



Inventing the future

2019 ANNUAL REPORT

 Air Liquide

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Inventing the future

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**“We must always believe in the future
and, more than ever, invent it.”**

Benoît Potier, Chairman and Chief Executive Officer



Inventing the future is in our DNA

At one of Air Liquide's Smart & Innovative Operations centers



Fermob furniture workshop, France



Alongside our customers

Ghent industrial port, Belgium



Saint-Joseph maternity hospital, France



In close proximity to patients

With one of our patients at his home, Spain



Innovation Campus Paris, France



With our innovation partners

La Digital Factory, Air Liquide

Moving the industry forward



GAB

GAC

GAC



Supporting the healthcare sector

Saint-Joseph hospital, France



Hydrogen charging station, Paris-Charles-de-Gaulle airport, France



And contributing to the progress of society as a whole

Busan, South Korea.



La Digital Factory, Air Liquide



**Let's invent
the future together!**

Energy Observer



Interview with Benoît Potier, Chairman and Chief Executive Officer

What are your thoughts about 2019?

I'm very proud of all our teams. 2019 was a landmark year for many reasons. We combined a significant improvement in performance with a high level of investments to serve our customers and strengthen our efficiency, and the implementation of a robust climate action plan. More generally, some new and significant achievements were made in all our business lines. In Large Industries, numerous long-term contracts were signed, notably in the United States, with for example Methanex and GCGV, and also Shell in Canada and the Philippines. In our Industrial Merchant activity, I can mention the acquisition of Tech Air by our American subsidiary Airgas and the launch of Qlixbi, a new-generation cylinder concept for welding. In Healthcare, several acquisitions in home healthcare were completed in Europe. In Electronics, major contracts were signed, especially in Asia. Significant progress was also made in our major markets, with the development of biomethane, for example, and Turbo-Brayton advanced technology, which is helping reduce CO₂ emissions

from maritime transportation. 2019 was also a key year for deploying hydrogen mobility, with the signature of new partnerships in Asia and our pursued investments worldwide. In addition, we renewed our organization. The Group's Executive Committee was reinforced with four new members: it is now younger, more international and more gender-balanced, with a wealth of different profiles and skills. Their energy and diversity of perspectives clearly offer new strengths for the future! I would like to thank our 67,000 employees in 80 countries, who commit day after day to the success of our Group. It is their energy that has enabled us to successfully pursue our objectives in 2019.

Could you tell us more about Air Liquide's financial performance in 2019?

In 2019, our Group posted a 4.3% increase in revenues to reach 21,920 million euros, and a 6.1%⁽¹⁾ increase in net profit, at 2.2 billion euros. On a comparable basis, all Gas & Services activities,⁽²⁾ which account for 96% of Group revenue, progressed over the year, with particularly dynamic Electronics and Healthcare. Geographically, every region grew,⁽³⁾ notably the Europe and Asia-Pacific regions. Overall, and despite the expected global economic slowdown observed in the fourth quarter of 2019, the Group delivered robust results, confirming the relevance of its economic model and strategy.

(1) 6.1% published growth in net revenues (Group share). 11.1% comparable growth in recurring net revenues (Group share).

(2) On a comparable basis, excluding currency, energy and significant scope impacts.

(3) Excluding currency, energy and significant scope impacts.

The improvement in our operating margin reflects the dynamic management of both pricing and product mix, the asset portfolio, and efficiencies reaching 433 million euros. The Group's investment decisions rose sharply to 3.7 billion euros. The year's performance is in line with all our NEOS program targets and Climate objectives.

What is your view today of the customer-centric transformation strategy you introduced in 2016?

This strategy continues to bear fruit. The satisfaction of our 3.7 million customers and patients is what drives all our action. To continually serve them better, we make a priority of ensuring a very high level of reliability, safety and competitive value. We've successfully pursued our continuous improvement approach, notably through the Voice of the Customer program, which collects and analyzes customer opinions worldwide. The digitization of our business lines is also helping us to offer customers increasingly personalized solutions and more agile interactions. Overall, digital technology is increasingly integrated into our offering, processes and work methods. This progress was recognized in the 2019 eCAC40 Awards, where we were ranked first⁽⁴⁾ among French companies for digital transformation, compared with 16th in 2015. This is a fine achievement.

What action has been carried out since announcing the sector's most ambitious Climate objectives at the end of 2018?

We're aiming to reduce our carbon intensity by 30% by 2025, based on our 2015 emissions. To achieve this goal, we've introduced a global approach with action in three complementary areas: within our company, with our customers and for a low-carbon society. Since early 2019, a number of tangible projects have supported this ambition. I would like to mention three that are particularly innovative: our participation in the Northern Lights project for the development of offshore CO₂ capture and storage on the Norwegian continental shelf, and our partnerships with customers thyssenkrupp Steel and ArcelorMittal to reduce carbon emissions from their steel production. In hydrogen, we've set up new partnerships with major clients like Sinopec in China to develop hydrogen mobility. We've also started building the world's largest membrane-based electrolyzer in Canada to produce carbon-free hydrogen. In my view, hydrogen is a critical solution to the challenges of the energy transition and clean transportation. A growing number of global stakeholders are moving in this direction, particularly as part of the Hydrogen Council, which I have been co-chairing for the past two years and now has more than 80 members. In this Council, we're committed to accelerating the technological and economic progress already made, through our ambitions and investments. A good example is the design and deployment of 120 charging stations worldwide.

“In my view, hydrogen is a critical solution to the challenges of the energy transition.”

Benoît Potier

These examples also demonstrate the Group's capacity for innovation. What progress have you made in this area?

In 2019, we continued to reinforce our open innovation approach, focused on energy transition, the environment, health and digital transformation. We finalized the deployment of our five Innovation Campuses worldwide, a connected network open to our innovation partners (universities, technology institutes, customers and start-ups). For example, since June 2019, the brand-new Innovation Campus Paris has housed Accelair, our deep tech⁽⁵⁾ start-up accelerator for disruptive technologies. In addition, the Air Liquide Scientific Challenge continued to reinforce our cooperation with the academic community. In 2019,

we named three winners who will benefit from a partnership with the Group to develop new market-oriented technologies as part of their projects.

How do you see the near future for Air Liquide?

In the short term, at the start of 2020, more than ever amid the current health crisis impacting the entire world, our priority remains protecting the safety of our employees and partners, while maintaining business continuity for our customers, patients and healthcare professionals. In the longer term, innovation will also remain essential for developing new solutions and ways of working in a constantly changing world. I'm confident in the Group's future and I'm convinced that our employees' commitment will enable us to continue on the path of profitable, regular and responsible growth for the benefit of industry, health and a sustainable society.

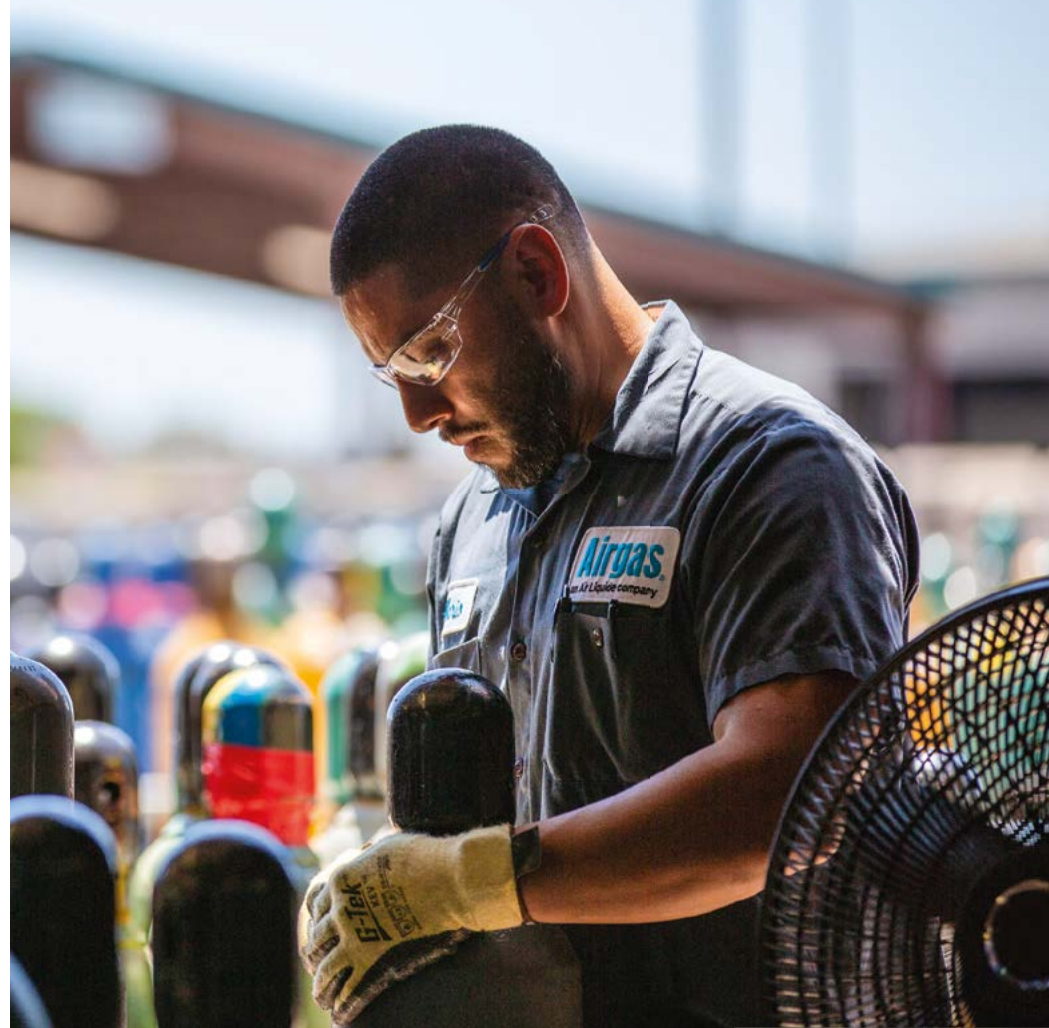
(4) Les Echos eCAC40 Awards, October 2019.

(5) Disruptive technologies based on scientific breakthroughs that can fundamentally change design and production methods.

AMONG OUR ACHIEVEMENTS IN 2019

Airgas acquired Tech Air in the United States

Airgas, Air Liquide's U.S. based subsidiary, finalized the acquisition of Tech Air, a distributor of industrial, medical and specialty gases and welding supplies. Tech Air serves more than 45,000 customers across the United States. This acquisition enables Airgas to expand its distribution network and reinforce its proximity to customers, while producing significant efficiency gains.



Accelair: a deep tech start-up incubator in Paris

Air Liquide inaugurated Accelair, a unique place for deep tech⁽¹⁾ start-ups located at its new Innovation Campus Paris. Around 20 young companies will benefit from the best possible conditions for accelerating their technology projects, thanks to testing facilities and a support program with Air Liquide experts.

⁽¹⁾ Disruptive technologies based on scientific breakthroughs that can fundamentally change design and production methods.



Promoting hydrogen mobility in China

Air Liquide supported the deployment of clean mobility in China through two key agreements. The first, in April, created a joint company with Houpu, a supplier of clean energy filling equipment. The second, in November, reinforced the Group's collaboration with Sinopec, the world's leading operator in the refining sector.

10

This is the number of European countries in which Air Liquide now provides support to diabetic patients.



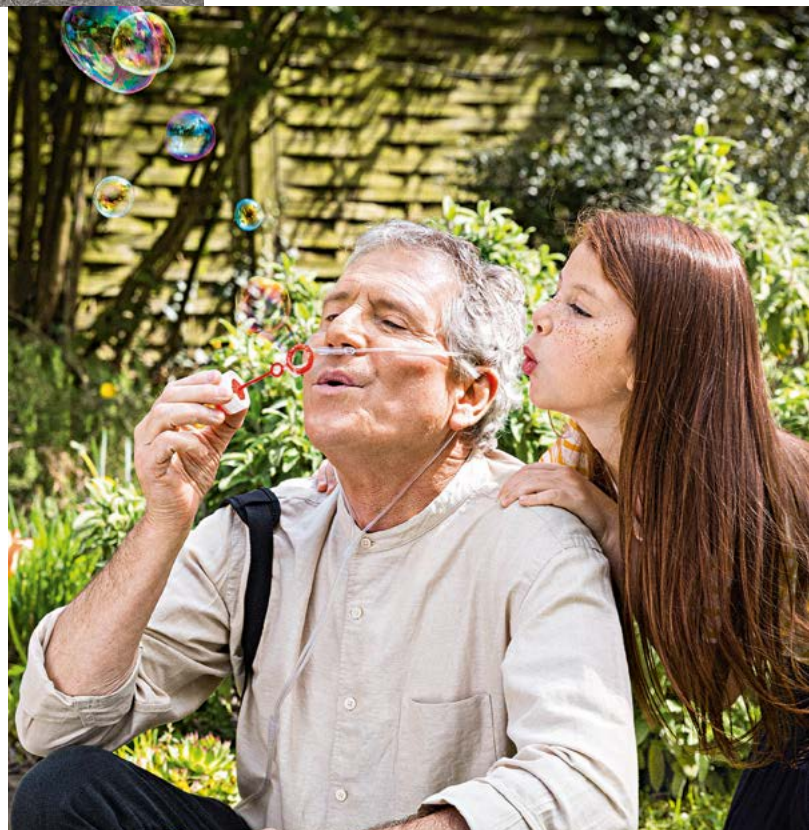


A new cutting-edge Innovation Campus in Tokyo

Air Liquide inaugurated its Innovation Campus Tokyo in Japan. Open to customers, start-ups and academic partners, the Campus illustrates the Group's open innovation approach.

Medidis joins Air Liquide in the Netherlands

With the acquisition of Medidis, Air Liquide boosts its presence in Europe as well as in new therapeutic segments. The Group now directly serves 26,000 new patients with respiratory failure. It has diversified its customer base with home care, serving nursing homes and paramedics, in addition to hospitals.



Turbo-Brayton: a promising technology for the maritime industry

By reliquifying natural gas boil-off generated by carrier vessels, Turbo-Brayton technology saves natural gas and helps reduce greenhouse gas emissions. Around 50 Turbo-Brayton cryogenic units were sold between 2018 and 2019 for a total value of almost 180 million euros, with the potential to avoid more than 240,000 tons of CO₂-equivalent emissions per year.



#1

in digital transformation! This is the result obtained by Air Liquide during the eCAC40 Awards⁽¹⁾, a ranking of French listed companies by digital maturity.

(1) Les Echos eCAC40 Awards, October 2019.

Major contracts for the industry in North America

Air Liquide reinforced its position in the United States and in Canada by signing four long-term contracts with regional leaders:

- Providing oxygen, nitrogen and services to Methanex for a plant

- extension project in Geismar, Louisiana;
- Supplying oxygen to Marathon Petroleum Company refineries in Texas City and Garyville;
- Supplying oxygen and nitrogen to the future Gulf Coast Growth Venture plant near Corpus Christi in Texas;

- Renewing the Group's supply agreements for oxygen, nitrogen, steam and electricity to Shell Chemicals' Scotford plant in Alberta, Canada.

Through its unique business model, Air Liquide is able to post long-term growth that creates value for its employees, customers, patients and shareholders, as well as society as a whole.

For profitable, regular and responsible growth

Air Liquide serves a very wide variety of customers around the world and acts as a partner to nearly every sector of the economy. At the core of the Group's business, industrial and medical gases are used in numerous industrial processes, such as water treatment, glass manufacturing and farming. They are present in consumer products (food, beverages, smartphones, cars, etc.), hospitals and patients' homes.

Whether producing gas or supplying technological equipment and services, Air Liquide designs and implements a multitude of solutions, tailored to the needs of its customers. The Group's presence in the field, alongside small businesses, large companies and healthcare professionals alike, enables it to detect new needs, develop a detailed understanding of the changes in various markets and offer innovative solutions to meet its customers' needs.

Furthermore, the long-term contracts signed by the Group (for up to 25 years), particularly with Large Industries customers, provide it with long-term visibility and stability. In healthcare, new patient-centric technologies and the development of health systems in emerging economies all represent growth opportunities for the Group.

A diverse range of markets and applications, a very strong capacity for innovation, and a long-term business model all form a winning combination that offers the Group a profitable and regular growth model.

Profitable and regular but also responsible... Our growth can only be sustained if we bring long-term benefits to society as a whole. This is why Air Liquide has introduced a global approach for the climate.



“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

3.7 M
customers and patients

420,000
individual shareholders

80
countries



CLIMATE OBJECTIVES: AN ACTIVE APPROACH

Long committed to limiting its own and its customers' environmental footprint, Air Liquide reached a new milestone in 2018 by setting the most ambitious Climate objectives of its sector. To this end, the Group introduced a global approach, reducing carbon emissions from its own assets (plants and facilities), helping customers move toward cleaner industries and driving the development of a low-carbon society. As a committed industrial leader, the Group intends to contribute to a more sustainable world by mobilizing all its stakeholders.

Numerous projects were initiated in 2019: partnerships with industrial leaders (ArcelorMittal and thyssenkrupp Steel), investments in the United States and Canada to provide low-carbon hydrogen and the Northern Lights carbon capture and storage project in Norway (see p. 63). At the end of 2019, Air Liquide's carbon intensity was further reduced and reached 27%⁽¹⁾ compared to 2015.

30%

This is the Group's target for reducing the carbon intensity⁽¹⁾ of its activities by 2025, as compared to 2015.

€100 M

This is the annual amount of innovation expenses dedicated to reducing CO₂ emissions.

DOUBLE "A"

In 2020, Air Liquide joined the select group of companies that have obtained two "A" scores from CDP⁽²⁾, a non-profit organization that evaluates companies on their environmental action. This double "A" recognizes the Group's efforts to promote environmental protection and sustainable water management.

(1) Kg of CO₂ equivalent per euro earnings before depreciation, excluding the impact of IFRS 16, at 2015 exchange rates.
(2) Formerly Carbon Disclosure Project.

FOUR STRATEGIC PILLARS

Air Liquide deploys its customer-centric transformation strategy by focusing on four pillars.

Operational excellence

Air Liquide is committed to serving its customers with the highest standards of safety, reliability, quality and competitiveness on the market. This excellence comes with two requirements: continually improving its equipment and increasingly simplifying its interactions with customers and patients.

— **Digitized operations play a major role.** In 2019, the Group continued to roll out its SIO⁽¹⁾ program to remotely manage production at its plants and introduced robotics technologies at its Feyzin plant in France.

> **See story #1 p. 47**

Open innovation

A key driver of transformation, the Group's innovation approach has been radically redesigned over the last five years to become more open and collaborative, allowing us to work hand in hand with customers and innovation partners.

— **In 2019, Air Liquide worked with its new global network of Innovation Campuses** to accelerate its technological innovation program in partnership with universities, through its venture capital investment company ALIAD and also with its new deep tech start-up incubator Accelair.

Selective investments

Air Liquide follows a policy of targeted investments, prioritizing high-potential markets and the most promising technologies, while taking into account its Climate objectives (see p. 28).

— **In 2019, significant investment decisions were taken, in particular to pursue growth and support the Group's innovation.** This was particularly true in the energy transition field, where the Group invested in clean transportation and low-carbon industry. For example, Air Liquide created a joint venture with Houpu to produce and market hydrogen stations in China. The Group also announced the construction of the world's largest membrane-based electrolyzer in Canada to produce carbon-free hydrogen.

> **See story #5 p. 79**

A network organization

In a constantly changing world, a network organization helps ensure agility, high performance and proximity to customers. Skills that are distributed and shared more effectively both globally and regionally enable the Group to reinforce its proximity to customers and markets, accelerate decision-making processes and attract new talent locally. The Group is integrating more and more new profiles (designers, user researchers, data scientists and others), who promote innovation.

(1) Smart & Innovative Operations.



Governance:
the Board of Directors
in the field

On December 31, 2019, the Board of Directors was composed of 12 members, including 11 nominated at the Annual Shareholders' Meeting, and one member representing Air Liquide employees, appointed by the France Group Committee. The Board of Directors brings together a diverse

range of profiles: six nationalities are represented from three continents where the Group operates (Europe, America and Asia) and 45% of elected members are women. The Board of Directors offers a wealth of skills (finance, management, industry, science,

international development, etc.) in a variety of sectors (consumer products, healthcare, research, engineering and gas, energy, services, construction, automotive, etc.). The Board of Directors sets the major strategic orientations for Air Liquide's business. To this end, it examines and approves the Group's

major **strategic issues** (including Group performance monitoring, acquisitions and investment decisions linked to the Climate objectives), **governance**, and **social and environmental responsibility**.



Benoît Potier
Chairman and
Chief Executive Officer
Born in 1957 – French



Jean-Paul Agon
Lead Director
Chairman of the Appointments
and Governance Committee
Member of the Remuneration
Committee
Born in 1956 – French



Pierre Dufour
Chairman of the Environment
and Society Committee
Born in 1955 – Canadian



Thierry Peugeot
Member of the Audit
and Accounts Committee
Born in 1957 – French



Karen Katen
Member of the Appointments
and Governance Committee
Born in 1949 – American



Siân Herbert-Jones
Chairman of the Audit
and Accounts Committee
Born in 1960 – British



Sin Leng Low
Member of the Audit
and Accounts Committee
Born in 1952 – Singaporean



Annette Winkler
Member of the Remuneration
Committee
Member of the Appointments
and Governance Committee
Born in 1959 – German



Philippe Dubrulle
Director representing employees
Member of the Environment
and Society Committee
Born in 1972 – French



Geneviève Berger
Member of the Environment
and Society Committee
Born in 1955 – French



Brian Gilvary
Member of the Audit
and Accounts Committee
Born in 1962 – British



Xavier Huillard
Chairman of the Remuneration
Committee
Born in 1954 – French

Governance:
the Executive Committee
at work



The Executive Committee has been reinforced by four new members. It is now younger, more international and more gender-balanced, with a wealth of different profiles and skills. Their energy and diverse perspectives represent new strengths for the future.



Benoît Potier
Chairman and Chief Executive Officer
Born in 1957 – French



Michael J. Graff
Executive Vice President supervising the Americas and Asia Pacific hubs, he is also in charge of the Electronics world business line
Born in 1955 – American



François Jackow
Executive Vice President supervising the Europe Industries, Europe Healthcare and Africa/Middle East & India hubs, as well as the Healthcare world business line and Customer Experience function
Born in 1969 – French



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



Guy Salzgeber
Executive Vice President in charge of the Industrial Merchant and Hydrogen Energy business lines as well as the following functions: Innovation, Digital and IT, Safety, Procurement, Public Affairs and Sustainable Development. He also supervises the Global Markets & Technologies activity
Born in 1958 – French



Jean-Marc de Royere
Senior Vice President in charge of Inclusive Business. He is also Chairman of the Air Liquide Foundation
Born in 1965 – French



François Venet
Senior Vice President in charge of Strategy. He also supervises the Large Industries world business line and Engineering & Construction
Born in 1962 – French



François Abrial
Vice President in charge of the Asia Pacific hub
Born in 1962 – French



Susan Ellerbusch
Vice President in charge of the US Large Industries, Electronics and Hydrogen Energy businesses, as well as Canada's Large Industries, Industrial Merchant and Healthcare businesses
Born in 1967 – American



Matthieu Giard
Vice President supervising the Industrial Merchant world business line, Procurement and Efficiency programs
Born in 1974 – French



Armelle Levieux
Vice President, Group Human Resources
Born in 1973 – French



Émilie Mouren-Renouard
Vice President in charge of Innovation, Digital & IT, and Intellectual Property, as well as Global Markets & Technologies activity
Born in 1979 – French



Diana Schillag
Vice President in charge of Healthcare activities in Europe
Born in 1971 – German



Pascal Vinet
Chief Executive Officer of Airgas
Born in 1962 – French



INVENTING THE FUTURE FOR INDUSTRY, HEALTHCARE AND THE PLANET

Developing innovative, effective solutions for our customers and patients is what makes us useful to the planet and society at large in the fields where we can make a difference.

Creating meaningful value

Air Liquide is present alongside millions of customers and patients worldwide: from oxygen cylinders to smartphones, refineries to food manufacturers, we support the growth of nearly every business sector. This proximity gives us a head start in anticipating needs, understanding market changes and proposing innovative solutions that have a positive impact on industry, society and the planet.

Aeronautics, food, automotive, chemicals, steel production, electronics... Air Liquide is a partner to nearly every sector of the economy. We use our expertise and capacity for innovation to support their growth, especially in three fields:

— Contributing to industrial progress

With industry 4.0, artificial intelligence and cobots, in-depth transformation is underway in industry and we are supporting these changes by making digital technology a powerful driver of acceleration. We are co-building a more innovative industry with some of our customers and partners, anticipating solutions for the future. For example, in the manufacturing sector, we have designed with and for welders the revolutionary Qlixbi solution, which transforms their welding experience.

With our electronics customers, we are designing cutting-edge molecules for latest-generation smartphones. In addition, with our customers, we are developing technologies to support their policies for reducing greenhouse gas emissions.

— Supporting healthcare

As a major global player in home healthcare and a provider of medical gases and materials for hospitals, we are working to make the healthcare system effective and virtuous for all. Our very close proximity to home-based patients for more than 30 years, combined with our capacity for innovation, especially in digital solutions, enables us to offer more personalized service, helping transform home healthcare.

— Acting for the climate

Air Liquide is also taking action to reduce its environmental footprint. With the most ambitious Climate objectives of its sector, the Group is reducing its carbon intensity and inventing a cleaner industry with its customers, helping create a low-carbon society.

We continue to move forward with the same ambition: to help drive progress in industry and healthcare and support a more sustainable model of society.

Five stories illustrating our contribution:

Digital transformation: above all, a human odyssey
p. 47

Home healthcare: every patient is unique
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Toward low-carbon industry
p. 63

Electronics: in the factory of high-performance materials
p. 71

Toward a hydrogen-powered society
p. 79



STORY #1

How can digital
technology serve **more
effective industry?**

#DIGITAL #INDUSTRY





We place people at the heart of our strategy
and make digital an accelerator
of the customer experience.



#DIGITAL #INDUSTRY

2019 Annual Report

As the digital revolution transforms every business sector, including industry 4.0, robotics and artificial intelligence, Air Liquide offers a people-centric approach that places new technology at the heart of its digital transformation. The result is improved performance, along with an enhanced customer and employee experience.

Digital transformation: above all, a human odyssey

#1

in digital transformation:
result in the eCAC40 Awards,
a ranking of French listed
companies by digital maturity.

Digital transformation has become inevitable for industry. New technologies such as big data, the Internet of Things, cloud computing and artificial intelligence are entering every sector of activity. By 2024, the global market for industry 4.0 could represent 155 billion dollars, compared to 66 billion dollars in 2017.⁽¹⁾ New uses are proliferating, the rate of change is accelerating and industrial customers are adopting the same habits as consumers in daily life, especially when it comes to responsiveness and an increasingly seamless, enhanced and personalized experience.

Air Liquide serves more than 2 million industrial customers in nearly every sector of the economy: food and pharmaceuticals, steel production, energy, chemicals, automotive manufacturing, aeronautics, etc. At the heart of these very diverse markets, the Group is in a prime position to observe and detect new needs and uses at the source. This very close proximity, combined with a large number of customers, field employees and assets (plants, facilities, cylinders, etc.), offers an ideal playground for developing new solutions focused on the customer and employee experience.

Seen very early on as a remarkable performance driver, digital technology is now increasingly integrated into the Group's services and working methods. In just a few years, this transformation has occurred at every level of the organization: manufacturing, logistics, traceability, operational performance, on-site and truck safety, a simplified employee experience with a single online work platform, and more.

(1) Zion Market Research - Industry 4.0 Market by Technology and by Vertical: Global Industry Perspective, Comprehensive Analysis, and Forecast, 2017-2024.



“Our greatest strength is believing that digitization doesn’t just mean implementing technology. It’s about putting people first. Upstream, that means creating brand-new services and products based on an in-depth observation of our customers’ issues. And downstream, we transform our organization to continually make it more agile, by engaging our employees and developing new skills.”

Olivier Delabroy, Vice President Packaged Gases at Air Liquide's Industrial Merchant business line

The infinite potential of digital technology serving our operations

— Digital technology represents a vast source of solutions for managing the Group’s assets more effectively. The Smart & Innovative Operations (SIO) program is a prime example: control centers remotely adapt production at the Group’s plants to improve reliability – especially with predictive maintenance - and optimize energy consumption. The objective is to respond more effectively in real time to customers’ varying supply needs. Launched in France in 2015, the SIO program is now deployed in Europe, the United States, Asia Pacific and the Middle East.

At the end of 2019, Air Liquide inaugurated its first automated order preparation system at the gas cylinder packaging plant in Feyzin, France. This offers numerous benefits: increased operational efficiency, a clear improvement in the quality of service provided to customers, and reduced handling by operators. This technological progress would not have been possible without the involvement of plant operators during the earliest project phases and cross-functional teams during the design and digitization phases.

New ways of working — The successful deployment of new technologies depends largely on users’ (customers’ or employees’) ability to adopt them. The Group is committed to developing a digital culture as well as internal expertise, and this transformation involves new, more collaborative and cross-functional working styles. This was the spirit behind the creation of our Digital Fabs in 2016. Focusing on a business line or function, these fabs bring together diverse teams from Air Liquide operations, business

THE INDUSTRIAL MERCHANT ACTIVITY AT AIR LIQUIDE

Every day, Air Liquide serves more than 2 million industrial customers worldwide, from craftsmen to large companies in sectors as diverse as food and beverage, steelmaking, energy, chemical, automotive construction and aeronautics. The Group offers comprehensive, innovative industrial gas solutions, including advanced technologies, equipment and related services.

lines and R&D, as well as digital/IT experts: developers, data scientists, designers and user research specialists. This latter resource enables Air Liquide to further its understanding of customers’ and employees’ needs and behaviors (user journey, qualitative studies, etc.) to maximize the adoption of new technologies for a continually enhanced experience.

Co-building with customers — Launched in 2019, Qlixbi was designed with and for welders through co-building workshops in their work environment. Combining an easier-to-use new generation gas cylinder and a range of digital services, this solution is revolutionizing the welding business. It is a real boon for welders, who work in a competitive market and need to manage numerous constraints, including gas supplies. With Qlixbi, they receive a cutting-edge connector to link their welding station and gas cylinder in a single click. Continuous supply is ensured by connected services that enable the user to monitor their gas reserves online and automatically replenish supplies, while facilitating collaboration between workshop teams. Another example of technology that serves people is “cobots” or collaborative robots that help operators perform tasks. This is the case of BotX Welder, a solution co-developed by Air Liquide’s U.S. subsidiary Airgas and its Red-D-Arc branch, the Innovation Campus Delaware and start-ups Hirebotics and Universal Robots. Designed using welder expertise, this cobot is programmed to carry out a wide range of welding operations to industry standards. As a workshop assistant, BotX Welder is a flexible way to compensate for a shortage of labor in the welding market.

An optimized and better integrated customer journey — As industrial customers expect an increasingly simple and seamless procurement relationship, Air Liquide is reinforcing its multichannel distribution strategy, combining physical presence with e-commerce. In the United States, Airgas offers a unique integrated approach incorporating its network of more than 900 sales outlets nationwide, its telemarketing team and its e-commerce portal. The aim is to offer customers the best possible service, based on simplicity, speed and efficiency. In Europe, Air Liquide has rolled out, in addition to the distributor network, the myGAS digital portal and mobile app, to cover the entire customer journey, from stock management and ordering to tank level monitoring. This partnership approach is intended to help customers (craftsmen and small to medium business owners) increase their everyday efficiency.

Air Liquide puts people at the heart of its customer-centric transformation to meet today’s imperatives for simple, effective service – a transformation that generates value for all the Group’s stakeholders.

1 bn

items of data collected every day in Air Liquide plants worldwide

The Qlixbi solution was co-built with and for welders: more than 700 took part in the innovation process.

With myGAS, customers can order supplies from their smartphones by scanning the barcode on a cylinder or find the nearest distributor using geolocation.



STORY #2

Is it possible to make healthcare solutions more **effective and beneficial for all?**

#PATIENTS #HEALTHCARE





**With healthcare professionals
and patients, we are helping to
reinvent home healthcare.**



#PATIENTS #HEALTHCARE

Committed to home healthcare, Air Liquide is developing innovative, patient-centric solutions for a truly personalized approach.

Home healthcare: every patient is unique

50%

of chronically ill patients do not adhere to the prescribed treatment, according to the World Health Organisation.⁽¹⁾

The stakes are high. The world is facing a steep rise in chronic diseases such as sleep apnea, diabetes and respiratory failure as a consequence of aging populations, pollution and changing lifestyles (diets, sedentary habits, etc.). Because these diseases are long-term conditions, patients have to learn to live with them. Maintaining their independence and quality of life while protecting their loved ones becomes a daily challenge.

At the same time, health systems worldwide are questioning the types of changes they need to make. One major challenge is managing the costs associated with chronic diseases, both direct (complications and urgent hospitalizations) and indirect (treatment for side effects, rehospitalizations, sick leave, etc.). In the European Union, for example, the cost of chronic respiratory disease exceeds 380 billion euros, while lung conditions account for at least 6 million hospitalizations.⁽²⁾

To meet this challenge, demand for home care is constantly rising. As a leader in this field, Air Liquide believes that helping patients to correctly follow treatment at home should reduce the cost of care, while improving their autonomy and quality of life. We are convinced patients should once again become the key focus of a healthcare approach that is increasingly connected and responsive to their needs, their everyday lives, and their family and friends.

(1) Sabate, E. "Adherence to Long-Term Therapies: Evidence for Action." Geneva: World Health Organization, 2003.

(2) "Lung Health in Europe: Facts and Figures," European Lung Foundation and European Respiratory Society, 2013.



“We’re working on patient adherence to treatment. The aim is to encourage people to play an active role in their own care. Every treatment that is correctly followed means a healthier patient, less pressure on the doctor and lower indirect costs for the payer.”

Gabriela Gabriel, Vice President Markets and Offers at Air Liquide's Healthcare business line

This patient-centric approach requires a comprehensive understanding of the care pathway and personalized support, in coordination with all the various health stakeholders. — This is because patient treatment can only be optimal from a therapeutic, organizational and financial standpoint when everyone works together.

To embark on this transformation, Air Liquide is mobilizing two major strengths: its close relationship with patients at home, having provided home care for more than 30 years, and its capacity for innovation, especially in digital solutions and equipment. By combining human expertise with digital technology, Air Liquide offers the kind of close support that takes treatment from a strictly curative approach to truly personalized care. It is this unique combination, along with an operational excellence that is renowned among health professionals, that enables Air Liquide solutions to generate real value.

To provide personalized support, Air Liquide considers each patient's physiological data, lifestyle and family situation, while ensuring strict data confidentiality. In Spain, for example, PIMA,⁽¹⁾ a treatment program for patients with sleep apnea, was launched in 2019. Our starting point was a basic, but important, question: if every patient is different, why offer them identical support? For example, Maria is a 50-year-old lawyer who travels often, uses digital tools and lives near an Air Liquide *Punto Inspira*, a dedicated Air Liquide center at a hospital for patients with chronic respiratory disease. Her 78-year-old father Juan lives alone nearby. He goes for a walk every morning and uses his mobile phone mainly to

1.7 M

patients with chronic diseases are treated at home by Air Liquide.⁽²⁾

THE HEALTHCARE ACTIVITY AT AIR LIQUIDE

In more than 35 countries, our nurses, researchers, technicians, engineers, doctors and data scientists at the Air Liquide Healthcare business line work alongside patients, health professionals and hospitals to help patients live better with their disease. As a major world player in home healthcare, an expert in chronic disease follow up at home, and a supplier of medical gases and hygiene products for hospitals, Air Liquide is working to make the health system effective and virtuous for all.

(1) PIMA: a personalized program for improved patient adherence.
(2) 2019 Air Liquide Universal Registration Document, p. 5.

measure his daily physical activity. With the PIMA program, Air Liquide considers the unique features of each patient and the results of a personal assessment interview to predict their adherence to treatment and tailor therapeutic support to their profile. At this stage in the program, the results are encouraging: Air Liquide has noted that patients are more involved in their follow-up treatments, which should improve their quality of life.

Personalizing care pathways also means developing new services for health professionals.

— For example, the EXPLOR! center is a unique laboratory created in France in 2016 to assess the medical approaches and new technologies used by patients with chronic diseases. It brings together a multidisciplinary team of Air Liquide experts (researchers, biomedical engineers and technicians) in the fields of ventilation, sleep disorders, oxygen therapy, intravenous treatment, nutrition and diabetes. Its specific role is to assess the performance (efficacy, safety, ease of use, connectivity, etc.) of each medical device, taking into account the multitude of possible patient profiles.

EXPLOR! is equipped with assessment tools that have been developed in collaboration with doctors and academic researchers to analyze and compare the performance of different medical devices. For example, these tools can evaluate the behavior of different ventilators used in respiratory failure, the possible impact on the patient, and analyze the ergonomics (quietness, ease of use, compactness, reliability and mobility) of medical devices to facilitate their daily use by patients.

By meeting the new needs of health professionals, listening to patients and sharing our expertise, we can reinvent home healthcare together. Our aim is to have a comprehensive vision of each patient's needs and be able to provide the right support at the right time to anyone involved in the care pathway.

EXPLOR!

Every year, 120 assessments and 190 doctors are received by a team of 6 experts and 3 PhD researchers.

E-HEALTH

When combined with human expertise, connected health can facilitate the care pathway: before treatment, by personalizing follow-up and detecting possible complications, and afterwards, by facilitating interaction between everyone involved. For example, Air Liquide's Chronic Care Connect™ solution is designed for patients at risk of hospitalization. With a doctor's authorization, a patient may use one or more connected devices (scales, glucometer, etc.) and have their data analyzed remotely by Air Liquide nurses, who regularly discuss the results with the patient and his or her doctor.

STORY #3

How can we help limit
global warming?

#LOW-CARBON #INDUSTRY





We are helping our customers reduce their environmental footprint while reducing our own.



#LOW-CARBON #INDUSTRY

2019 Annual Report

As global warming is a critical concern, Air Liquide has decided to take action. First of all, the Group has made an ambitious commitment to reduce the carbon intensity of its own activities, driven by innovative projects. Air Liquide is also increasing its initiatives worldwide with customers and partners.

Toward low-carbon industry

3

innovative projects to combat climate change:

- The Northern Lights carbon capture and storage project in Norway
- With thyssenkrupp Steel for using hydrogen to reduce carbon emissions in steel manufacturing
- With ArcelorMittal to capture and recycle carbon emissions from steel production

Limiting global warming in line with the 2015 Paris Agreement requires fast unprecedented transformation. According to the Intergovernmental Panel on Climate Change (IPCC), to achieve carbon neutrality and contain climate deregulation by 2050, industry as well as other sectors (energy, transport, agriculture, etc.) will need to drastically reduce CO₂ emissions. As a responsible company, Air Liquide has long made efforts to protect the planet. At the end of 2018, the Group announced the most ambitious Climate objectives of its sector, committing to a 30% reduction in the carbon intensity of its activities by 2025, as compared to 2015. Air Liquide also intends to contribute globally to a more sustainable world by helping its industrial customers reduce their carbon emissions and by developing new technologies and skills to support their low-carbon transition. Its recent investments in low-carbon hydrogen and biomethane demonstrate this commitment.

Acting on its own operations — Air Liquide has started by reducing its own environmental footprint, mainly through clean manufacturing in compliance with the highest standards, by lowering the electricity consumption of its industrial processes and by reducing the carbon intensity of its factories and equipment. The Group's commitments are demonstrated in several projects initiated in 2019. Air Liquide has contributed to the development of a windfarm in Texas to supply its industrial gas production plants with renewable energy, avoiding 1.5 million tons of CO₂ emissions for the duration of the agreement. The Group is also drastically reducing its carbon emissions by investing in new production units and shutting down its older, energy-intensive facilities.



“Thanks to its technology and logistics expertise in extracting and transporting CO₂ in gas or liquid state, Air Liquide is working alongside partners on an innovative, large-scale carbon capture and storage project in Norway. This partnership is a good illustration of the Group’s ability to offer solutions for decarbonization at its own plants and for customers in the Antwerp and Rotterdam industrial basins.”

Jean-Baptiste Salles, Vice President Strategic Customers and Business Model at Air Liquide’s Large Industries business line

This is particularly the case in Russia and the United States, where Air Liquide is building leading-edge air separation units (ASU) to supply its customers, Severstal and Methanex, with the help of sustainable, high-performance solutions.

Similarly, the Group is building a world-scale latest-generation hydrogen production plant at the Tabangao refinery in the Philippines. Owned and operated by Air Liquide, it will be paired with a capture and liquefaction unit for CO₂ initial discharge, which could then be directed to other uses to reduce direct carbon emissions.

Supporting the energy transition in industry — In addition to these efforts are several innovative initiatives to help manufacturers reduce their environmental footprint and move toward a low-carbon future. The Group is testing several solutions with its partners, and around 30 projects are likely to be implemented in the next five years. Air Liquide is already working with ArcelorMittal on a pilot scheme for capturing and recycling carbon emissions in steel manufacturing. This involves filtering blast furnace waste, using a technical solution developed by Air Liquide. In this way, the ArcelorMittal steelworks in Ghent, Belgium, will become Europe’s first bioethanol production site to use waste gas from steel manufacturing. In addition in the steel industry, Air Liquide and thyssenkrupp Steel have together launched a pioneering project: for the first time, hydrogen will be injected on a large scale to partly replace the coal used in the blast furnace during steel production. After full-scale deployment at its Duisburg plant in Germany, thyssenkrupp Steel is targeting a

**THE LARGE INDUSTRIES
ACTIVITY AT AIR LIQUIDE**

Air Liquide provides gas and energy solutions to improve process efficiency and reduce environmental footprints, mainly in the refining and natural gas, chemicals, metals and energy markets.

20% reduction in carbon emissions from the steelmaking process. As CO₂ emissions remain a growing concern for industrial companies, Air Liquide has also joined Northern Lights, a full-scale carbon capture and storage (CSS) project on the Norwegian continental shelf. Handling large volumes of emissions, CSS offers an effective way to decarbonize industry. The Northern Lights project could become the world’s first storage facility to receive manufacturing gas waste from different European countries.

A sustainable future in the shipping and transportation industry

— Likewise, the maritime industry is facing the issue of greenhouse gas emissions. This sector represents approximately 3%⁽¹⁾ of total CO₂ emissions worldwide. A number of solutions are being introduced to reduce this footprint and Air Liquide is playing an active role with its Turbo-Brayton technology. Developed over the past decade by Air Liquide, the Turbo-Brayton technology has proven its reliability in day-to-day use and met with encouraging success in liquified natural gas (LNG) shipping. This innovation, which is implemented on LNG ships, prevents methane evaporation during transport through reliquefaction. This offers a real advantage over classic gas capture solutions. The potential applications are numerous, both in shipping and for liquifying biogas from household or agricultural waste methanization facilities.

Another example is biomethane. Air Liquide is pursuing strong growth in this promising production market. The Group owns 18 biomethane production units worldwide, representing an annual capacity of 1.1 TWh. This recent business offers strong potential, especially for customers wanting to convert their vehicle fleet to low-carbon energy. Biomethane offers transporters a 90% reduction in CO₂ emissions and an 85% reduction in fine particles. In addition to clean mobility, biomethane naturally has its place in the energy mix and an important role to play in the energy transition. Finally, a major investment in producing carbon-free hydrogen in Canada (see p. 81) will help supply low-carbon hydrogen to the growing mobility market in North America.

Given its strong commitment to reducing its own environmental footprint, the Group is constantly extending its ambition to its industrial partners, who are increasingly concerned about limiting their greenhouse gas emissions and successfully exploring promising markets. In this way, Air Liquide is anticipating and building a more sustainable industry.

Turbo-Brayton technology is growing fast, with 50 cryogenic units already sold.

The solution developed by Air Liquide for ArcelorMittal should eventually lead to the annual production of 80 million liters of bioethanol.

**APPROXIMATELY
€480 M**

Cumulative capital expenditure for the 2014-2019 period in biomethane and hydrogen mobility

(1) Third International Maritime Organization (IMO) Gas Study 2014.

STORY #4

How can we achieve
high performance with increasingly
small electronic components?

#ELECTRONICS #PERFORMANCE





We are developing advanced molecules with our customers to meet new manufacturing challenges.





#ELECTRONICS #PERFORMANCE

When it comes to technologies driving the digital revolution, size matters, as do speed, power and sustainability. To stay in the race in fiercely competitive markets, electronics leaders are continually packing more performance into innovative products, while limiting their impact on the environment.

Electronics: in the factory of high- performance materials

100%

of latest-generation smartphones contain chips, memory, sensors and displays made with Air Liquide's gases and advanced materials.

As the latest generations of smart devices push the boundaries of physics, manufacturers of microprocessors, memory and components require hundreds of high-purity gases and materials, some so specialized that they have never been used before in any other industry. Working hand in hand with customers every step of the way, Air Liquide invents the advanced solutions they need to accelerate innovation from the research laboratory to full-scale fabrication.

Designing small, thinking big — Smartphones offer a striking example of how the Group brings real value to manufacturers, specifically the makers of critical semiconductor components. In a little over a decade, these powerful devices have transformed the way people live and work. Longer battery life, expanded memory, faster processing and increasingly sophisticated sensors enable users to enjoy an incredible range of apps and features that are narrowing the gap between the digital and physical worlds. Progress shows no sign of slowing, with impressive new capabilities on the horizon: 5G communication, foldable screens, enhanced voice recognition, augmented reality, virtual reality, holographic projections and artificial intelligence.

As technology drivers become more complex, so do the challenges for electronics manufacturers, and in particular the makers of microprocessors, the "brains" behind smart devices. These days, the typical "system on a chip" (SoC) that integrates all the various computing components covers a surface area of barely 9 mm², yet contains more than 4 billion transistors, which is more than double the amount possible



“We are able to move from a problem statement to a selection of proposed solutions very rapidly. We then test these solutions in our lab and our customer’s fab before scaling up. We love this challenge. It’s where we can really bring value.”

**Ashutosh Misra, Chief Technology Officer
at Air Liquide’s Electronics business line**

two years ago. The smallest features on each of these basic building blocks measure about 10 nanometers, which is 7,000 times thinner than a human hair. What’s more, they are incredibly fast, switching hundreds of billions of times per second.

The key challenge is how to build something so small reliably, sustainably and in a way that can be reproduced at industrial scale. With every new generation of a device, the design needs to be updated to increase performance while reducing power consumption, surface area and cost. That’s where Air Liquide comes in.

Moving fast from problem to solution — Chips start off as silicon, which is purified and sliced into wafers before undergoing a complex process of deposition, patterning, etching and other high-precision tasks. Up to 800 different steps are involved, requiring around 300 enabling gases and materials, including a large portion of all the elements in the periodic table. These range from commonly used inert gases such as nitrogen and helium to specialty reactive gases and advanced liquids or solids. In simple terms, producing an integrated circuit on a chip is like building a multi-story tower one level at a time, using specific tools to accomplish different tasks. When new questions arise, inventive answers are required.

Air Liquide materials scientists and engineers turn these design problems into solutions through innovation. This involves working closely with customers to tailor Air Liquide’s advanced solutions and materials to

**THE ELECTRONICS
ACTIVITY AT AIR LIQUIDE**

Air Liquide is a world leader in molecule design, manufacturing and delivery for the electronics industry. The Group’s Electronics business line continually innovates to support the makers of semiconductors, photovoltaics and flat-panel displays, working alongside them as a long-term partner. Worldwide, more than 3,800 Air Liquide employees are dedicated to the electronics sector to ensure customers receive the agile, reliable solutions they need.

their needs. More than 3,800 Air Liquide employees are dedicated to the semiconductor industry, including those working in our network of Innovation Campuses and Product Development Labs worldwide. Research in these centers focuses on discovering and developing advanced materials for the production of next-generation semiconductors and displays. In practice, the Group develops and synthesizes the right molecules for new processes and tests them in its Product Development Labs for proof of concept.

Guaranteeing quality, reliability and safety — Quality, reliability and safety are critical to high volume manufacturing, since at the nanometric scale, even the slightest imperfection in materials can have a major impact on customers’ processes. Air Liquide has therefore developed a Quality Management System for its Electronics activity, with specific processes, performance indicators and tools. An integral part of this approach is our commitment to support the Responsible Business Alliance’s mission to promote sustainable sourcing and working conditions in the electronics industry.

Pioneering new materials — Many of the advanced materials developed by Air Liquide have gone on to become industry standards, largely thanks to the company’s early engagement with its customers in the development phase. Among the Group’s latest innovations are enScribe range of advanced etching materials that facilitate the manufacturing of complex 3D memory structures, while greatly reducing the environmental impact. For example, when a major semiconductor customer adopted one of these molecules, it cut the entire sector’s equivalent carbon emissions by 1%. Another major innovation, a range of thin-film deposition and production materials based on Air Liquide’s unique expertise in silicon materials, illustrates the Group’s ability to continually enhance its molecule offering, developed to meet the electronics industry’s regulatory, design and safety requirements.

As the electronics sector continues to grow, market leaders are designing more “mega-fabs” that require considerably larger quantities of gas and new materials than previous generations. Air Liquide is supporting the growing needs of its customers. As a leading player in the business of infinitely small technology, the Group is perfectly placed to harness the remarkable potential of this market in the coming years and support the sector’s move toward more environmentally friendly manufacturing.

€1,964 M

Electronics activity revenue
in 2019

7.9%

growth in revenue from the
Electronics activity in 2019

“We’re constantly engaging with our customers to understand the technical challenges they’re facing as they introduce new materials into the manufacturing process. Our aim, through innovation, is to help them overcome these challenges.”

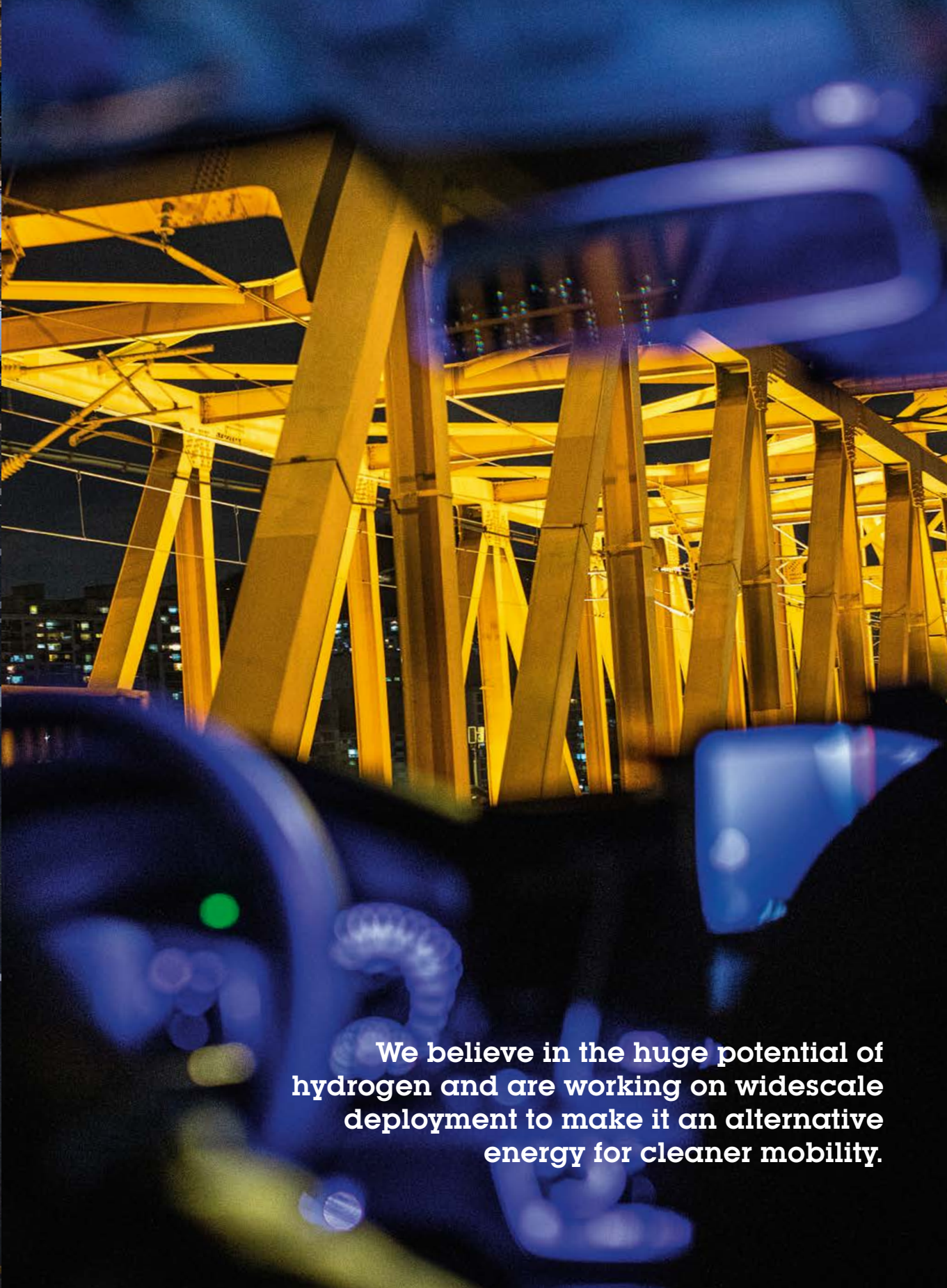
Ashutosh Misra

STORY #5

What role can hydrogen play
in **the energy transition?**

#HYDROGEN #MOBILITY





We believe in the huge potential of hydrogen and are working on widescale deployment to make it an alternative energy for cleaner mobility.



#HYDROGEN #MOBILITY

Hydrogen is becoming a major solution for the energy transition, attracting growing interest from multiple stakeholders worldwide. As a pioneer in this field, Air Liquide is bringing its expertise to mobility as well as numerous industrial processes.

Toward a hydrogen-powered society

The Bécancour proton exchange membrane (PEM) electrolyzer will save 27,000 tons of CO₂ emissions annually compared to traditional hydrogen production processes.

In June 2019, the environment ministers at the G20 meeting in Japan officially announced their intention to cooperate on promoting the use of hydrogen. This agreement was motivated by the climate emergency and the significance of recent innovations for a hydrogen energy society. Co-chaired by Benoit Potier, Air Liquide Chief Executive Officer, and Euisun Chung, Executive Vice Chairman of Hyundai Motor Group, the Hydrogen Council has grown from 13 members at its inception in January 2017 to more than 80 manufacturing and investment partners three years later. Politicians, business leaders and researchers all agree on one point: hydrogen has a key role to play in the energy transition.

Recognized strengths — This gradual alignment of the various leaders is a remarkable acknowledgment of the pioneering work carried out by Air Liquide, which has been producing and transporting hydrogen for nearly 50 years. This molecule, which is light, storable and transportable can be used in fuel cells with double the efficiency of traditional internal combustion engines. Hydrogen is a carrier for low-carbon energy — with zero greenhouse gas emissions and zero particles at the point of use — that can be produced by virtuous processes such as electrolysis.⁽¹⁾ It has vast potential, particularly for sustainable mobility, but also heating and heat networks, clean manufacturing processes, eco-friendly IT servers and renewable energy storage to compensate for intermittent production. With a charge time of less than 5 minutes and an autonomy of more than 770 kilometers,⁽²⁾ hydrogen fuel cell vehicles offer an effective solution for intensive use and long trips, which represent the bulk of CO₂

(1) Electrolysis consists of placing two electrodes into water to capture naturally occurring hydrogen. The electric current generated splits water (H₂O) molecules into hydrogen (H₂) and oxygen (O₂). This is a virtuous process if the electricity comes from a renewable source.
 (2) Bertrand Piccard drove 778 km in a standard Hyundai NEXO in normal traffic conditions. This is a world record for the longest distance driven by a hydrogen vehicle on a single charge.



“Hydrogen’s vast potential for the energy transition is well known today. Ambitious plans, particularly for transportation, have been introduced in Europe, South Korea, Japan, China and California. We have been an expert of this molecule for more than 50 years. Now the main challenge is to produce low-carbon hydrogen and ensure widespread use to create an entire sustainable value chain and take a step further towards clean mobility.”

Éric Sebellin, Markets and Strategy Director at Air Liquide’s Hydrogen Energy business line

emissions in the transportation sector. By reducing greenhouse gas emissions, urban pollution and reliance on petroleum-based fuel, hydrogen is proving its worth.

Unique expertise — As an expert in this molecule, Air Liquide can apply its expertise at every step of the hydrogen value chain, from production to distribution and storage. Managing around 200 production units and thousands of kilometers of pipeline, the Group has also designed and installed more than 120 charging stations worldwide. In addition, Air Liquide is committed to producing low-carbon hydrogen using water electrolysis, biogas and even Cryocap CO₂ capture technology, which it has implemented at its largest French production facility in Port-Jérôme since 2015.

Tangible solutions for industry and transportation — The Group has been building on its expertise to help industrial clients find low-carbon solutions. In 2019, Air Liquide collaborated with thyssenkrupp Steel on an innovative project for low-carbon steel production based on hydrogen (see p. 64).

It is also contributing to the widespread deployment of hydrogen in transportation, a sector responsible for 24% of CO₂ emissions.⁽¹⁾ From forklifts, buses and trucks to utility vehicles or even trains and ferries, hydrogen fuel has numerous applications. In France, the Group is helping Hype expand its fleet of hydrogen-powered Parisian taxis from around 100 vehicles in 2015 to 600 by the end of 2020. To this end, it has created

THE HYDROGEN ENERGY ACTIVITY AT AIR LIQUIDE

Air Liquide manages the entire hydrogen supply chain from production to storage, distribution and the development of applications for end users. Through its expertise, the Group is driving the widespread use of hydrogen as a source of clean energy, especially for mobility. To date, the Group has designed and installed 120 hydrogen charging stations worldwide and is investing in low-carbon hydrogen production. Used in fuel cells, hydrogen combines with oxygen from the air to produce electricity while releasing only water. No pollution is generated at the point of use.

⁽¹⁾ According to the International Energy Agency, 2017.

HysetCo with its partners (Ilex, Kouros, STEP and Toyota France) to accelerate sustainable mobility in the Paris region. In South Korea, Air Liquide is contributing to the ambitious national hydrogen mobility plan, which involves investing 2 billion euros in 310 charging stations by 2022 (700 by 2030). In same vein, the Group is also supporting China, which is actively involved in reducing greenhouse gas emissions. Already present in the country with around 90 industrial gas production plants, the Group has set up a joint venture with Houpu to install and market hydrogen charging stations. It has also signed a memorandum of understanding with Sinopec (China Petroleum & Chemical Corp) to help accelerate the rollout of hydrogen mobility solutions in what represents the world’s largest mobility market. Air Liquide will offer Sinopec its expertise in hydrogen supply chains to bring competitive solutions to the Chinese clean mobility market.

Creating an entire value chain — Aiming to become a leading supplier of low-carbon hydrogen, the Group has committed to producing 100%⁽¹⁾ of the hydrogen intended for the mobility market from virtuous processes⁽²⁾ by 2030. In the United States, Air Liquide has invested 150 million dollars in low-carbon liquid hydrogen production to supply the Californian market and meet the State’s ambitious targets: installing 200 charging stations by 2025 to drive the development of the world’s largest fleet of hydrogen-powered electric vehicles. Another major investment announced in early 2019 is the construction of the world’s largest membrane-based electrolyzer for the production of carbon-free hydrogen. This 20 MW electrolyzer will increase the current capacity of the Bécancour plant in Canada by 50% and help supply North American markets for industrial use and mobility.

Through its numerous innovations and achievements, Air Liquide is playing a leading role in making hydrogen a global reality and paving the way to a more environmentally friendly society.

18%

By 2050, hydrogen could account for 18% of the global energy mix.

10 M

Air Liquide’s current hydrogen production is capable of charging 10 million hydrogen vehicles.

In the United States, Air Liquide has invested in a new renewable liquid hydrogen power plant capable of charging 40,000 fuel cell vehicles.

⁽¹⁾ When the right regulation is in place.
⁽²⁾ Biogas, renewable energies generated by water electrolysis, and capture and processing technologies for the CO₂ emitted in natural gas-based hydrogen production.



INVENTING THE FUTURE TOGETHER

For more than a century, we have been driven by a taste for discovery, cultivating this mindset through ongoing dialogue with our employees, customers, shareholders and innovation partners. We believe that when we understand and address shared challenges, we can create value for all and work together towards a more sustainable world.

Inventing the future with all our stakeholders

Air Liquide has come a long way since the invention of an air liquifaction process in a hangar in 1902! Our employees' taste for discovery and inventiveness have given rise to more than 11,000 patents covering nearly every sector of the economy and bringing innovative solutions to the challenges and needs of our customers (whether artisans, small and medium-sized businesses or large companies) and our patients.

67,000 employees	5 Innovation Campuses focused on the energy transition and the environment, healthcare and digital transformation
4,300 employees focused on innovation, including 1,300 researchers	
150 + nationalities in 80 countries	32% of Air Liquide share capital held by individual shareholders

Inventing the future is possible thanks to the demanding standards and taste for discovery of the Group's 67,000 employees, with their

wealth of diverse profiles and skills. Multicultural, multiskilled teams form a unique human asset, and their cohesiveness and commitment to Air Liquide values are the foundation for our success. Based on safety, ethics and diversity, this unique culture is supported by an ambitious human resources policy. Long-term careers and mobility are encouraged in the Group. To take into account new ways of working, which are becoming more collaborative and team-based, the Be, Act, Engage program was launched in 2019, with guidelines for promoting dialogue at every level of the organization. In particular, by encouraging employees to express their ideas and listen to one another, Air Liquide is creating the right environment for the Group's talent to engage more fully and move forward together.

The My Voice program, for example, urges employees to regularly share their feedback by asking them to score their satisfaction and engagement based on various criteria, including safety, customer-centricity, inclusiveness, trust and self-actualization. The aim is to better understand their needs, while identifying and implementing the necessary actions to improve their experience at Air Liquide.

In partnership with external innovation ecosystems, Air Liquide teams design and continually roll out new solutions to offer customers and patients the best experience on the market. This open innovation approach is demonstrated in a wealth of partnerships with around 100 industrial customers and 120 academic institutions, and collaborations with more than 100 start-ups all over the world.

Demonstrating this mindset, the Group's R&D centres worldwide have been transformed into five open and collaborative Innovation Campuses. Aimed at cross-pollinating skills and nurturing new ideas, the teams at these centers make a priority of customers, co-building new solutions with them.

In healthcare, a fast-changing sector, the Group is providing support to 1.7 million home-based patients. By working alongside healthcare professionals and patient associations, Air Liquide teams can develop innovative solutions for these patients, combining human expertise with digital technology while continually improving the support provided across the care pathway.

In the energy transition, Air Liquide is actively working with its Hydrogen Council partners to promote hydrogen globally as a key solution to the challenges of climate change.

Committed to communities, Air Liquide teams aim to help develop their local regions and support projects benefitting society. Through the Air Liquide Foundation and their entities, employees can engage with local and scientific communities, sponsoring initiatives in every region where the Group is present.

All this dialogue, energy and resulting action is made possible by the trust of our individual shareholders and institutional investors. With them, we are building profitable, regular and responsible growth.

In fact, we are building the future with all our stakeholders, as shown in the following pages showcasing some collaborations from 2019.



With our employees



300 Air Liquide inventors, experts and innovators were recognized in 2019 for their contribution to new solutions for customers and patients.

Anabel Morales, Process Engineer, and Nicholas Thomas, Product Manager at Air Liquide USA

The same spirit of invention has driven Air Liquide from the start. Through its annual Be Innovation internal event, the Group honors the in-house inventors, experts and innovators who have helped create and launch innovative

solutions. In 2019, more than 300 of them received awards in Frankfurt, Houston, Shanghai, Dubai and Paris. Making a shared commitment to developing and accelerating innovation: **that's inventing the future.**

With our customers



“When I have my helmet on, I’m in my own world, and Qlixbi is now part of it. With its simplicity, rapidity and reliability, this solution has radically changed the way I work.”

Craig Hall,
Managing Director,
IM Fabrications Ltd.

Developed with more than 700 welders, Qlixbi is revolutionizing the welding experience by combining new-generation gas cylinders and digital innovation.

Considering the real needs of our customers to improve their everyday work and create long-term value: **that’s inventing the future.**

With our patients

“Our ambition is to improve everyday life for people living with Parkinson’s disease. Recognizing the role of caregivers alongside health professionals is critical to improving patient care.”

Russell Patten,
Secretary General of the
European Parkinson’s
Disease Association
(EPDA)

Present for 10 years alongside patients living with Parkinson’s disease, Air Liquide has teamed up with EPDA to conduct an international survey aimed at raising public authorities’ awareness of the little-known but

essential role played by caregivers. Making a shared commitment to improving patients’ everyday lives and helping the people who help them: **that’s inventing the future.**



With our shareholders



“With my music, I feel I can impact the world in my own way. I feel the same about my Air Liquide shares. I’m sure I’m investing responsibly and ethically.”

Eurêka, aka Olivier,
slam artist and composer

Like Olivier, 420,000 individual shareholders support Air Liquide. Today, they hold 32% of the Group’s share capital. Their relationship of trust and loyalty with Air Liquide has existed since the Group’s creation in 1902, based on respect,

dialogue and proximity. For the Group, it’s a guarantee of stability and independence. Building lasting relationships with our shareholders: **that’s inventing the future.**

With civil society

“Unlike other forms of pollution, we could offset atmospheric pollution with ambitious measures carried out by governments and local authorities. The solution is shared. Everyone must act on their own scale.”

Gaëlle Uzu,
IRD Research Manager at the Institute of Environmental
Geosciences (IGE) in Grenoble⁽¹⁾

With the support of the Air Liquide Foundation, Gaëlle Uzu and her team are developing new indicators of air pollution exposure that could predict the toxicity of

particles present in the air, as well as their short-term impact on populations' health. Working together to improve health for all: **that's inventing the future.**

⁽¹⁾ A joint research unit supervised by CNRS/INSU, IRD, University of Grenoble, CNRS and Grenoble-INP.

With our innovation partners

“We’re undergoing a period of transition that’s imposing drastic changes in energy, construction and transportation. Flying Whales is at the cutting edge of this transformation, proposing a unique air transport solution with a light environmental footprint.”

Sébastien Bougon,
CEO of Flying Whales



With its helium-filled, hybrid-powered and ultimately 100% electric airship, Flying Whales proposes an innovative air transport solution for heavy cargo (up to 60 tons) with a light environmental footprint. The first flight is scheduled for 2023, with Air Liquide there to ensure take-off!

ALIAD, the Group's venture capital arm, has taken a stake in this promising young aviation company to support its development with Air Liquide's industrial and technological experience. Accelerating the ecological revolution: **that's inventing the future.**



PERFORMANCE 2019

2019 was a landmark year, characterized by a significant improvement in performance, a high level of investments to serve our customers and strengthen our efficiency, and the operational implementation of our climate action plan.

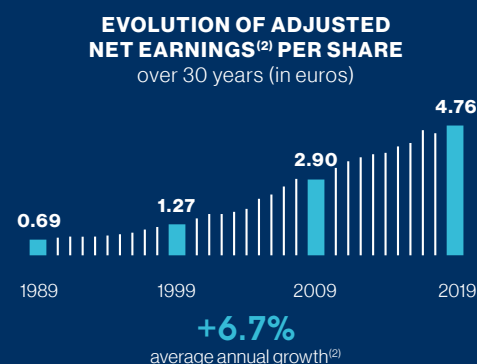
A regular long-term performance

2019 Key financial figures



REVENUE
€21,920 M

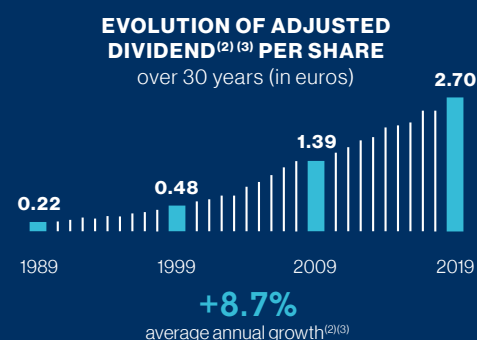
NET PROFIT
(Group share)
€2,242 M
+11.1%⁽⁴⁾



OIR MARGIN⁽⁵⁾
17.3%
+70 pbs⁽⁶⁾

RECURRING ROCE⁽⁷⁾
8.6%
+60 pbs

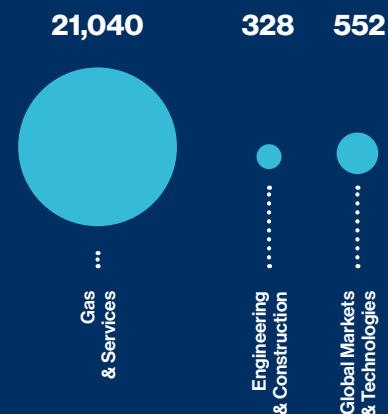
INVESTMENT DECISIONS
€3.7 bn



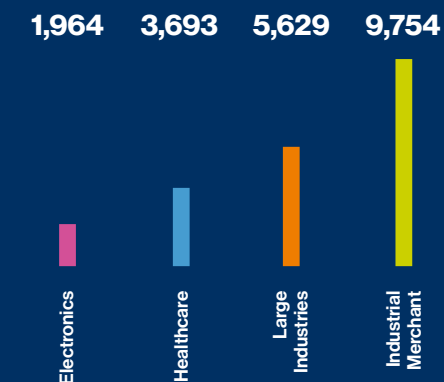
EFFICIENCY GAINS
€433 M

(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.
 (3) 2019 dividend subject to the approval of shareholders during the General Meeting on May 5, 2020.
 (4) Excluding exceptional and significant operations not impacting the Operating Income Recurring.
 (5) Operating Income Recurring.
 (6) Excluding energy impact.
 (7) Return on capital employed based on recurring net profit.

DISTRIBUTION OF GROUP REVENUE
(in millions of euros)



GAS & SERVICES REVENUE BY ACTIVITY
(in millions of euros)



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



INNOVATION

€317 M
of innovation expenses

330
new patents filed in 2019

> 300

industrial and scientific partnerships and collaborations with start-ups

GROUP SHAREHOLDERS
(as of December 31, 2019)



420,000
individual shareholders

€2.70

dividend per share proposed in the AGM of May 5, 2020

2019 Key extra-financial figures

SAFETY

1.2

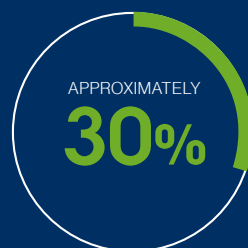
frequency rate of accidents with time off work per million hours worked. **This is the lowest frequency rate of the last 20 years.**

DIVERSITY

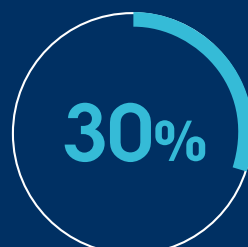
29%

of women among engineers and managers

ENVIRONMENT



Percentage of 2019 investment decisions that respond to environmental and climatic issues



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



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, while being more connected to its stakeholders and more innovative.

PERFORMANCE

+6 to 8% CAGR⁽¹⁾

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 in 2021-2022

Maintaining rating from S&P

“A” range

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

RESPONSIBILITY

- > Improving air quality and preventing global warming
- > Strengthening dialogue with Group stakeholders

Consolidated income statement (summarized)

AS OF DECEMBER 31, 2019

(in millions of euros)	2018	2019
Revenue	21,011	21,920
Other income	188	201
Purchases	-8,276	-8,154
Personnel expenses	-4,146	-4,411
Other expenses	-3,562	-3,625
Operating income recurring before depreciation and amortization	5,215	5,932
Depreciation and amortization expenses	-1,766	-2,138
Operating income recurring	3,449	3,794
Other non-recurring operating income	4	1
Other non-recurring operating expenses	-166	-189
Operating income	3,287	3,606
Net finance costs	-303	-362
Other financial income	13	8
Other financial expenses	-63	-114
Income taxes	-731	-801
Share of profit of associates	4	1
PROFIT FOR THE PERIOD	2,207	2,338
- Minority interests	94	96
- Net profit (Group share)	2,113	2,242
Basic earnings per share (in euros)	4.49	4.76
Diluted earnings per share (in euros)	4.47	4.73

Consolidated balance sheet

(summarized)

AS OF DECEMBER 31, 2019

ASSETS (in millions of euros)	December 31, 2018	December 31, 2019
Goodwill	13,345	13,943
Fixed assets	20,847	22,673
Other non-current assets ⁽¹⁾	1,026	1,083
TOTAL NON-CURRENT ASSETS	35,218	37,699
Inventories and work in progress	1,460	1,532
Trade receivables & other current assets	3,533	3,379
Cash and cash equivalents ⁽¹⁾	1,770	1,057
TOTAL CURRENT ASSETS	6,763	5,968
TOTAL ASSETS	41,981	43,667
EQUITY AND LIABILITIES (in millions of euros)		
Shareholders' equity	17,783	18,870
Minority interests	424	454
TOTAL EQUITY	18,207	19,324
Provisions and deferred taxes	4,367	4,573
Non-current borrowings	11,710	11,567
Non-current lease liabilities	0	1,088
Other non-current liabilities ⁽¹⁾	268	308
TOTAL EQUITY AND NON-CURRENT LIABILITIES	34,552	36,860
Provisions	325	268
Trade payables and other current liabilities	4,526	4,396
Current lease liabilities	0	244
Current borrowings ⁽¹⁾	2,578	1,899
TOTAL CURRENT LIABILITIES	7,429	6,807
TOTAL EQUITY AND LIABILITIES	41,981	43,667

(1) Including derivatives.

Consolidated cash flow statement

(summarized)

AS OF DECEMBER 31, 2019

(in millions of euros)	2018	2019
Funds provided by operations	4,242	4,859
Changes in working capital	613	-37
Other cash items	-139	-110
Net cash from operating activities	4,716	4,712
Purchase of property, plant and equipment, and intangible assets	-2,249	-2,637
Purchase of financial assets and the impact of changes in scope	-129	-537
Proceeds from sale of property, plant and equipment, intangible and financial assets	108	589
Net cash in investing activities	-2,270	-2,585
Distribution	-1,234	-1,237
Increase in capital stock	138	39
Purchase of treasury shares	-64	-148
Transactions with minority shareholders	-1	-31
Lease liabilities repayments (including net interests)		-287
Impact of exchange rate changes and net debt of newly consolidated companies and others	-449	-301
Change in net debt	836	162



Air Liquide

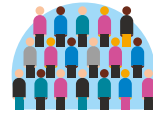
A world leader in industrial gases and related services

A unique model

OUR PROFILE



~67,000 committed employees in 80 countries



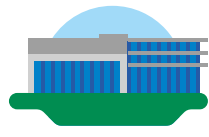
+3.7 million customers and patients



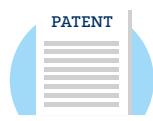
Extensive scientific and technical expertise in industrial gases (oxygen, nitrogen, hydrogen, etc.)



4,300 employees contributing to innovation



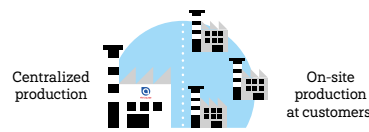
5 Innovation Campuses



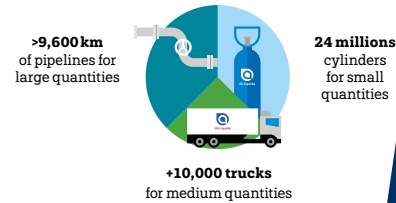
11,000 patents



2 industrial gases production modes



3 industrial gases distribution networks



OUR BUSINESS MODEL



Long-term vision and clear strategy



A wide range of customers and applications



Major ability to innovate



Long-term customer contracts, indexed to energy prices



Management and optimization of production and distribution chain



Active involvement in new markets



Global presence and local activity

OUR ACTIVITIES

LARGE INDUSTRIES 26%^(a)

Industrial gases in large quantities in the framework of long-term partnerships

INDUSTRIAL MERCHANT 44%^(a)

Industrial gases in small and medium quantities, application technologies, small equipment and related services serving a wide range of customers

ELECTRONICS 9%^(a)

Ultra-pure gases in large quantities and development of new molecules

HEALTHCARE 17%^(a)

Medical gases, products and services to support patients and customers in the hospital and at home

GLOBAL MARKETS & TECHNOLOGIES 3%^(a)

Molecules, equipment and services to support the markets of energy transition and deep tech^(b)

ENGINEERING & CONSTRUCTION 1%^(a)

Plants and equipment for industrial gas production

TO SUPPORT ALMOST ALL ECONOMIC SECTORS



- ▶ Chemicals
- ▶ Refining & energy
- ▶ Metals



- ▶ Materials & energy
- ▶ Automotive & fabrication
- ▶ Food & pharmaceuticals
- ▶ Technology & research
- ▶ Entrepreneurs & distributors



- ▶ Semiconductors
- ▶ Flat panels
- ▶ Photovoltaic



- ▶ Hospitals
- ▶ Home healthcare
- ▶ Hygiene & specialty ingredients



- ▶ Energy transition
- ▶ Deep tech^(b)



- ▶ Customers choosing to insource their industrial gas needs

(a) Percentage of 2019 Group revenue.

(b) Disruptive technologies based on scientific breakthroughs that can fundamentally change design and production methods.



**Thank you to
all our employees,
customers, patients,
shareholders and
innovation partners.**

**We are proud to be
working with you
to help build a more
sustainable world.**

**Together, let's continue
to invent the future.**



AIRLIQUIDE.COM

See our annual publications on our website: Annual Report,
Universal Registration Document, Shareholder's Guide,
On Air Magazine, Interactions....



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We would like to thank all our employees, customers, patients and partners who received our photographers for this Annual Report, and in particular ArcelorMittal, Daedo Energy, Ghent industrial port, IM Fabrications Ltd., Incheon International Airport Corporation, the Institute of Environmental Geosciences in Grenoble, Fermob, Flying Whales, Klaus Hesse and Monika Bischoff, and Licher MT teams, Saint-Joseph Hospital in Paris.

Published by the Communications department of the Air Liquide group, April 2020
75 quai d'Orsay, 75007 Paris, France

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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 2,602,235,812.00 euros

A world leader in gases, technologies and services for Industry and Health, Air Liquide is present in 80 countries with around 67,000 employees and serves over 3.7 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.