

# Inventors of the Future

2018 Annual Report

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**The Paris Innovation Campus,  
which opened in 2018, is located on the  
“Plateau de Saclay” in France and is also  
home to Air Liquide’s largest R&D center.**

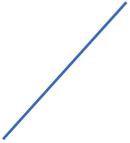


# Inventors of the Future

Air Liquide supports the development of almost all sectors of the economy and deploys an open innovation approach around three main challenges: the energy transition and environment, healthcare and digital transformation.

Every day, our 66,000 employees across 80 countries harness their expertise to serve over 3.6 million customers and patients throughout the world. Every day, together with all our stakeholders, they contribute to build the world of tomorrow.

Innovation has always enabled us to support our customers in their challenges and to push the industry forward.



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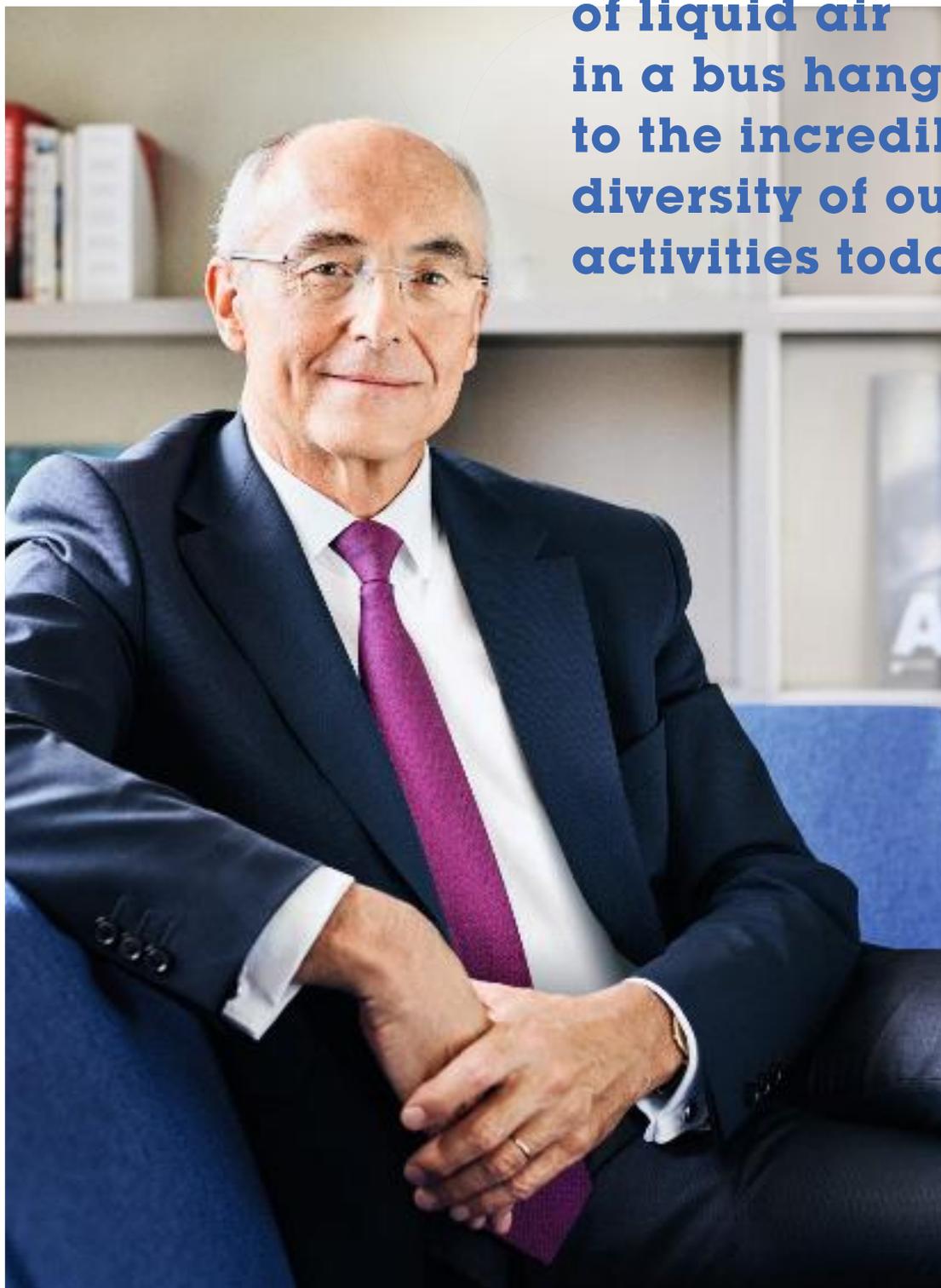
# Convictions

In the fields where we can make a difference, such as the energy transition, the fight against climate change or home healthcare, we contribute to move society forward.





**“The taste for discovery has always driven us, from the invention of liquid air in a bus hangar, to the incredible diversity of our activities today.”**



**“A taste for discovery.”** This is what I answer when I am asked to sum up Air Liquide’s identity. This taste for discovery has driven us and guided us in our innovations over the last 117 years, from the invention of liquid air in a bus hangar, to the incredible diversity of our activities today.

**Our molecules, stemmed from an idea as simple as it is revolutionary, are now everywhere:** in hospitals, behind the screens of our smartphones, in the bubbles of your soda, in refrigerated trucks, 3D printers, and even in space shuttles. These molecules are at the heart of innovative solutions that answer the challenges faced by all economic sectors and players, from craftsmen to medium- and large-sized companies.

**This taste for discovery, this curiosity, this inventiveness has always allowed us to push beyond boundaries,** not only in our own activity, but also for our customers – because we understand their needs, because we can see what works on a large scale, and because we constantly ask ourselves what challenges we can support them in next.

**We cultivate this state of mind in everyone,**  
**among our employees,** who can experience multiple careers within one company,  
**with our customers,** who we support in their innovation approach through our R&D and our partnerships with start-ups,  
**and for the society as a whole,** with the aim of being useful in the fields where we can make a difference. We do this by offering home care for people suffering from chronic diseases, in the best interests of the patients, their relatives and the community. By developing new sources of clean energy, such as hydrogen or biomethane. By supporting the energy transition, by transforming mobility, and by helping to fight global warming.

**Because the best discovery is always the next one,  
let’s continue to be the inventors of the future, together!**

**BENOÎT POTIER**  
Chief Executive Officer

# Interview

**“The Air Liquide model is one of profitable, regular and responsible growth.”**

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**2018 has been a year of major advances for Air Liquide. Can you give us your insights about the past year?**

2018 was particularly dynamic for Air Liquide, with its greatest increase in sales since 2011. The Group has improved in all of its performance indicators, whether in terms of the efficiencies and synergies achieved, or the high level of industrial investments made.

Our Group has continued to improve its competitiveness and won a number of significant contracts. All around the world, our teams have done remarkable work to improve our operational excellence and to better meet the needs of our customers, in particular by pursuing our NEOS company program. All of these advances have been made possible thanks to the commitment of our 66,000 employees, in 80 countries, and I would like to thank them for their work.

**Can you tell us a bit more about the Group's financial performance?**

In 2018, our Group saw its sales increase by 6.1%<sup>(1)</sup> to €21 billion, and its net profit increased by 4.2%<sup>(2)</sup> to €2.1 billion. All of our activities have grown, in particular the Gas & Services activities, which represent 96% of the Group's revenue, with a particularly dynamic final quarter in Electronics and Industrial Merchant. Geographically speaking, all of the regions are progressing, notably the Americas and Asia Pacific, and especially China.

**BENOÎT POTIER**  
Chief Executive  
Officer

In addition to its strong sales, all of our financial indicators have improved. We finalized the synergies linked to the integration of Airgas one year ahead of schedule, confirming the success of this operation. At the same time, operating efficiency objectives were surpassed, reaching €351 million for 2018, contributing to an increase in the Gas & Services operating margin. Cash flows improved and the debt ratio fell significantly to 69%, reaching a level comparable with that prior to the acquisition of Airgas.

Lastly, 2018 was marked by a record level of investment decisions, at €3.1 billion, which puts us in a good position for the future.

### **Is the customer-focused transformation strategy adopted by the Group in 2016 bearing fruit?**

This strong performance reflects several important decisions that we have taken in the last two years, in particular the integration of Airgas in the United States in 2016, the reorganization of the company around the customer and the extensive digitalization of our operations.

We have placed the experience and satisfaction of our 3.6 million customers and patients at the heart of our transformation. More than ever before, we are committed to a continuous improvement process to offer them first-class service, with a level of security, reliability, quality and competitiveness that meets the highest standards on the market.

Digital has played a key role in this performance. In 2018, we accelerated deployment of several programs such as Voice of the Customer, which collects and analyzes feedback from customers in more than 45 countries in real time, so that we can meet their expectations more effectively. We also opened a new Smart Innovative Operations center in Malaysia to remotely manage the production, energy efficiency and reliability of our production units in eight countries in the Asia Pacific region.

### **2018 also saw some key events, such as the opening of the Paris Innovation Campus and the announcement of your Climate objectives. How do these fit into your strategy?**

Innovation has been in our Group's DNA for 117 years. It lies in our ability to adapt in order to meet the needs of our customers and support changes in society. It is the key to profitable, regular and responsible growth.

This is why we have completely reinvented our innovation approach in the last five years. Resolutely open to our ecosystems, this new approach was materialized in 2018 by the modernization of our global network of Innovation Campuses in Europe, Asia and the United States. The Paris Innovation Campus is the flagship site. A place for sharing and discussing with our customers and partners, this Campus will also welcome a deeptech start-up<sup>(3)</sup> accelerator in 2019. Cross-fertilization of skills is vital for getting new solutions to the market quicker, for the benefit of our customers and society.

This contribution to society is perfectly in line with our responsible growth strategy. As well as serving our customers and patients, it is also our ambition to make a positive contribution to society, whenever we can make a difference. This is the case, for example, in the field of energy transition, climate change, air quality and home healthcare. The Climate objectives we presented last November are the most ambitious in our industry. They aim to reduce our carbon intensity by 30% by 2025, based on our 2015 emissions, by working on our own activities, with our customers and more generally encouraging the emergence of a low carbon society.

### **Related to this commitment to the climate, what are your plans in the field of hydrogen?**

I am convinced that hydrogen is essential for rising to the challenge of the energy transition and clean transportation. Awareness on the subject is global and 2018 saw many advances in this field.

I am also delighted to see more and more world leaders making a commitment to hydrogen development, particularly within the framework of the Hydrogen Council of which I am the co-chair and that now brings together more than 50 large global companies. For Air Liquide, my priority is to continue this dynamic to help make hydrogen an everyday reality.

**+6.1%**<sup>(1)</sup>  
Increase in  
the Group's sales in 2018,  
the strongest since 2011

### **How are things looking for 2019?**

In 2019, in a comparable environment, Air Liquide is confident of its ability to increase its net profit<sup>(4)</sup>. In the longer term, our Group will continue to innovate, for and with its customers, by relying on the inventiveness and commitment of its employees around the world. Together, we move forward with one ambition: contribute to the emergence of a new industry, and work towards a more sustainable social model.



(1) like-for-like increase. (2) Compared with the "recurring" net profit for 2017 which excluded exceptional items and the impact of the US tax reform that had no impact on cash flow. (3) Start-up seeking to push technological boundaries, thanks to scientific advances that will lead to real breakthroughs. (4) Calculated at constant exchange rate.

# Board of Directors

As of 12/31/2018

The Board of Directors is made up of twelve members, including eleven who were appointed at the Annual Shareholders' Meeting, and one member, representing employees, appointed by the France Group Committee. 45% of the elected members are women. In total, six nationalities are represented from three continents where the Group operates: Europe, Americas and Asia. The Directors possess a broad range of skill sets (financial, managerial, industrial, scientific, international growth, and more) in a wide variety of sectors, including consumer product markets, healthcare/research, engineering, oil & gas, services, construction, pharmaceutical and automotive.



**A BENOÎT POTIER**  
Chairman and Chief Executive Officer

**B JEAN-PAUL AGON**  
Lead Director  
Chairman of the Appointments and Governance Committee  
Member of the Remuneration Committee

**C PIERRE DUFOUR**  
Chairman of the Environment and Society Committee

**D THIERRY PEUGEOT**  
Member of the Audit and Accounts Committee

**E KAREN KATEN**  
Member of the Appointments and Governance Committee

**F SIÂN HERBERT-JONES**  
Chairman of the Audit and Accounts Committee

The Board of Directors determines the main lines of Air Liquide's activity. To this end, it examines and approves the Group's main strategic developments. In 2018, **it focused on strategy issues**, and in particular the objectives set as part of the NEOS company program, Airgas synergies and a review of changes in the competitive framework associated with the Praxair-Linde merger; **governance issues**: renewal of Benoit Potier's CEO mandate, composition of the Board and its Committees; implementation and monitoring of the capital increase reserved for the Group's employees; **issues relating to Corporate Social and Environmental Responsibility** and, within this context, the definition of the Group's Climate objectives.

**Visit to the USA**

In November 2018, during the meeting of the Board at the Airgas headquarters near Philadelphia, the Directors visited sites over two days. The goal was to meet with the teams to get concrete insight into the Group's activities.

In particular, Directors visited a sales outlet and the Airgas distribution center. The visit offered them a backstage view of the company's multi-channel distribution strategy. They also toured the Air Liquide Delaware Innovation Campus and its Advanced Fabrication Center, a powerful co-development and testing platform for metal fabrication customers and partners.



**G SINLENG LOW**  
Member of the Audit and Accounts Committee

**H ANNETTE WINKLER**  
Member of the Remuneration Committee  
Member of the Appointments and Governance Committee

**I PHILIPPE DUBRULLE**  
Director representing the employees  
Member of the Environment and Society Committee

**J GENEVIÈVE BERGER**  
Member of the Environment and Society Committee

**K BRIAN GILVARY**  
Member of the Audit and Accounts Committee

**L XAVIER HUILLARD**  
Chairman of the Remuneration Committee

# Executive Committee

As of 01/01/2019

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## A BENOÎT POTIER

Chairman and Chief Executive Officer  
Born in 1957 - French

## B MICHAEL J. GRAFF

Executive Vice President,  
Americas hub Executive Vice President.  
He also supervises  
the Electronics business line,  
Safety and Industrial Systems.  
Chairman of the Board of Airgas  
Born in 1955 - American

## C FABIENNE LECORVAISIER

Executive Vice President  
in charge of Finance, Operations  
Control and General Secretariat  
Born in 1962 - French

## D GUY SALZGEBER

Executive Vice President,  
Europe hub Executive Vice President  
supervising Europe Industries  
and Group Procurement  
Born in 1958 - French

## E FRANÇOIS DARCHIS

Senior Vice President,  
Innovation and Development  
Vice President.  
He also supervises  
Information Technologies, the  
Industrial Merchant business line and  
the Group's Sustainable Development  
Born in 1956 - French

## F JEAN-MARC DE ROYERE

Senior Vice President,  
in charge of the Corporate Sustainability  
Program - Dialogue with the Stakeholders.  
Chairman of the Air Liquide Foundation  
Born in 1965 - French

## G FRANÇOIS JACKOW

Senior Vice President,  
in charge of the Healthcare activities.  
He supervises Middle East and Africa.  
Vice President Customer Experience  
Born in 1969 - French

## H FRANÇOIS VENET

Senior Vice President,  
Strategy Vice President.  
He also supervises  
the Large Industries business line  
and Engineering & Construction.  
Born in 1962 - French

## I FRANÇOIS ABRIAL

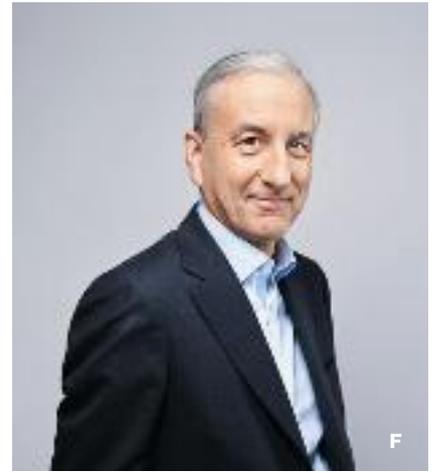
Vice President,  
Executive Vice President  
of the Asia Pacific hub.  
Born in 1962 - French

## J PASCAL VINET

Vice President,  
Chief Executive Officer of Airgas  
Born in 1962 - French

## K ARMELLE LEVIEUX

Vice President,  
Group Human Resources  
Born in 1973 - French



1

We are pursuing a customer-centric transformation strategy.

2

This strategy, which is designed to achieve long-term profitable growth, relies in particular on **open innovation** to help our customers increase their efficiency and competitiveness.

# Strategy in action

3

It is part of a global dynamic to attain **responsible and meaningful growth** that creates value for our customers, partners, shareholders, and society as a whole.





Air Liquide is a partner of the **Energy Observer**, the first vessel in the world to be propelled with hydrogen and renewable energies, self-powered and not generating any greenhouse gas or fine particle emissions.

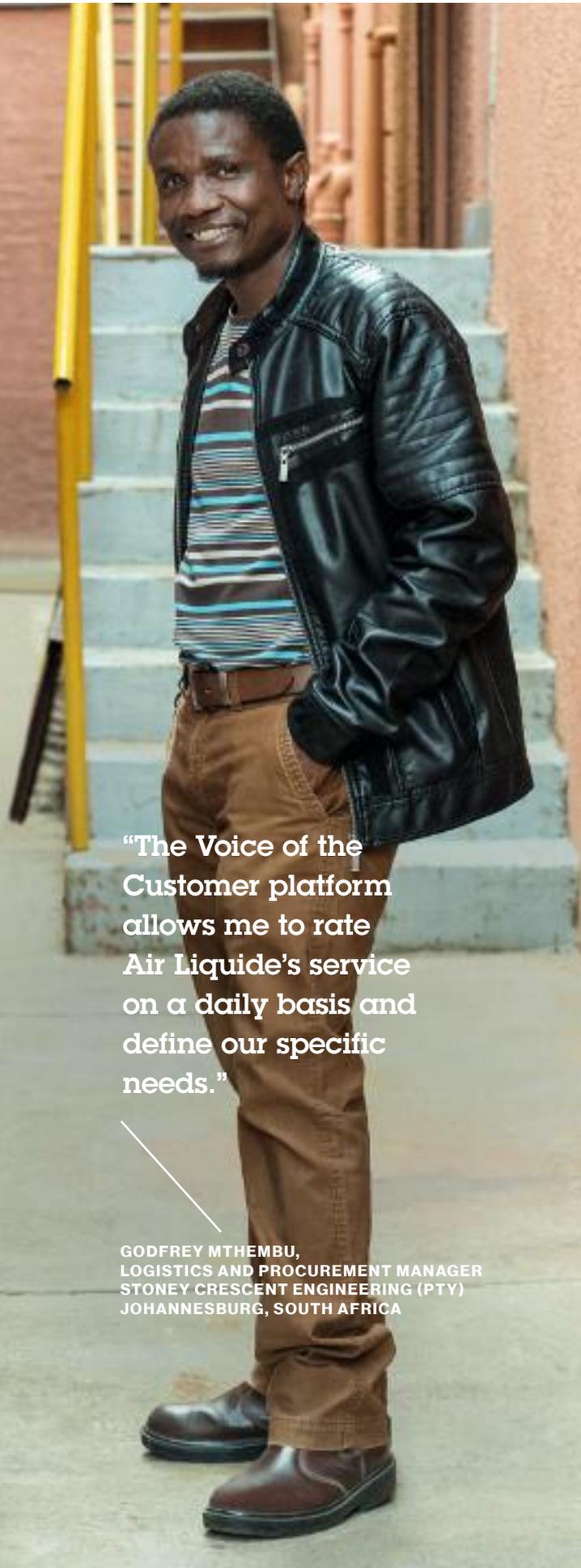
# Every customer is unique

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For Air Liquide, being customer-centric means incorporating the customer's needs into all of the company's actions and decisions, from the most strategic to the most operational topics. The goal of this strategy is to offer a first-class customer experience through personalized follow-up of each customer. This represents a considerable challenge for a global company that serves 3.6 million customers and patients throughout 80 countries.

Four conditions for success:

**#listening**  
**#customization**  
**#operational  
excellence**  
**#digital  
transformation**



“The Voice of the Customer platform allows me to rate Air Liquide’s service on a daily basis and define our specific needs.”

GODFREY MTHEMBU,  
LOGISTICS AND PROCUREMENT MANAGER  
STONEY CRESCENT ENGINEERING (PTY)  
JOHANNESBURG, SOUTH AFRICA

# #listening

## Three-question interview with Godfrey Mthembu, an Air Liquide customer in South Africa

### Can you tell us about your company?

Stoney Crescent Engineering specializes in metal fabrication, toolmaking and wire work. We offer a wide variety of products for the mining, food processing and power generation markets. We’ve been working with Air Liquide over the last ten years. They supply us with oxygen and acetylene for metal cutting, and also with the ARCAL™ range of gases for welding.

### How do you work with Air Liquide?

We have regular operational meetings, and it’s easy to reach Air Liquide’s Sales Representative, Lebohang Molotsi, when we need to discuss issues. I also use the Voice of the Customer platform, which allows me to rate the day-to-day supply service, define our needs and express concerns. It provides an opportunity to engage more rapidly and more frequently with Air Liquide.

### Can you provide an example of improvement in your relationship with Air Liquide?

Initially, we used to collect the product directly from their branch, then the operating mode changed and we started to get the product delivered to our site. Yet we were not satisfied with this change as we had to wait for delivery, contributing to longer lead times. Listening to our needs, Lebohang came up with a solution to assist with this transition, proposing an additional allocation of cylinders to reduce production downtime.



LEBOHANG MOLOTSI,  
AIR LIQUIDE SALES  
REPRESENTATIVE  
IN SOUTH AFRICA



“I use the Voice of the Customer platform to better understand the customer. It is a valuable interactive tool for analyzing their experience, empowering us to act on their concerns with customized improvements to the services we offer.”

# #customization

# + 30,000

customer feedback reports are submitted through  
the Voice of the Customer platform every year  
(two times more than the previous satisfaction program).

In March 2017, as part of its effort to become a leader in customer satisfaction in its industry, Air Liquide launched the digital platform, Voice of the Customer, to collect and analyze customer reviews in real time throughout the world.

The goal is to quickly call back each and every dissatisfied customer. The platform, which is at the cutting-edge of customer satisfaction in the industry, makes Air Liquide's sales teams more responsive and effective. With real-time information, teams can provide a fast, individualized solution for any complaint. The platform allows each Air Liquide entity to measure customer satisfaction and share feedback throughout the Group as part of a continuous improvement and transparency approach.

Following an accelerated roll-out plan, the platform is already active in 70 entities in over 45 countries and has also added new features. Semantic analysis, for example, helps interpret large numbers of customer comments in order to better identify and address their needs. The creation of a strengths and weaknesses map allows entities to quickly see their strong points and areas for improvement.

#### **Employee engagement: a key factor in customer satisfaction**

In addition to the Voice of the Customer platform, Air Liquide is rolling out the internal program My Voice which will be tested in several entities in 2019. The goal of this initiative is to collect employee feedback on a regular basis to better understand their expectations and work with them to create appropriate action plans. This program is in keeping with the Group's HR strategy, which relies on one key factor: employee engagement. To help foster engagement, Air Liquide makes sure it offers every employee a successful experience by focusing on listening and dialoguing with them at every step in their careers within the company. This level of attention is an attractive benefit that increases employee loyalty and fulfillment. It also boosts collective performance in the interest of achieving a single goal: happy employees and happy customers.

# #operational excellence

**At Air Liquide, operational excellence is first and foremost a commitment to providing customers with a top-rate service including a level of safety, reliability, quality and competitiveness that exceeds market standards. Operational excellence, which is a key part of the Group's NEOS company program, hinges on two factors, namely the continuous improvement of production tool performance, and the relationship with both customers and patients by providing simple, seamless, and responsive solutions.**

To achieve this goal, the Group is making considerable investments in technology, innovation, and digital development. It is initiating a number of programs in all of its business lines to further improve its operational excellence. In Europe, for example, the Group has committed to using clean energy trucks to reduce the environmental impact of its gas deliveries. The reliability and effectiveness of its services has also been increased thanks to the expertise of teams using more sophisticated algorithms for route optimization and automated packaging centers.

In addition, to better anticipate the needs of its customers and patients and provide them with increased efficiency and visibility, the Group can rely on the billion data points collected per day on its production units and connected objects.

## **People are at the heart of our strategy**

To increase its operational excellence, Air Liquide pays special attention to the engagement of its employees, which is encouraged through regular awareness-raising initiatives in an effort to help spread a culture of continuous improvement. Air Liquide also focuses on training the teams that design, operate, and maintain production and delivery equipment. For example, the Technical Community Leaders Program helps employees improve their skills and expand their networks within their field of expertise. The Group also promotes a close relationship between the teams that design and build the production equipment and those that operate it in order to increase their effectiveness. In every instance, safety is a prime concern.



# #digital transformation

## In 2018

### A new remote operations center in Malaysia

In Kuala Lumpur, Air Liquide has built a new Smart Innovative Operations center for the Asia-Pacific region. Its role is to remotely oversee the production, energy efficiency, and reliability of its production units in eight countries. Using predictive analysis and digital technologies, the Group can better anticipate and respond to the needs of its customers throughout the region on a 24/7 basis.

### SIO Predict: anticipating breakdowns

SIO Predict is a cutting-edge tool that can detect changes in the behavior of some of Air Liquide's production machines that could indicate a future breakdown. In 2018, SIO Predict was rolled out to 160 of the Group's sites throughout the world.

### myGas: a customer portal that can adapt in real time

In Europe and the Asia-Pacific region, Air Liquide has rolled out the digital myGas portal along with a myGas mobile app. This system provides customers with a range of services, including personalized access, the ability to submit an order from a smartphone, and real-time tracking of storage tank levels and orders.

### The Internet of Things (IoT): a source of optimization

Thanks to its accelerated roll-out of the IoT, Air Liquide is increasing its effectiveness and responsiveness. For the health sector, the Group is carrying out several pilot projects designed to locate medical oxygen cylinders within large French hospital complexes to improve inventory management. In the field of industrial gases, remote measurement systems have also been installed on customers' storage tanks, so they can be resupplied without the need to submit an order.



Digitalization is key to improving operational excellence. It allows Air Liquide to significantly boost efficiency for customers and bring them a more seamless experience. To stay ahead of the pack, Air Liquide is now implementing digital transformation programs for each of its business lines. With over 200 data scientists and analysts in its teams, the Group has also developed the skills commensurate with its ambitions.

# Openness to ecosystems accelerates innovation

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With the conviction that science, technology, and an entrepreneurial spirit are key to solving the major industrial, health, and environmental challenges of the future, Air Liquide has profoundly reinvented the way it innovates over the past five years. The Group has turned innovation into the driving force behind its transformation strategy, which is centered on its customers' needs and connected to major societal issues.

Three main areas of focus are:

[#ecosystem](#)  
[#co-construction](#)  
[#solutions](#)





# #ecosystem

Air Liquide is connected to innovation ecosystems throughout the world and now draws on a global Innovation Campus network. Strategically located in the United States (Delaware), Asia, (Shanghai and Tokyo), and Europe (Paris and Frankfurt), these campuses are working to improve the Group's expertise in accordance with its customers' needs in fields such as electronics, health, biomethane, hydrogen fuel, the Internet of Things, combustion, and more. The Paris Innovation Campus, inaugurated in September 2018, is now the Group's largest Campus and Air Liquide's flagship innovation site.

These Campuses are collaborative, socially-oriented facilities that are open to the outside world. They bring together all parties involved in the process of innovation, from both inside and outside the company, to blend skills and disciplines, facilitate collective intelligence, and accelerate the pace of innovation. Each Campus includes its own R&D center, which works closely with Operations, universities, technology institutes, customers, and start-ups. This open innovation approach can be seen in our 100 industrial partners, and nearly 120 academic partners as well as in our collaborations with over 100 start-ups around the world.

# #co-construction

AUDE BERTRANDIAS,  
R&D ENGINEER AT THE  
PARIS INNOVATION CAMPUS,  
ON THE LIFE SCIENCES TEAM

Air Liquide's R&D experts work hand in hand with the business teams. Aude Bertrandias, an engineer at the Paris Innovation Campus, and Benjamin Fillion, Biomethane Operations and Projects director in the United Kingdom, tell us how they work together to optimize the production of clean energy derived from organic matter (also see page 48). This example of cooperation shows how diversity of view points is a source of collective intelligence that accelerates innovation to serve the customer.

## What kinds of projects do you collaborate on with business Operations?

**AB:** I work with the business teams on biomethane projects, specifically on biomass treatment and the methanization process – transforming matter, such as straw, food residue or household waste, into biogas. The aim is to develop innovative solutions to optimize biomethane production and provide our customers with solutions that perfectly match their needs and uses. Because Air Liquide operates along the entire biomethane value chain, from production to distribution, we collaborate on a wide variety of topics.

## Are the research projects always long term?

**AB:** No, not necessarily! If an Air Liquide customer asks Air Liquide to work on one of its facilities, Benjamin can call on our expertise: that is what we call Operations support. When this happens, we have to act fast. The business teams usually contact us earlier in the process when they identify a new need or a possible improvement for their customers. So the research project may last anywhere from a few months to several years depending on its scale and its corresponding issues. For example, we have several medium to long-term research projects seeking to optimize our purification processes; this is a real challenge with the diversification of the sources used to produce biogas.

## What are the benefits of these collaborations for R&D teams and, more generally, for Air Liquide?

**AB:** As R&D engineers, these joint efforts give us better insights into the challenges of our customers. I see it as crucial because this enables us to work together on concrete innovations that are closely aligned with market needs. In addition, it allows the Group to deploy a true strike force that combines biomethane business and research acumen, which is a major advantage for opening this market and differentiating ourselves.



**BENJAMIN FILLION,  
BIOMETHANE OPERATIONS  
AND PROJECTS DIRECTOR  
IN THE UNITED KINGDOM**

**At what stage in a project do you work with R&D?**

**BF:** We really collaborate throughout the entire project, from beginning to end. In most cases, we jointly define a working approach, then continue to interact throughout all the research and testing phases. The R&D teams then support us with implementing the innovative solutions they developed so that we can offer them to our customers. But it does not end there: they can subsequently recommend new adjustments to any given solution. It is really a continuous improvement cycle.

**Can you share an example of an innovation introduced to customers thanks to your collaboration?**

**BF:** What comes to mind are membranes, which are at the heart of the process of purifying biogas into biomethane. The synergy between Operations and research made it possible for us to develop new, more effective membranes that generated higher yields in biomethane production and optimized energy consumption. Those are two essential factors to make our offerings more competitive and to better serve our customers and partners.

**More broadly, what does your collaboration with the R&D teams mean for Air Liquide customers?**

**BF:** Real value added. We are able to offer them concrete, innovative and effective solutions to address the challenges they identify. Operations has been working with research for a long time. What is different today is that this collaboration happens faster, in phase with the development of a very open Innovation Campus network, which promotes dialogues with start-ups, research centers and universities.

**What factors make this collaboration successful?**

**BF:** Listening and open-mindedness. It is exciting to put forward concrete solutions, to help them mature in order to serve our customers and then see their results. This lends meaning to my work, which I am proud to share with R&D: together we can go further, to respond to today's environmental challenges.

# #solutions

**There is a clear goal behind Air Liquide's innovation strategy: deliver concrete, effective solutions to the challenges raised by three major worldwide trends: the energy transition, changes in the healthcare sector and the digital transformation.**

To meet these goals, the Group not only draws on its knowledge of essential small molecules – oxygen, hydrogen and nitrogen – which lie at the core of its scientific work, but also relies on technology and digital resources.

The Group is supporting the energy and environmental transition with innovative solutions to make transportation cleaner and enable its customers to reduce their carbon footprint. It innovates to support the evolution of the healthcare sector, with pioneering products and services, creating value for patients, healthcare professionals and health systems. Finally, the Group harnesses its innovation capabilities to put the full power of the digital transformation in the hands of its customers and give them an unparalleled experience.

## **Chronic Care Connect™, Air Liquide's first e-health solution**

Since 2017, Air Liquide has been rolling out Chronic Care Connect™, a medical tele-monitoring solution that makes it possible to provide remote support to patients suffering from chronic diseases in their own home. Based on the medical follow-up protocol prescribed by the physician, the patient uses one or more measurement devices that are connected to a digital tablet for monitoring. The medical data, which is stored in a dedicated, secure area, is submitted and remotely analyzed by nurses at the Air Liquide center, who correspond regularly with the patient and their physician. The result is daily, individualized support with the goal of improving the patient's quality of life, providing better healthcare, and helping to control healthcare system expenses by preventing hospitalization.



### **enScribe™, a technological revolution in electronics**

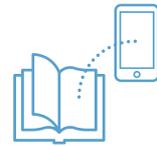
Electronics manufacturers must respond to the growing need for data storage capacity, even as components are increasingly miniaturized. To help them meet this challenge, Air Liquide developed enScribe™, a new family of advanced etching materials. Designed for 3D production, they can etch the latest chip structures very deeply, on the nanometric scale. Additionally, since the lifespan of these materials in the atmosphere is shorter, they help reduce greenhouse gas emissions. The enScribe™ line is the culmination of an open innovation initiative, led by the Group with manufacturers of memory hardware production equipment and customers, in close collaboration with the Innovation Campuses in Japan and the United States.



# Reconciling performance and purpose

Air Liquide's development is part of a responsible growth dynamic. Committed along its customers, its shareholders and its partners, the Group deploys solutions that are beneficial to the planet and society in the fields where it can make a difference, such as the energy transition and the fight against global warming.

[#climate objectives](#)





# #climate objectives

Air Liquide has been working for a long time to limit greenhouse gas emissions linked to its operations or those of its customers: on-site gas production, use of lighter containers, continuous improvements along its supply chain and, more recently, the development of Smart Innovative Operations centers (see page 19).

These are all innovations that, over time, have enabled the Group to deliver solutions for cleaner manufacturing and transportation. This responsible behavior is regularly recognized by non-financial rating agencies. For example, Air Liquide was awarded a rating of "A" by MSCI, "A-" in the Carbon Disclosure Project, and a score of 69/100 by Sustainalytics.

In 2018, Air Liquide achieved a new milestone in this responsible approach, with the announcement of its Climate objectives, which are the most ambitious in its sector. Air Liquide wants to contribute to reducing global greenhouse gas emissions by controlling its own emissions and by providing its customers and society with innovative, sustainable solutions.

27

## €100 M

This is the annual amount of innovation expenses dedicated to reducing CO<sub>2</sub> emissions.

## 15.5 Mt

These are the CO<sub>2</sub> emissions avoided by Air Liquide in 2018.

**OBJECTIVE 1**  
**IN OUR COMPANY:**  
**REDUCE THE CARBON**  
**INTENSITY OF**  
**OUR ACTIVITIES BY 30%**  
**BETWEEN 2015 AND 2025**

**Renewable electricity:**  
 a new large-scale  
 contract

In 2018, Air Liquide signed a contract to buy 50 megawatts of renewable, wind-powered electricity in the United States. The supplier is a subsidiary of NextEra Energy Resources LLC, the world's largest producer of renewable energy. The wind farm that will supply electricity to Air Liquide is currently being developed in Menard County, Texas, and should be finished in the fourth quarter of 2020. With this agreement, Air Liquide's objective is to supply a significant portion of its industrial gas production assets in Texas with renewable energy. This will enable the Group to offer its customers low-carbon products at prices that are still competitive.

By using wind-generated electricity, the Group will avoid 1.5 million tons worth of CO<sub>2</sub> emissions. The share of renewable energies consumed by Air Liquide is growing. This is a long-term strategic initiative that combines sustainable development, growth and competitive advantage to face the steadily rising demand for low-carbon solutions.

- \_ **By increasing the share of renewable electricity in our energy purchases**
- \_ **By improving energy efficiency at our production units**
- \_ **By reducing the carbon footprint associated with transporting our products**



**OBJECTIVE 2**  
WITH OUR CUSTOMERS:  
TAKING ACTION FOR  
CLEANER INDUSTRIES



“Our industry consumes traditionally a lot of energy to reach the very high temperatures required for glass melting. Thanks to the expertise and support of Air Liquide, we respond to the challenges of our sector, with environmental and financial benefits.”

**COŞKUN GÜNERİ**  
PRODUCTION MANAGER  
SISECAM IN BULGARIA  
AIR LIQUIDE CUSTOMER

- By offering low-carbon solutions, such as oxy-combustion
- By inventing new solutions, such as CO<sub>2</sub> capture and reuse, hydrogen use for steel production or new materials for electronics...

**Oxy-combustion:**  
cleaner technologies  
for the glass industry

Air Liquide has developed an innovative patented high temperature oxy-combustion technology, reducing the environmental impact of the glass melting process. This technology is used, for example, by the Sise-cam Group, one of the leading manufacturers of glass in Europe: at its plant in Bulgaria, its oxy-combustion furnace has allowed it to reduce its energy consumption and CO<sub>2</sub> emissions by 19% compared to an air furnace.



**OBJECTIVE 3**  
FOR THE PLANET:  
CONTRIBUTE  
TO DEVELOPING  
A LOW-CARBON SOCIETY

- **By developing biomethane for industry and transportation**
- **By offering clean solutions for refrigerated transportation**
- **By promoting carbon-free hydrogen in many applications, such as clean transportation, renewable energy storage and industrial uses**

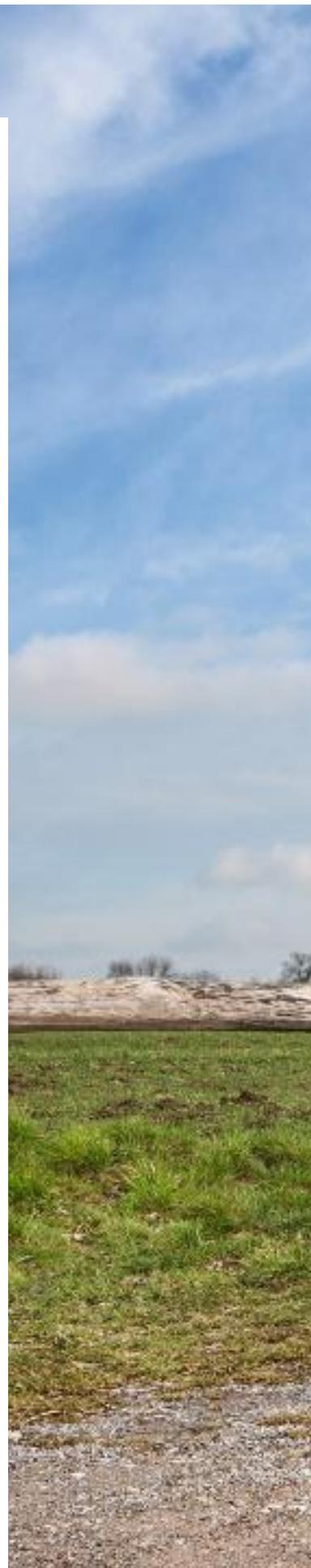
## Focusing on hydrogen

Hydrogen is one solution to accelerate the energy transition in response to the climate challenge. First, because it meets the challenge of clean transportation: the first hydrogen cars are on the road and they do not produce any pollution in use (zero greenhouse gas emissions, zero particulate discharge and zero noise). Buses, trains and boats will soon follow suit.

Beyond transportation, hydrogen has enormous potential: it can be used to power portable machines and devices, such as computers, drones, captive fleets of utility vehicles (e.g. forklifts) or heat homes. It can also compensate for the intermittency of renewable energies, such as wind and solar power, by storing excess electricity. This makes it a tremendously ally in spreading their use and in responding to the exponential rise in energy demand stemming from the digital revolution.

As a pioneer on this market, Air Liquide has expertise along the entire hydrogen value chain and is helping to promote its use, especially for transportation via the deployment of hydrogen stations around the world. In 2018, the Group continued to support this promising market by: commissioning a production site in Denmark and making new investments in the United States, launching the construction of new plants in France and South Korea, and supporting the implementation of hydrogen energy around the world, especially through its key role in the Hydrogen Council.

Created by Air Liquide and Toyota in 2017, the Hydrogen Council is a group of over 50 internationally known companies that represent 1.8 trillion euros in total sales and nearly 3.8 million employees. Its role is to establish hydrogen as a key solution in the energy transition by promoting the harmonization of industry standards across regions and sectors. The council maintains an ongoing dialogue with all stakeholders, including NGOs and governments.





Industry, health, electronics,  
clean energy, climate...  
Air Liquide supports progress  
in all sectors of the economy  
and prepares for the future, with  
a unique approach to innovation  
and to customer-centricity.



# Stories of the future

32



5

stories  
embodying  
the changes  
of tomorrow.

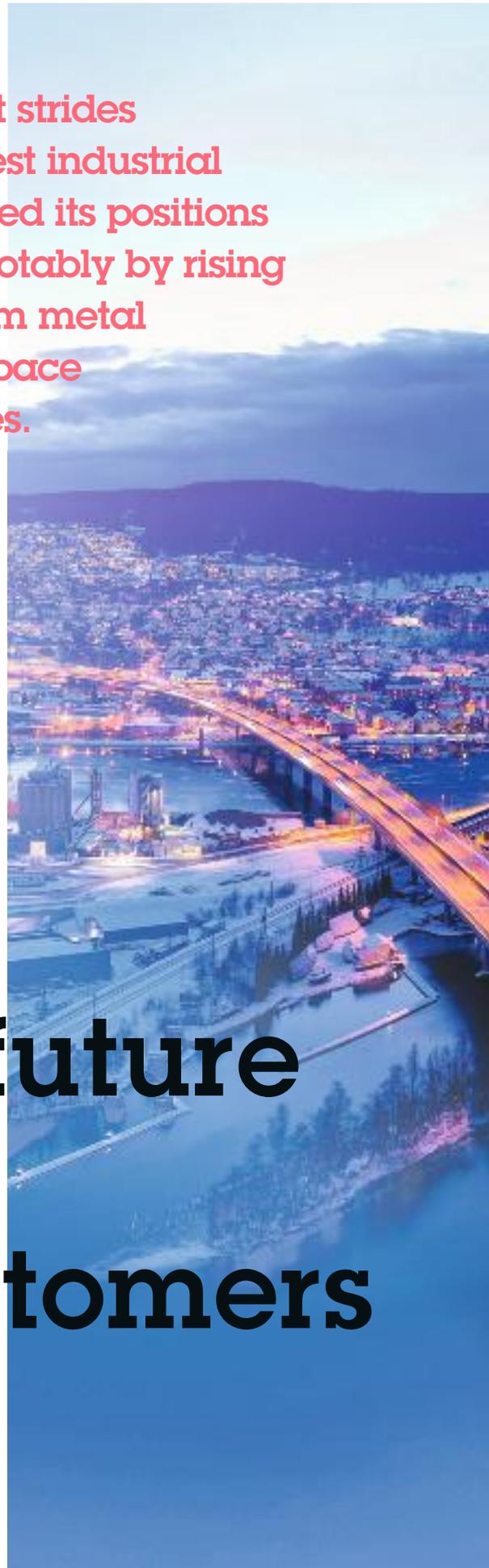


In 2018, Air Liquide made significant strides in the United States, the world's largest industrial gases market. The Group strengthened its positions in this fast-growing market, driven notably by rising demands in a variety of sectors – from metal fabrication to automotive and aerospace manufacturing to chemical industries.

34

USA

**Driving the future  
of industry  
with our customers**





**Thanks to its customer-centric mindset, operational excellence, and unique innovation approach, Air Liquide offers customers of all sizes reliable gas supply and high-value solutions that allow them to improve competitiveness and think ahead to meet the challenges of tomorrow.**

**Airgas**  
A successful  
customer-centric approach

A number of milestones were achieved in 2018 by Airgas, Air Liquide's U.S. based subsidiary, acquired by the Group in 2016. The 300 million-US dollar target of cumulated synergies was reached in the 1<sup>st</sup> quarter of 2019, more than a year ahead of schedule, confirming the success of this operation.

Thanks to its unique multi-channel approach, including e-commerce, telesales teams, and a large network of more than 950 retail branches, Airgas is well positioned to capture growth opportunities.

A symbolic milestone was achieved in 2018 with the 500<sup>th</sup> acquisition in Airgas' history – a perfect illustration of its successful development model aimed at strengthening its network and proximity with local customers to grow. The company went one step forward in customer-centricity with the expansion of its Welding Efficiency Analysis program, which helps customers evaluate and improve their welding processes, allowing them to be more competitive in their market. Based on decades of experience and customer data from around the country and across many industries, this program includes onsite analysis and offsite courses to help customers boost quality, productivity and profitability.

Another example of Airgas' successful customer-centric approach is the 'one-stop shop' developed by the company to provide customers coast to coast with a complete package – gases, equipment, safety products and services – to streamline their operations. This approach is a competitive asset for the company.

## FOCUS

### AIRGAS 2018 FIGURES

**> 1 million** customers

**> 950** retail branches

**12 million** transactions

**10 million** deliveries

## Large Industries: helping our customers grow

Chemical and petrochemical industries on the Gulf Coast are ramping up, requiring fast-growing volumes of industrial gases. This positive momentum has led to several large contract wins in 2018 with major customers in key industrial basins. Air Liquide's assets, including its extensive Gulf Coast pipeline network, allow these high capacity needs to be met with a high level of reliability. Two long-term contracts were signed with LyondellBasell, one of the world's largest plastics, chemicals and refining companies: the first will supply oxygen for a new petrochemical plant, currently under construction in Channelview, Texas; the second will supply the plant with steam, electricity, treated water and nitrogen to another LyondellBasell unit located in the Bayport area.

Another major milestone was reached in 2018 with the ramp-up of the Natgasoline's methanol plant in Beaumont, Texas – the largest in North America to date. This plant includes Air Liquide's full know-how, from unit design and construction to the production of oxygen, nitrogen and argon. It also integrates the Group's proprietary MegaMethanol™ technology which converts natural gas to methanol.

To further increase the reliability, efficiency and flexibility of its supply, in 2018 Air Liquide accelerated the deployment of its Smart Innovative Operations program (see page 19), which leverages the latest advances in digital technology to transform the way the Group operates its production units and to reach the next step of operational excellence. More than 65 production units in the US are now remotely monitored, and focusing for example on predictive maintenance. More than 650 predictive analytics models have been developed and implemented to help identify and prevent maintenance issues before they impact customers. The Group can therefore better anticipate and meet the needs of its customers, 24/7.

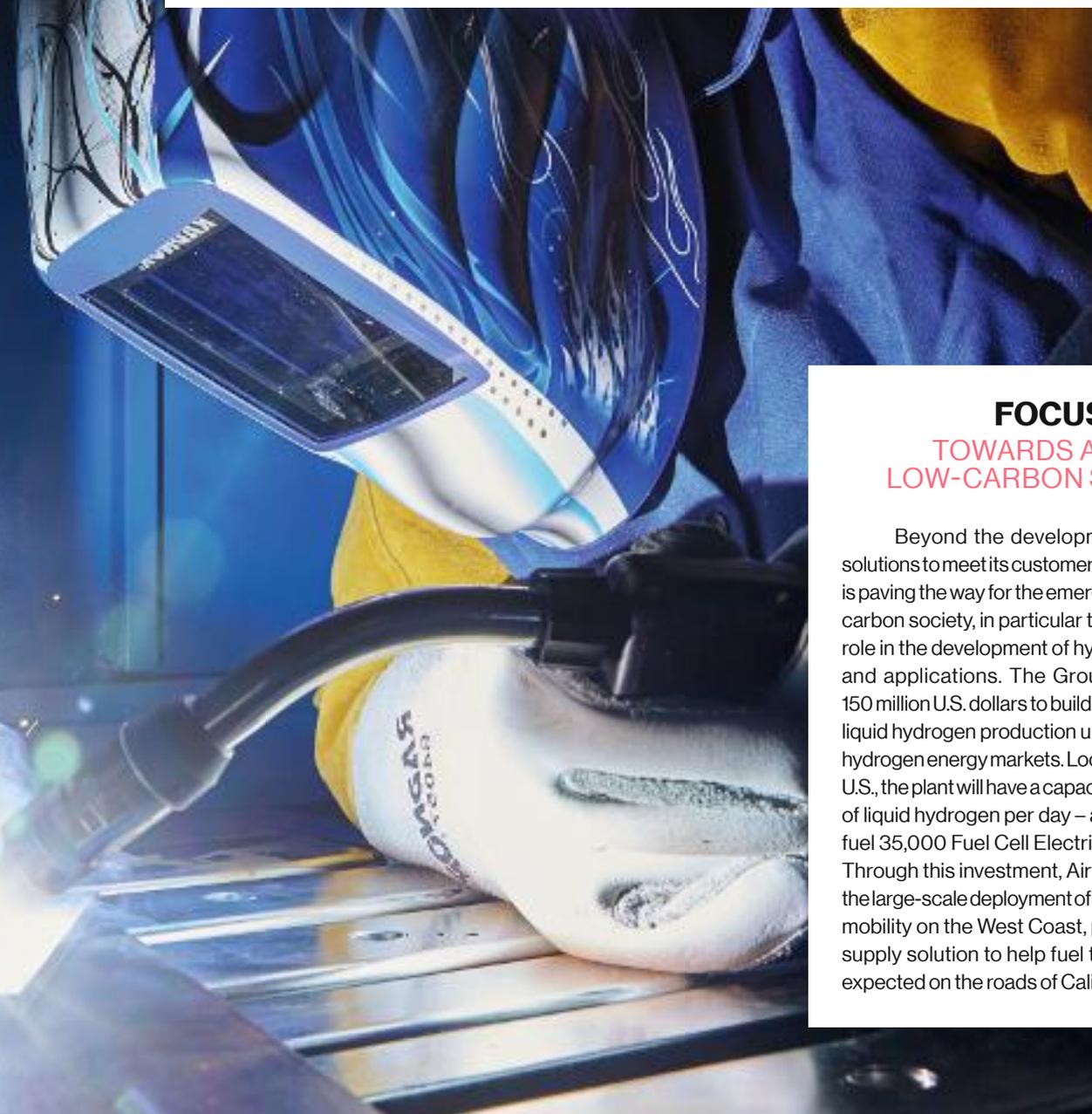
## Preparing the future

To help its customers face their operational challenges, Air Liquide relies on a unique open innovation approach and a worldwide network of Innovation Campuses (see page 21). In November 2018, the Group opened an Advanced Fabrication Center at its Delaware Innovation Campus.

A manufacturing expertise center with advanced training, testing and development platforms, the center involves customers and industrial partners early in the innovation process to accelerate the development of added-value solutions – from finding optimal process gas

compositions to augmenting process efficiency and operational safety, health and sustainability.

The center benefits from Air Liquide's innovation capacity and Airgas' deep market knowledge and customer base. Located at the heart of the world's largest metal manufacturing market, it will allow new solutions in innovative fields such as advanced plasma cutting, cobotic<sup>(1)</sup> welding and additive manufacturing to be brought to market rapidly.



## FOCUS TOWARDS A NEW LOW-CARBON SOCIETY

Beyond the development of innovative solutions to meet its customers' needs, Air Liquide is paving the way for the emergence of a new low-carbon society, in particular thanks to its leading role in the development of hydrogen production and applications. The Group will invest over 150 million U.S. dollars to build the first world scale liquid hydrogen production unit dedicated to the hydrogen energy markets. Located in the western U.S., the plant will have a capacity of nearly 30 tons of liquid hydrogen per day – an amount that can fuel 35,000 Fuel Cell Electric Vehicles (FCEV). Through this investment, Air Liquide will enable the large-scale deployment of hydrogen-powered mobility on the West Coast, providing a reliable supply solution to help fuel the 40,000 FCEVs expected on the roads of California by 2022.

(1) Cobotics (a neologism from the words "cooperation" and "robotics") is a discipline focusing on direct or remote interaction between an operator and a robotic system. The "cobot" provides assistance to the human operator with his or her tasks, here welding.

## HEALTH

# Taking care of patients at home

38

Chronic diseases are now one of the leading causes of death worldwide<sup>(1)</sup>. As a pioneer and leading player in home healthcare, Air Liquide takes care of 1.6 million patients suffering from chronic diseases at home. This represents an effective way of improving the quality of patients' lives, preventing complications, and improving the effectiveness of healthcare systems.



(1) Source: World Health Organization.



**The healthcare industry is experiencing some major shifts, including aging populations, accelerated urban growth, technological progress, sedentary lifestyles, and the increase of chronic illnesses. Healthcare systems, which are often organized around hospitals, do not always encourage support for chronic diseases that require regular, long-term monitoring.**

A leading player in home healthcare for the last 30 years, Air Liquide is a key partner for addressing these changes. The Group aims, in particular, to provide lasting responses to the challenges posed by the global increase in chronic diseases. Thanks to its recognized expertise and its close relationships with doctors and patients, the Group has acquired a strong legitimacy in the field of home healthcare by helping preserve the quality of life and independence of patients, while helping control healthcare spendings.

## Recognized expertise born in Europe

In recent decades, Air Liquide has developed recognized expertise in home healthcare. Capitalizing on its experience in supplying medical gases to hospitals, the Group started by supplying medical oxygen to the homes of patients suffering from respiratory failure. It then extended its services to other respiratory conditions, such as sleep apnea, and other chronic diseases, including diabetes and Parkinson's disease, which call for highly technical support and regular monitoring.

Improving patient adherence and encouraging effective coordination between healthcare professionals to avoid hospital readmission are two of the main challenges facing home healthcare.

Today, Air Liquide sets itself apart through its ability to ensure comprehensive patient care, combining the implementation of technological

equipment with support from multidisciplinary teams made up of pharmacists, nurses, nutritionists, healthcare professionals, and technicians working with the medical community.

The Group also relies on digital technologies to offer innovative e-health solutions, ensuring better patient monitoring and facilitating coordination between stakeholders at the various stages of the healthcare journey.

It also collaborates with start-ups to offer a wider range of value-added services. For instance, in June 2018, Air Liquide purchased EOVE, a French company that has developed a portable connected ventilator that takes into account patients' mobility needs and helps doctors in their daily work.

This strategy of targeted acquisitions, combined with its scientific expertise, knowledge of the medical world, and proximity with patients, now makes Air Liquide the European leader in home healthcare.

## Opening up new markets

Building on its positioning in Europe, Air Liquide has been developing its home healthcare business for around fifteen years in other areas of the world, such as Asia, the Middle East, and South America. With a presence in 35 countries already, the Group is seeking to diversify its activities by offering value-added services in regions where it already operates. It also targets new countries where it generally makes targeted acquisitions to grow quickly.

South Korea is one example of this strategy. Eight years after it moved into the country, the Group has tripled its sales in home healthcare and is now the ventilation leader in the local market. This success is primarily explained by the Group's ability to make valuable acquisitions to ensure its long-term growth. After its 2010 acquisition of the South Korean firm, Medions, which specializes in care for heavily ventilated patients in their homes, the Group gradually added to its offering by making three acquisitions to help patients suffering from other chronic diseases.

Each time, the Group makes sure the company it is purchasing shares its values. It focuses on integrating the new teams and encourages expertise pooling. This strategy of targeted acquisitions has allowed it to develop a solid position in the country in just a few years, where it is now a real partner of the healthcare systems. Feedback from the teams at its VitalAire Korea subsidiary was taken into account, contributing to add new rebates to the national healthcare system, including a service designed for patients suffering from sleep apnea.

## FOCUS

### AIR LIQUIDE CONSOLIDATES ITS POSITION IN SAUDI ARABIA

Air Liquide, which already operates in the Saudi Arabian healthcare sector by supplying medical gases to hospitals, expanded its activities in the country in 2018 with the acquisition of the respiratory division of Thimar Al Jazirah Company (TAC), a key local player in the pharmaceutical, medical, and dental industries, that provides home healthcare to more than 1,400 patients throughout the country. With this acquisition, the Group has managed to consolidate its position in a region that boasts significant potential. With more than 32 million inhabitants, growing healthcare needs – in particular due to the prevalence of diabetes – and a pledge from the public authorities to improve the quality of services, the home healthcare sector in Saudi Arabia has significant growth potential.

**ELECTRONICS**

# Increasing the power of digital technology

42

Digital technology is transforming our world: the way we work, learn, socialize, shop and travel. Central to this revolution is the electronics industry.





**The electronics industry uses gases and other innovative materials for the manufacturing of smaller and faster chips. Air Liquide is a world leader in the supply of many of these advanced materials.**

In 2018, this dynamic propelled its Electronics activity to a significant growth of 10%.

The acceleration of the electronics market began with the rise of computing and mobile phones in the 1980s. Since then, the sector has been growing exponentially, transforming every aspect of our lives, with yesterday's science fiction becoming today's reality: big data, the Internet of Things, virtual reality, artificial intelligence, self-driving cars. Behind these innovations are increasingly powerful electronic components: processors that convert real-world information to digital signals and perform massively complex calculations, memory chips that store vast amounts of data, and touchscreens that simplify the life of users.

### Unleashing the potential of materials

Air Liquide products are used to build all these components, either as inerting gases like ultra-pure nitrogen used to inert the manufacturing environment, or as deposition and etching materials for building chips and flat panels.

The last decade's advances in the semiconductor industry – from hard disks to microprocessors to today's smartphones – have been enabled, in part, by Air Liquide innovations in advanced materials. In 2018, the Group supplied almost \$ 2 billion worth of gases and materials to electronics customers and the potential of this fast-growing market is huge: every year, 1.5 billion smartphones are sold and each of them contains chips that are made with about \$2 of gases and advanced materials. Also, each of today's connected cars contains about \$3 of these materials, which are used in microprocessors, memory chips, sensors or screens.

### Innovating for the future

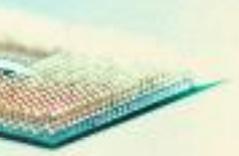
In this rapidly evolving industry, with its constant demand for improved technologies and capabilities, new materials play a more critical role than ever before. The challenge is both technical and economic: the performance of computers, smartphones and servers must keep improving, while reducing their energy consumption and costs. Meanwhile, manufacturers must also reduce the environmental footprint of their etching process.

In this context, R&D is a key differentiator. Air Liquide's strategy is to work alongside its customers and partners in their ecosystem to design customized solutions. This collective intelligence approach has allowed the development of advanced materials that have today become industry standards. In 2015, the Group combined its ALOHA™ and Voltaix™ product lines, designed for some of the most critical steps of the microchip manufacturing process, to create Air Liquide Advanced Materials, a global entity serving this market segment.



**100%**

of latest generation smartphones have components, chips and memories made with Air Liquide's advanced materials.



More recently, the enScribe™ family of etch gases was launched and adopted in 2018 by several customers (see page 25). Developed in close cooperation with semiconductor manufacturers, universities and customers, this new offer enables addressing the growing complexity of 3D memory chip structures while helping reduce greenhouse gas emissions.

Beyond innovation, the electronics sector demands infallible quality at ever-growing volumes. As the industry consolidates, the market leaders are building more and more 'mega fabs' that require several times the volumes of gases and new materials needed previously. Thanks to its technological expertise, its worldwide presence and investment capacity, Air Liquide can meet its customers' growing needs and support the industry-wide effort to become more environmentally responsible.

A major actor of the infinitely small, the Group is in a strong position to capture the great potential of this market in the coming years.

**10%**

growth rate for Electronics sales in 2018

In a world where climate change is making us reconsider how we live and travel, our current energy mix needs to be reapportioned to include significantly more renewable and clean energy sources. Air Liquide, a pioneer in this field, is drawing on its technological expertise to facilitate this change.



NEW MARKETS

# Accelerating the deployment of clean energies

47

**The development of clean energies depends on society's ability to design and market innovative technological solutions while inventing new economic models that are viable over the long term.**

Air Liquide, which has already made ground-breaking strides in hydrogen energy, is helping create new energy sources and implement cleaner modes of transportation, both of which improve air quality.



# €100 M

the amount Air Liquide  
has invested in biomethane  
over the past four years

## Biomethane: a doubled production capacity

Air Liquide is a main player in biomethane, a clean and renewable energy source derived from purified biogas, originating from organic matter sourced from farming or household and industrial waste.

Biomethane is injected into the natural gas network, where it is used as fuel, known as bio natural gas for vehicles (bio-NGV), at natural gas fueling stations. It may also be liquefied and transported in bulk to these stations. To date, Air Liquide operates more than 60 bio-NGV stations in Europe, which promotes the use of biomethane as a fuel alternative and reduces fine particle emissions by 85% and CO<sub>2</sub> emissions by 90%. Aside from serving as a fuel source for transportation, biomethane can also replace natural gas in the home and be used to produce hydrogen in a carbon-free way.

In just a few short years, Air Liquide, which is well aware of the market's potential, has become one of the few stakeholders to have a hand in every step of the global biomethane value chain, including investment in and operation of methanization units, membrane purification technology, as well as the transportation, storage, and distribution of liquefied gas.

The Group doubled its production capacity in 2018 by opening three new production units in France, the United Kingdom, and the United States. It now owns 12 production sites throughout the world that purify biogas to be transformed into biomethane.

## Hydrogen: energy of the future

Hydrogen holds immense potential and has many applications: clean transportation, renewable energy storage, industrial uses, and more. As a result, this molecule has become an indispensable solution to meet the challenges of the energy transition. It might even be able to provide 20% of the reduction in CO<sub>2</sub> emissions needed to limit global warming to 2°C between now and 2050.

For over 40 years, Air Liquide has developed unique expertise along the entire hydrogen value chain: production, storage and distribution. The Group is helping to promote its use via the worldwide deployment of hydrogen stations and through its key role in the Hydrogen Council (see article on page 30).

## Blueeze: innovating our way towards cleaner refrigerated transportation

In addition to bio-NGV, Air Liquide is developing a clean and silent solution for refrigerated trucks called Blueeze. This cryogenic, liquid nitrogen-based solution is used in on-board cold transportation systems and creates zero local emissions (fine particles, NO<sub>x</sub><sup>(1)</sup>, NO<sub>2</sub><sup>(2)</sup>, etc.), unlike refrigeration units that use diesel.

Blueeze is also an innovative alternative solution for the cold chain. For example, it can decrease the temperature twice as fast and allows for much more precise temperature control compared to a traditional solution. Another advantage is its smart control system, which maximizes thermal efficiency.

Once again, Air Liquide is involved in every part of the value chain to make sure it can provide its customers with a complete solution. The Group provides transporters with an on-board cryogenic refrigeration unit that is both clean and easy to use, safe refilling stations that can be accessed at any time, and a network of experts to help with training and maintenance.

With Blueeze and bio-NGV, which some transporters use simultaneously, Air Liquide helps refrigerated transportation companies meet the challenges facing their sector, namely preserving the cold chain, protecting the products being transported, and developing cleaner, more environmentally friendly solutions. Air Liquide offers concrete solutions for challenges presented by society's transition to greener energy sources.

## FOCUS MULTI-ENERGY STATIONS

To promote the use of these new energies, Air Liquide designs and operates clean, multi-energy stations. The first such station was opened in 2016 in France. Now there are 14 of these stations, which are particularly focused on ground freight transportation. They serve as a single supply point distributing natural gas for vehicles (NGV), bio-NGV (biomethane) and liquid nitrogen. This makes them a real environmental and economic advantage for carriers using the Blueeze solutions. By positioning itself at the start of the value chain, from production to distribution, Air Liquide can optimize the use of its own biomethane production.

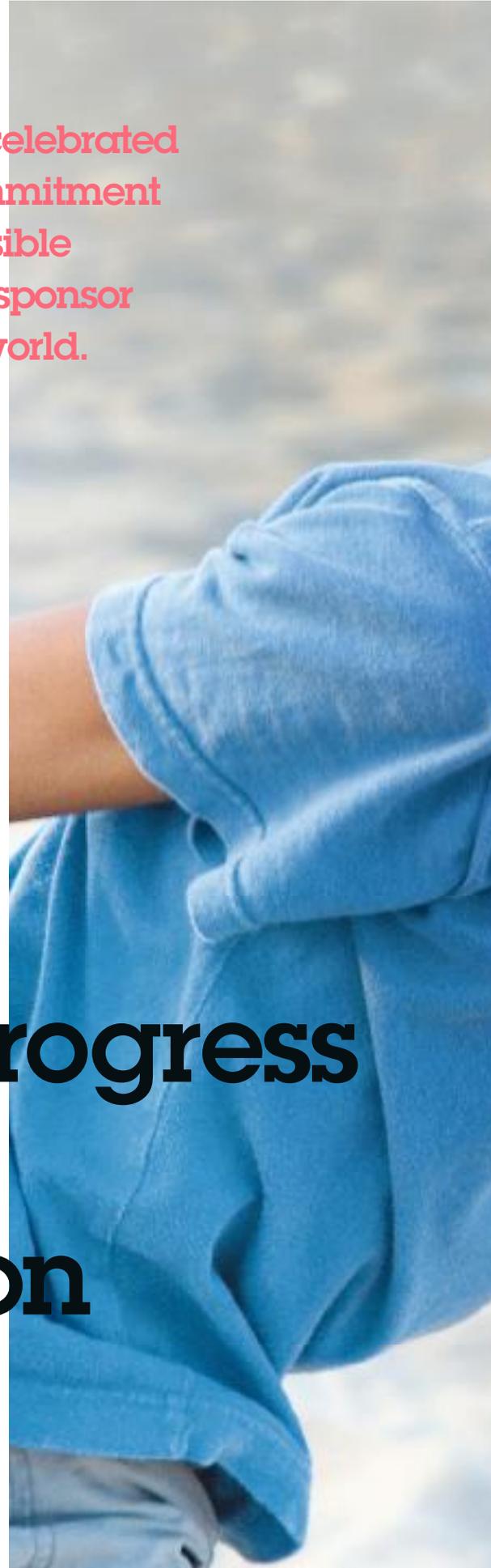
(1) NO<sub>x</sub>: Nitrogen oxide. (2) NO<sub>2</sub>: Nitrogen dioxide.

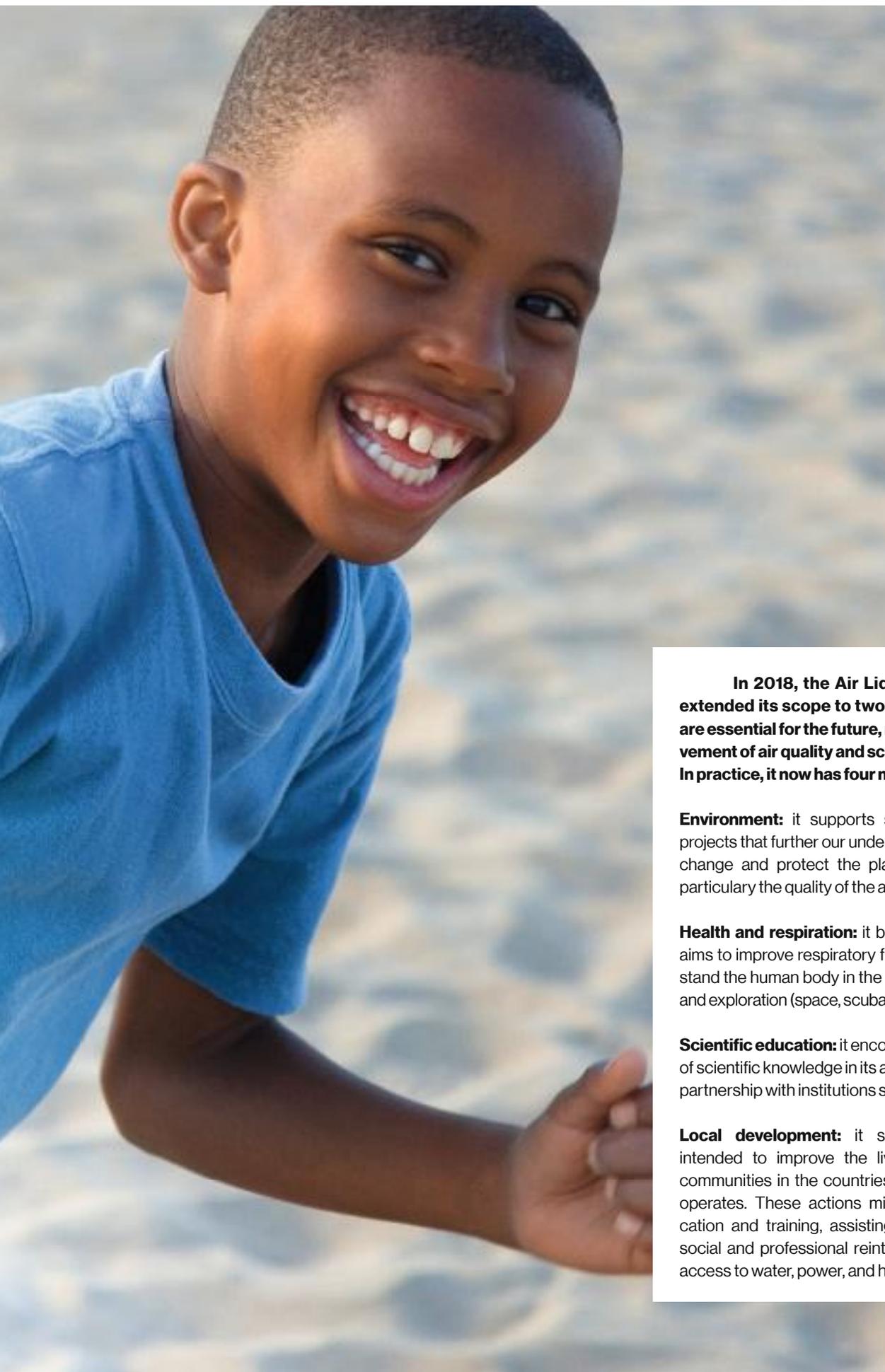
In 2018, the Air Liquide Foundation celebrated its 10<sup>th</sup> birthday and renewed its commitment for 2019-2023. This goal is made possible by the actions of all employees who sponsor or recommend projects all over the world.

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AIR LIQUIDE FOUNDATION

# Supporting progress of science and education





**In 2018, the Air Liquide Foundation extended its scope to two new themes that are essential for the future, namely the improvement of air quality and scientific education. In practice, it now has four main missions:**

**Environment:** it supports scientific research projects that further our understanding of climate change and protect the planet's atmosphere, particularly the quality of the air.

**Health and respiration:** it backs research that aims to improve respiratory function and understand the human body in the fields of healthcare and exploration (space, scuba diving, and sports).

**Scientific education:** it encourages the transfer of scientific knowledge in its areas of expertise in partnership with institutions such as museums.

**Local development:** it supports initiatives intended to improve the living conditions of communities in the countries where the Group operates. These actions might relate to education and training, assisting disabled people, social and professional reintegration, and even access to water, power, and healthcare.

### **Ice Memory: protecting priceless scientific heritage**

In 2018, the Air Liquide Foundation renewed its support for the Fondation Université Grenoble Alpes as part of the international Ice Memory project. The aim of this initiative was to preserve in Antarctica ice samples taken from high-altitude glaciers around the world. These scientific archives hold valuable information that can help us understand climate change and the environment.

Under the effect of global warming, most of the world's glaciers are steadily retreating and will eventually disappear. The Ice Memory project therefore aims to protect this heritage and make it available for tomorrow's scientists to conduct new research.

For each glacier selected, an initial sample is analyzed to establish a reference database. Another sample is kept in the French-Italian Concordia Research Station on the Antarctic Plateau. Placed in a dedicated cave, around ten meters under the snow, it is secured in a natural freezer at  $-54^{\circ}$  and will remain safe for centuries to come.

The Air Liquide Foundation helps purchase analytical equipment, fund core sampling mission expenses, and acquire containers for the storage cave. To date, four samples have already been drilled from glaciers in France, Bolivia, and Russia in 2018. In the next two decades, samples from some twenty glaciers must also be preserved for future generations.

The UNESCO Executive Board, which brings together 58 member states, adopted two decisions in 2017 and 2018: recognizing the scientific and cultural importance of glaciers and the relevance of the Ice Memory initiative, and urging the international community to act quickly.

## Employee engagement in the field

In addition to scientific projects like Ice Memory, Air Liquide Foundation employees are also very active in the field of local development. Each initiative is sponsored by a volunteer employee working in a Group entity that is close to the project site. In 10 years, hundreds of employees have become involved with the Foundation.

Marie Ba Lacouture and Elisabeth Ndiaye Ndong, two Air Liquide Senegal employees, are a great example. Together, they helped renovate the maternity ward in the village of Bassar, which is located in an isolated area that is only accessible by boat. Expanded and equipped with new medical and other equipment, including a solar power system, the building can now host five times as many prenatal consultations. The two colleagues received the "Jury's Favorite" prize for Group employees, which was presented as part of the 2018 Social Engagement Awards.

Furthermore, the Group's various entities throughout the world take action in their regions in fields ranging from education, healthcare, and training to environmental protection.

Following the forest fires that affected the Iberian Peninsula, Air Liquide employees in Spain and Portugal also volunteered in 2018 through field days dedicated to controlling invasive species or planting and protecting shoots of native trees.

Since its creation in 2008, the Foundation has supported

**46**

scientific projects

**275**

societal projects in 52 countries,  
in line with the Group's societal  
commitment

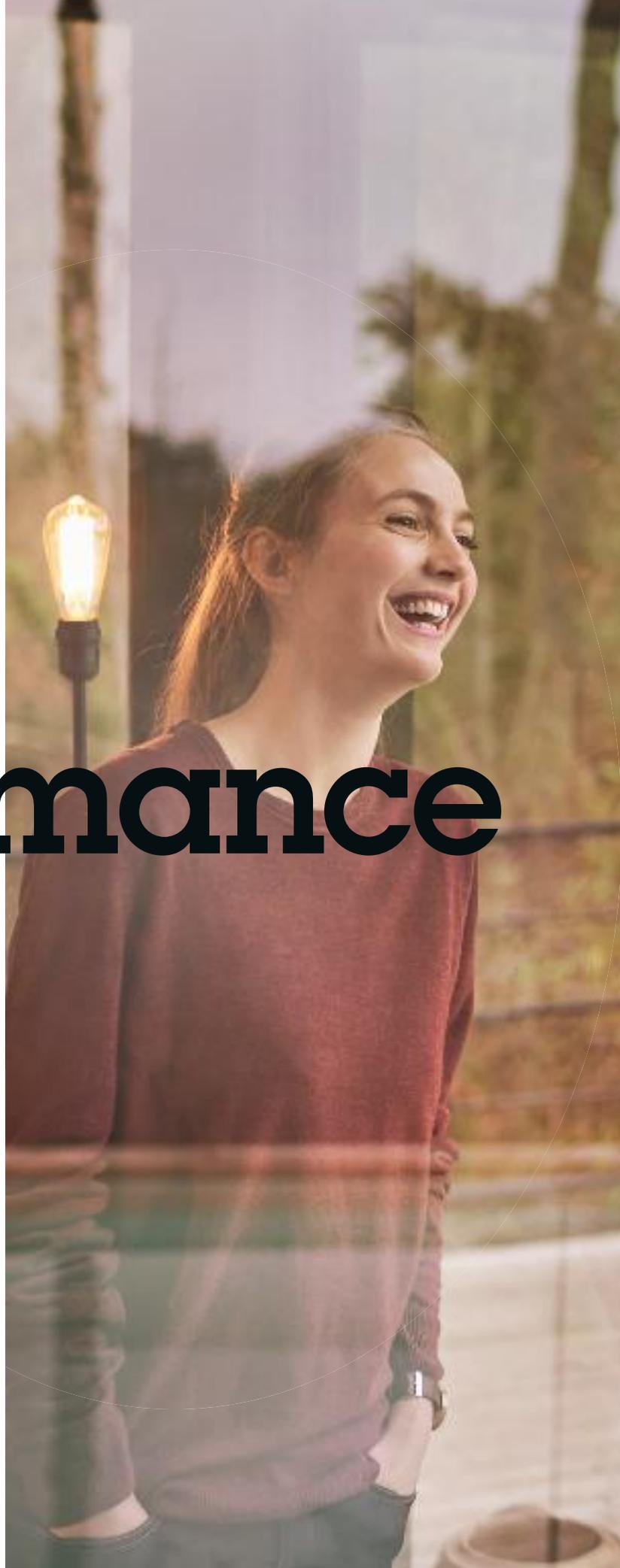
**“It is essential for me to be a shareholder in a group that combines performance and responsibility. That’s what I found at Air Liquide.”**

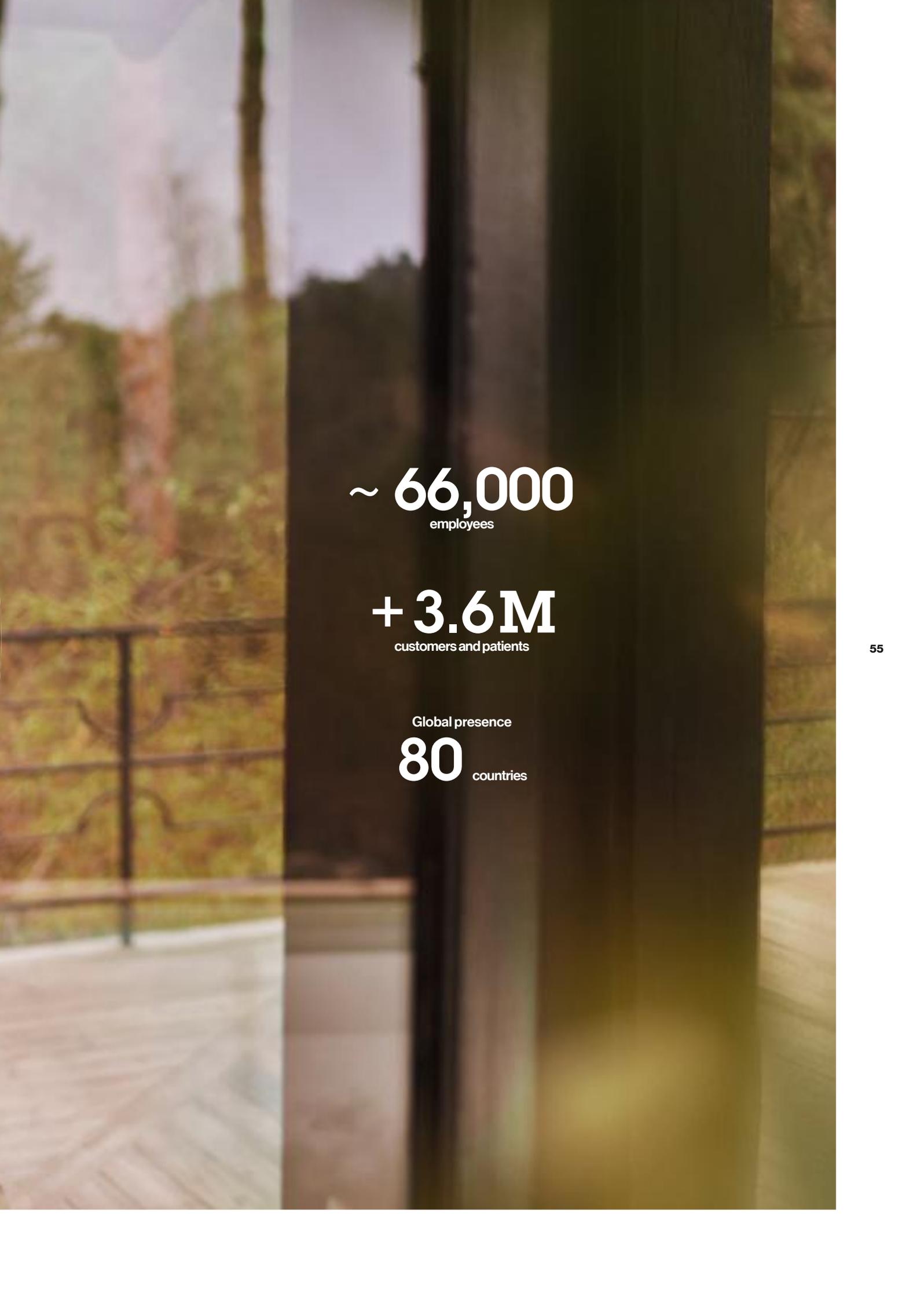
CONSTANCE,  
AIR LIQUIDE SHAREHOLDER

# Performance

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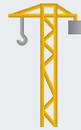
~ **66,000**  
employees

+ **3.6M**  
customers and patients

Global presence  
**80** countries

# Air Liquide supports the growth of all economic sectors

DESIGNING INDUSTRIAL GAS PRODUCTION UNITS FOR AIR LIQUIDE AND CUSTOMERS PRODUCING DIRECTLY



Centralized production

On-site production at customers'

AIR SEPARATION UNITS, HYDROGEN AND CARBON MONOXIDE PRODUCTION UNITS

LARGE QUANTITIES by pipelines

MEDIUM QUANTITIES by tanker trailers



SMALL QUANTITIES in cylinders

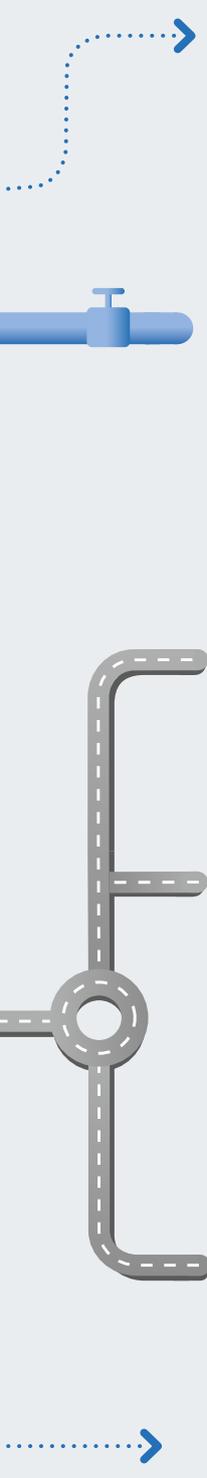


SUPPLYING GASES AND SERVICES FOR ALL INDUSTRIES AND HEALTH

DEVELOPING NEW MARKETS AND BREAKTHROUGH TECHNOLOGIES



BIOMETHANE PRODUCTION UNITS, HYDROGEN CHARGING STATIONS AND OTHERS



- 
**CUSTOMERS CHOOSING TO INSOURCE THEIR GAS NEEDS**
- 
**CHEMICALS**
- 
**REFINING**
- 
**METALS**
- 
**MATERIALS & ENERGY**
- 
**AUTOMOTIVE & MANUFACTURING**
- 
**FOOD & PHARMACEUTICALS**
- 
**TECHNOLOGY & RESEARCH**
- 
**PROFESSIONALS & RETAIL**
- 
**HOSPITALS**
- 
**HOME HEALTHCARE**
- 
**HYGIENE/SPECIALTY INGREDIENTS**
- 
**SEMI-CONDUCTORS**
- 
**FLAT PANELS**
- 
**PHOTOVOLTAIC**
- 
**ENERGY TRANSITION**
- 
**MARITIME LOGISTICS**
- 
**DEEP-TECH<sup>(2)</sup>**

**ENGINEERING & CONSTRUCTION**  
Building plants and equipment for gas production



2%<sup>(1)</sup>

**LARGE INDUSTRIES**  
Producing and delivering gases in large quantities



27%<sup>(1)</sup>

**INDUSTRIAL MERCHANT**  
Serving a wide range of customers thanks to the Group's expertise in gases and processes



44%<sup>(1)</sup>

**HEALTHCARE**  
Providing gases, medical products and services to support our clients and patients, in the hospital and at home



17%<sup>(1)</sup>

**ELECTRONICS**  
Designing, manufacturing, and providing molecules and equipment for this sector



8%<sup>(1)</sup>

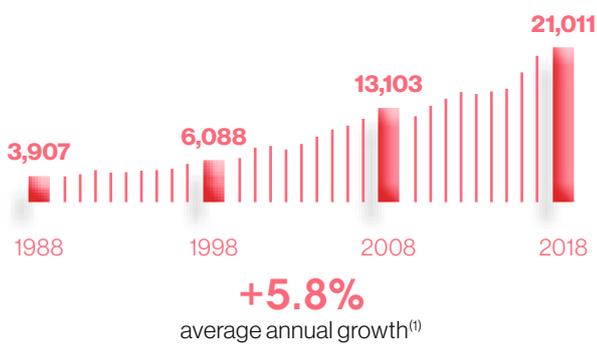
**GLOBAL MARKETS & TECHNOLOGIES**  
Providing technological solutions (molecules, equipment and services) for new markets



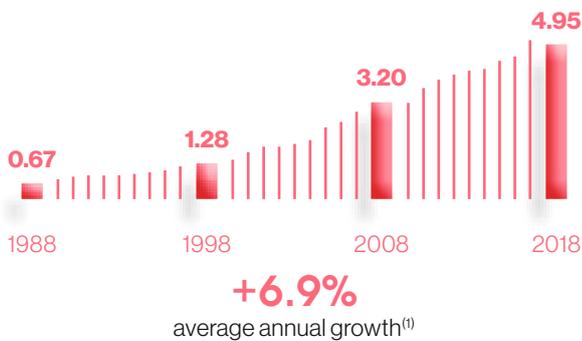
2%<sup>(1)</sup>

# A regular long-term performance

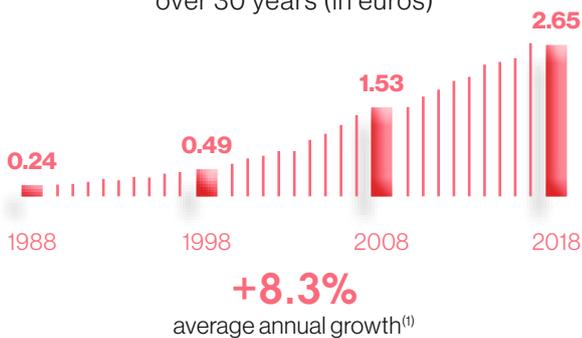
## EVOLUTION OF THE GROUP REVENUE over 30 years (in millions of euros)



## EVOLUTION OF THE ADJUSTED NET EARNINGS<sup>(2)</sup> PER SHARE over 30 years (in euros)



## EVOLUTION OF THE ADJUSTED DIVIDEND<sup>(2)</sup> PER SHARE over 30 years (in euros)



(1) Calculated according to prevailing rules over 30 years.

(2) Adjusted for the 2-for-1 share split in 2007, for attributions of free shares and for a factor of 0.974 reflecting the value of the rights of the capital increase completed in October 2016.

# 2018 Key financial figures

## REVENUE

**€21,011 M**

## NET PROFIT (Group share)

**€2,113 M**

## INVESTMENT DECISIONS

**€3.1 bn**

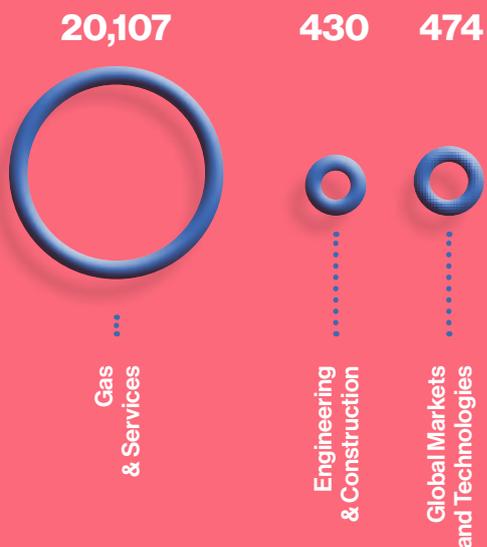
## EFFICIENCY GAINS

**€351 M**

## CUMULATIVE AMOUNT OF AIRGAS SYNERGIES SINCE ACQUISITION (end of 2018)

**US\$290 M**

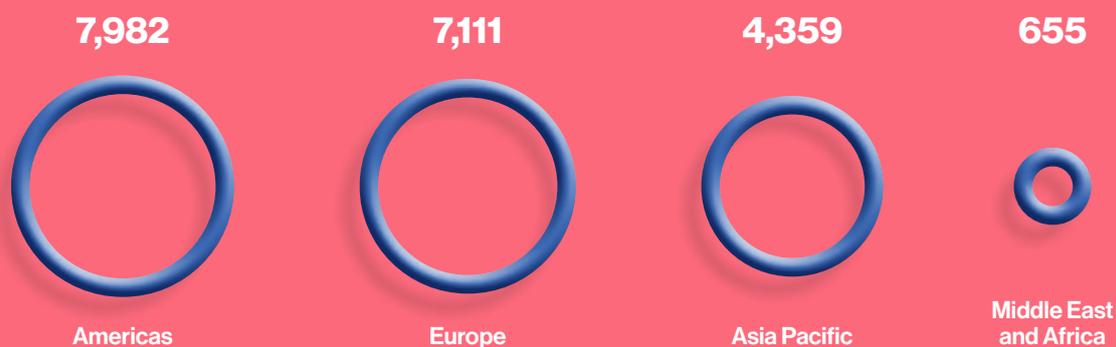
**DISTRIBUTION OF GROUP REVENUE**  
(in millions of euros)



**GAS AND SERVICES REVENUE BY WORLD BUSINESS LINE**  
(in millions of euros)



**DISTRIBUTION OF GAS & SERVICES REVENUE BY GEOGRAPHY**  
(in millions of euros)



**INNOVATION**

**€300 M**  
of innovation expenses

**309**  
new patents filed  
in 2018

**> 200**  
industrial and scientific  
partnerships

**GROUP SHAREHOLDERS**  
(as of December 31, 2018)



**> 410,000**  
individual shareholders

**€2.65**  
dividend per share  
proposed in the AGM of  
May 7, 2019

# 2018 Key extra-financial figures

## SAFETY

**1.3**

frequency rate of accidents with time off work per million hours worked

## DIVERSITY

**29%**

of women among engineers and managers

## ENVIRONMENT

ALMOST  
**40%**

Percentage of 2018 investment decisions that respond to environmental and climatic issues

**30%**

The reduction goal for carbon intensity of Group activities over the 2015-2025 period

ALMOST  
**70%**

The objective of increasing the Group's renewable electricity purchases over the 2015-2025 period

# Company Program objectives

## 2016-2020

Air Liquide is implementing its Company Program, NEOS, to meet its targets for the period 2016-2020. With this program, the Group is able to ensure long-term performance, be more connected to its stakeholders and be more innovative.

## PERFORMANCE

**+ 6 to 8% CAGR<sup>(1)</sup>**  
revenue growth

**> €400 M**  
annual efficiency gains over the 2019-2020 period, which is 100 million euros more than the initial target

**> US\$300 M**  
Airgas synergies

**> 10%**  
ROCE after 5 to 6 years

Maintaining rating from S&P  
**"A" range**

## RESPONSIBILITY

- > Improving air quality and preventing global warming.
- > Strengthening its dialog with Group stakeholders.

(1) Including Airgas consolidation scope effect in 2017, corresponding to a +2% CAGR.

# Consolidated income statement

(summarized)

AS OF DECEMBER 31, 2018

<i>(in millions of euros)</i>	2017	2018
<b>Revenue</b>	<b>20,349</b>	<b>21,011</b>
Purchases	-7,721	-8,276
Personnel expenses	-4,138	-4,146
Other income and expenses	-3,348	-3,374
<b>Operating income recurring before depreciation and amortization</b>	<b>5,142</b>	<b>5,215</b>
Depreciation and amortization expense	-1,778	-1,766
<b>Operating income recurring</b>	<b>3,364</b>	<b>3,449</b>
Other non-recurring operating income and expenses	-344	-162
<b>Operating income</b>	<b>3,020</b>	<b>3,287</b>
Net finance costs	-421	-303
Other financial income and expenses	-68	-50
Income taxes	-207	-731
Share of profit of associates	5	4
<b>NET PROFIT FROM CONTINUING OPERATIONS</b>	<b>2,329</b>	<b>2,207</b>
<b>NET PROFIT FROM DISCONTINUED OPERATIONS</b>	<b>-37</b>	<b>-</b>
<b>PROFIT FOR THE PERIOD</b>	<b>2,292</b>	<b>2,207</b>
• Minority interests	92	94
• Net profit (Group share)	2,200	2,113
<b>Basic earnings per share</b> (in euros)	5.16	4.95
<b>Diluted earnings per share</b> (in euros)	5.14	4.93
<b>Basic earnings per share from continuing operations</b> (in euros)	5.25	4.95
<b>Diluted earnings per share from continuing operations</b> (in euros)	5.22	4.93
<b>Basic earnings per share from discontinued operations</b> (in euros)	-0.09	-
<b>Diluted earnings per share from discontinued operations</b> (in euros)	-0.08	-

# Consolidated balance sheet (summarized)

AS OF DECEMBER 31, 2018

<b>ASSETS</b> (in millions of euros)	<b>December 31, 2017</b>	<b>December 31, 2018</b>
Goodwill	12,840	13,345
Other intangible assets and property, plant and equipment	20,137	20,847
Other non-current assets <sup>(a)</sup>	1,059	1,026
<b>TOTAL NON-CURRENT ASSETS</b>	<b>34,036</b>	<b>35,218</b>
Inventories and work-in-progress	1,334	1,460
Trade receivables and other current assets	3,963	3,533
Cash and cash equivalents <sup>(a)</sup>	1,694	1,770
<b>TOTAL CURRENT ASSETS</b>	<b>6,991</b>	<b>6,763</b>
<b>ASSETS HELD FOR SALE</b>	-	-
<b>TOTAL ASSETS</b>	<b>41,027</b>	<b>41,981</b>
<b>EQUITY AND LIABILITIES</b> (in millions of euros)		
<b>Shareholders' equity</b>	<b>16,318</b>	<b>17,783</b>
<b>Minority interests</b>	<b>400</b>	<b>424</b>
<b>TOTAL EQUITY</b>	<b>16,718</b>	<b>18,207</b>
Provisions and deferred taxes	4,401	4,367
Non-current borrowings	12,522	11,710
Other non-current liabilities <sup>(a)</sup>	241	268
<b>TOTAL NON-CURRENT LIABILITIES</b>	<b>17,164</b>	<b>16,345</b>
Provisions	333	325
Trade payables and other current liabilities	4,264	4,526
Current borrowings <sup>(a)</sup>	2,548	2,578
<b>TOTAL CURRENT LIABILITIES</b>	<b>7,145</b>	<b>7,429</b>
<b>LIABILITIES HELD FOR SALE</b>		
<b>TOTAL EQUITY AND LIABILITIES</b>	<b>41,027</b>	<b>41,981</b>

(a) Included derivatives.

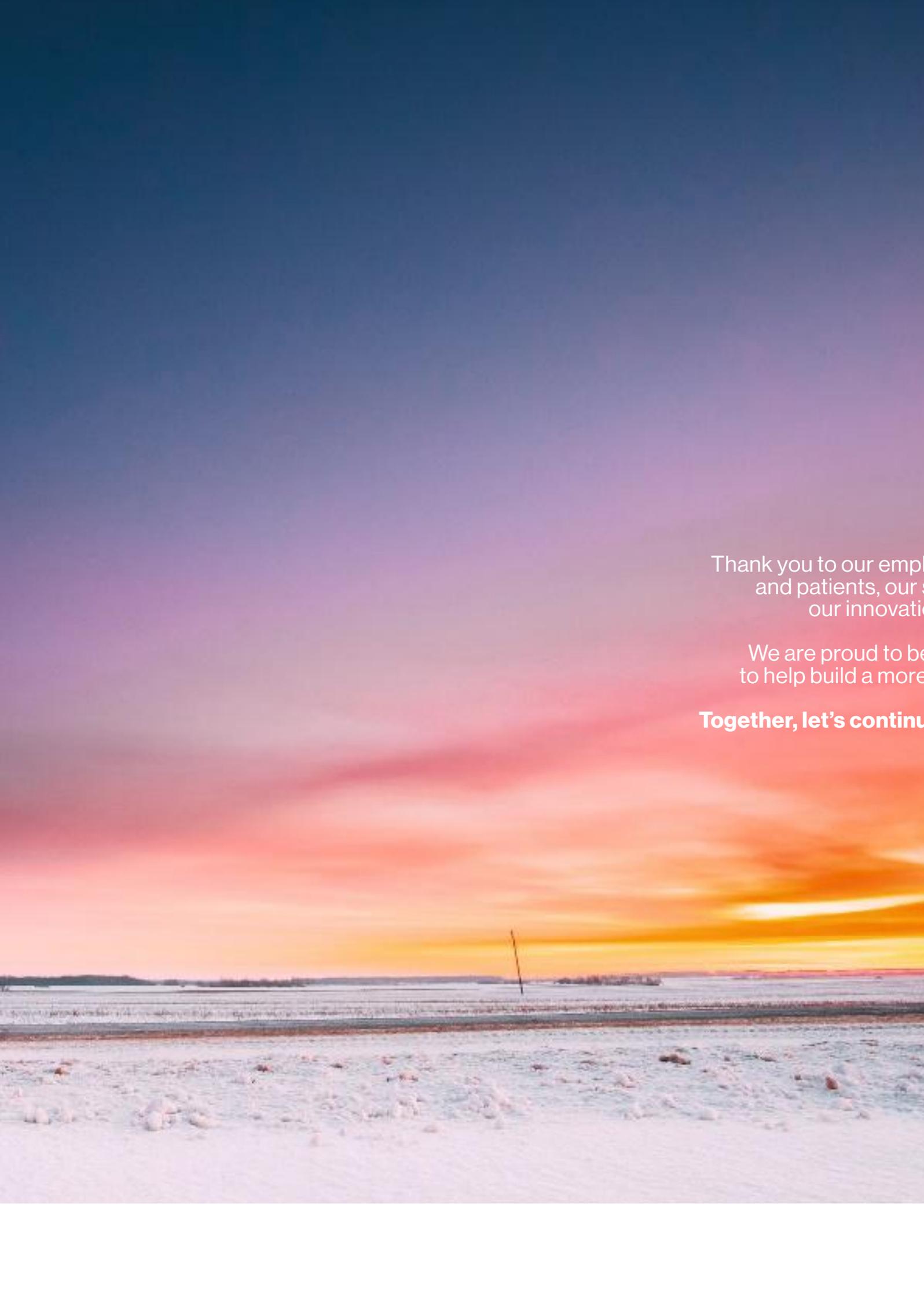
# Consolidated cash flow statement (summarized)

AS OF DECEMBER 31, 2018

<i>(in millions of euros)</i>	2017	2018
<b>Operating activities</b>		
<b>Cash flows from operating activities before changes in working capital</b>	<b>4,133</b>	<b>4,138</b>
Changes in working capital	188	613
Others	-67	-35
<b>Net cash flows from operating activities</b>	<b>4,254</b>	<b>4,716</b>
<b>Investing activities</b>		
Purchase of property, plant and equipment and intangible assets	-2,183	-2,249
Acquisition of subsidiaries and financial assets	-140	-129
Proceeds from sale of property, plant and equipment and intangible assets and financial assets	477	103
Dividends received from equity affiliates		5
<b>Net cash flows used in investing activities</b>	<b>-1,846</b>	<b>-2,270</b>
<b>Financing activities</b>		
Dividends paid		
• L'Air Liquide S.A.	-1,031	-1,159
• Minority interests	-68	-75
Proceeds from issues of share capital	70	138
Purchase of treasury shares	-158	-63
Transactions with minority shareholders	-4	-2
<b>Net cash flows used in financing activities excluding increase (decrease) in borrowings</b>	<b>-1,191</b>	<b>-1,161</b>
Effect of exchange rate changes, opening net indebtedness of newly acquired companies and others	780	-449
<b>Change in net indebtedness</b>	<b>1,997</b>	<b>836</b>
<b>NET INDEBTEDNESS AT THE BEGINNING OF THE PERIOD</b>	<b>-15,368</b>	<b>-13,371</b>
<b>NET INDEBTEDNESS AT THE END OF THE PERIOD</b>	<b>-13,371</b>	<b>-12,535</b>



Hydrogen could account for up to 20% of the reduction in CO<sub>2</sub> emissions needed to limit global warming to 2°C by 2050.



Thank you to our employees  
and patients, our shareholders,  
our innovators

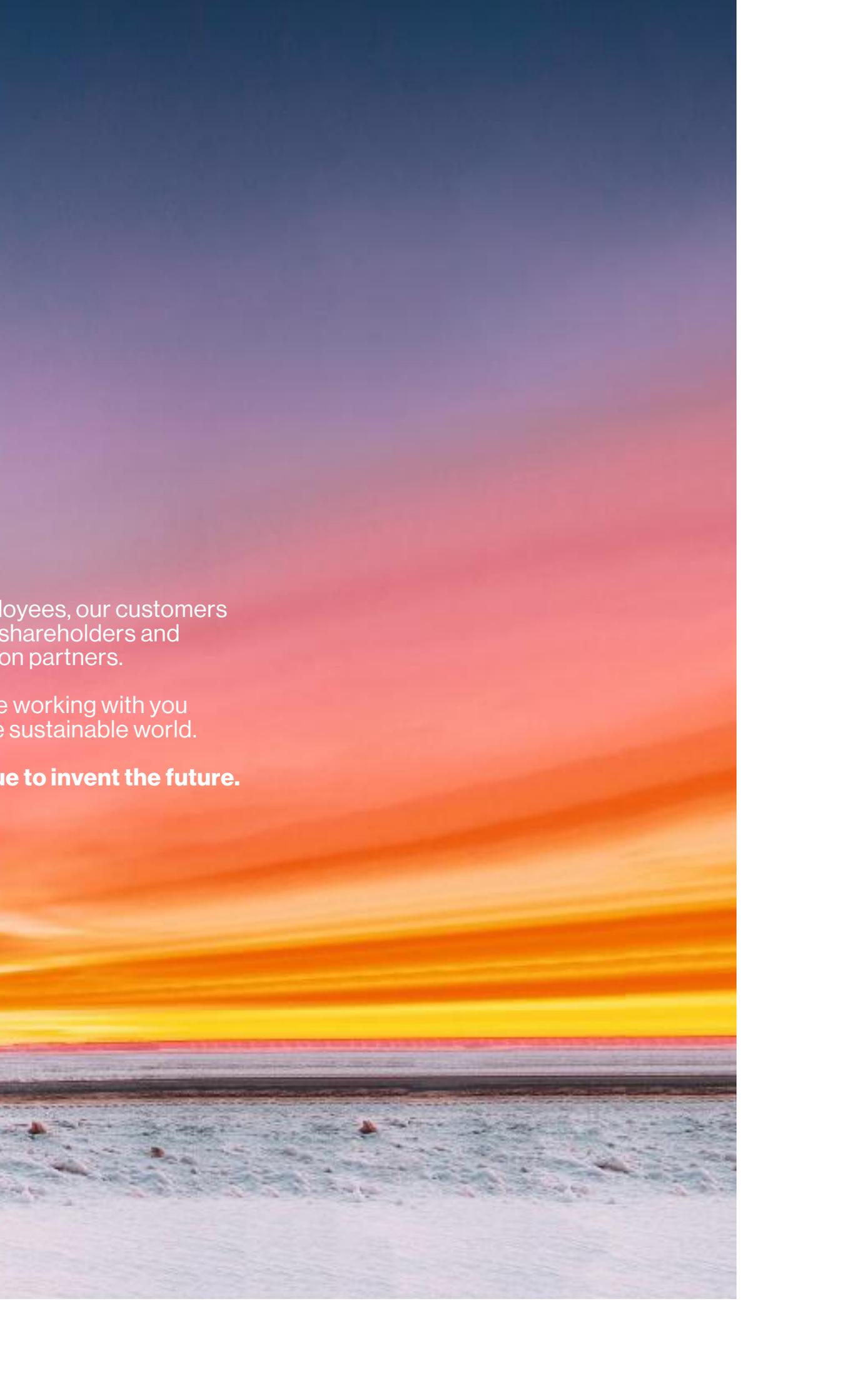
We are proud to be a part of  
to help build a more

**Together, let's continue**

employees, our customers  
shareholders and  
community partners.

we are working with you  
to create a more  
sustainable world.

**Join us to invent the future.**





## AIRLIQUIDE.COM

See our annual publications:  
Annual Report, Reference Document,  
Shareholder's Guide, On Air Magazine,  
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L'Air Liquide - S.A. company established for the study and application of processes developed by Georges Claude  
with issued capital of 2,361,913,658.50 euros

A world leader in gases, technologies and services for Industry and Health, Air Liquide is present in 80 countries with around 66,000 employees and serves over 3.6 million customers and patients. Oxygen, nitrogen and hydrogen are essential small molecules for life, matter and energy. They embody Air Liquide's scientific territory and have been at the core of the company's activities since its creation in 1902.