

# INTERACTIONS

AIR LIQUIDE'S LETTER TO SHAREHOLDERS - NOVEMBER 2018

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3,800

IS THE NUMBER  
OF EMPLOYEES  
CONTRIBUTING TO  
INNOVATION.

 **Air Liquide**  
creative oxygen



**BENOÎT POTIER,**  
Chairman and CEO

## EDITORIAL

# Innovation, a growth driver at the core of our strategy

**Our Group delivered solid performance in the 1<sup>st</sup> half of 2018 as we deployed our customer-centric strategy in a more supportive economic environment.**

Group revenue reached up to 10.2 billion euros, driven by growth of all our activities. Geographically, every region of the world where we are present progressed. Along with global sales growth, Group performance benefited from an increased operating margin in Gas & Services, excluding energy impact. We are also performing well in terms of operational efficiency gains and we will reach Airgas synergies one year ahead of plan. In addition, investment opportunities 12 months out have reached their highest level in the last three years.

**The solid performance during the first half of this year and the business development momentum we are seeing strengthens our confidence in our ability to pursue growth and achieve our objectives, in line with our NEOS strategic plan.**

**Innovation figures at the heart of our strategy** and has been part of Air Liquide's DNA since the founding of the company. Air Liquide remains the most innovation-focused Group in its industry, with around 300 million euros spent in 2017, and with 3,800 employees contributing to innovations. **This is why we are spotlighting innovation in this new edition of your Letter.**

Our innovation is customer-centric in order to provide effective solutions tailored to customers' needs. And our innovation is open to the world in order to accelerate the implementation of new ideas. Our Paris Innovation Campus, located in France at "Plateau de Saclay", is emblematic of this approach. It was created to facilitate cross-fertilization of expertise and engage with a world-renowned scientific ecosystem.

**I firmly believe that innovations from a Group such as ours can help deliver better solutions to the many challenges** our planet and societies currently face. This is especially true for issues such as the **energy transition, the environment, healthcare and the digital transformation.**

**Being an Air Liquide shareholder means more than just a financial investment: it means contributing to the emergence of responsible growth as part of a commitment to sustainable development.** With its focus on innovation, this issue of *interactions* illustrates this strategy. This is also an excellent opportunity to thank you for your loyalty and your trust in Air Liquide.

**Thank you for your commitment, and enjoy your reading.**



**READ THE GROUP'S  
LATEST RESULTS**  
on the website [airliquide.com](http://airliquide.com)

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07.25.2018

Europe

## Partnership with IDF Europe to support organizations advancing diabetes care

Air Liquide has announced its support for IDF Europe, the European headquarter of the International Diabetes Federation, in its advocacy and awareness-raising activities targeting people affected by this chronic illness, society, and policymakers in Europe. The Group's support also aims to advance diabetes research. As a major public health issue, this disease affects 425 million adults worldwide<sup>(1)</sup>.

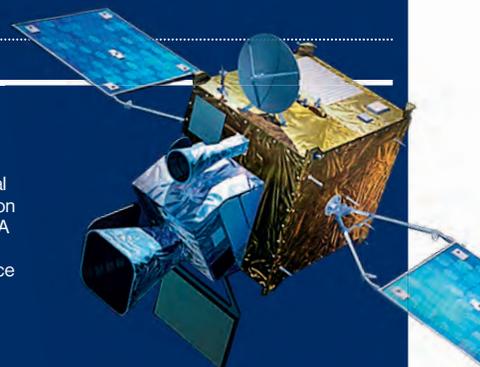
*(1) IDF Diabetes Atlas, 8<sup>th</sup> edition 2017.*

07.10.2018

Europe, United States, Asia

## New xenon and krypton contracts for Space and Electronics customers

Air Liquide has signed several multi-year contracts worth a total of more than €50 million, and started supplying xenon and krypton to the semiconductor and satellite industries in Europe, the USA and Asia. The semiconductor industry uses these noble gases to produce high-end flash memories at a lower cost. In the space industry, all-electric propulsion satellites also use xenon, reducing the satellite's weight and therefore reducing launching costs.



09.27.2018

Paris, France

## A deep-tech start-up accelerator on the Paris Innovation Campus

On the occasion of Paris Innovation Campus inauguration, Air Liquide announced that its Campus will host in 2019 a deep-tech<sup>(1)</sup> start-up accelerator. The Group will host start-ups, grant them access to shared experimental facilities and customized support from Air Liquide experts, with the objective to accelerate the industrialization of their offer.

*(1) Start-ups seeking to push technological boundaries, thanks to scientific advances that will lead to real breakthroughs.*



06.28.2018

Shanghai, China

## Partnership for the development of hydrogen mobility

Air Liquide and the Chinese start-up STNE have signed a partnership to accelerate the rollout of hydrogen-powered electric truck fleets in China. Through this agreement, Air Liquide has acquired a minority stake of around €10 million in the Chinese start-up. Furthermore, the Group will provide STNE with its expertise in the entire hydrogen supply chain, from production and storage to distribution. STNE aims to run a fleet of up to 7,500 trucks and to operate a network of around 25 hydrogen stations by 2020.

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**FOLLOW US on Twitter @AirLiquideGroup**



09.03.2018

Hobro, Denmark

## Inauguration of a pilot site for the production of carbon-free hydrogen

Air Liquide has inaugurated HyBalance, a pilot site for the production of carbon-free hydrogen. This facility uses electrolysis technology and allows to balance the electricity grid and store surplus electricity in the form of hydrogen that will be used in industry and transportation. The project, initiated in 2016, is led by Air Liquide.

06.22.2018

Cestas, France

## Inauguration of a new biomethane production unit

Air Liquide has inaugurated a new biomethane production unit in Cestas, near Bordeaux, which enables the production of biogas from organic matter of farm origin and its purification into biomethane. This energy injected into the natural gas grid supplies a new multi-energy station that distributes, in particular, bio-NGV (Natural gas for vehicles). This clean non-fossil fuel reduces fine particulate emissions by 85%, CO<sub>2</sub> emissions by 90%, and noise pollution by up to 50%. By the end of 2018, the station will also supply liquid nitrogen to trucks equipped with cryogenic coolers. This opening illustrates the strong growth of the new energy transition markets, notably in France, and is an example of a circular economy.

INNOVATION

# The Air Liquide global ecosystem

With their unique, constantly expanding scientific expertise in essential small molecules, the Air Liquide innovation teams are working around the world to offer innovative solutions capable of rising to energy, environmental and societal challenges.

**3,800**  
employees  
contribute to innovation

**300**  
new patent  
applications per year

**60%**  
of Research and Development  
projects conducted with  
external partners

**100**  
start-ups work  
with Air Liquide  
around the world

## AIR LIQUIDE INNOVATION CAMPUSES





**“Our Innovation Campuses are not only interconnected, they are open to their environment. For example, our Shanghai Campus in China receives almost 500 visitors a month, half of whom are from outside the Group.”**

**Philippe Queille**, Air Liquide Vice President Research and Development for Asia



develop solutions for new markets and meet our customers' specific needs in terms of gas applications.

**Tackling societal challenges**

Our R&D approach in Innovation Campuses is dedicated to the essential small molecules territory and data science. The aim is to develop Air Liquide's knowledge of the molecules that have been at the heart of the Group's activities since it was founded: oxygen, nitrogen, hydrogen, helium, argon, etc. Essential for life development, these molecules also play a key role in contemporary issues such as climate change, the rise in chronic diseases or the acceleration of the digital revolution. To tackle these challenges, 3,800 women and men with a wide range of profiles and expertise contribute every day to innovation.

**“Today, our Research and Development is working to enrich our knowledge of molecules, explore new applications in order to meet societal challenges, and bring a differentiating offer in our markets.”**

**Olivier Letessier**, Air Liquide Vice President Research and Development

**A network open to the world**

R&D projects involve collaborative work between teams from the Group's different Innovation Campuses, whose skills complement one another. These Campuses are strategically located around the world: in China, France, Germany, Japan and the United States (see left-hand page), and develop expertise in tune with the needs of their local markets: electronics, healthcare, new energies, hydrogen energy... The teams are in constant interaction with the Group's other business lines and build partnerships with universities, research institutes, suppliers, customers, start-ups, within the context of an open innovation approach. Air Liquide also has several expertises centers around the world where teams



**PARIS  
R&D CENTER  
KEY FIGURES**

**500**  
employees

**15,000 m<sup>2</sup>**  
surface area

**48**  
laboratories

# The R&D Center of Paris Innovation Campus revamped

On September 27, Air Liquide has opened its new Paris Innovation Campus, on which the biggest Research and Development Center has been fully renovated. This Campus confirms that France is a key country for Air Liquide in terms of innovation. It has a great deal of talent there and can benefit from its international influence. France accounts for almost two-thirds of innovation expenditure.

### Encouraging cross-fertilization

This new place is open to the scientific and technological ecosystem of "Plateau de Saclay"<sup>(1)</sup>, which will eventually host 20% of French research<sup>(2)</sup>. Its campus organization strengthens Air Liquide's open innovation approach, facilitating exchanges with leading universities and colleges, public research institutes, private partners, SMEs and start-ups. The Campus will also include a deep-tech start-ups<sup>(3)</sup> incubator, starting 2019. The Group will offer those start-ups accommodation, access to shared testing spaces, as well as a support program by Air Liquide experts to accelerate their offers industrialization.

### An innovative, sustainable building

The new building of the R&D Center also sets an example in terms of sustainable development. In addition to its high energy

efficiency, it favors renewable energy sources such as biomethane, wind power and solar power. A fuel cell powered by hydrogen has also been installed to supply part of the building's heating, cooling and electricity needs.

### Connecting with society's trends

The purpose of this Campus is to explore new applications and develop technologies linked to the energy and environmental transition, health and the digital transformation. The subjects include new technologies for capturing and using CO<sub>2</sub> and preventing global warming, data science and artificial intelligence committed to energy efficiency, and connected healthcare to support patients and make the work of healthcare professionals easier.

*(1) A French scientific and technological cluster near Paris.*

*(2) According to the Paris-Saclay community.*

*(3) Start-ups seeking to push technological boundaries, thanks to scientific advances that will lead to real breakthroughs.*



**“Paris Innovation Campus is a place where Group employees, together with our customers and partners, work to transform ideas into innovative products and services and help tackle the challenges faced by our society!”**

**Olivier Letessier**, Air Liquide Vice President Research and Development



## Working towards cleaner and quieter deliveries

**As a result of the popularity of online orders for fresh or frozen produce, urban deliveries are on the increase.**

Considered to be noisy and dirty, they have become a major issue for online sales and refrigerated transport companies, which also have to comply with increasingly strict environmental standards. Until now, the refrigerated small utility vehicles (SUV) delivering these products in urban centers have used a conventional refrigeration system that runs on diesel, which requires a lot of energy and is noisy. To respond to these pollution and noise issues, vehicles are gradually shifting to electric motors and must be equipped with new, more sustainable, cleaner cooling solutions.

A team of researchers from Air Liquide, based at the Paris Research and Development Center, has studied this problem with French operational teams and developed a standalone, clean and silent cryogenic refrigeration unit, specially designed for this category of vehicles. The solution, named Cryocity™, uses dry ice, a powerful cold source at -78 °C<sup>(1)</sup>. Dry ice is injected in the state of liquid CO<sub>2</sub> and changes to solid state

in a heat exchanger tank, set up in a cold box on the truck's ceiling. Thanks to this system, the required temperature is ensured for 10 hours.

A prototype has quickly been developed thanks to different expertises within the Group. It has been tested in real conditions with two partners in France: Comptoir du Frais, a distributor of chilled products for restaurants, and Petit Forestier, a refrigerated vehicle rental specialist. The first tests proved very successful and enabled improvements in the device's performance, particularly for dealing with demanding climate conditions. The Group is therefore continuing development of this solution in order to produce it on a larger scale and meet the needs of a buoyant market. Cryocity™ has many benefits, including a 50% reduction in the carbon footprint compared with fossil-fuelled systems, day and night silent deliveries, and improved air quality in cities.

(1) -172.4 °F.

# Medical gases: essential tools in the continuum of care

Air Liquide supplies medical gases to diagnose, prevent and treat various diseases. The Research and Development department's expertise and interdisciplinary approach in the medical field enable to explore the potential of these gases and demonstrate their effectiveness and benefits across a range of indications. Three questions to Dr Juan Fernando Ramirez, Medical Research and Development Vice President at Air Liquide.

## What are the Air Liquide medical gases?

Air Liquide provides healthcare professionals with pharmaceutical gases with drug status. Our main medical gases are used in different therapeutic areas, such as medical oxygen for respiratory diseases or intensive care, medical nitrous oxide, oxygen and nitrous oxide premix in anesthesia and analgesia, or nitric oxide, in resuscitation.

Used at hospitals, Air Liquide medical gases are also provided to some specialists in primary care. Like any medication, they are subject to market authorization procedures issued by healthcare authorities based on the results of preclinical and clinical trials led by the Group. In addition to gas quality, Air Liquide oversees the security of their administration system and the entire supply chain (delivery, storage and maintenance) and guarantees the continuity of medical gas supply.

## What are the R&D objectives in the medical sector?

Our ambition is to develop offers that target an unmet medical need, offer a real therapeutic benefit to patients and healthcare professionals,

## Air Liquide supports patients throughout their hospital stay

### Explore

#### CELLS CULTURE

Biological cultures are developed within gaseous controlled atmosphere

#### SAMPLING

Calibration of analysers by gases

#### CRYOPRESERVATION

Liquid gas is used to cool, preserve and store tissues and cells

### Diagnose

#### LAPAROSCOPY

Gases are insufflated to dilate the abdominal wall and enable better visualization of organs

#### PULMONARY FUNCTION TEST

Specific gaseous mixtures are used to carry out lung functional tests for checking blood gaseous exchanges

#### MRI

Liquid gas cools the MRI magnets

### Prevent or treat

#### ACUTE HYPOXIA

Gas for the treatment of low oxygen saturation

#### PAIN

Gas for managing the pain associated with medical procedures

#### ANAESTHESIA

Gas used as an anaesthetic adjuvant

#### RESUSCITATION

Gas used to support breathing

#### PULMONARY HYPERTENSION

Medical gases are used to support breathing and to treat acute pulmonary hypertension



and also respond to healthcare system challenges. Our teams identify new properties of pure gases and gas mixtures and demonstrate their use to the patient through clinical trials. In addition to the therapeutic effectiveness of a formulation, we show how it optimizes patients continuum of care by reducing their time in hospital and medication use or improving their quality of life.

**What are Air Liquide's current lines of research in the area of medical gases?**

In 2016, we launched a clinical research program to test the effectiveness of nitrous oxide in the treatment of chronic neuropathic pain<sup>(1)</sup> which affects 7% of the global population<sup>(2)</sup>. The results of this study will be available in 2019. We are also carrying out exploratory work on the therapeutic properties of rare gases such as argon which could have a protective effect on the brain in the event of a disruption in oxygen supply. All of our research draws on a detailed analysis of the patient's needs, which underpins our programs by factoring in his pains, disease and uses.

*(1) Diabetes, chemotherapy or trauma-related pain lasting more than three months.*

*(2) Based on the 2014 epidemiology study into neuropathic pain by the International Association for the Study of Pain.*

# Digital solutions in healthcare



care, whether upon treatment initiation (tutorials, coaching, etc.) or for its monitoring. For example, Chronic Care Connect, a remote monitoring solution, supports remotely patients with chronic conditions at home, providing them with personalized support and teaching content. Medical data is sent to and analyzed remotely by the prescriber. Air Liquide's objective is to offer, in the medium term, platforms for monitoring patients throughout their continuum of care.

## THE CHALLENGES

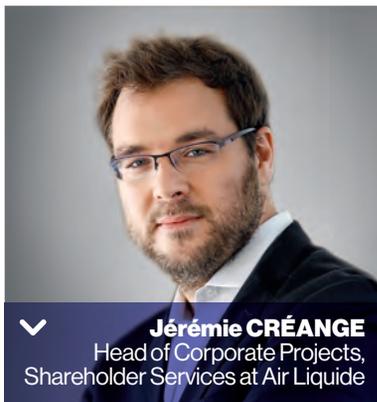
**In a context of challenges faced by the healthcare field and the new digital usages, Air Liquide strives to provide effective responses for the whole ecosystem.** Digital has simplified numerous aspects of everyday life, for communicating, consuming, managing administrative procedures, etc. In the healthcare field, digital can also be a way of facilitating exchanges between doctors and patients. At the same time, given the challenges of cost control, healthcare systems need to rethink their models of care and funding, and are looking for tools to measure the effectiveness of treatments and continuum of care. Digital tools also have a key role to play in data collection, long-term monitoring and reporting.

## THE ADVANTAGES

**Air Liquide's digital solutions aim to encourage the observance of treatments and ensure therapeutic effectiveness.** For some chronic diseases, hospitalization can be avoided thanks to remote monitoring at home. Tomorrow, by crossing technical, medical, behavioral and social data, such solutions will help to define a specific profile for each patient, which will help healthcare professionals to understand each person's individual needs and provide an appropriate service. Lastly, the sharing of information facilitates coordination throughout the continuum of care, ensuring that patients are taken care of through all channels and by all those interconnected in the healthcare ecosystem (prescribing doctors, nurses, hospitals, etc.).

## THE SOLUTIONS

**The digital solutions developed by Air Liquide are designed both for patients and healthcare professionals.** They support patients through part of their continuum of



**“Protecting our shareholders’ personal data is an inherent part of the trust between us.”**

### THE QUESTION

**“How does Air Liquide ensure personal data protection for its shareholders?”**

Protecting individual shareholders’ personal data is a priority at Air Liquide. Shareholders with registered shares made the decision to be known by Air Liquide. We only collect data that is strictly necessary and this data is useful for involving shareholders in Group activity such as the Annual General Meeting and Shareholder’s meetings across France, and keeping them up to date with Group news. This data is collected in the ‘Register’, securely stored, managed by strictly authorized persons and retained for a fixed period of time in compliance with regulations. For more information, you can read the legal notice at [airliquide.com](https://www.airliquide.com).

### FURTHER INFORMATION

**In line with the General Data Protection Regulation (GDPR) enforced in the European Union on May 25 of this year, you may exercise your rights over this data at any time** (access, rectification, erasure, restricted processing or portability) by writing to: Laurence Thomazeau, Data Protection Officer – 75, quai d’Orsay – 75007 Paris, France, or by completing our dedicated contact form (<https://www.airliquide.com/group/contact-us-gdpr>).



**“Collective intelligence enables to accelerate innovation.”**

### THE QUESTION

**“How do you illustrate Air Liquide’s open innovation approach?”**

Our open innovation approach relies on the collective intelligence of our employees and external partners – universities, start-ups, research and technology institutes. It enables us to accelerate the Group innovation. One of our many initiatives that illustrate this approach is the Air Liquide Scientific Challenge, launched by the Research and Development department in 2016 and renewed this year. Air Liquide invites the scientific community to submit new applications related to the essential small molecules<sup>(1)</sup> in order to provide new solutions to society’s present and future challenges of air pollution and climate change. The three awarded projects will benefit from up to €1.5 million in funding through cooperation agreements signed with the Group, and each winner will receive €50,000. In 2016, the first edition of this challenge rewarded three projects from the 130 proposals submitted from 25 countries, which Air Liquide is currently developing with the winners. The 2018 edition looks promising for the three categories: hydrogen production, its use in industrial processes and sustainable food production thanks to the essential small molecules.

*(1) Oxygen (O<sub>2</sub>), nitrogen (N<sub>2</sub>), hydrogen (H<sub>2</sub>), helium (He), argon (Ar), etc.*

# Offer shares!



**Would you like to give your children, grandchildren, nieces and nephews, a gift that has value and meanings? Beyond the financial investment, giving them Air Liquide shares means sharing with them the shareholder culture and your commitment to the Group.**

It is also a way of getting them started in finance, passing on your interest in investment and showing them that they can participate in the real economy through their involvement in the development of a global industrial leader.

To celebrate a special occasion (end-of-year celebrations, graduation, birthday, wedding, etc.), it is very easy to give shares, as a customary gift, without having to make a legally notarized declaration or pay a duty. It must represent a relatively small part of the grantor's assets.

Other forms of gifts are available: hand-to-hand, simple, shared, or transgenerational gifts. Depending on your relationship with the grantee, you may benefit from some tax

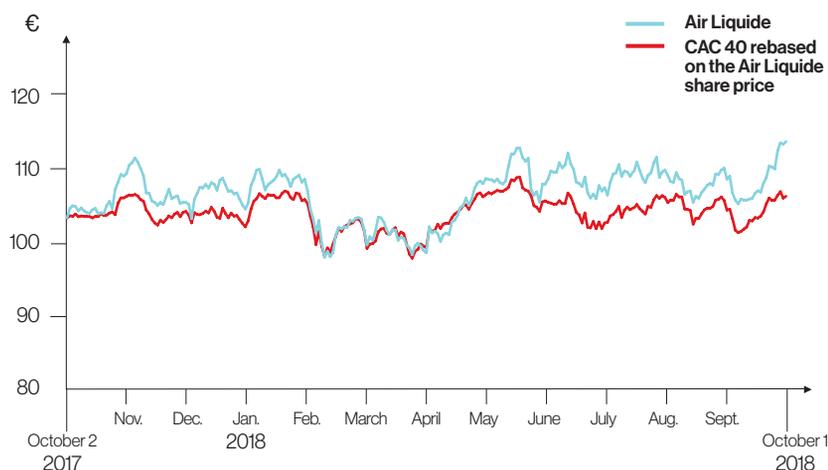
advantages. In some cases, donations can help to reduce inheritance tax: you can get advice from your notary. You can also give your Air Liquide shares while continuing to receive dividends by enabling partial gifting. You can also opt for a facility to forbid disposal if you want to prevent the grantee from selling them. Shareholder Services experts are available to give you more information and provide you with support.

## SHARE PRICE

### EVOLUTION OF THE AIR LIQUIDE SHARE PRICE FROM OCTOBER 2, 2017 TO OCTOBER 1, 2018<sup>(1)</sup>

**Air Liquide: +10.0%**

**CAC 40: +2.9%**



<sup>(1)</sup> Share price adjusted to take into account the 2017 attribution of free shares.



### AIR LIQUIDE ON THE PODIUM!

**Air Liquide received the 1<sup>st</sup> Prize for “Democracy shareholding, transparency of information and quality of communication” and the 1<sup>st</sup> Prize “Composition of the Council” of the Corporate Governance Awards organized by the French magazine L’AGEFI.** An acknowledgment of the good governance of your Group and its commitment to its individual Shareholder’s relations.

**Air Liquide was also a winner at the Young Shareholders Palmes d’Or, organized jointly by the French business school EDHEC and French federation of investors F2iC.**

This prize is awarded by a panel of students to honor the most appealing companies from young and future shareholders’ point of view.



22

November 22 and 23, 2018  
**ACTIONARIA FAIR**

Air Liquide attends the 21<sup>st</sup> Actionaria Fair, a trade fair in Paris dedicated to corporate investments. Come and discover how Air Liquide is contributing to change the world.

26

November 26, 2018  
**SHAREHOLDERS' MEETING**

Air Liquide Shareholder Services meet with shareholders in La Rochelle, France.

30

November 30, 2018  
**WITHHOLDING TAX EXEMPTION FOR FRENCH RESIDENTS**

**Deadline for receiving your statement.** If your official income for tax purposes in 2017 (printed on the income tax notice you received in August or September 2018) is less than €50,000 for a single person or €75,000 for a couple taxed jointly, you can claim an exemption from the 12.8% withholding tax on the dividends you will receive in 2019. You have until November 30, 2018 to send your account manager a sworn statement with your tax threshold level. This application must be renewed each year. As a direct registered shareholder, you can apply for the exemption from your personal online Account.



December 2018  
**REGISTER YOUR SHARES!**

**If you hold bearer shares, do not delay in sending your bank a request to convert them into registered shares.** This will allow you to begin receiving the loyalty bonus in 2021. The form is available from the Media Library, in the "Shareholders" section at [airliquide.com](http://airliquide.com).

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December 27, 2018  
**SELL ORDERS**

In order to be recorded in 2018, sell orders must be placed by this date.

31

December 31, 2018  
**BUY ORDERS**

In order to be recorded in 2018, buy orders must be placed by this date, before 2 pm (closure of Paris stock exchange trading).

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February 14, 2019  
**RESULTS**

Publication of 2018 Full Year Results.



**CONTACT US**

- Via the "Shareholders" section at [airliquide.com](http://airliquide.com)
- By mail at **75, Quai d'Orsay, 75 321 Paris Cedex 07, France**
- By phone +33 (0)1 57 05 02 26 (from outside France) or 0 800 166 179 Free from a French landline



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Open Monday-Friday  
9 am to 6 pm (GMT +1)  
**75, quai d'Orsay, Paris 7<sup>e</sup> - France**



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