 MWh / year.

OBSTACLES

- Difficult ratio of return on investment in view of the opportunities offered by innovative markets at random volumes
- Heavy and costly requalification procedures for industrial processes in binding certification markets (aeronautics, automotive)
- Rarity of qualified and local human resources on industrial sites

KEY LESSONS

- Continuous innovation in manufacturing processes must be facilitated in order to ensure not only the development of new solutions for customers in France and abroad but also to create virtuous circles within companies that combine energy efficiency and operational and economic performance.

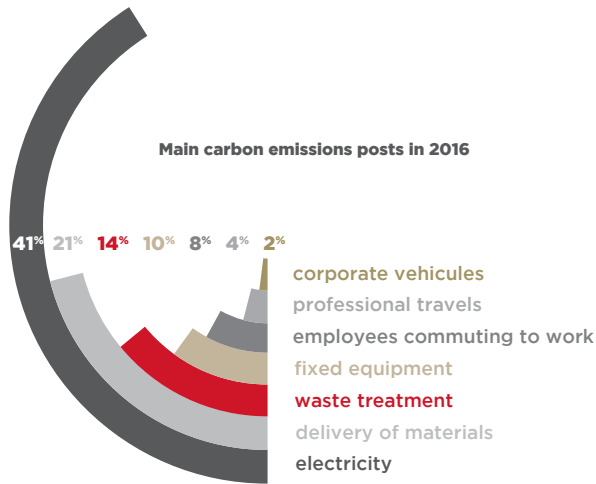
➔ Associated recommendation: **RECOMMENDATION V**



LM Wind's commitment to carbon neutrality

DESCRIPTION OF THE SOLUTION / DIFFICULTIES ENCOUNTERED

In 2016, GE's LM Wind division, which produces wind turbine blades, committed to carbon neutrality through the «Clean LM» program. Carbon neutrality is framed by a global agreement on greenhouse gas reporting called the Greenhouse Gas Protocol. This protocol consist in having a net zero carbon footprint, by balancing emissions and reductions as well as off-sets. This commitment by LM Wind is part of the reduction efforts of the GE group, which itself has achieved in 2017 to reduce greenhouse gas emissions of its activities by 27% compared to 2011. LM Wind has reached its goal of carbon neutrality in July 2018.



In the first year of the «Clean LM» program, LM Wind focused on four aspects:

- **Accounting for greenhouse gas (GHG) emissions**, by determining the main emission stations of the sites. Each plant provides data on energy, water, waste generation and emissions through a sustainability-reporting tool (SoFi).
- **Energy efficiency**, with the implementation of three energy saving measures that, once fully deployed, will reduce energy consumption by about 12%: ventilation control to ensure that it follows the production process (rather than running continuously at full speed), energy management system to track energy consumption (and identify possible savings), and LED lighting.
- **Switch to 100% renewable electricity** - whilst renewable energy certificates cover the first year. At the same time, LM Wind is exploring the option of purchasing renewable electricity for all of its European operations through a long-term power purchase agreement (PPA).
- **Offset unavoidable CO2 emissions through the purchase of carbon credits** This includes, for example, emissions due to business travel, waste, commuting to work, etc.



LM Wind's commitment to carbon neutrality

KEY FACTORS FOR SUCCESS

- LM Wind's management's commitment and the short timeframe for implementing the program have been key elements to ensure action.
- Resources have been allocated to the division carrying the initiative, without creating functional subdivision.
- The ability to demonstrate that energy efficiency measures and the switch to renewable electricity supply generate immediate cost savings has been decisive.

OPPORTUNITIES

- A carbon neutral goal requires a new business perspective, which opens up many opportunities, first commercially and operationally (including better access to finance) but also in terms of company reputation and employees' commitment.

OBSTACLES

- It is difficult to obtain all the data required for accounting for GHG emissions. Achieving a satisfactory level of data requires a lot of perseverance. This is, however, necessary since it gives a starting point for the rest of the process.
- Carbon neutrality and related issues need to be clearly explained. GE has developed special educational tools to engage all employees (eg, developing a «Go Carbon Neutral» game).

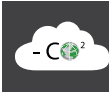
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KEY LESSONS

- Careful consideration of electricity consumption results in significant savings in terms of costs and emissions.
- Such an important project should not be conducted only «in parallel» with others. This is a real commitment to a business transformation process that requires allocating enough resources. The result in terms of savings, efficiency gains and commitment of the teams is therefore even more important.

➔ Associated recommendation: **RECOMMENDATION V**





2| Develop and deploy low-carbon solutions

Companies have leverage points for the efficiency of their operations and their supply chain. They can also work towards a low-carbon economy by developing innovative products whose manufacture, use, and end-of-life generate a reduced amount of greenhouse gases, allowing users of the product to reduce their own impact on global warming.

Their product innovations address the decarbonisation of all applications (buildings, mobility, etc.). The challenge for businesses is to develop technological innovations while supporting the scaling up of existing low-carbon solutions and encouraging users to adopt more virtuous behaviours through new offerings and new business models.

In order to do so, companies innovate along several axes:

- **Improving the energy efficiency of products**, in order to reduce the energy consumption induced by the use of these products. In Europe, with the Ecodesign Directive implementing regulations, and with the thermal building regulations, these efforts are widely prescribed by public authorities. The French Agency for the Environment and Energy Management (ADEME) assesses that improving the energy efficiency of products could lead to a 22% drop in specific electricity consumption by 2030²
- **The development of products** to increase the use of recycled or renewable materials (natural materials or materials whose stocks are rapidly renewed in relation to the current rate of consumption), strengthen the resistance of products and facilitate their repair or dismantling in recycling, in an

ecodesign approach. The transition to a circular economy and the new approach regarding the complete life cycle of products are pushing an increasing number of companies to act on the energy intensity and the environmental impacts of the production process - including particularly the consumption of raw materials and the products' end-of-life. Indeed, for many electronic equipment, the impact of the manufacturing is predominant compared to its use. For example, in the case of a smartphone, 80 to 99% of the impacts considered in the life cycle analysis are related to the components of the device and therefore take place during manufacture or end-of-life of the product³.

- **The change of the energy vector (of the product or the product itself being a new energetic vector)** implying the substitution by a less carbonated energy source: this innovation axis is well illustrated by the efforts in favor of multimodal electric mobility (individual vehicles, buses, river shuttles and maritime transport), the development of 3rd generation biofuels from algae or the production of green hydrogen for industrial applications, electricity storage or mobility. The decarbonisation of the electricity mix by the integration of renewable energies will be simplified by **hybridization. In other terms the**

2 ADEME. Alléger l'empreinte environnementale de la consommation des français en 2030 : Vers une évolution profonde des modes de production et de consommation. 2015.

3 ADEME, Ibid.

integration of different technologies into the same system to exceed the capacities of individual technologies and compensate for the shortages of each energy source. In Galdorf, Germany, GE has set up 15 MW of wind turbines combined with a water reservoir to combine wind power and pumped energy storage (PSH).

- **Developing products that have an incentive role** towards the users' behaviour or that provide services or tools for monitoring the environmental impact.
- **Reducing costs of existing low-carbon solutions**, in particular by exploiting economies of scale in production. This issue is reflected by the gradual decline in investment costs in onshore wind and solar photovoltaic or the need to achieve a reduction in the price of hydrogen vehicles.
- As conventional energy remains important in the current energy mix, the reality principle also requires the **development of technologies** that limit the emissions of existing technologies. For example, it will be necessary to reduce the emissions of coal-fired power plants, which currently produce around 40% of the world's electricity, and should remain the second generation technology until 2030 (behind renewable energies, and in front of nuclear power)⁴.

By vertical market, these companies' efforts to develop new solutions with less impact on the climate are based on four major axes:

- **Improving energy efficiency and energy independence of buildings.**
- **Accelerated deployment of low-carbon mobility** (electricity, hydrogen, biofuels, biogas, etc.).
- **Industrial energy efficiency and, more generally, the reduction of emissions from industrial processes.**
- **The decarbonisation of the energy sector**, through the use of new, low-carbon energy sources, the hybridization of technologies and the improvement of the efficiency of existing energy sources.

4 Sustainable Development Scenario de l'AIE (scénario compatible avec les objectifs de l'Accord de Paris).

› Energy autonomy of buildings and equipment

Buildings (residential and commercial) account for 20% of French greenhouse gas emissions. As part of the French national low-carbon strategy this sector will have to make the most significant reduction efforts with a 54% drop in emissions between 2013 and 2028. Already involved in the process to retrofit the energy consumption of existing buildings (with a fleet renewal rate approaching 1% per year), companies are innovating to improve the energy performance of new buildings. These efforts include the energy autonomy of buildings and equipment, such as the development of an energy-autonomous hydrogen lift (Otis) and the deployment of an energy-efficient residential building (ABB).

DESCRIPTION OF THE SOLUTION / DIFFICULTIES ENCOUNTERED

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Otis has made extensive R&D efforts to develop an energy-efficient lift. Important progresses have already been made for many years in terms of energy efficiency to reduce the needs of the cabin (for instance with the use of LED lighting). The devices are also equipped with a regenerative drive system that can reduce the electricity consumption of the lift by up to 75%.

With the Gen2 Switch Otis has developed a lift able to store energy to operate autonomously (up to 100 rides) and to store solar or wind energy coming from the grid or produced locally (self-consumption). Otis' ambition is now to achieve complete autonomy with hybrid technologies (electrochemical batteries and hydrogen)..

A hydrogen lift prototype (fully autonomous in energy), developed in partnership with the CNRS, has been operating since 2017 on the Otis test tower in Gien (Loiret).

AABB inaugurated in 2016 in Brütten (Switzerland) a residential building entirely autonomous in energy. With 1,000 m² of photovoltaic panels installed on roofs and facades, the building produces enough energy to supply the consumption of the nine homes. In the summer, one hour of sunshine is enough to provide the energy needed for a period of 24 hours.

The electricity surplus produced is stored either in batteries, with a capacity of 153 kWh representing short-term storage, or is used to heat water stored in two 125 cubic meters tanks, a long-term storage facility to meet the needs of heating in winter. The combination of control of consumption and storage technologies allows the building to be devoid of any connection to a supplier of electricity, gas or oil.

KEY FACTOR FOR SUCCESS

- The experience acquired by Otis in operating its device with solar-powered batteries (Gen 2 switch) was essential in prefiring a more complex project.
- The strength, the alignment and willingness of the local ecosystem (public and private) have been key to the success of the project.

› Energy autonomy of buildings and equipment

OPPORTUNITIES

- The system does not require the use of substances such as lead or cadmium or three-phase current.
- Due to hybrid technologies, the tests conducted at Gien should help push the current technical limits of autonomous elevators based on electrochemical batteries (630 kg and 7 levels).
- Energy autonomous, the elevator remains functional even in case of power cuts.
- Initially, the production of solar energy was aimed at resale. The Brütten project foreshadows the evolution of energy consumption patterns towards more self-consumption among individuals.
- The control of consumption and storage technologies allow maximizing the self-consumption of photovoltaic electricity produced on site to cover the energy needs of the building and its inhabitants

OBSTACLES

- The highly regulated elevator industry has to deal with strict standards that vary across major economic zones around the world (eg European Union, North America and Japan). Greater flexibility of standards to support innovation combined with convergence at the international level will allow a greater distribution of these innovative solutions.
- The rigidity of French regulations limits the deployment of self-consumption.

KEY LESSONS

- The industrialization and deployment of this type of innovative solutions will be favored by the agility and convergence of standards.
- It is still necessary to increase users' awareness of the price signal and the existence of solutions for a living environment participating in the energy transition.
- It is important to adopt a regulatory framework (collective self-consumption, building energy regulation) encouraging the deployment of this type of building with a low impact on the climate.

➤ Associated recommendation: **RECOMMENDATION V**

› electric mobility

The transport sector accounts for about 30% of national greenhouse gas (GHG) emissions. This is the second largest contributor in absolute value to the decline in French emissions as part of the national low carbon strategy (SNBC - currently under revision). In relative terms, transport will have to reduce its emissions by almost 30% between 2013 and 2028. To achieve these objectives, one of the main leverage points is based on the development of clean or low-emission modes of transport. This is the case of electric mobility when associated with low-carbon electricity. Companies are innovating both to improve the performance and autonomy of electric vehicles and to deploy the corresponding charging infrastructures and electric mobility for all modes of transport (public surface transport, water transport).

DESCRIPTION OF THE SOLUTION / DIFFICULTIES ENCOUNTERED

The gain in autonomy is identified as the best cause for users to accept the transfer from combustion engine to the electric vehicle. Energy efficiency and lightning are the main drivers. The safety challenge also requires working on the risk of thermal runaway of the battery. It is thus necessary to act on two leverage points, on which 3M develops and deploys innovations:

- The increase in battery safety, allowing an increase in the available on-board power made possible by the use of new materials technologies (gap filler) allowing a better heat dissipation in the batteries of the vehicles, the cooling of the batteries by immersion and to thermal management of the batteries.
- The energy efficiency of the vehicles using:
 - Thermal insulation of the cabin for a lower consumption of air conditioning (multilayer films for glazed surfaces to reject infrared rays).
 - Lightening the total weight of the electric vehicle, which is the main source of efficiency gains. The addition of hollow glass microspheres in the materials used for equipment (bumpers, dashboard, etc.) and the asymmetrical bonding of various materials (metals, composites, etc.) used in the manufacture of automotive parts allow to lighten the vehicle up to 194 kg.

ABB offers a range of solutions to facilitate the development of the electric vehicle market. These vehicles are individual as well as collective and are terrestrial or fluvial. These solutions focus on:

- Fast charging infrastructures:
 - Development of an ultra-fast and scalable charging station for new generation private electric vehicles that can reach 350kW (compared to the slow charges of 7kW).
 - For buses: charging solutions adapted to operator operating constraints. Therefore based on charging technologies at the depot, the terminus and even flash charging at stops.
 - Installation of high capacity batteries in ferries for an emission-free crossing.
- Control solutions limiting the impact of charging infrastructures on electricity networks:
 - Introduce batteries in fast charging infrastructure at the station to allow energy storage to smooth power calls (which can be divided by ten).
 - Deployment of virtual plants in Germany, which guarantees a recharge with 100% renewable electricity. Operators can also aggregate and enable consumption flexibilities to control the power demand on the network, or even provide certain services to the grid (voltage adjustment, power reserves).



INNOVATIONS FOR THE ELECTRIC VEHICLE



SOLUTIONS FOR MULTIMODAL ELECTRIC MOBILITY (fast charging of electric vehicles, electric buses, marine and fluvial mobility)

› electric mobility

KEY FACTORS FOR SUCCESS

- An ambitious ecosystem (public and private) supported by a proactive governance.
- Global research capacity to help local developments.
- The electrification of mobility requires bringing together all the actors of the sector (vehicles, infrastructure) to plan this electrification («chicken / egg» dilemma).
- Incorporate the needs due to the diversity of electric transport modes and recharging infrastructures into the planning work and highlight the new services that electric mobility is able to bring to the transport network.

OPPORTUNITIES

- Energy efficiency gains related to the battery and the vehicle can allow to increase the range of the electric vehicles and would accelerate the deployment of this technology
- The trend towards a significant increase in the range of electric vehicles (400 to 500 km) is creating a need for fast charging infrastructures.
- Fast charging makes it possible to limit the changes imposed on the user by the electric mobility
- France has a diversified industrial base active in the field of mobility. This will simplify the implementation of the solutions after tests in other countries.
- Due to the battery of vehicles, electric mobility can provide flexibility services to the transport network.

OBSTACLES

- The public power could rely more on available technologies to boost the market by emphasizing:
- the reduction of energy consumption and emissions in transport, in particular light vehicles, including low-carbon.
 - the energy efficiency of electric vehicles: engines, equipment (such as air conditioning) and materials
 - the safety, lifetime, performance and battery efficiency (minimum autonomy, maintenance of performance over time, etc.)
 - the reduction of the overall weight of the vehicle.
 - The purchase of an electric vehicle is often conditioned by the insurance perceived by the user to have points of charge to cover his needs for travel.
 - Preferred financial choice to sustainable choices of infrastructure.
 - Lack of knowledge of available and proven technologies.

› electric mobility**KEY LESSONS**

- The current development dynamic of the electric vehicle calls for work on the efficiency and safety of these vehicles. Existing technologies allow to act on the lightening and thermal management of the battery and the cabin.
- Public policies could work on available technological solutions by putting in place:
 - requirements concerning the battery (safety and longevity) and the autonomy of the vehicle in particular by reducing cooling energy consumption needs.
 - a roadmap to reduce the total weight of vehicles (for example through the use of new materials)..
- The development and planning of the electrification of transport requires multi-stakeholder work bringing together the entire ecosystem involved in this transformation.
- Fast and ultra-fast charging infrastructures are a key means to reduce the constraints on the development of electric mobility.
- Innovative technological solutions that limit the impact of charging infrastructure on networks must be simultaneously encouraged.

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➤ Associated recommendation: **RECOMMENDATION V**

› Production of 3rd generation biofuel from algae

DESCRIPTION OF THE SOLUTION / DIFFICULTIES ENCOUNTERED

Following a collaboration started in 2009, ExxonMobil and Synthetic Genomics, Inc. have developed a strain of algae that can convert carbon into a sufficient amount of energy-rich fat substance that can be processed into biodiesel. This innovation would allow the use of algae as a low-carbon fuel in the transportation sector. Furthermore, an additional step was taken in 2018 with the doubling of fat yield. Outdoor production will now be tested on a large scale in a California farm. This is the very first outdoor test phase of this magnitude. The objective of this pilot farm is to evaluate the possibility of producing up to 500,000 tonnes of biofuel per year.

The main challenges for these 3rd generation biofuels are:

- the adaptation of production to an external environment: until recently, the production of algae for biofuel production was mainly carried out in enclosed environments and in laboratories. It is now important to understand the growth parameters of algae tested in the laboratory, such as viscosity or flux, in order to adapt them outdoors. This phase of adaptation is a critical step to allow potential future large-scale marketing.
- introducing production capacity on a very large scale and at a reasonable cost in order to reach the objective of covering the energy needs of the transport sector (as a reminder French consumption represents 40 million tonnes of fuel per year).

KEY FACTORS FOR SUCCESS

- Demonstrate the ability to control the entire process of algae production.
- The deployment of this solution requires public and political approval.
- The costs must be controlled, in conformity with the purchasing power of consumers.

OPPORTUNITIES

- Algae are a potential source of low-emission energy for the transport and chemical industries.
- Unlike other sources of biofuels such as maize, algae production does not compete with crops and food production.
- This type of innovative production does not require arable land or fresh / clean water for consumption.
- Algae cultivation has no particular seasonality. Thus, they can be produced throughout the year.

OBSTACLES

- A long period of laboratory research is needed to deploy the production of these algae, by varying the production under various factors to achieve further increase the production of algae fat from the conversion of light.
- This project may face public opposition due to the potential disruption of aquatic ecosystems.

KEY LESSONS

- Algae represent a sustainable source of low-carbon renewable energy, suitable for rapid use in transportation, without waiting for a fleet transformation, and using existing distribution infrastructure.
- This is an industrial pilot of a production that can supply refineries in the future.

➤ Associated recommendation: **RECOMMENDATION I**



3| Rethink the principles of business organization and business models

Structurally, business models are shifting towards a circular economy, based on economic growth that would no longer be correlated with an increase in the environmental impact. Hence, business activity will participate to reduce CO2 emissions. Transport is the main source of CO2 emissions in France. By adapting their transportation practices, companies have the ability to reduce these emissions. These actions do not face major technological obstacles, but instead imply strong cultural changes within companies.

Some companies are also reviewing their business models on their core business

business in the direction of a circular economy: development of the second-hand market and services (rental, for example) beyond the sale of material, use of plastic and recycled metals. While the calculation of CO2 equivalent emissions on the French territory based on the territorial approach (which considers emissions emitted on the territory) shows a reduction of emissions in France by 7% between 2000 and 2010, the calculation of CO2 emissions equivalent based on French consumption (which considers emissions emitted on the territory plus emissions abroad for import and subtracted from the emissions produced in France for production intended for export) indicates on the contrary an increase of 15% over the same period¹. In other words, there is a deterioration of the carbon footprint of the consumption model of the French economy, a phenomenon that is observed globally for the whole of the European Union. Beyond a change in consumption practices, companies must therefore review their production model in order to absolutely reduce the carbon footprint of their activity and the goods they produce. By decoupling economic growth of an activity from its environmental impact, new models based on the economics of functionality can help reduce the carbon footprint of operations².

Beyond their production processes, their upstream chain and end-users, business activity generates environmental impacts related to their logistics activities and travel. Transportation is responsible for the majority of French greenhouse gas emissions (29%), a proportion that has increased since 1991 given the particular difficulty of decarbonising this sector. Since that date, emissions have decreased in all economic activities except in transport, where they have increased by 9.1%.

Companies have very important leverage points on logistics and transport.

Based on international practices, innovations in the ways of organizing work (implantation of sites, up to business models), to organize professional mobility (to move less and better), ways to stock up, ways to deliver, companies are already acting on several levels to reduce the costs and CO2 emissions associated with their logistics:

- Reduction of long logistic chains;
- Optimization of logistics flows (optimization of routes, reverse logistics, etc.);
- Use of alternative modes of transport to road and air (maritime, river, railway) and hybridization of modes of transport (intermodality);
- Use of low-carbon vehicles (electric, hydrogen, etc.).

1 ADEME, CITEPA, RAC. Les émissions importées – Le passager clandestin du commerce mondial. 2013

2 ADEME. *op. cit.*; IDDRI. Économie du partage: enjeux et opportunités pour la transition écologique. Juillet 2014. p. 20-23

Similarly, companies have the ability to reduce the climate impact of their employees' , journeys by raising their awareness, by encouraging them to turn to greener modes of transport (public transport, cycling, carpooling, car sharing), even rethinking the organization of work to structurally reduce business travel and the real estate footprint (remote collaboration tools, telework promotion¹). According to ADEME, business travel (business trips and commuting) is the largest greenhouse gas emissions item in office activities (12 million tonnes per year), due in particular to the use of the car as a means of transport for 3 trips out of 4²

Innovating in these areas does not face major technological barriers, but calls for strong management change within companies and among their customers. For example, transforming companies' business models by looking for value creation opportunities via new services extending the life of products, or to promote synergies of mutualization or substitution between economical actors³. Internally, companies will be able to favour public transportation, overcome the presenteeism culture in the world of work, or favour the preference of their purchasing departments for the purchase or rental of second-hand products.

1 Good Planet. Entreprises : Guide pratique « Réduire les déplacements des collaborateurs ». 2011.

2 ADEME. Écoresponsable au Bureau : Actions efficaces et bonnes résolutions. Décembre 2017. P. 23.

3 CGDD. Ecologie industrielle et territoriale : le guide pour agir dans les territoires.2014

› Evolution of the business model towards a circular economy

DESCRIPTION OF THE SOLUTION / DIFFICULTIES ENCOUNTERED

Cisco is aiming to recover 50% of its end-of-life equipment in order to repackage it to offer used equipment, use spare parts or offer a rental service.

The difficulties encountered are of several kinds:

- A stock of rental equipment is more difficult to manage, with a reduced visibility;
- Consumers habits are persistent: many prefer to purchase new product rather than renting or buying used

KEY FACTORS FOR SUCCESS

- Produce less and better, while offering new services (reuse refurbished equipment, either by selling used equipment or by using spare parts);
- Develop equipment rental.

OPPORTUNITIES

Two new business models emerge:

- the second-hand market;
- renting (the sale of services on hardware replaces the sale of hardware).

OBSTACLES

- This new circular model comes up against the difficulty of traceability of the sold equipment, to recover it at the end- of-life.

KEY LESSONS

- It is possible to modify the company's activity by developing a new, more sustainable business model through the circular economy: offering services in addition to selling equipment (such as repair, repackaging and rental of products).
- Positioning a company on the second-hand market is a way to develop business while limiting its environmental impact.



» Recycling gold and plastic from old PCs and servers in the United States

DESCRIPTION OF THE SOLUTION / DIFFICULTIES ENCOUNTERED

- Dell Technologies' funding offers help give PCs and servers a second life. At the end of the leasing offers agreed with its customers, the computer equipment is either reused or conserved to be recycled. As part of a pilot project, Dell Technologies creates gold motherboards from recycled computers for use in Latitude 5285 2-in-1 computers. One of Dell Technologies' CSR goals is also to use more than 45 million tonnes of recycled plastic and other durable materials in its products. By comparison, in 2017, the company used 20.5 million pounds of durable materials in its products.
- The use of recycled materials significantly reduces the carbon impact of products placed on the market. Customers and suppliers thus enter into a real circular economy.

KEY FACTORS FOR SUCCESS

- Ces schémas permettent à Dell Technologies de maîtriser entièrement le cycle de vie de ses produits
- Les clients sont dédouanés de la prise en charge de la fin de vie de leurs produits, notamment des DEEE (difficiles à gérer pour les plus petites entreprises)

OPPORTUNITIES

The carbon footprint is significantly reduced by the reuse of end-of-life materials recovered by Dell Technologies, including:

- Gold: There is 800 times more gold in a tonne of printed circuit boards than in a ton of gold ore. It is therefore much more efficient to use recycled gold. It also eliminates some of the social and environmental challenges associated with gold mining (disposal of residues, extractions in conflict zones and hard working conditions).
- Closed-loop plastics: In addition to buying on the open market, Dell Technologies harvests plastics from its own recycling streams to create new parts for desktops and displays.

OBSTACLES

- Industrialization of the collection process in France and Europe, in order to extend the gold and plastic recycling practices in place in the United States. In France and Europe, financing the purchase of IT products already extends the life cycle of these products by giving them a second life and allowing customers to use ever quieter, more energy-efficient products. made from more recycled materials.

KEY LESSONS

- Promote the collect of precious metal.

› **Voluntary teleworking policy**

DESCRIPTION OF THE SOLUTION / DIFFICULTIES ENCOUNTERED

Dell Technologies has set a goal that 50% of its employees worldwide will be teleworking by 2020. A teleworking policy was implemented in France in 2009. Currently in Paris, more than 50% employees attached to the site are eligible for teleworking and can work from home 1 to 5 days a week.

This policy is a strong opportunity for Dell Technologies to reduce greenhouse gas emissions by allowing:

- Reduce GHG emissions related to employee transportation to workplaces,
- Reduce the impact of real estate (use of an office for 4 persons in open space).

In a study carried out by Dell Technologies on the benefits of the teleworking policy in the United States, the group determines the net amount of greenhouse gas avoided per employee per year at 1.15mT CO2eq. This quantity takes into account, on the one hand, avoided emissions (due to the reduction of car journeys between homes and workplaces, lower office electricity consumption) but also a rebound effect (increased use of home electricity by employees while working from home, emissions related to the use of IT tools that allow employees to work remotely).

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KEY FACTORS FOR SUCCESS

- In addition to the prior involvement of the social partners, this policy is part of a voluntary framework with reversibility and requiring the agreement of each employee.
- Emphasis is placed on the value of the results of the work rather than on the way, time and place of work.

OPPORTUNITIES

- Reducing car travel at peak times and reducing the number of offices to collaborative spaces, reduce the impact on the environment while reducing the stress of employees and helping them to better reconcile their private lives and professional life.
- The reduction in the number of offices and the number of employees in the office in particular reduces electricity consumption in common premises.

OBSTACLES

- It is difficult to assess a net environmental impact, as emissions avoided in offices are partially replaced by the use of personal housing.
- In the same way, estimating the rebound effect is complex, particularly for calculating the GHG emissions induced by the IT solutions needed for teleworking.

KEY LESSONS

- The net impact of the teleworking policy is beneficial, it is a major opportunity since it is applicable to almost all sectors and all types of companies.



4| Using digital means as a key factor for reducing emissions

Digital technology is playing an increasing role in society, the economy, and in the functioning of companies. Moreover, digital technology also has an environmental impact and represents a promising and crucial solution for companies and their stakeholders to act in favour of the climate.

Digital technology is a powerful lever for reducing emissions in all sectors of the economy, notably through energy optimization, the improvement of the internal organization of companies, and the reduction of logistics chains. The Global e-Sustainability Initiative estimates that digital could reduce global CO₂ emissions by 20% by 2030¹. In the building sector, for example, intelligent energy management makes it possible to reduce energy consumption by around 20%². In the energy sector, smart grids allow the electricity system to meet demand and incorporate high levels of renewable energy while minimizing network reinforcement requirements. Finally, in industry, the digitization of industrial processes (industry of the future) improves the efficiency of production. More broadly, data analysis (big data, data analytics) is a major source of innovation that can be put at the service of the climate.

Global data traffic has increased by a factor of 4.5 between 2011 and 2016, and is expected to increase sixfold by 2020, from 8 to 44 zabytes (IDC). More than 8 billion connected objects were sold worldwide in 2017, 31% more than in 2016³. In connection with this growth in the volume of data in circulation, the power consumption and emissions of information systems are growing very rapidly⁴. In terms of climate

impact, digital represents 2% of global GHG emissions and more than 13% of French electricity consumption.

Companies are also innovating to contain the impact of digital on the climate:

- Efforts are concentrated in data centres, which account for about a quarter of digital broadcasts (compared to 28% for network infrastructures and 47% for consumer devices: computers, smartphones, tablets, connected objects, GPS).
- In addition to powering data centres with electricity from renewable sources, these efforts are guided by the quest for efficiency and greater frugality in IT operations. Thus, the energy efficiency of the equipment that make it up (servers, electrical equipment) as well as the software for managing computing power and data storage make it possible to reduce the electricity consumption of the data centres and the associated emissions. To further reduce over-consumption of machinery and the use of cooling, innovation is also focused on building data centres in the Far North or submerging them.
- Furthermore, manufacturers, such as Dell or Apple, are innovating to further reduce the power consumption of user terminals. We must, however, remain vigilant to the rebound effect and ensure

1 Global e-sustainability initiative. System Transformation. How digital solutions will drive progress towards the sustainable development goals. 2017. P. 4.

2 ADEME. Alléger l’empreinte environnementale de la consommation des Français en 2030. 2014. P. 16

3 ADEME. La face cachée du numérique. 2017. P. 5.

4 Iddri, Fing, WWF et GreenIT.fr. Numérique et environnement : Faire de la transition numérique un accélérateur de la transition écologique. Mars 2018.

that these efficiency gains are not fully offset by the growth in use and the number of connected devices, particularly among individuals (the impact of on-line video viewing is about 1,500 times

more than the power consumption of the smartphone itself)⁵. A certain «digital sobriety», a behavioral moderation of the use of devices, is in order.

5 The Shift Project. Lean ICT: Pour une sobriété numérique. Octobre 2018.



Experimenting smart building with Paris Habitat

DESCRIPTION OF THE SOLUTION / DIFFICULTIES ENCOUNTERED

Cisco conducted an experiment with the city of Paris to rethink Parisian buildings for better energy efficiency. Four buildings participated in the experiment, covering three facilities in Paris and one hundred social housing units. An innovative system for capturing and then analyzing data has been put in place (relating to energy and water consumption, comfort conditions and the operation of equipment).

Based on real-time analysis results, recommendations have been addressed to building users and managers aiming to:

- Automate data collection and make it accessible on a web interface (open data platform);
- Reduce the carbon footprint of buildings;
- Adapt the consumption of different energies;
- Detect energy losses.

KEY FACTORS FOR SUCCESS

- The solution is transposable and adapts to an existing and heterogeneous building stock.
- It is profitable since it capitalizes on existing infrastructures.
- It is duplicable to all new services and buildings.

OPPORTUNITIES

- Due to this experiment, it will be possible to create consumption management solutions that can be used in all cities.
- It will address the different Climate Plans of the cities.

OBSTACLES

- There may be different approaches to the final result.
- There are differences in the apprehension of the respective professions of the partners.

KEY LESSONS

- Co-construction is needed between all actors.
- It is crucial to set the «return on investment» of stakeholders upstream.
- Must be able to replicate quickly to extend the scope of use cases.

➔ Associated recommendation: **RECOMMENDATION V**





› Digital Power Plant for Steam

DESCRIPTION OF THE SOLUTION / DIFFICULTIES ENCOUNTERED

40% of the world's electricity comes from coal, which is expected to remain the second generation technology until 2030 (behind renewable energies, and ahead of nuclear power)¹. Its importance, especially in the developing economies (China, India, Africa, Middle East) makes improving the efficiency of coal plants one of the biggest challenges in the electricity industry. The deployment of digital technologies to reduce the carbon footprint of the installed base represents a great opportunity to enable and accelerate the energy transition.

GE has therefore developed software for coal-fired power plants to help countries meet the greenhouse gas emission reduction targets of COP21. This software, the Digital Power Plant for Steam, interprets the data from the sensors of the entire thermal power plant (more than 10,000 sensors) and highlights the key factors that could affect its performance, such as the quality of the fuel used, the aging of the plant or the ambient conditions. This solution improves plant performance, reduces downtime and extends equipment life.

KEY FACTORS FOR SUCCESS

- Built as part of GE's digital platform (Predix), this solution relies on industrial Internet support that is sufficiently developed to exploit large amounts of data.

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1 Voir par exemple le Sustainable Development Scenario de l'AIE(compatible avec les objectifs de l'Accord de Paris).





› Digital Power Plant for Steam

OPPORTUNITIES

- This solution increases the efficiency of coal plants by 1.5%, while avoiding 0.58 gigatonnes of greenhouse gas emissions, equivalent to 120 million cars.
- The digitization of power plants opens up the possibility of transforming all energy production activities. If the efficiency of the installed base were increased by 1%, \$ 66 billion in savings would be achievable.

OBSTACLES

- Steam plants operate according to grid demand, which forces them to increase production more quickly and more often. Real-time monitoring of these factors is therefore all the more important. Without effective monitoring and control of the plant's key processes, fuel consumption is inefficient, emissions increase, and equipment life can be affected.

KEY LESSONS

- The environmental responsibility of industry players lies in the development of new solutions, but also requires taking into account the existing energy mix. This reality principle must lead companies to adopt a realistic and pragmatic approach, by developing technologies that limit emissions from installed bases..



High-efficiency servers for lower-impact data centers

DESCRIPTION OF THE SOLUTION / DIFFICULTIES ENCOUNTERED

HPE and Orange have collaborated in the design and implementation of several data centers with best practices in energy performance and service levels, particularly in France in Val-de-Reuil (in service for 5 years), and in Senegal and Côte d'Ivoire (recently delivered).

The first of these data centers (Val-de-Reuil in Normandy) was the first pilot project in France for HEQ (High Environmental Quality) certification of data centers. It uses an innovative direct cooling (free cooling) technology for cooling IT infrastructures, helping to reduce the energy consumption of the site by more than 30% compared to conventional technology for this site that represents a nominal capacity of 10 MW computing, equivalent to the consumption of a city of nearly 20,000 inhabitants.

The main difficulty was to design and implement the technology of direct air cooling for such a power of data center (10 MW per building) which represented a first in Europe. Many parameters, difficult to automate and regulate, come into play, both for maintaining an optimal temperature for the servers, but also for the humidity and the quality of the air which must be perfectly filtered in order not to damage the computer equipment. It was also necessary to combine this technology with a mechanical co-production of cold in a conventional chilled water network to provide free cooling during the hot summer hours.

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KEY FACTORS FOR SUCCESS

- HPE's studies regarding developments and energy consumption performance, air conditioning and cooling have helped make this pilot site a success in terms of energy saving and low-carbon footprint. Several years of production have shown the real economy, which represents at full power an energy saving of more than 25 GWh per year.

OPPORTUNITIES

- Free cooling technologies are now very well controlled and are spreading quite rapidly, including in small and medium power sites.
- Public authorities should consider a regulating in a way that would create financial incentives based on the use of «free» technologies.

OBSTACLES

- Free cooling technologies are more expensive to invest than conventional technologies. These technologies must in any case coexist to overcome the «free» technologies in temperate or hot countries.
- It is therefore necessary to consider this approach in terms of total cost of ownership, looking at the savings achieved in the medium and long term thanks to lower energy consumption. Any ecodesign approach can only be justified from this angle.

KEY LESSONS

- In a temperate region like France, free-cooling technologies can generate a gain in energy consumption of data centers of around 30%. If we consider that data centers represent about 3% of the total energy consumption in the world, their generalization could reduce overall energy consumption by 1%.

➔ Associated recommendation: **RECOMMENDATION V**



5| Innovate in financing low-carbon solutions

The target of 1.5 ° C cannot be reached without a mobilization on a new scale of private financing towards a carbon-free economy. The aim is to finance disruptive innovations, but above all to innovate to finance the massive deployment of existing low-carbon technologies, such as renewable energies, energy efficiency or clean urban transport.

Mitigation of climate change and adaptation to its effects will require significant investment for decades to come, especially in infrastructure (sustainable urban equipment, energy production and networks, IT networks). In 2016, the New Climate Economy report estimated \$90 trillion worth of investments to be made by 2030¹. This figure only takes into account the investments needed to mitigate climate change and not to adapt to its effects. However, the «green» share of infrastructure investment is currently between 7% and 13% of total global investments in infrastructure, a proportion that is very insufficient to keep global warming below 2°C². This estimate raises the question of a «universal» taxonomy (or classification) of investments that can be considered green, which remains to be created. The European Commission's Roadmap for Sustainable Finance, presented in May 2018, takes a step in this direction³.

The One Planet Summit in December 2017 focused on the diversification of funding sources and the importance of private actors alongside public funding. The question arises of the financing of disruptive innovations, but also and especially of the capacity to use the leverage effect of private financing for scaling up existing low-carbon solutions. **This may involve leveraging conventional financing systems** - such as supplier credit

financing - to serve proven low-carbon technologies. **However, financial and industrial players are also innovating in products offered**, to give access to dedicated capital (green bonds) or to enhance the sustainability approach of companies, with concessional loans (or positive incentive loans) based on the principle of the «green supporting factor».

Similarly, the Power Purchase Agreements (PPAs), long-term bilateral contracts through which companies acquire electricity produced by renewable installations have emerged as an alternative model of renewable energy remuneration with increasing public support. These new contractual structures allow companies to have their own renewable energy production site by contracting the purchase of electricity in the long term. On the side of the industrial solution provider, the corporate PPA allows the raising of debt financing more or less on a long term basis (depending on the quality of the counterparts of the APP and in particular the financial strength of the buyer of electricity). Corporate PPPs illustrate the many facets of business climate innovation, beyond technological innovation (business model innovation).

1 The New Climate Economy. The sustainable infrastructure imperative: financing for better growth and development. 2016. P. 10.

2 Commission Pascal Canfin - Alain Grandjean. Mobiliser les financements pour le climat : une feuille de route pour financer une économie décarbonée. Juin 2015. P. 11.

3 Commission européenne. Legislative proposals on sustainable finance. Mai 2018.



Corporate PPAs: the example of Microsoft

DESCRIPTION OF THE SOLUTION / DIFFICULTIES ENCOUNTERED

Faced with the growing energy needs of its data centers in Ireland, Microsoft announced in October 2017 the signing of a major partnership with General Electric and ElectroRoute. By signing this Power Purchase Agreement (PPA), Microsoft has committed to purchase all energy generated by the 37 MW Tullahennel wind farm for a 15-year term. Having acquired a power distribution license from General Electric for the Irish territory, Microsoft will be allowed to inject renewable energy into the Irish grid. ElectroRoute will be responsible for marketing the electricity generated by the Tullahennel wind farm.

In addition to contributing to the development of renewable energy in Ireland, this agreement is a major step forward for experiments on storage solutions in Europe. The turbines installed by General Electric Renewable Energy will be the first in Europe to have an integrated battery. By storing the excess energy produced by wind turbines during periods of low consumption, and re-injecting them into the grid during peak consumption, the batteries will optimize energy production. The wind farm will also be equipped with «Digital Wind Farm» technology in order to maximize the amount of electricity produced and respond effectively to demand.

KEY FACTORS FOR SUCCESS

- A willingness by Microsoft to engage in the development of renewable energies. In 2016, the company made a commitment to supply its data centers and the networks of the countries where it is established in renewable energy.
- Innovative and efficient technology: combining wind energy, storage and digital solutions, the Tullahennel farm benefits from the latest generation technologies.
- The support of GE Energy Financial Services, which accompanied Microsoft in its first European PPP project.

OPPORTUNITIES

- Increased business demand for green energy as part of their low-carbon strategies. The PPP market is booming (as of 1 October 2018: + 60% in terms of capacity compared to the whole of 2017).
- Predictability of long-term electricity costs for the signatory company (risk reduction due to price volatility).
- The guarantee of purchase of the energy produced by the wind turbines contributes to make the projects viable and reduces the risks for the developers.

OBSTACLES

- National regulations specific to self-consumption / self-production. The restriction of self-consumption in France is an example.
- The instability of renewable energy support programs is also a hindrance in some countries, such as Ireland.

KEY LESSONS

- The development of PPAs will be facilitated by the automation of administrative processes, including the creation of standardized PPP contracts.
- The allocation of more financial and human resources will also be a key element in the development of large-scale PPPs.

➔ Associated recommendation: **RECOMMENDATION V**

Financements verts

Buildings (residential and tertiary) account for 20% of French greenhouse gas emissions. This is the sector that will have to make the most significant reduction efforts, with a 54% drop in emissions between 2013 and 2028 as part of the national low carbon strategy. In addition to boosting the energy retrofit actions of existing buildings (with a fleet renewal rate approaching 1% per year), companies are innovating to improve the energy performance of new buildings. These efforts include the energy autonomy of the building and its equipment, such as the development of a self-sufficient hydrogen energy elevator (Otis) and the deployment of an energy-efficient residential building (ABB).

DESCRIPTION OF THE SOLUTION / DIFFICULTIES ENCOUNTERED

Anglian Water has launched an ambitious sustainable development strategy based on its «Love Every Drop» campaign, aimed at integrating sustainable development into its core business. In this context, Anglian Water decided to issue Green Bonds (bonds) whose issuance is reserved for qualified issuers and aimed at financing relevant projects.

BNP Paribas worked with Anglian Water (AW) while coordinating several banks for several months to structure and invest 8-year green bonds aimed at accelerating the development strategy through the financing and refinancing of eligible projects. Anglian Water is committed to using all of the funding raised to finance eligible projects directly related to sustainable development and / or the mitigation of climate change impacts.

Projects eligible for use of Anglian Water's Green Bond funds include projects to reduce CO2 emissions through more energy efficient equipment and facilities, water conservation techniques or facilities to fight against the increased risks of floods due to global warming. These commitments will be followed throughout the life of the bonds.

The Anglian Water financing framework has been subject to an independent third-party review process (DNV GL), certifying its alignment with the Green Bond Principles.

Anglian Water, with the help of its lead banks, had to educate investors during a long roadshow to highlight its progress in sustainable development and the fight against global warming, and to present eligible projects funded by green bonds.

Positive Incentive Loans (or PILs) are banking market financing instruments for companies wishing to index a portion of their financing margin on their performance in ESG (Environmental, Social and Governance) ratings. An issuer using this type of instrument can thus see its financing cost drop if its ESG performance improves. This market is in full development phase with 20 transactions in 2017 and 2018, for a total of 23.9 billion euros in volume, mainly in the form of RCFs (revolving credit facilities). In 2018, volumes to date have already exceeded the figures for the whole of 2017, demonstrating the dynamics of the market.

Most of these transactions include, in the financing margin, a tranche whose quantum depends on the issuer's ESG rating or ad hoc criteria. For example, in the case of Danone's PIL, one of the criteria used is the transformation of Danone into «B-Corp» (a label for the responsible economy).

The main difficulty in setting up this type of instrument stems from identifying the measure of the company's sustainable performance - whether through an ESG score or ad hoc criteria - that is ambitious. In particular, for some advanced issuers, such as Danone, improving the ESG score is more difficult when a lot of effort has already been made. Danone has added a transformation criterion to «B-Corp» because of its already very high ESG rating. Finally, these instruments are still reserved for sophisticated borrowers because of the different advice involved and the need for detailed reporting.



» Financements verts

KEY FACTORS FOR SUCCESS

- The issuer, AW, is a company entirely dedicated to integrating sustainable development into its environment. Its level of credit investment grade, was able to give good levels of guarantee to investors.
- AW was able to demonstrate the positive environmental impact of the projects funded by the funds raised. Most investors with funds dedicated to green bonds and / or socially responsible investment (SRI) strategies will also look at the issuer's environmental and social policy and governance, as well as the consistency of green bond issuance. with the overall strategy of the issuer.
- A bank experienced in the field of green bonds (BNP) at the head of a pool of secondary banks also experienced.
- A mature investor universe able to appreciate AW's investment strategy and benefiting from dedicated funds under management.
- A strong mobilization of AW's management and financial teams during the roadshow and the preparation phase.
- Recognition by a recognized third party of the proposed use of funds raised, criteria for selecting eligible projects, monitoring the use of funds and the proposed framework for reporting.
- Qualified emitters with real success stories in sustainable development can access specific financing schemes in the form of Green Bonds (or green bonds) for financing qualified projects.
- These sophisticated instruments attract quality investors managing dedicated investment pools.

GREEN BONDS: THE EXAMPLE OF ANGLIAN WATER
POSITIVE INCENTIVE LOANS
Financements verts
OPPORTUNITIES

- | | |
|--|--|
| <ul style="list-style-type: none"> • Access to dedicated capital pools. • Investor diversification. • Optimization of available financing. • Opportunity to communicate on the social and environmental strategy of the issuing company. | <ul style="list-style-type: none"> • Borrower demand exists and the market is growing strongly for general lines of credit. • This instrument allows the borrower to directly receive the benefit of improving their ESG rating on their financing cost. |
|--|--|

OBSTACLES

- | | |
|--|---|
| <ul style="list-style-type: none"> • A lot of preparation work for the issuer before the transaction. • Investor identification for a targeted roadshow. • A necessary work of codification and taxonomy of the internal projects that can be qualified for this type of investment. • Coordination of specialized advice. | <ul style="list-style-type: none"> • Significant preparation work is required to calibrate the ESG score indicators. |
|--|---|

KEY LESSONS

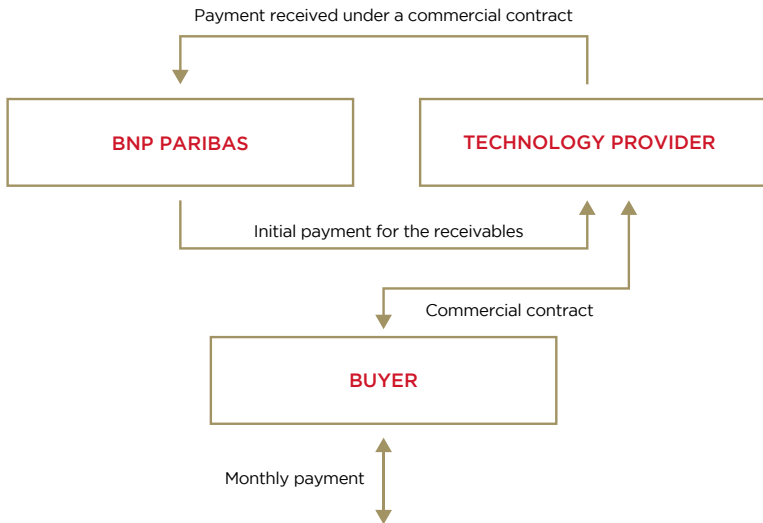
- | | |
|---|---|
| <ul style="list-style-type: none"> • The issuance of this green bond is a key element that will allow Anglian Water to achieve its 60% reduction of their carbon footprint between 2010 and 2020. • Qualified emitters with real success stories in sustainable development can access specific financing schemes in the form of Green Bonds (or green bonds) for financing qualified projects. • These sophisticated instruments attract quality investors managing dedicated investment pools. | <ul style="list-style-type: none"> • Positive Incentive Loans are debt instruments that make it possible to borrow on the banking market with an interest rate that depends, in part, on the issuer's performance in terms of ESG rating. • These instruments require preparatory work but reward, to some extent, the most active and successful issuers of social and environmental responsibility. |
|---|---|

➤ Associated recommendation: **RECOMMENDATION VII**

› Financing supplier credit for green technologies

DESCRIPTION OF THE SOLUTION / DIFFICULTIES ENCOUNTERED

The technology provider sells green technology to the buyer to help reduce greenhouse gas emissions. The buyer may be a community (for example, municipalities), the private operator of a utility or any other potential buyer of equipment (for example, a fleet manager). BNP Paribas arranges the financing of a supplier credit with the technology provider. The financing, which covers up to the full cost of the initial investment, is structured as commercial financing, in which the banks purchase the receivables due from the equipment or technology supplier under the contract. commercial. Investments will be reimbursed through expected savings on energy bills and will ultimately be used to repay the financing of supplier credit. Initial investment costs can usually be recovered in 3-4 years due to induced energy savings.



KEY FACTORS FOR SUCCESS

- This system encourages businesses and communities to install environmentally friendly equipment despite their current budget constraints.
- After repayment of the financing, the customer benefits from recurring savings on his energy expenses.
- Supplier credit contributes to the development of proven green technologies (for example, low-energy street lighting, low-carbon buses, electric vehicle batteries, solar photovoltaic, etc.).
- The bank has the capacity to assume the risk of equipment performance. It will appeal against the solution provider, who must be solvent.
- The proposed financing allows the technology provider and the buyer to optimize their working capital and possibly finance the acquisition of large quantities of equipment.

› Financing supplier credit for green technologies

OPPORTUNITIES

- The availability of private insurance or, in the case of communities, a sovereign guarantee could potentially mitigate the buyer's solvency risk and allow the provider to offer a larger project.
- Applicable to a wide range of equipment and potentially suitable for different sizes of financing (10 to 20 million euros), which is often the case for contracts related to these technologies.

OBSTACLES

- The credit risk of communities or businesses that purchase and install the underlying green technology. Expanding the system for public purchasers will probably require support from the state.
- Financing supplier credit requires proven green technologies, produced by solvent manufacturers.

KEY LESSONS

- Integrated funding provided by a third party financier for green equipment and technologies.
- This system finances 100% of the receivables under the commercial contract, which will cover the full investment cost of green technology.
- The investment can be cost neutral to the buyer in the early years and will generate recurring savings after repayment of the financing. This is of great interest to communities facing budgetary constraints.

➤ Associated recommendation: **RECOMMENDATION VI**

Conclusion: 3 development axes to create a favourable framework to climate innovation in France

The findings of the task force underscore the important contribution of business to the emergence and deployment of climate innovations. The analysis of the different experiences of companies also leads to the identification of favorable conditions for climate innovation in France. The following recommendations are addressed to both public and private decision-makers, and highlight the actions needed to meet these conditions for success. Three main areas for improvement emerge, aimed at:

- Create a political and regulatory framework favorable to the emergence and experimentation of low-carbon innovations in France;
- Deploy these innovations in each sector, with operational recommendations in industry, construction and transportation;
- Encourage the orientation of funding towards climate innovation.

In order for these recommendations to be followed up, AmCham France members will continue to mobilize to help establish a framework favorable to climate innovation in France.

1. DEFINE A FAVOURABLE BUSINESS ENVIRONMENT FOR INNOVATION AND EXPERIMENTATION OF LOW-CARBON SOLUTIONS:

- I. Accelerate the development of experimental projects by introducing a regime that derogates from the regulation applicable to experimental projects in order to allow companies to quickly test their innovations on a small scale («quick test» concept).**

In France, the average development time of a wind farm is currently 7 to 8 years, compared to around 2 to 4 years in Germany. Regulation as well as the large number of permits required and the high risk of appeal against certain permits are real obstacles in the energy sector.

- II. **Develop experiments by stimulating local ecosystems mixing local communities, universities, and companies and by simplifying their access to funding for the implementation of concrete decentralized projects (smart grids, hydrogen mobility, etc.).**

German stakeholders (companies, public authorities) **have understood the strength of partnerships**. Research laboratories, universities and companies systematically seek to bring together research institutes, universities and private companies. Major French public research laboratories (CEA, CNRS, INRIA, etc.), universities and schools are currently implementing a similar momentum but this initiative needs to be generalized.

2. ACCELERATE THE DEPLOYMENT OF SOLUTIONS BY STRENGTHENING THE COMPETITIVENESS OF LOW-CARBON SOLUTIONS AND BY LOOSENING THE CONDITIONS FOR PROJECT IMPLEMENTATION:

- III. **Develop the awareness around climate change and push innovation in the procurement process of companies and the state (green procurement), based on the ISO 20400 standard.**

In France, public purchases represent **nearly 200 billion euros per year, which represents about 10% of France's GDP**. While the recent reform of public procurement in 2016 opens up new opportunities for 'greening' public procurements, there is room for improvement in favoring innovative low-carbon solutions in the state purchasing process. Similarly, it is important to **guide private sector procurements** by promoting low-carbon purchases as part of corporate CSR policies.

- IV. **Encourage the convergence of technical standards (ranging from building equipment to the definitions necessary for the implementation of the circular economy) between economic zones via international standardization.**

For example, in highly regulated industrial sectors, the deployment of innovations would be facilitated by **greater regulatory convergence** across different economic zones and **more regulatory agility** at the national level to support innovation.

V. Stress the ambition of lower energy consumption in heavy industry, building industry, and transport, combined with incentives and support for the deployment of key solutions in these sectors:



Heavy Industry



Building Industry



Transport

BLOCKING POINTS

The average age of machinery in the French industry is **is 19 years, compared to 9 in Germany**¹. French heavy industry has also a lower robotization rates². The major cause for this situation is due to French industrial companies' difficulties to invest in their production tool, particularly for solutions with long payback periods.

The French market for corporate PPAs is still emerging. At the end of 2017, France had **20,000 renewable electricity self-consumption installations, compared with 1.5 million in Germany**³. As it stands, French regulations still limit the deployment of self-consumption (lack of an incentive pricing model, limitation of the geographical scope of collective self-consumption and obligation for participants to be linked within the same legal entity).

In order for corporate users to switch to low-emission engine vehicles, better **autonomy and an increased access to charging points** have to be guaranteed.

The transition to low-carbon mobility modes (electricity, hydrogen, etc.) requires the **simultaneous deployment of vehicles and infrastructures**.

RECOMMENDATIONS

Implement more regularly incentives (such as over-depreciation, which accelerates the depreciation) **favouring investment of industrialists in their production tool** (development of new solutions, modernization of the installed base, promote automation, robotization and digitization), for better energy and environmental efficiency.

Loosening the public procurement code to allow public actors to sign corporate PPAs.

Promote the emergence of collective buildings combining autonomous construction, intelligent management and self-consumption models, including for public buildings.

Integrate all innovations that are available and approved according to their respective standards, **in the incentive schemes for energy efficiency of existing buildings.**

Set minimum autonomy objectives for low-carbon vehicles, (which includes electric vehicles). Moreover set energy efficiency goals excluding traction and weight reduction systems by vehicle category.

Promote the use of low-carbon vehicles for corporate fleets, by adopting ambitious low-emission vehicle purchase targets when renewing fleets.

Support the acceleration of infrastructure deployment in favour of low-carbon mobility (electric vehicle charging stations, hydrogen stations) by local authorities and public service entrants (car parks, etc.).

1 Fédération des industries mécaniques, 2014
 2 Fédération internationale de la robotique, 2018
 3 Commission de régulation de l'énergie, 2018

3. ENABLE ACCESS TO FUNDING FOR ALL INNOVATIONS LEADING TO A LOW-CARBON PATH:

- VI. Quick roll out of proven low-carbon solutions by giving them easier access to private equity and / or debt financing. In order to quickly modernize equipment (urban transport fleet, street lighting, etc.), it is necessary to mobilize, for example, sovereign guarantee instruments to enable medium and small sized communities to access private financing.

Integrated financing provided by a third-party financier for green equipment and technologies may be **cost-neutral to the purchaser** in the early years and will generate recurring savings after repayment of funding. This is of great interest for local communities and SMEs facing budgetary constraints.

- VII. Promote SMEs' access to green financing (Green Bonds and Positive Incentive Loans) by harmonizing the taxonomy applicable to the necessary criteria to access financing based on these instruments, thus making them accessible to a wider range of companies.

Qualified issuers that demonstrate real success in sustainable development **can access specific financing options** such as Green Bonds for the financing of relevant projects. These advanced instruments attract quality investors who manage dedicated investment pools.

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ABOUT AMCHAM

Founded in 1894 to promote the transatlantic relationship, AmCham France brings together more than 300 French, American, and European companies spanning all sectors of the economy. AmCham France is a nonpartisan organization and has recently transformed into a think tank that aims to promote the attractiveness of the French economy and to contribute to the public debate with new ideas surrounding economic and geopolitical issues.

Find out more about our organization at amchamfrance.org

ABOUT EY CLIMATE CHANGE & SUSTAINABILITY

Since 1994, the EY Western Europe & Maghreb (WEM) Climate Change & Sustainability team has been supporting its customers in their transformation towards a more sustainable business model, by taking into account CSR risks and opportunities in all functions of the company. With more than 160 consultants dedicated to the issues of sustainable transformation of the economy, our team has training in technical engineering, economics, finance, marketing, law and communication and prior experience in companies, public institutions and NGOs. Our teams rely on an international network of more than 900 consultants.

Find out more about our organization at ey.com/fr/sustainability

ABOUT GE FRANCE

With nearly 300,000 employees and present in 180 countries, GE is a major industrial player in various sectors of activities. GE develops and markets solutions that are essential to the future of its customers, such as access to energy, transport, or health, particularly through the development of digital solutions. GE is present in France thanks to its 16,000 employees spread over 20 industrial sites.

Find out more about our organization at ge.com/fr

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