Air Liquide

Climate Transition Plan

2024

SUMMARY

Executive Summary

Our Convictions on Climate Change: achieve carbon neutrality by 2050

1. We have a role to play in decarbonizing the industry, and it brings opportunities
2. We must decarbonize our own activities
3. We are well positioned to mitigate risks and capture opportunities
4. We align our actions with the pace of society

Focus

The world we are preparing for

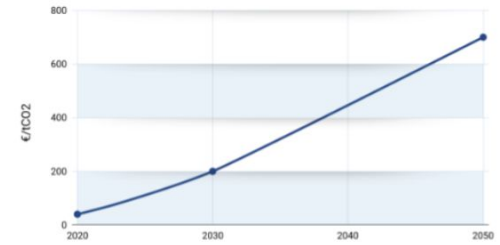
As the world confronts the escalating impacts of climate change, aligning global efforts with a 1.5°C pathway as outlined in the Paris Agreement is essential to ensure a sustainable future for all.

Preparing to participate in and contribute to a 1.5°C world, as is the objective of this plan, requires projections of long-term energy transition scenarios. Because achieving such a transition at this pace is a formidable challenge, these scenarios require unprecedented global collaboration and commitment from governments, civil society and the industry. They form the basis for our Climate Transition Plan.

Energy transition pathways typically go as follows: implicit CO_2 pricing rises willingness-to-pay for decarbonized solutions, zero-carbon electricity deployment accelerates (88% of total electricity production in 2035 in IEA scenarios) driving the energy sector to Net Zero. It is later followed by the industry and transportation sectors thanks to massive electrification and low-carbon industrial gases.

1/ the implicit price of CO_2 will need to evolve to drive customer willingness-to-pay for decarbonized solutions

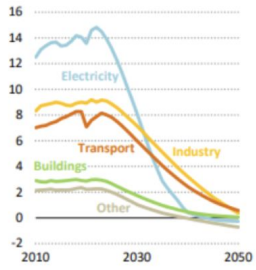
Implicit CO_2 price in a 1.5°C transition scenario



Source: IPCC SR-15, chapter 2

2/ the pace of decarbonization will vary across industries and geographies

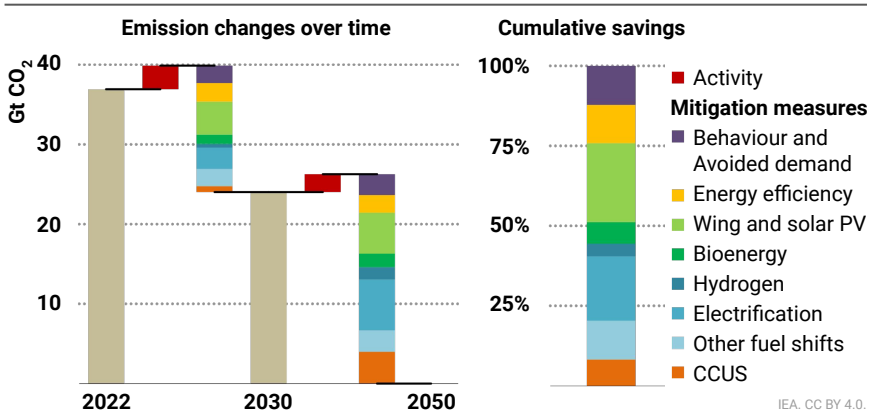
Net emissions by sector in NZE Scenario



Source: International Energy Agency, Net Zero Roadmap, 2023 Update

3/ deployment of renewables, carbon capture and hydrogen will need to accelerate and will be critical

Figure 2.5 ▷ CO_2 emissions reductions by mitigation measure in the NZE Scenario, 2022-2050



Notes: Activity = energy services demand changes from economic and population growth. CCUS includes BECCS and DACS

Expansion of solar PVC, wind and other renewables, energy intensity improvements and direct electrification of end-uses combined contribute 80% of emission reductions by 2030

Source: Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach - 2023 Update, IEA

As some sectors will be deeply reshaped by the transition to a carbon neutral world, industrial gases will therefore be ever more crucial – pushing the Group to leverage innovation to shift its technology, energy and feedstock sourcing and to accompany its customers' transitions as it did during previous market evolutions. How the Group prepares to achieve what is expected from it for the energy transition is the object of this plan. It serves as our blueprint to undertake coordinated and ambitious actions necessary to shift towards a net zero world by 2050. Our Group's Climate Transition Plan is strongly tied to the assumptions[1] described above as our trajectory will have to be synchronized with levers and instruments that may evolve at different paces.

[1] See Appendix 2 for details on the material assumptions supporting this plan.

Our Convictions on Climate Change: achieve carbon neutrality by 2050

At Air Liquide, we recognize the climate urgency and strive to participate in the implementation of the Paris Agreement[2]. Because this implies reaching net zero CO_2 emissions around mid-century[3], the Group is committed to achieving carbon neutrality across the value chains it operates in by 2050.

This has two interrelated implications:

- on one hand, because the Group is a key decarbonization enabler, it must have a clear vision of how it will accelerate the development of its activities where they are necessary for the energy transition;
- on the other hand, this must come with a roadmap to decarbonize its own activities in order to achieve carbon neutrality by 2050.

All of which can only happen while acting with other economic players and society as a whole.

1. We have a role to play in decarbonizing the industry, and it brings opportunities

As the world embarks on a transition to carbon neutrality, many industries will be deeply reshaped, driving emerging needs around our historical products: hydrogen, air gases and CO_2. As a consequence, Air Liquide has a key role to play in bringing its operational and technological expertise:

- to accompany our existing customers' shift towards low-carbon processes, which will rely on large amounts of low-carbon industrial gases (e.g., chemicals, steel markets etc.);
- to meet the needs of other market transitions driving new industrial gas and associated services demand (e.g., mobility, cement and lime etc.).

This, while continuing to bring higher efficiencies to the healthcare sector and the numerous industries that will need our small essential molecules.

The Group is prepared to play this role, relying on:

- its customer intimacy and geographically balanced footprint;
- its portfolio of technologies to decarbonize with advantageous CO_2 abatement costs and technological innovation excellence, ensuring competitiveness vs. alternative solutions and CO_2 pricing on a 1.5°C transition pathway[4];
- its deep market knowledge and understanding of associated energy transition requirements

Focus

CO_2 pricing

Establishing an adequate price on CO_2 emissions is an essential component of the global strategy to limit warming to 1.5°C. By integrating the CO_2 emissions externality in a product cost structure, it sends a clear market signal to businesses and consumers about the cost of carbon emissions, thereby incentivizing their reduction and investment in cleaner alternatives.

CO_2 pricing can therefore help level the playing field between carbon-intensive industries and greener alternatives. To do so, it must come not only at the right level, but also through clear and stable frameworks, in order to foster the investment needed.
Because explicit CO_2 pricing can carry various challenges, such a policy can take various forms (tax, cap-and-trade, mixed system) including mandates and subsidies, in which case the pricing is deemed "implicit".

[2] Along with actions targeted at reducing worldwide greenhouse gas emissions, as per this plan, the Group is actively engaged in pursuing other Sustainable Development Goals, as defined by the United Nations. These actions are not detailed here, but can nonetheless be found in Chapter 5 of the Air Liquide Universal Registration Document.
[3] International Panel on Climate Change (IPCC) Special Report Global Warming of 1.5°C (SR-15, 2018).
[4] As derived from IPCC SR-15 Chapter 2 and detailed in the "Our vision" chapter, 2 - Our actions to meet those needs, implicit CO_2 pricing in 2035 in a 1.5°C transition scenario should land between \$150/tCO_2 ("high-overshoot") and \$350/tCO_2 ("low-overshoot").

Air Liquide's activities can thrive in a 1.5°C transition scenario, especially if it takes place in a fair and orderly manner. It would entail significant business opportunities, alongside decarbonization of all of the Group's assets at competitive prices. Accounting for and communicating on this planet-wide contribution however remains a challenge, particularly in the absence of strong consideration for metrics quantifying Air Liquide's contribution to the transition to neutrality ("avoided emissions"), without which the Group's positive impact is difficult to assess.

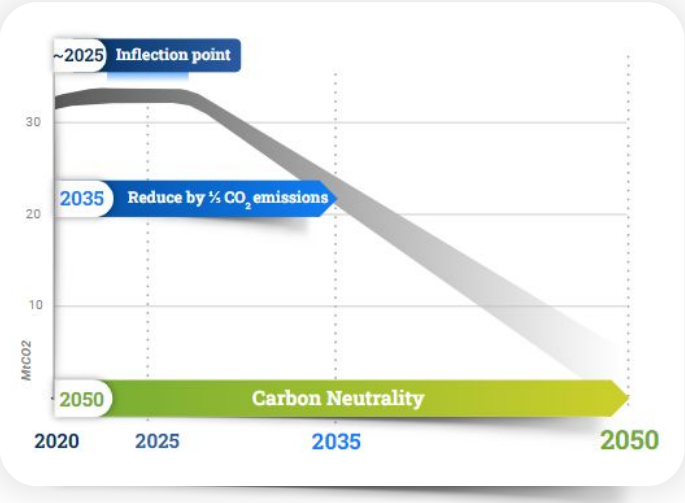
How Air Liquide approaches these opportunities is detailed in the *"Our vision"* chapter of this plan.

2. We must decarbonize our own activities

Providing solutions to decarbonize industry and mobility goes hand in hand with the Group's own decarbonization: the Group is therefore committed to achieving carbon neutrality along its value chain by 2050. This means abatement of the lion's share of the CO_2 that Air Liquide emits or induces in its value chain, while, in a subsequent stage when major reductions have been achieved, compensating the remaining low levels of residual emissions with carbon removals.

The Group's trajectory towards its own carbon neutrality by 2050 is first and foremost based on a deep reduction of emissions along its value chains, starting with the emissions on which it has more levers. As a result, this trajectory is anchored with critical mid-term milestones:

- to reach an inflection point for the absolute Scope 1 and 2 CO_2 emissions around 2025;
- to reach a <33%> decrease of Scope 1 & 2 CO_2 emissions by 2035 compared to 2020[5,6].



Our decarbonization plan: how does it position us with respect to a 1.5° C trajectory

Air Liquide's climate strategy and carbon neutrality ambition were the first to be publicly communicated in the industrial gases industry. The 2035 targets submitted to the Science Based Target initiative (SBTi) were validated as aligned with "well below 2°C" in 2022.

Our two slope trajectory with an inflection point around 2025 and <33%> ambition by 2035 and carbon neutrality by 2050 shows the same pattern as what the IEA considers to be a 1.5°C trajectory for the Chemical sector, a "hard to abate" sector that will decarbonize at a slower pace than the world average on a 1.5°C trajectory[7], as developing and implementing decarbonization projects in these sectors can take time[8], and often depends upon the decarbonization of the power sector;

In addition, the Group's activities will continue to grow to meet the energy transition's needs (as explained above), which, combined with the Group's absolute emissions reduction objective, underscores its ambition.

The wider neutrality ambition is deemed to be aligned with a 1.5°C scenario when assessed against the IEA Net Zero Roadmap for the chemicals industry, taking into account the required growth of its energy transition solutions.

[5] Validated as "well-below 2°C" by SBTi using a 2021 baseline, so as to integrate changes in Scope following the Sasol units acquisition. The target also contain a <60%> target on emissions related to residual sales of natural gas, originating from purchased biogas distribution assets before their full conversion to biogas. These emissions represent less than 1% of Scope 3.

[6] Another target the Group intends to meet while maintaining its absolute CO_2 emissions reduction objective is to reduce by -30% its Scope 1 & 2 carbon intensity in kg CO_2/€ Ebitda in 2025, compared to 2015, in accordance with the commitment made in 2018. This threshold was reached for the first time in FY2023.

[7] IEA Net Zero Roadmap, 2023.

[8] For example, receiving Zero Carbon electricity from a power purchase agreement that enables the development of a large renewable electricity production asset can take 4 to 10 years (e.g., identification, development and construction of a solar or wind farm project). Similar delays can be expected in securing the sourcing of substantial volumes of biogenic fuel or feedstock or in establishing a Carbon Capture and Storage supply chain.

Focus

1.5°C alignment

With the Paris Agreement, countries around the world committed to "substantially reduce global greenhouse gas emissions to hold global temperature increase to well below 2°C above pre-industrial levels and pursue efforts to limit it to 1.5°C above pre-industrial levels". This commitment was then translated into a maximum amount of net greenhouse gas emissions to be emitted by 2050 (or carbon budget), at which point net emissions per year should be null and gross emissions should be reduced by at least 90% (as per common interpretations of IPCC recommendations).

Science-based targets correspond to short-term, mid-term and long-term targets entailing a curve compatible with such an objective. They can be assessed at a systemic level (with a strong normative assumption that all geographies and sectors follow the same curve) – this is the methodology in the SBTi Absolute Contraction Approach standard by which Air Liquide is considered "well-below 2°C". Alternatively, one can, for instance, consider that different sectors should decarbonize at different paces depending on their specificities, and reach the same global result. This is the outcome of projections such as the IEA Net Zero Emissions scenario[9]. SBTi however does not yet provide this level of granularity for the Chemicals' nor the Industrial Gas sectors.

Air Liquide's solutions for the planet encounter two additional challenges in being assessed under such frameworks, which therefore tend to understate the ambition of its trajectory. On the one hand, the Group's growth is in part happening in the heavy industry segments of emerging economies, which have more carbon-intensive 1.5°C pathways, especially in the short-term. On the other hand, while Air Liquide brings solutions to deeply reduce emissions of some industrial activities (example: cement), this often happens at the expense of additional residual emissions on its own carbon footprint due to the outsourcing nature of the business model. As of today, these avoided emissions benefits are not accounted for in target-setting standards while they alter the Group's position vis-à-vis the necessary global trajectory.

The Group's ability to accomplish its carbon neutrality objective by 2050 relies heavily on the achievement of its medium term targets. Its progress on these targets will in fact be symptomatic of the acceleration in its decarbonization and its capacity to act in parallel with broader policy and infrastructure development. This is why the "*Our duty*" chapter of this plan focuses on Air Liquide's path to 2035.

Our decarbonization plan has well identified actionable levers

The Group's CO_2 emissions sources come from a limited number of assets and countries. Indeed, 60% of Scope 1 direct emissions come from around 20 production units and 80% of Scope 2 indirect emissions linked to power consumption come from 6 countries. Meeting the Group's CO_2 emissions reduction objectives therefore requires activation of a few well identified levers, which are intertwined with global Climate Change mitigation actions:

- zero-carbon electricity sourcing for existing assets (estimated today at around 10 TWh by 2035) and the Group's growth, which will benefit from proactive actions and the global uptake in renewable and nuclear electricity production;
- asset management, with electrification of a few units, efficiency measures and asset shifts to low-carbon fuel and feedstock consumption, to answer customer appetite for low-carbon solutions;

[9] IEA Net Zero Roadmap, 2023.

- carbon capture, as part of large industrial basin decarbonization projects across the world, which will decarbonize the Group's hydrogen production units while meeting the growing needs for large volumes of low-carbon hydrogen.

Importantly, the Group's carbon neutrality and energy transition enabler journey are deeply intertwined, as its solutions and business model allow it to decarbonize existing assets and capture growth opportunities at the same time. **As a result, Air Liquide's decarbonization investments will fuel the Group's growth.** They will provide economical and environmental value to its customers, thus **generating additional recurring operating income** (OIR).

3. We are well positioned to mitigate risks and capture opportunities

The energy transition nonetheless comes with uncertainties. Being structured to mitigate risks and capture opportunities is therefore key to a company such as Air Liquide. The Group does this through forward-looking control of its investments. They include CO_2 pricing sensitivity analysis, as well as emissions and energy deep-dives when certain criteria are met. A review of existing activities also takes place in order to assess and mitigate transition risks and opportunities on a world, geographical and asset-specific level. It covers risks related to policy and legal, technology, market and reputational transition related events.

The Group's net exposure to transition risks is currently assessed to be low due to the contractual risk pass-through nature of its business model, the opportunities it has to gain from the energy transition as well as its capacity to accompany its customers' process shifts with competitive technologies and customer intimacy.

In addition to its attention to transition-related events, the Group also conducts vulnerability assessments and develops mitigation plans regarding climate related physical events. This process is detailed, along with transition risks, in the *"Risks and opportunities"* chapter of this document.

4. We align our actions with the pace of society

The implementation of this climate transition plan is ensured by structured accountability across the Group, notably executive-level governance structures for climate and energy related matters and incentive programs which are detailed in the "*Governance*" chapter of this plan. Air Liquide's path to decarbonization is therefore well achievable, provided its external environment is compatible with energy transition scenarios, as explained below.

Company Net Zero commitments stem from the cascading of the Paris Agreement objectives on corporate responsibility. It is a powerful, yet a limited tool, given that such a target can only be achieved with the cooperation of society as a whole. This is why engagement of all stakeholders and associated advocacy are key to fulfilling the Group's commitments and living up to the role we set ourselves.

As a result, achieving the Group's decarbonization will require significant cooperation with the stakeholders that Air Liquide engages with in its daily operations, because of our reliance on public goods and nascent infrastructure (e.g., zero-carbon electricity, CO_2 transport and storage), which will require adequate public policy guidance and market designs[10].

The Group is already acting to embark stakeholders on those topics – notably companies and states on market design and infrastructure considerations, and civil societies with which the Group works for a "just" transition, as detailed in the *"Governance"* chapter.

With respect to other indirect emissions in our value chains (Scope 3), which are further out of our reach and command, reduction levers are already well identified, as detailed in the "*Our duty*" chapter, and will require measuring efforts and cooperation to track and achieve reductions.

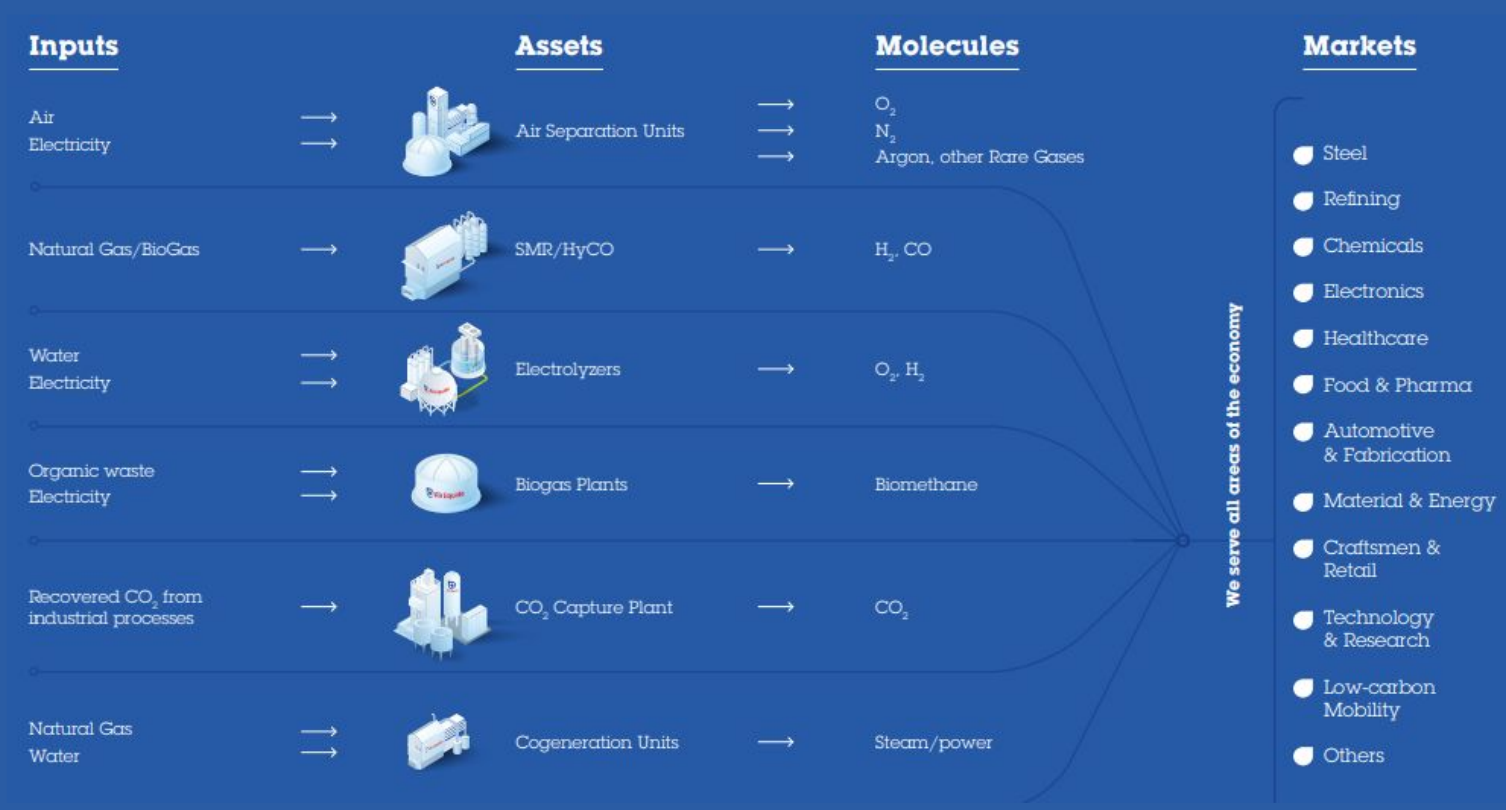
[10] For instance, reduction of its Scope 2 requires that the Group procures a large amount of renewable power, implying production infrastructure build-out and grid upgrades. An efficient decarbonization of the power sector and adequate market designs are needed to ensure a level-playing field for electro-intensive companies operating in renewable-rich power systems.

A business model allowing to serve multiple market segments

Focus

Since its creation in 1902, Air Liquide has been providing small essential molecules (oxygen, nitrogen, hydrogen etc.) to various industries that rely on them. Either as a product or as a service, the Group's pledge is to produce and deliver them in a safe, efficient and cost-effective manner in order to improve its customers' processes.

Air Liquide supplies these industrial gases to its customers from - (a) dedicated plants or pipeline networks (Large Industries, 28% of sales, to chemicals, refining and steel markets) and (b) in smaller quantities produced on-site or delivered in liquid form in bulk, or in gaseous form in cylinders (Industrial Merchant, 43% of sales, to automotive and manufacturing, materials and energy, food and pharmaceuticals, craftsmen and retail and technology and research customers). The Group also serves the Healthcare (15%) and Electronics (9%) markets[11].



[11] Chapter 1 of the Group's Universal Registration Document features a more detailed explanation of its activities and business model.

Our vision: decarbonizing the industry

1. Our role in the energy transition

2. Our actions to meet those needs

For Air Liquide, the climate crisis is an opportunity to bring its solutions and know-how where they will be needed in the energy transition. This is how the Group projects itself in the future and builds its investment plans.

1. Our role in the energy transition

For the world to achieve a clean energy transition, many industries will need to shift their processes towards low-carbon manufacturing production. As a result, (i) multiple Air Liquide customer segments will embark on a transition journey, requiring higher volumes of low-carbon industrial gases (such as hydrogen for steel in Direct Reduced Iron processes) and (ii) Air Liquide's products, expertise and technologies will be needed for new uses (such as emerging CO_2 management needs and clean mobility). It is therefore crucial that the Group positions itself to be able to support and bring those ambitions to term.

Decarbonizing our customers' industries

As one can see in the projections below, derived from the IEA Net *Zero Roadmap*[12], markets currently served by Air Liquide are set to shift to alternative technologies. Successfully achieving these transitions will require reliable and often higher volumes of industrial gases, offering a strong opportunity for a key enabler such as Air Liquide.

Chemicals manufacturing

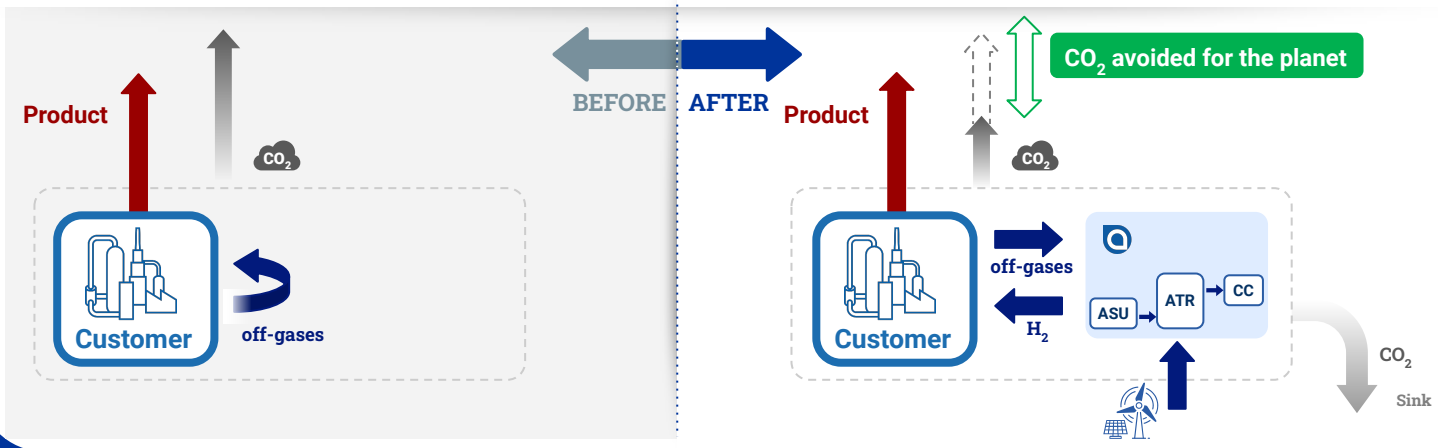
A first example is the transition of chemical manufacturing to low-carbon processes.

Among its decarbonization levers one can find: decarbonization of inputs (e.g., shift to low-carbon or biogenic CO demand), decarbonization of manufacturing process (e.g., eliminating emissions in crackers with low-carbon H2 from offgas reforming in presence of gaseous oxygen) and circular economy principles (e.g., using low-carbon H2 as an enabler to convert CO_2 back to chemicals). All of these transformations rely on low-carbon industrial gases.

Example

Auto-Thermal Reformers (ATR) for chemicals manufacturing

ATRs are an Air Liquide proprietary technology which is key in the chemicals' manufacturing transition. By installing such a process, combined with carbon capture, a chemical manufacturer replaces its high emitting offgas burning in its cracker with Air Liquide's production of large quantities of low-carbon hydrogen from the same offgases. As a result, the customers' emissions reach almost zero and overall emissions are deeply reduced[13].



[12] Market evolutions in these figures result from projections derived from the 2023 IEA Net Zero Roadmap update. All markets start at basis 100.
[13] It should further be noted that producing and burning low-carbon hydrogen in an ATR is more efficient than carbon capture directly "plugged" on the existing process.

Steel manufacturing

Steel manufacturing is another current Air Liquide end market which is transitioning to low-carbon manufacturing. Most steelmaking in the world is based on the melting and reduction of iron ore in coal-powered blast furnaces, with high associated CO_2 emissions. Oxygen is largely used to improve the efficiency of such manufacturing processes.

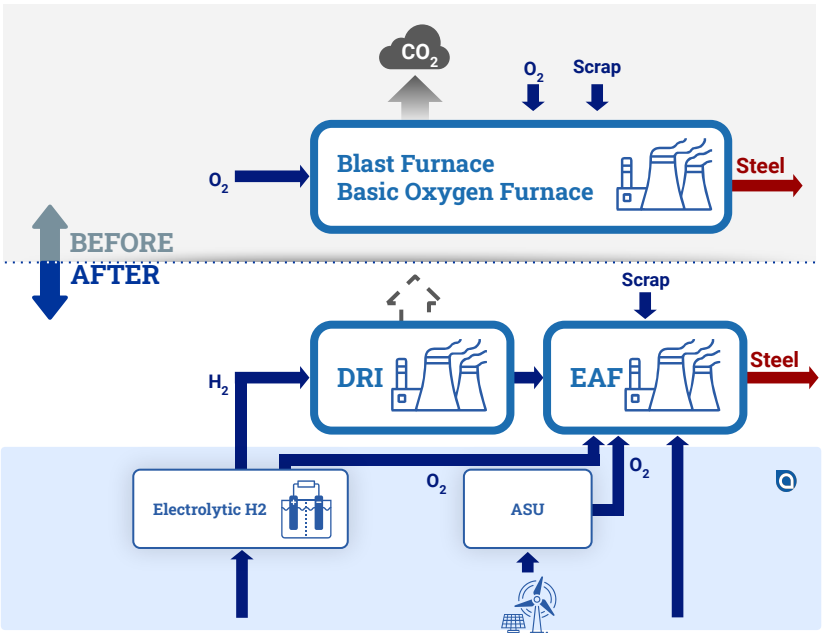
The path to low-carbon steel will require more of two key existing processes, but which are so far less developed than the blast furnace route: Electric Arc Furnaces (EAF) and Direct Reduced Iron (DRI), both of which consume large amounts of oxygen. The second process can be fueled with natural gas, or low-carbon hydrogen as an alternative.

Example

Industrial Gases for Steel Production

Direct Reduced Iron with low-carbon hydrogen could progressively take a significant share of steel production until 2050 in a 1.5°C trajectory (IEA 2023). A few pilots have already demonstrated the feasibility of hydrogen-based "green steel" and a couple of projects are under development today.

For Air Liquide, supplying low-carbon hydrogen for steel production would result in large amounts of avoided emissions.



Industrial Merchant Markets

Large industrial customers are however not the only ones which will rely on the Group's low-carbon industrial gas production capabilities to achieve their transition. We see vast opportunities in providing such products for Air Liquide's Industrial Merchant customers as well. Good examples of which are the Group's ECO ORIGIN offers for low-carbon industrial gases in bulk or liquid form.

Several customers in the food industry are already using this offer, such as for reducing the carbon footprint of sparkling water production or refilling canisters for soft drinks machines used in homes, as well as for production of natural ingredients for markets such as human and animal nutrition and cosmetics[14].

[14] Such markets typically use CO_2 for the extraction of active compounds from plants.

New industrial needs for our products and processes

Another key feature of Air Liquide's activities is the extended role they can play in the energy transition with multiple industrial transitions to low-carbon manufacturing that drive new demand for industrial gas expertise. One of these drivers will be carbon capture as a service for hard-to-abate industries that have limited decarbonization options.

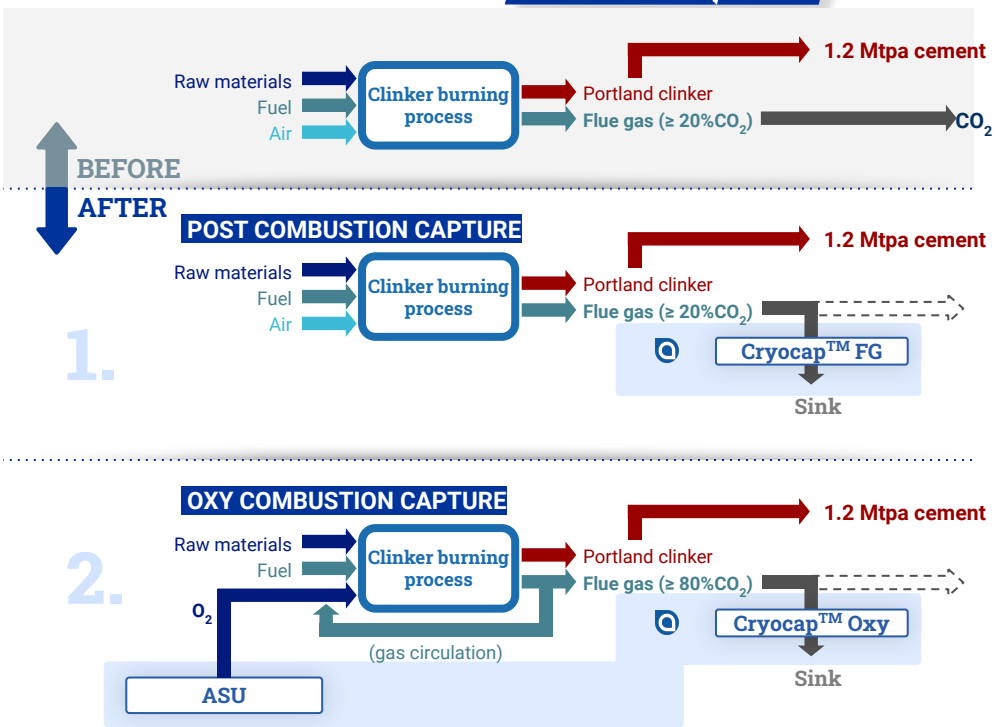
Cement and lime production

In cement and lime manufacturing, CO_2 is emitted as an inevitable co-product (about ⅔ of associated emissions are released from the raw material, vs. ⅓ coming from the combustion process). Low-carbon cement can however be produced by capturing CO_2 at point sources of the process, compressing it and storing it so that it isn't re-emitted. Further CO_2 efficiency can be achieved when adding an oxy-combustion process, making Air Liquide's industrial gas expertise particularly well-suited to accompany the sector's transition.

Example

Carbon Capture as a service

Air Liquide's proprietary Cryocap technology, CO_2 transport and oxy-boosting expertise make it a strong partner for cement production decarbonization.



Mobility

The transition of the mobility sector to low-carbon transportation will induce strong low-carbon air gases and hydrogen demand. Such sectors are good examples of how Air Liquide can position itself on a specific part of the value chain for a sector's energy transition, resulting from where it has the most value to bring through its technologies and know-how.

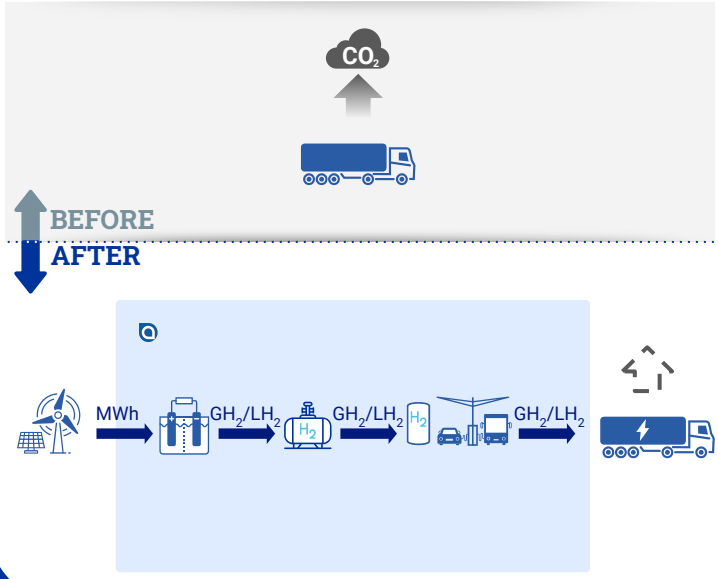
The Group will participate in high overall emission reductions brought about by various end-solutions.

In the transportation sector, this could be low-carbon air gases supply for cathode active material manufacturing (a key part of battery supply chains), low-carbon hydrogen production, transport and liquefaction for mobility purposes (such as fuel-cells and sustainable fuels), as well as providing its innovative and well-referenced syngas cleaning, hydrogen purification and carbon capture (RECTISOL™) technologies for production of Sustainable Aviation Fuels (SAFs).

Example

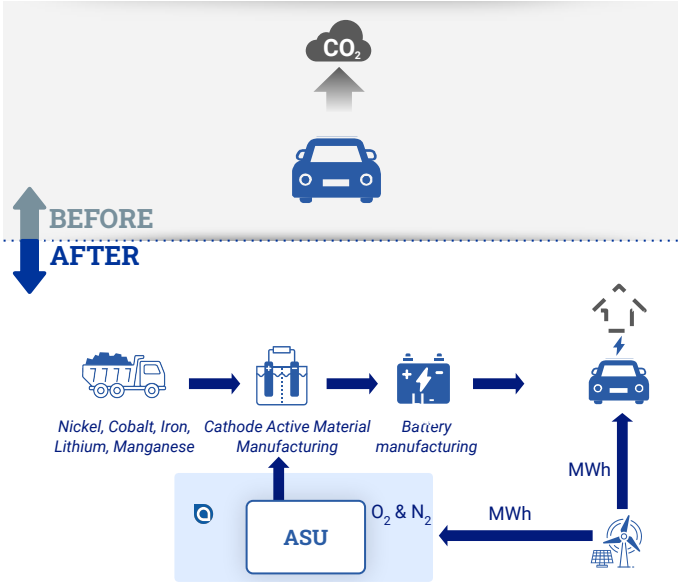
Hydrogen mobility

To achieve the highly ambitious targets set on road freight transport decarbonization, hydrogen-powered fuel cell electric vehicles will be indispensable. This will trigger large low-carbon hydrogen production and management needs.



Battery electric vehicles mobility

With battery electric vehicles manufacturing scale-up comes the need for large industrial air gas supplies, particularly in this segment of the value chain. The new Bécancour platform in Quebec (Canada), which should be operational in 2025, exemplifies such projects.



As a result of these market evolutions, Air Liquide will be poised to deliver low-carbon industrial gases, participate in the transformation of its customer's processes and provide carbon capture as a service across multiple bricks of the energy transition.

Assessing our planet-wide impact

With its innovative technologies and products, Air Liquide can play a key role in significant overall emissions reductions. It is essential to assess and highlight such positive impacts in order to drive decision-making towards global carbon neutrality. In fact, in the absence of such considerations, certain activities may be wrongly assessed as having a negative impact when considered at the company-level.

For instance, in several cases, the climate benefits brought by Air Liquide's energy transition solutions are realized by taking the customers' emissions into Air Liquide's perimeter and massively reducing them, while the un-abatable residual emissions are kept on the Group's footprint. Under current CO_2 accounting and reporting standards, these residual emissions therefore increase Air Liquide's reported emissions while overall emissions are deeply reduced at the planet boundaries (avoided emissions). This highlights the critical need for adapted tools and metrics to evaluate the Group's net positive impact on climate.

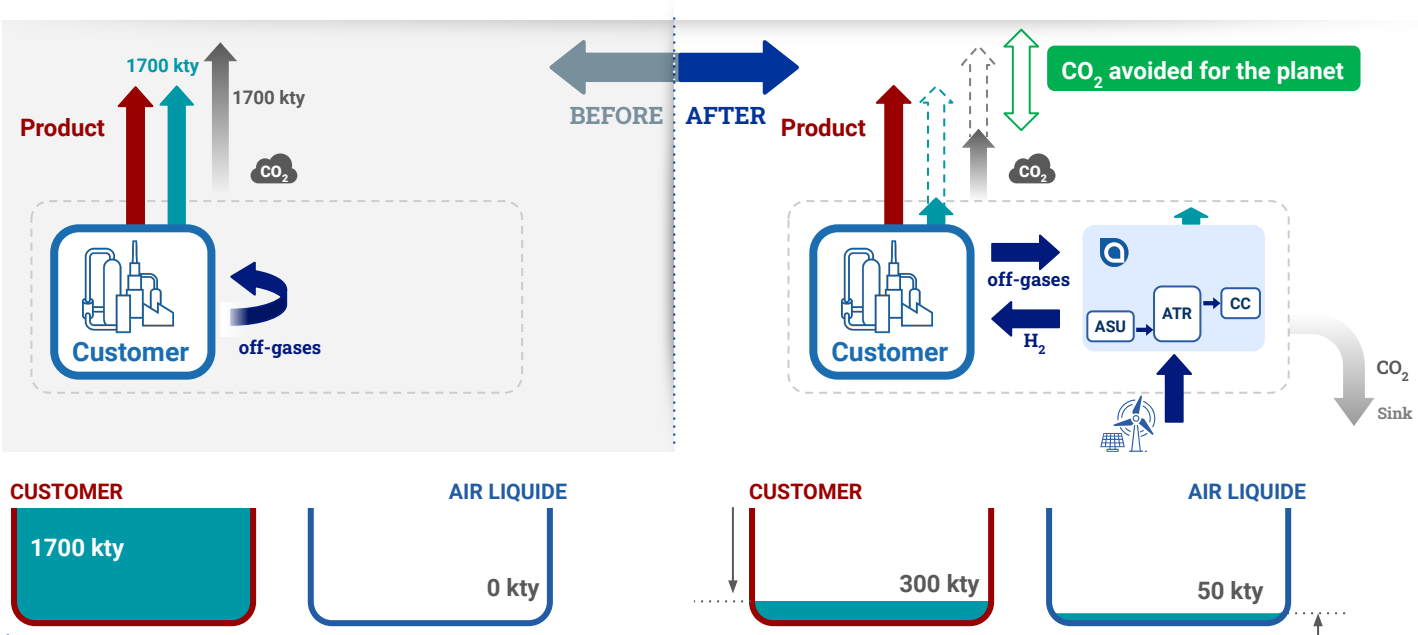
Additionally, these residual emissions are the ones for which an offset strategy will need to be developed, as part of the neutrality commitment, although the primary focus is to ensure that deep reductions are delivered before detailing residual compensation needs.

Example

Auto-Thermal Reformers

An example of such projects is when Air Liquide installs an ATR combined with a carbon capture unit for a chemicals customer to reduce emissions related to heat consumed in its processes.

In such instance, while the customer's emissions reach almost zero, Air Liquide may now have in its perimeter (a) Scope 1 emissions linked to CO_2 not captured in the ATR and (b) Scope 2 emissions linked to the ASU and carbon capture unit's electricity consumption (around 10% of total, coming from the blue perimeter).



[1]*Illustrative, simplified for the sake of clarity. Adding Scope 3 indirect emissions or sourcing electricity at the average grid emission factor does not change the substantial planet-wide avoided emissions*

Because of the methodological difficulties in conducting an assessment of the net positive impact, such as the one illustrated above, no standardized metric exists as of date. One solution is therefore to rely on avoided emissions for which the Group develops its own calculation methodologies in accordance with existing guidelines.

Avoided emissions are an essential tool to evaluate Air Liquide's positive impact in fighting climate change. Two main types of positive impacts shall be measured and quantified:

- the **relative** positive impact versus a current average market reference. For instance, the inherent efficiencies brought by the Over The Fence business model[15], or the carbon benefits resulting from the use of oxygen in blast furnace in comparison to the air-blown blast furnace route;
- the **absolute** positive impact of a technology or a product compared to another climate scenario, that is a metric that accounts for the reduction, or avoidance, of emissions in comparison to an overall business-as-usual scenario. Typical examples are the deployment of CCUS for cement or low-carbon hydrogen mobility, where the benefits with respect to continued unabated cement production or fossil-based road fuels use shall be adequately quantified. These are benefits due to Air Liquide's products and services versus a world where such products and services would not exist. This metric gives a sense of the necessity of the Group's activities in the supply chains it is involved in and follows industrial gas sector practice.

2. Our actions to meet those needs

The Group's opportunities from its positioning as an energy transition enabler are significant, and it has dedicated resources and actions planned to seize them.

Customer intimacy and geographical reach

The Group's historical focus on customer intimacy and long-lasting relationships with industrial champions around the world allows it to monitor their needs and propose tailored decarbonization solutions for their own transition. For instance, through the Strategic & Key Accounts program, Air Liquide has developed a privileged relationship with leaders in their respective sectors, planting the seeds for new partnerships as their businesses evolve.

This customer intimacy is strengthened by the Group's well balanced geographical portfolio. As renewable power production and environmental policies vary across the world, Air Liquide's ability to accompany its customers' choices will be key to capturing market opportunities as they adapt to the new industrial maps drawn by the energy transition. All the more given the Group's strong positioning in key industrial basins, where it benefits from its pipeline networks, allowing it to offer various shades of industrial gases depending on customer needs.

[15] Over The Fence (OTF) is a business model in which Air Liquide invests, builds, owns, operates and maintains assets as a producer and distributor, enabling customers to increase their performance and profitability.

Technological innovation excellence

The Group's investments in development of frontier decarbonization technologies and associated operational expertise are another key asset in capturing energy transition growth opportunities. This is notably the consequence of a three step innovation process and governance which allows Air Liquide to maximize the opportunities and lower the risks associated with such developments:

Step 1

a technological watch during which the Group screens technologies at low technical readiness levels. The most promising ones are followed closely, until the Group decides to further invest in them by either launching focused internal R&D programs, acquiring technologies or entering into joint development agreements, thus lowering the risk of missing out on decisive innovations;

Step 2

Technology Roadmaps for selected technologies. Once identified, Technology Roadmaps are used as a strategic planning tool to outline the vision, goals, and key steps necessary to navigate further development of the technology. Being integrated in a roadmap comes with a strong monitoring program to ensure the right resources are allocated to the development of the technology, with technical steering committees, as well as regular business reviews to make sure that the development program evolves with market needs. Finally, when reaching the industrial scale development stage, technical and economic risks and opportunities are reviewed to deliver a final investment decision. As a result, development risks associated with programs that are unsuccessful for technical or market-related reasons are closely monitored;

Step 3

technologies having passed the industrial scale investment decision stage then get integrated into the associated Product Roadmaps where, as long as they are on the frontier, the same level of monitoring is given to their continuous improvement in line with feedback from project pilots and market evolutions. Specific experience capitalization reviews also take place. It is in this continuous improvement, managed by its World Industrial Management, that the Group builds its long-lasting competitive advantage.

Among technologies selected for Technology Roadmaps, one can find examples of strategic areas for value-positioning along the low-carbon hydrogen value chains such as CO_2 transportation in Europe, pursued in a joint venture with Sogestran, or ammonia cracking with a first industrial pilot to take place in the port of Antwerp, Belgium.

Focus

Air Liquide's industrial innovation capabilities

Having a successful innovation process is a key Air Liquide capability. It however cannot be isolated from the Group's customer intimacy, business know-how and operational excellence management. This unique intersection effectively allows Air Liquide to safely bring on ambitious projects and build its reliability on nascent technologies.

The Group's first 20 MW PEM electrolyser in Becancour, Canada, operating since 2021, or the first Cryocap™ project at Port-Jérôme, France, operating since 2015, are good examples of this capability: by investing in these first of their kind units alongside large customers committed to buy the associated products, Air Liquide can learn at industrial scale and pace - the value of which is key in the accelerating energy transition context. It is well demonstrated by the progressive scale-up from 20 MW to the 200 MW electrolyser of the Normand'Hy project, building on experience gained on smaller operating units such as in Oberhausen, Germany.

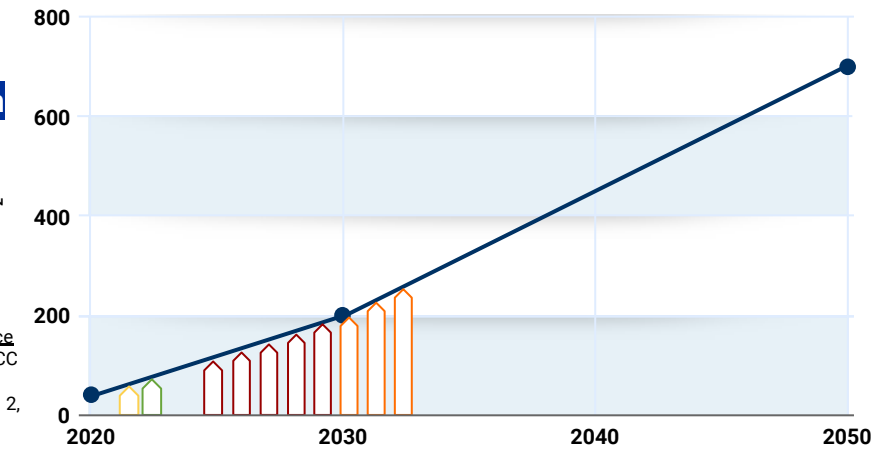
Being able to externally sell units through its Engineering & Construction business line is also a strong learning opportunity for the Group, as competing on the design of its assets further stimulates internal innovation and performance.

These investment roadmaps notably guarantee the Group's solutions' competitiveness vis-à-vis other low-carbon manufacturing processes and technologies.

For instance, as of today, Air Liquide's primary production units can all be decarbonized at competitive prices within 1.5°C transition scenarios. This is driven by the implicit CO_2 pricing these scenarios entail as well as Air Liquide's competitive decarbonization solutions, and is reinforced by the fact that over 80% of Air Liquide production assets are already fully electrified.

Using the average[16] CO_2 price translation of the necessary policies for a 1.5°C transition (as described with high confidence in the IPCC SR-15, Chapter 2), all Air Liquide CO_2 abatement costs[17] become financially beneficial before 2035 in an average CO_2 price pathway allowing a 1.5°C transition (i.e. low overshoot scenario). It can be seen in the following graph, which compares this CO_2 price pathway with the abatement costs associated with Air Liquide decarbonization levers, assuming that they should bring the same level of profitability as other investments:

IPCC implicit carbon price in 1.5°C transition



Source for CO2 price curve: based on IPCC Special Report on 1.5° (SR-15), Chap. 2, p.61 , published on Oct. 8th, 2018

[16] The 1.5°C with low overshoot scenario is used as a reference, with undiscounted CO_2 pricing given technological shifts should, if anything, become less costly with time.

[17] Abatement costs presented below are estimates which can vary according to geography and context. They were built according to internal expertise, public research and International Energy Agency forecasts.

Strategic investments and market knowledge

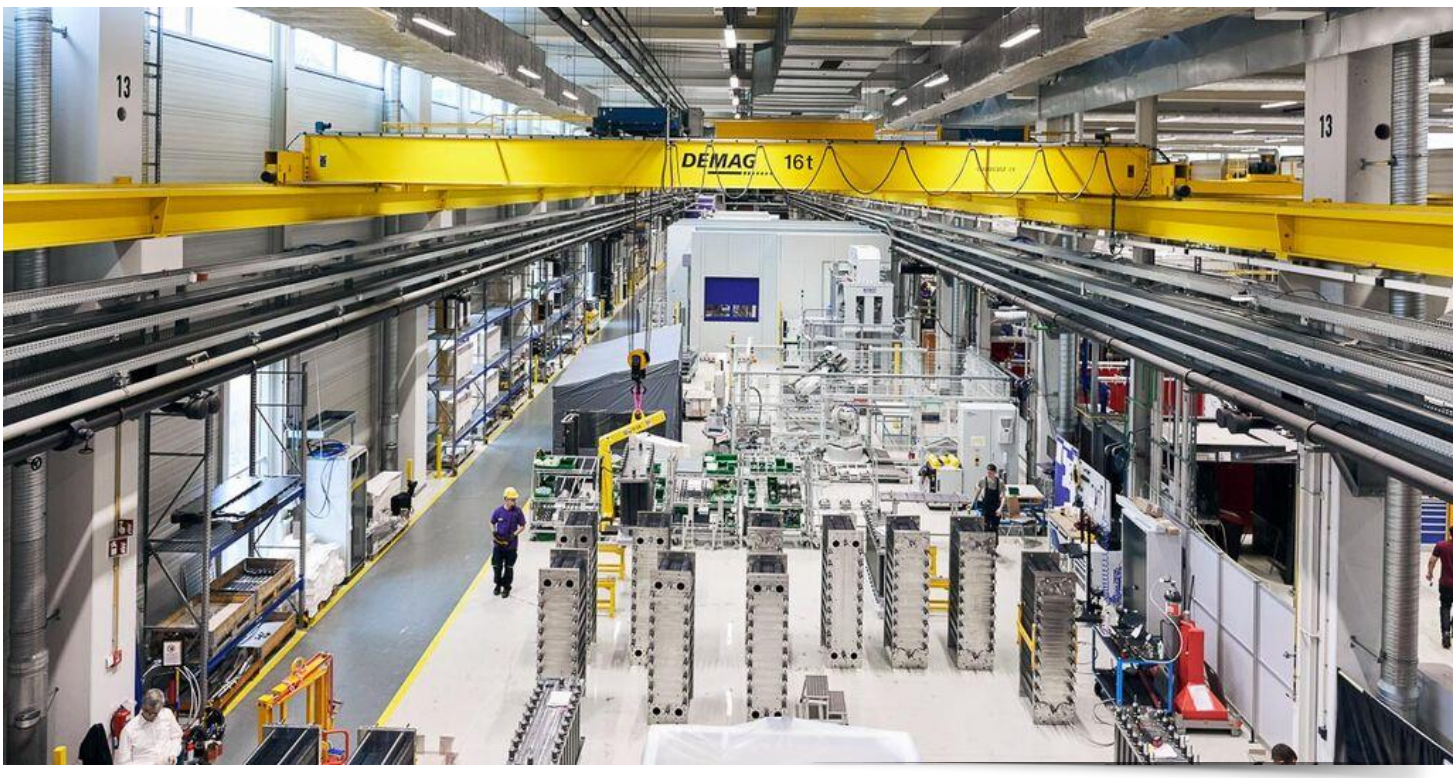
Finally, the Group has investment projections and committed resources to its role in the energy transition. Concretely, as per Air Liquide's ADVANCE strategic plan, 50% of the industrial decisions above 5m€ in the 16bn€ investments that the Group plans to make by 2025 will be in energy transition solutions. Simultaneously, the Group is already actively involved in a number of energy transition related investment opportunities post-2025.

Hydrogen-related investments hold a special place in this action plan, with Air Liquide already being present in 6 out of 7 United States clean H2 hubs and investments of 8 Bn€ foreseen by 2035 in the field of low-carbon and renewable hydrogen.

2035 Energy Transition potential investment decisions for Air Liquide, subject to variability from external factors[2]

Categories	Opportunities
Low-Carbon **Manufacturing**	Hydrogen, Oxygen, CO_2 capture and management to decarbonize various industries: chemicals, metals, cement and lime, fertilizer
Low-Carbon **Energy**	Ammonia, e-Methanol, Bio-methane, Sustainable Aviation Fuels, Hydrogen to decarbonize global energy markets
Mobility	Hydrogen to decarbonize heavy dusty mobility and fleets in the nearterm maritime and aviation in the future

[2] Society's overall climate ambition, favorable policy & regulations, customer willingness to decarbonize their operations, availability of clean energy sources



Our duty: decarbonizing our assets

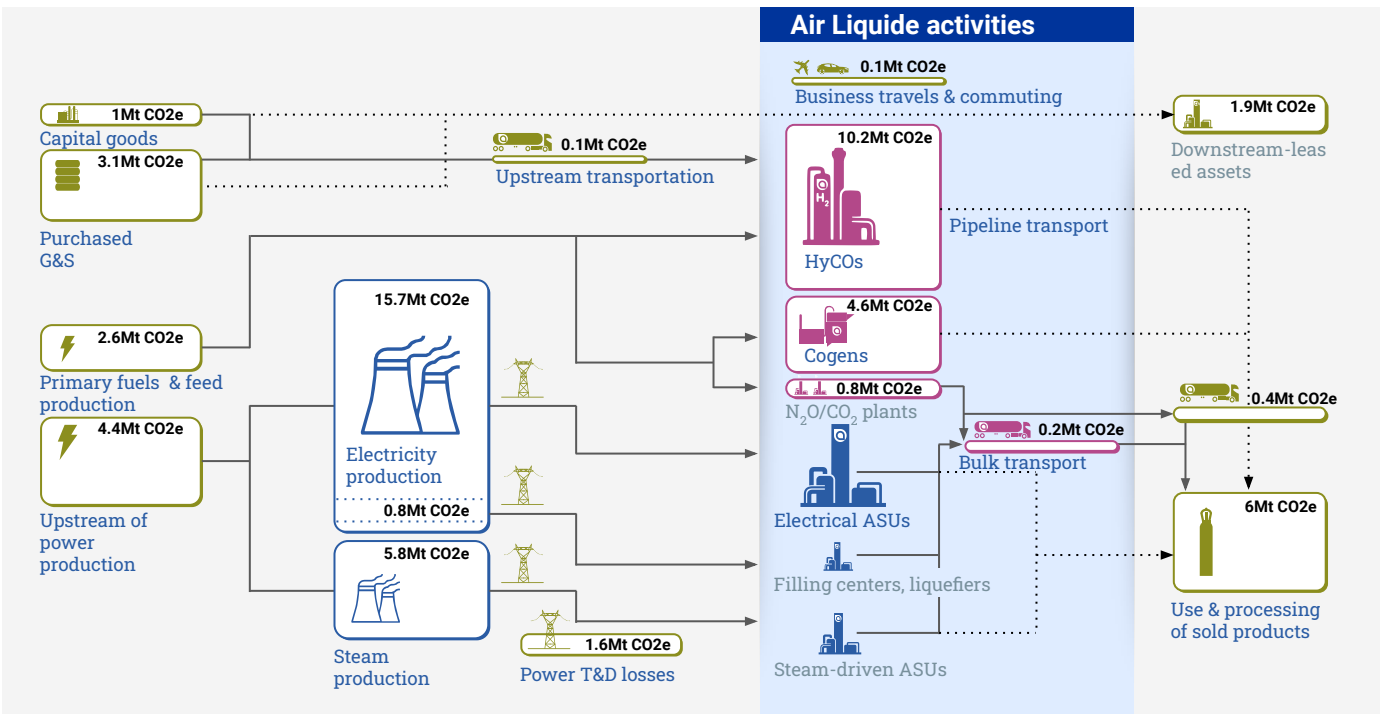
1. Our CO_2 emissions footprint
2. Acting on our emissions - metrics, levers and actions planned
3. Acting on our value chain - metrics, levers and action planned

Alongside our vision for playing our role as an enabler in the world transition to carbon neutrality comes the Group's commitment to decarbonizing its own activities. It relies on an understanding of where the Group's emissions lie as well as a view on where it has the most influence to reduce them. These levers, as well as the way Air Liquide plans to activate them, constitute the Group's decarbonization roadmap.

1. Our CO_2 emissions footprint

To act efficiently, Air Liquide first needs to adequately measure and understand its footprint. Such an analysis can then pave the way for a robust roadmap to decarbonize its activities and its growth in the energy transition.

Air Liquide's CO_2 footprint - FY 2023



Emissions under our operational control: Scopes 1 & 2

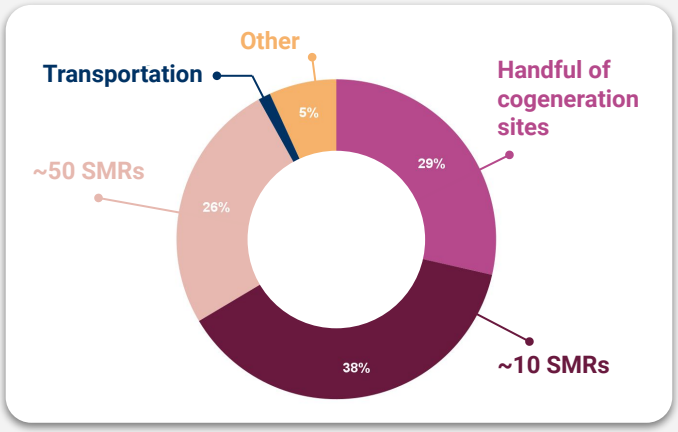
Scope 1 Emissions

The Group's direct Scope 1 emissions mainly derive from the following activities:

- producing Hydrogen and carbon monoxide, historically mainly from Steam Methane Reformers[18] (SMRs) which consume natural gas and emit CO_2;
- supplying steam and electricity produced from cogeneration units (COGENs) for efficiency and intermittency management purposes, which consume natural gas and emit CO_2;
- managing products which have a global warming potential such as CO_2 and N_2O and for which a portion can be undesirably released into the atmosphere;
- delivering products to customers across the world, requiring transportation by truck which emits CO_2.

These emissions amounted to 16.1 Mt CO_2e[19] in 2023, mostly from hydrogen production and steam and power cogeneration units located in North America and Europe. They however correspond to a small share of the Group's assets as 80% of the primary production units are already fully electrified and do not entail direct emissions.

Scope 1 emissions



Scope 2 Emissions

The Group's Scope 2 emissions mainly derive from the production of air gases in Air Separation Units (ASUs), with no direct CO_2 emissions (only indirect, related to the use of power).
To report its Scope 2 emissions, Air Liquide follows the market-based methodology, which reflects more accurately the emissions associated with electricity or steam that was purposefully sourced (rather than average emissions intensity of grids on which energy consumption occurs).

Focus

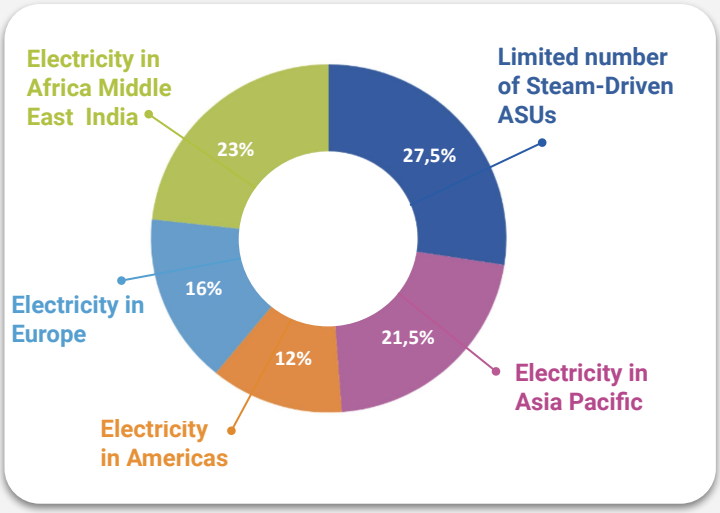
Scope 2 accounting methodologies

The GHG Protocol Scope 2 Guidelines provide a simple definition of the two main approaches to account for a company's emissions related to power consumption: location-based and market based accounting.
In location-based accounting, emissions calculations are based on the average emissions intensity of the country where the electricity is consumed, and is thus solely dependent on the country's energy production mix. Consequently, location based Scope 2 emissions of any facility will evolve proportionally to the country's grid decarbonization pace.
In market-based accounting, two types of sourcing are distinguished. On the one hand, power can be sourced from direct energy contracts with an attached emission intensity, distinct from the grid average. On the other hand, the power can be simply sourced from the grid.
A residual emission intensity should then be applied (based on the remaining energy mix of the grid after all the directly contracted power has been accounted for).
Air Liquide has chosen to move to market-based accounting in 2021[20] for Scope 2 emissions because this methodology enables a company to reflect its voluntary sourcing efforts in its emissions accounting (to the extent such sourcing is made possible by local infrastructure evolutions and market mechanisms).

[18] Other lower emitting technologies (such as Auto-Termal Reformers with carbon capture or Electrolysers) now exist at scale and will progressively replace SMRs.
[19] Carbon dioxide equivalent, or CO_2e, is a metric by which the impact of all greenhouse gases is converted to the equivalent amount of emitted CO_2 in terms of global warming power.
[20] This explains the different historical figures for years before 2021, to be taken into account when following Air Liquide's trajectory.

With the market-based methodology, the Group's Scope 2 emissions amounted to 21.5 Mt CO_2e in FY2023: coming mostly from a handful of steam-driven Air Separation Units in China and South Africa and purchased electricity for other ASUs, particularly in geographies with coal-based electricity production. Over 80% of total Scope 2 emissions therefore come from six countries.

Scope 2 emissions



Emissions outside of our operational control: Scope 3

At Air Liquide, we believe our role in the decarbonization of the planet extends beyond our own operations. The Group therefore conducts a thorough assessment of its GHG impact throughout its value chain. These emissions are categorized under the GHG Protocol Scope 3. They can further be distinguished between emissions induced upstream and those induced downstream of the Group's activities.

Addressing Scope 3 challenges

Focus

Given that these emissions take place outside of the Group's operations, addressing Scope 3 emissions is more complex. Having access to data to identify and quantify their composition presents its own set of challenges. Managing these emissions requires 4 complementary steps:

1. mapping emissions;
2. quantifying them with the highest reasonable level of precision in order to be able to design and track an action plan, in spite of these emissions being outside of our operational control;
3. identifying reduction levers, in spite of these emissions being out of our operational scope. This requires engaging with all stakeholders;
4. co-developing action plans with our stakeholders who have the direct reduction levers on these emissions.

Details of the Group's Scope 3 footprint appear below [21] :

Position	#	Category (in Mt CO_2e)	2023
	1	Purchased goods and services	3.1
	2	Capital goods	1
	3	Fuel and Energy (not included in Scope 1 or 2)	8.5
Upstream	4	Upstream transportation	0.5
	5	Waste	*Not material*
	6	Business travel	0.1
	7	Employee commuting	0.1
Upstream	8	Upstream leased assets	*Not relevant*
	9	Downstream transportation	*NS*[22]
	10/11	Processing and Use of sold products	6
	12	End-of-life treatment of sold products	*Not material*
Downstream	13	Downstream leased assets	1.9
	14	Franchises	*Not relevant*
	15	Investments	*Not material*

Upstream

Given Air Liquide's activities, key upstream categories of Scope 3 are - (a) upstream emissions related to the consumed power, fuels and feedstocks value chains[23] (e.g., extraction of fossil fuels), representing about 40% of total Scope 3 emissions in 2023, and (b) other procurement activities (goods and services and capital goods) which represent around 15% of total Scope 3 emissions.

Downstream

Air Liquide's business is to safely and efficiently provide small essential molecules to its customers.
In most cases, the use of our products allows them to improve their energy or carbon efficiency (e.g., for oxy-combustion in steel or glass manufacturing). In those cases, processing and use of our products do not induce emissions but reduce them. As a result, the emissions resulting from processing and use of Air Liquide's sold products are primarily concentrated in very specific sales segments:

those of gases which have a global warming power in applications where they are not abated by customers[24]. Typical examples are N_2O used for healthcare purposes or CO_2 sold to the food & beverage industry.

Although these products represent a small percentage of the Group's consolidated sales (less than 5% in 2023), the associated downstream emissions represent over 30% of its Scope 3 induced emissions.

A few gas production units operated by Air Liquide also induce emissions due to electricity purchases that are under customers' control. Sectoral practices are currently to report them in Scope 3.

Other

Other Scope 3 emissions can be linked to the Group's working environment, through business travel and employee commuting. They represent less than 1% of total Scope 3 emissions.

[21] See Chapter 5 of the Group's Universal Registration Document for more detail on variations and methodologies.
[22] Reported from 2022 onwards in "upstream transportation" to better align with the GHG Protocol.
[23] Although emissions released during production of consumed power feature in Scope 2, other emissions linked to the consumed power's value chain are accounted for in Scope 3.
[24] Some customer processes on the contrary include abatement mechanisms to avoid releasing the molecule in the atmosphere after its use.

2. Acting on our emissions - metrics, levers and actions planned

[25]

Lever	Action	Key success factor	2035 impact
CCUS	Limited number of SMR combined with CCUS or low-carbon ammonia cracking	Carbon pricing / carbon sink availability	~3-4 Mt
Asset Management	Limited number of SMR shift to low-carbon sourcing	Low-carbon feedstock availability	~5-7 Mt
	COGEN shift to low-carbon sourcing / peak load usage	Competitive low-carbon sourcing	
	Efficiencies (including leakage reduction equipment)	Operational excellence deployment	
	Fleet conversion to low or zero-carbon electric vehicles	Local infrastructure / market mechanisms	
	50% electrification of limited number of Steam-Driven ASUs	Customer process design update, Coal Quotas	
Zero-Carbon electricity sourcing	Zero-Carbon electricity sourcing	Renewables availability and market mechanisms	~5 Mt

Reducing Scope 1 emissions from existing operations

As explained above, the Group's direct operational emissions (Scope 1) come from three main sources covering over 90% of Scope 1, on which Air Liquide has set its focus:

- feedstock and fuel consumption in SMRs (~60%)
- fuel consumption in COGEN units (~30%)
- product transportation and fugitive emissions (~5%)

For each type of asset, decarbonization will come from specific technological solutions which are already within Air Liquide's capabilities and portfolio, as well as from continued efficiencies. In particular:

- for SMRs: Carbon Capture Utilization and Storage (CCUS) and conversion to low-carbon fuel and feedstock including low carbon ammonia;
- for COGEN units: shift to peak-load usage for electricity production[26], electric boilers for steam production and fuel conversion to low-carbon hydrogen or ammonia;
- for transportation fleet: conversion to alternative fuels for product transportation;
- process efficiencies to reduce electricity consumption; CO_2 and N_2O leak reduction across supply chain.

[25] Emission reduction impacts are given in CO_2e vs. a 2020 baseline. Levers are directional and could come to evolve according to the Group's adaptation to local contexts in its Climate strategy.
[26] This would concentrate electricity production on shorter intermittency compensation periods, thus improving the value of these units for local power systems and reducing their emissions.

Assessing various options at asset level, considering technological and market readiness, the Group has identified the following "early" emission reductions to be achieved by 2035;

- CCUS for a limited number of already identified large SMRs (10 of them representing close to 40% of total Scope 1 emissions);
- low-carbon fuel and feedstock (blue H2, green NH3 or biogenic) for a limited number of COGENs and SMRs ;
- other efficiency and transportation efforts, including switching bulk distribution to client on-site production.

While developing the first projects based on these technologies, the Group is already working on creating the conditions for the widespread success of these solutions through client discussions, regulation advocacy and engineering efforts. It should be noted however that external factors such as explicit or implicit CO_2 pricing, customer acceptance of a low-carbon price premium, biomass and carbon sink availability will play a key role in the speed with which they are implemented.

Although these stepstones form the bulk of our 2035 decarbonization target for Scope 1, the Group is also working on decarbonization of the rest of its direct emissions. Efforts such as truck-fleet conversion and local programs to reduce CO_2 and N_2O leakages are for instance underway.

More broadly, a feature of this action plan is that the necessary rate of decarbonization of the Group's assets to meet its climate objectives is well aligned with their useful life expectancy – no premature dismantlement will be needed on a 1.5°C trajectory.

Reducing Scope 2 emissions from existing operations

In terms of reducing Air Liquide's indirect operational emissions due to power consumption (Scope 2), the Group is engaged in two major directions:

- first is the electrification of a handful of steam-driven Air Separation Units (ASUs), representing 27% of Scope 2 emissions;

- second is proactive low-carbon electricity sourcing, preferably under power purchase agreements (PPA), in particular when they can be structured as competitive baseload supplies to match industrial requirements. In 2023, the Group's energy mix comprised 7.5 TWh of renewable energy and 6 TWh of nuclear energy – thus covering 37% of its electricity consumption with Zero-Carbon power. As the lever represents around ⅓ of the reductions to 2035, meeting the Group's mid-term climate objective on power consumption linked to existing assets is estimated to require sourcing around an additional 10 TWh of Zero Carbon electricity by 2035 (equivalent to an average 1 TWh per year).

This strategy is already well engaged, with the main risks being availability and accessibility of Zero-Carbon power, and appropriate market mechanisms on a local level, along with the consumers willingness to pay for low-carbon products. The latter is duly covered by Air Liquide's business model whereby electricity and carbon costs are passed-through to customers, combined with a continuous risk monitoring. Global appetite for low-carbon solutions will however be key in driving electricity production decarbonization.

	2023
Annual electricity consumption (in TWh)	41.5
Percentage of electricity consumed which is renewable	18%
Percentage of electricity consumed which is Zero-Carbon[27]	37%

[27] Zero-Carbon power covers all sources which emit no greenhouse gases in the power production process (e.g., renewables, nuclear).

When benchmarked with the International Energy Agency's Net Zero Emissions pathways (41.5% of zero-carbon electricity in 2023), the Group's trajectory appears to be very close. It should be noted, however, that the ***actual*** national ambitions for the decarbonization of power grids are not yet in line with a Net Zero power system requirement (as captured by the IEA's 2023 Announced Pledges Scenario). Achieving the Group's targets therefore cannot be considered separately from an increased ambition from other stakeholders, and national power systems, as transpires below:

	2023	2035
IEA *Net Zero* % of zero-carbon electricity production	41.5%	**88%**
IEA *Announced Pledges* % of zero-carbon electricity production	18%	**62%**

Investments in relation with decarbonizing our existing assets[28] will be made on contract renewal dates. As a consequence, they will yield their own cash flow and profitability. Similarly, by virtue of Air Liquide business model, any OPEX such as energy or CO2 management related costs (associated with decarbonization levers) will be contractually passed-through to customers. Last, any decarbonizing project will bring an opportunity to develop low-carbon offers

Overall, the Group's action plan is clear and strong enough for it to achieve its goal of reducing the carbon footprint of its activities by 33% by 2035, provided Air Liquide successfully embarks its stakeholders on key topics such as zero-carbon power generation and CO_2 transport and storage infrastructure and market mechanisms. The implementation of this plan is notably ensured through annual CO_2 envelopes cascaded to the operations and energy management teams, along with other governance processes detailed below (see the *"Governance"* chapter). Continued efforts will lead Air Liquide to carbon neutrality by 2050.

[28] Bearing in mind that a large fraction of the decarbonization will achieved through zero-carbon electricity sourcing, requiring no CAPEX

Managing Scope 1 & 2 emissions from Growth projects

As the Group decarbonizes its existing assets as outlined above, demand for Air Liquide products will continue to grow[29], driven by:

- base business growth in industries and healthcare
- energy Transition related projects with our existing customers, leveraging on Air Liquide's low-carbon products, technologies and know-how
- decarbonization projects from new AL customers in the hard-to-abate industries[30] or mobility

This growth could entail the following additional emissions sources:

- residual direct emissions from CCUS technologies (typically for Cement and Lime manufacturing or low-carbon H2): they will come as a result of deep decarbonization of other industries and may, by the strict application of current carbon accounting standards, increase the Group's Scope 1 emissions. These residual emissions are un-abatable and belong to the residual emissions that need to be compensated in a Net Zero world. The Group will first focus on achieving reductions where feasible, and eventually consider offsetting these residual emissions[31], as per science-based Net Zero scenarios;

- indirect emissions linked to power consumption, as a result of the broader decarbonization needs (typically for hydrogen liquefaction plants, CO_2 capture units, etc.). These emissions will be small versus the reductions these projects enable and will be managed through Zero Carbon electricity sourcing to the maximum possible extent (depending upon availability, accessibility and affordability criteria)[32].

As a result, this growth can be managed in a 1.5°C transition scenario wherein the power sector will decarbonize at the rate projected in IEA's Net Zero[33] scenario and is compatible with Air Liquide achieving its objectives.

Carbon offsetting

Focus

Because their use can hide controversial approaches to climate action, we believe it is important to have a clear stance on carbon offsetting practices.
Offsets correspond to netting a company's emissions by financing reductions, avoided emissions or carbon removals elsewhere. Though they are deemed to have a key role to play in reaching a Net Zero world by 2050, they remain a maturing market[34].
For offsets to be of high quality, they must come with rigorous measurement, reporting and verification to ensure that they are correctly accounted for and demonstrate (i) additionality (the emission reduction would not have happened otherwise) and (ii) durability (low risk of reversal).

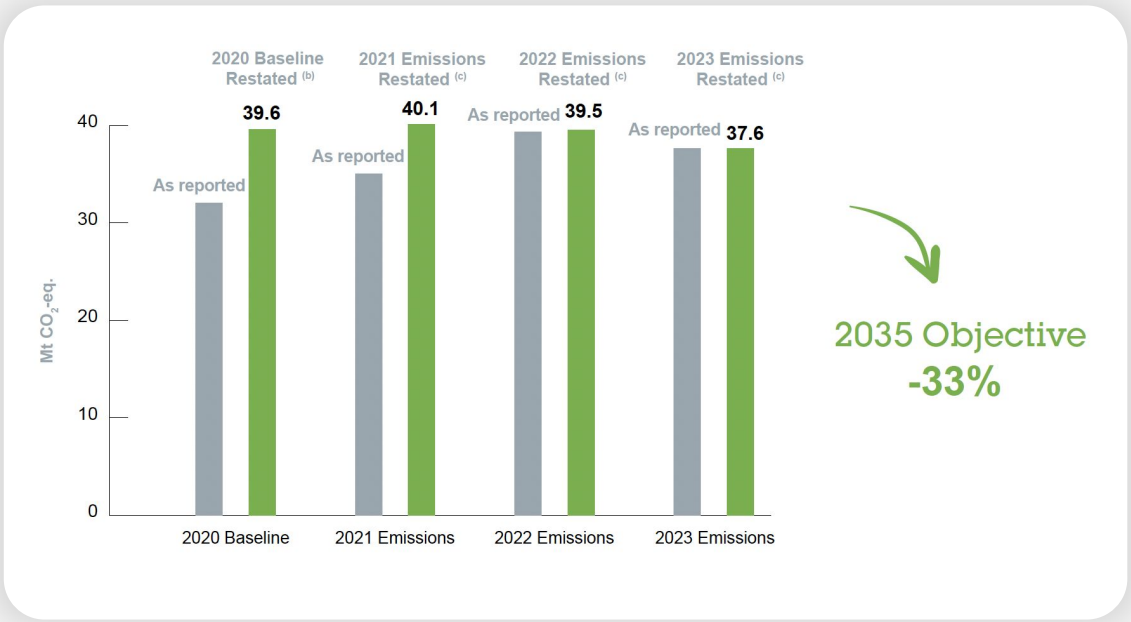
They should also avoid unintended negative consequences to ecosystems and communities. For Air Liquide, and as per the Oxford Principles for Net Zero Aligned Carbon Offsetting, offsets must not replace emission reductions where they are possible, but only cover the residual un-abatable ones. Removal offsets[35] should be prioritized and ultimately represent 100% of offsets used by 2050. Finally, they should correspond to durable storage (with low risk of reversal), though nature-based offsets with medium risk of reversal, or high quality verified emission reduction, may need to be used in the interim period, while waiting for the market to come to maturity.

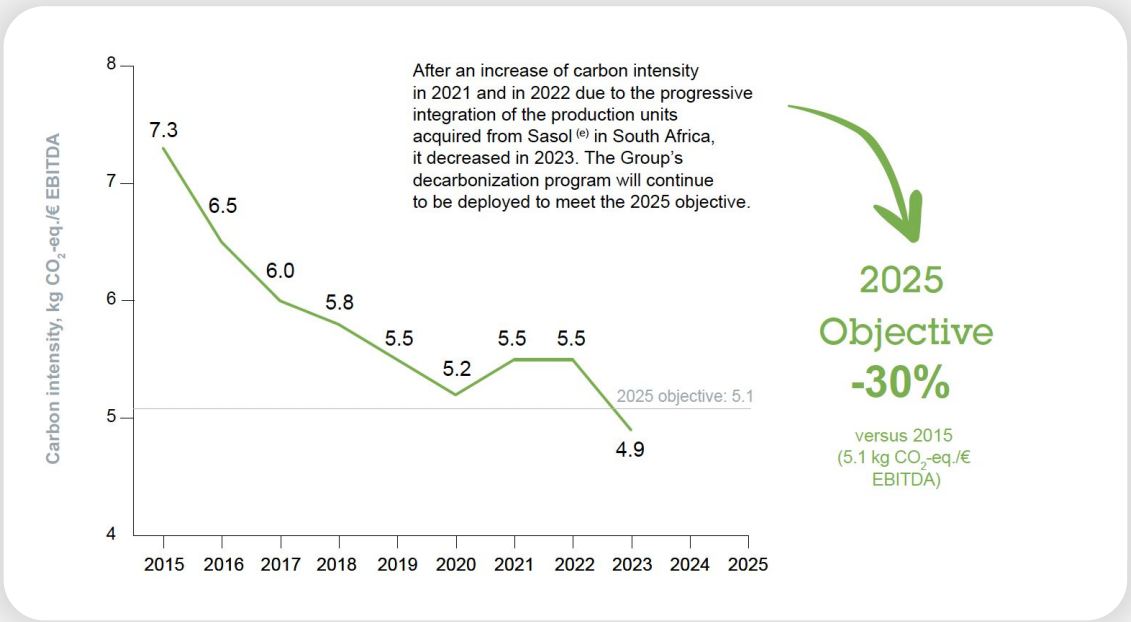
[29] See *"Our role in the Energy Transition"* chapter
[30] Cement or lime
[31] Details in *carbon offsetting* focus box.
[32] It is useful to note that zero-carbon electricity sourcing may come with a delay with respect to the power consumption growth entailed by these new projects, due to different development timelines. It does not however prevent those projects from being beneficial for the planet from the start. For instance an ATR (Autho-Thermal Reformer) and the corresponding ASU and Carbon Capture Unit provide 80% of the maximum potential overall emission reductions of the project, the remaining 20% being achieved thanks to zero-carbon electricity sourcing for the units' power consumption.
[33] In a 1.5°C transition, 88% of total electricity production will be zero-carbon by 2035 as per the IEA World Energy Outlook 2022 Net Zero Emissions scenario– which is higher than the required % of Air Liquide zero-carbon sourcing proportion in its most ambitious growth scenarios.
[34] The Oxford Principles for Net Zero Aligned Carbon Offsetting, 2024.
[35] Compared with emission reduction offsets, carbon removals scrub carbon directly from the atmosphere. They however represent a minor share of available offsets as of today.

Progress on Scope 1 and 2 targets

Air Liquide is already engaged in reducing its emissions as per the roadmap presented above. In 2023, two elements stand out:

- absolute emissions are starting to stabilize/reduce, despite significant business growth, bringing confidence in the Group's ability to reach its objective of an inflection point by 2025, and putting its trajectory on-track for its 2035 target;
- emission intensity is continuously decreasing, with a 2023 value already below the 2025 target;



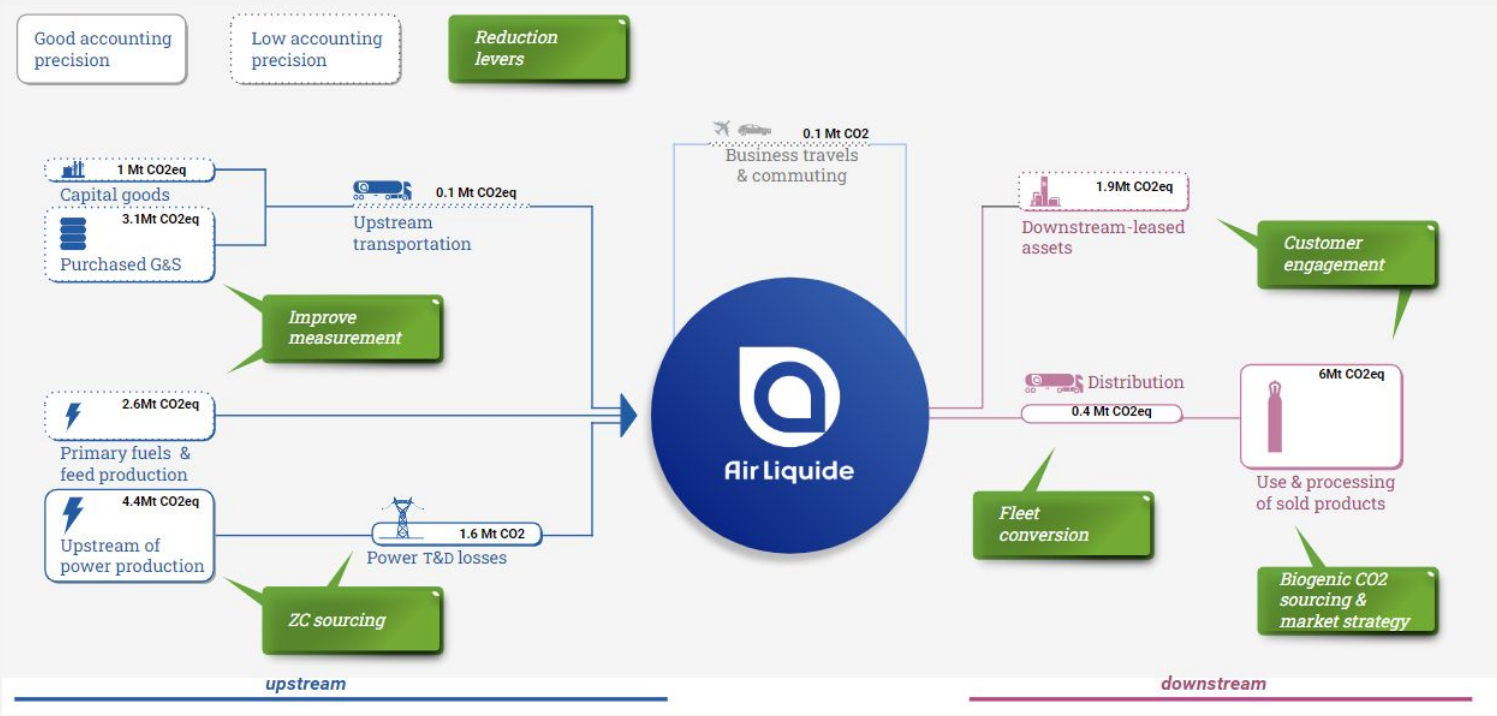


3. Scope 3 Emissions - Acting on our value chain

As previously stated, we strongly believe our role in decarbonizing our activities extends beyond our operational boundaries, throughout our value chain. This is why the Group is committed to decreasing its Scope 3 emissions, as part of its 2050 Carbon Neutrality ambition.

Acting on these indirect emissions induced by Air Liquide's activities must come through a cross-identification of, on the one side, where the Group's induced footprint is the highest and, on the other, where it has the most influence.

Air Liquide's Scope 3 emissions and levers - FY 2023



Reducing emissions attributed to upstream activities

The first lever on the Group's upstream induced emissions is acting on its electricity[36], fuel and feedstock sourcing (currently reported in category 3, representing 40% of Scope 3 emissions). Actions on this front are twofold:

- moving from fossil to zero-carbon electricity sourcing (70% of category 3). Although zero-carbon sourcing still entails upstream emissions (e.g., production of solar panels), these are however much lower than for fossil-based production. As the transition unfolds, they will further reduce as renewable developers turn to low-carbon materials (steel, cement or concrete, etc.). Leveraging the Group's actions to reduce its Scope 2 will therefore have an important positive impact on Air Liquide's Scope 3 footprint;
- reducing upstream emissions from natural gas consumption (30% of category 3, e.g., reducing methane leaks). This would require: (i) more precise data on upstream emissions from various suppliers, followed by (ii) actions on fuel and feedstock sourcing to reduce the CO2 intensity of the fuels and feedstocks consumed by the Group. Addressing these emissions, starting with measurement and engagement with suppliers, is part of Air Liquide's strategy to address its Scope 3.

[36] Although emissions released during production of consumed power feature in Scope 2, other emissions linked to the consumed power's value chain are accounted for in Scope 3.

The second lever consists in reducing emissions from other procurement activities (15% of Scope 3 emissions). To do this, the Group launched the *Procure to Neutrality initiative* in 2021, which relies on four pillars:

measure: improve the methodology for calculating Scope 3 where relevant and feasible. This is essential as current methodologies rely on statistical figures, which cannot fully account for the Group's sourcing efforts. Retrieving precise product carbon footprints relies on the second pillar;

engage buyers, through training of the purchasing community, and engage with suppliers who are the most significant emitters, for them to help the Group in measuring its procurement emissions, as well as to encourage science-based carbon neutrality commitments;

leverage the Group's procurement activities to effectively reduce Scope 3 emissions across the value chain by including climate footprint and commitment in procurement assessments. This is enabled with use of Air Liquide's award-winning TCO_2 tool[37];

reduce: define an objective, with the aim of being aligned with the Group's carbon neutrality ambition.

The third lever on upstream emissions addresses upstream transportation and distribution of products (2% of total Scope 3 emissions). Two thirds of these emissions correspond to outsourced distribution of Air Liquide's bulk and packaged gases. The Group's "Clean Fleet" initiative acts on this lever together with Scope 1 transportation emissions.

Reducing emissions attributed to downstream activities

In the Group's downstream induced emissions, the main reduction lever is on the sales of products with high global warming potential (mainly CO_2 and N_2O) which, in most applications, are later re-emitted further down in the value chain, resulting in 30% of Air Liquide' total Scope 3 emissions although they represent a small percentage of the Group's consolidated sales (less than 5% in 2023).

For CO_2 sales, the solution will come from shifting production towards biogenic sources[38]. The Group has started working on a roadmap for its European operations on this point.
For N_2O sales, many end usages are essential and difficult to substitute (e.g. use of N_2O in analgesia). The Group is currently studying end-markets for those sales so as to understand (i) where emission abatement can be further improved (e.g., electronics manufacturing, healthcare) and (ii) where alternate products could be developed.

More broadly, Air Liquide has committed to having by 2025 75% of its Top 50 customers committed to 2050 Carbon neutrality and 100% by 2035.
In 2023, 74% met this criteria.

As for the current category 13 emissions (5% of Scope 3 - energy supplied free of charge by our customers), as it consists of units which are almost all electrified, their footprint is bound to decrease with evolution of country energy mixes and customer sourcing efforts (many of them having strong emission reduction commitments). More proactive ways to monitor their actions and influence their sourcing are under investigation.

Reducing other induced emissions

Some Scope 3 emissions can also be attributed to working environment structuration at Air Liquide (such as commuting or business travel emissions). Although this does not represent a material part of the Group's footprint (below 1% of total Scope 3), we believe it is essential to address them to foster a broader sustainability culture in the Group and exemplarity in civil society. To this regard, Air Liquide has reviewed its responsible travel policy to include more sustainable practices and launched a company car conversion program.

[37] The Group's TCO2 tool, awarded in 2022, makes Air Liquide's CO2 reduction goals tangible by integrating them into three supplier selection criteria: the TCO (total cost of ownership*), risk assessment and the TCO2 (total CO2 emissions). The tool: (i) gauges the maturity of a supplier's Net Zero activity; (ii) measures the carbon content in a supplier's offer; (iii) applies weighting appropriate to the category being procured; (iv) sets a minimum required TCO2 score to be eligible to tender, from 2024 (v) will progressively raise the bar, setting the pace for ever-higher standards.
[38] Biogenic CO2 is fully embedded in the natural carbon cycle and is therefore not considered as contributing to Global Warming.

Managing risks and opportunities

1. Climate Transition risks
2. Climate physical risks

On the energy transition path, the world and economy will face many large-scale transformations, the impact of which are uncertain. Navigating this process can entail both opportunities and risks for a company like Air Liquide. Being able to assess them is essential to prepare for the Group's future in a prudent, yet ambitious approach.

1. Climate Transition risks

Climate transition risks refer to the potential financial, economic and social risks associated with the shift from a carbon-intensive to a low-carbon economy. The Group's approach to transition risks follows a three-step approach: identification of potential risk sources; establishment of risk assessment procedures, and preparation of risk mitigation plans.

Two types of processes can further be distinguished: (i) forward-looking control of investments, and (ii) reviews of existing activities.

Forward-looking control of investments

In order to make sure that future investments are compatible with a 1.5°C transition scenario (as described by the IEA Net Zero Emissions scenario[39]), as well as with the Group's financial and extra-financial commitments to its stakeholders, Air Liquide relies on its Resources & Investments Committee (RIC) that reviews every material investment opportunities and potential projects. For instance, among other considerations, the RIC guidelines include that:

- all projects must integrate a sensitivity analysis around the carbon price to assess the viability of the project for the customer[40] since by virtue of Air Liquide business model, any OPEX such as energy or CO_2 management related costs will be contractually passed-through to customers. This sensitivity analysis is to be carried out with the current local price and a value of 100 euros per ton or more chosen according to geography and context. The Group is currently reviewing its internal policy to adapt this minimum price, in line with CO_2 pricing projection evolutions since this policy was established;
- furthermore, whenever Scope 1 & 2 annual emissions for the associated investment, or the customer's annual emissions are above specific thresholds, investments must first go through an Emissions and Energy Risks Committee through which technology, reputation and market risks are considered. Results are then transferred to the RIC.

Additionally, and to prevent any investment from compromising the Group's carbon neutrality objective, the emission exposure of the Group is centrally managed via a yearly carbon budget. This budget is allocated to the different regions and is revisited every year, in line with climate objectives[41]. This trajectory is periodically reviewed by the Environment and Society Committee of the Board of Directors[42], which in addition to 3 annual meetings, also meets once a year in a joint session with the Audit and Accounts Committee. During this joint session, the two Committees review the progress on environmental objectives.

[39] As taken in the Net Zero Roadmap (2023) and the World Energy Outlook (2023).
[40] In Air Liquide's business model, contractually re-invoiced to the customer, significantly reducing the risk of depreciation of the assets concerned.
[41] See the "Governance" chapter, 2 – *Monitoring mechanisms and executive accountability* for details on the CO_2 budget allocation process.
[42] The ESC committee regroups 3 Directors and the Group CEO.

Review of existing activities

Another key dimension in managing the Group's transition risk is that of its existing assets and activities. To review this, Air Liquide is deploying a dedicated process, covering the 4 risk dimensions recommended by the Task Force on Climate-related Financial Disclosures (TCFD) : policy & legal, technology, market and reputation with a 2035 and 2050 time horizon, differences coming more from intensity of the risk drivers rather than from their nature.

- **Risks screening and identification.**
  Under the leadership of the Sustainable Development Department working with Finance teams and World Business Lines, a review of the transition risk drivers in a 1.5°C transition scenario is conducted.

- **Regional deep dives**
  Following the assessment performed by the central team, dedicated deep dives are conducted in the different geographies, with an asset-level analysis when relevant, taking into account the type of asset, its production capacity, the market served, and the local decarbonization policies.

In order to have a holistic view of the Air Liquide's net exposure, the Group assesses transition risks alongside associated opportunities. It can be synthesized as follows:

Driver [43]	Significance	Risk Assessment	Opportunity Assessment
Policy & Legal			
Increased pricing of CO_2 emissions	Higher cost stack due to CO_2 pricing	Low – potential costs have contractual pass-through provisions.	High – low-carbon manufacturing growth potential.
Mandates / regulation on existing products and processes	Mandates on LC H2 and CCUS regulation	Moderate – IEA alignment and positive regulatory signs.	High – accelerated scale-up of nascent value chains / cost-gap closure potential.
Enhanced reporting obligations	Cost of enhanced reporting process, reputational cost of transparency	Low – high-precision reporting validated by external auditors and enhanced disclosures under Corporate Sustainability Reporting Directive (CSRD).	Moderate – climate metrics knowledge and management improvement driven by CSRD robustness requirements.
Technology			
Substitution of existing products for lower emissions options	Low-carbon production of industrial gases	Low – Air Liquide is positioned to be a leader on the low-carbon H_2 value chain and is positioned in all new low-carbon industrial gas technologies. No product substitution for air gases.	High – opportunities from low-carbon hydrogen and industrial gases demand scale-up.
Unsuccessful investment in new technologies	Failure to develop new technologies in time, cost and accordance with market demand	Low – robust technology roadmaps with long successful track-record.	High – Strong technological development competitive advantage under lower time-to-market requirements and wide proprietary portfolio.
Costs of transition to lower emissions technologies	Cost of electricity sourcing, CCUS or low-carbon sourcing	Low – Abatement costs below implicit CO_2 pricing trajectories in 1.5°C scenarios.	
Market			
Changing customer behavior	Customers which might disappear or not need industrial gases in their shift	Low – Air Liquide's has a diverse customer base, due diligences for site and customer assessments, a resilient contractual structure and customer intimacy to anticipate shifts.	High – potential for more industrial gases and services sales to meet new demand.
Uncertainty in market signals	Uncertainty in H_2, CCS or electricity prices (for PPAs) perspectives	Moderate – Risks are passed through in contracts, market signals are monitored with strong customer intimacy. Advocacy ensures market signals come with clear and stable frameworks.	
Increased costs of raw materials	Increased costs of raw materials	Low – relatively low consumption of critical materials	
Reputation			
Shifts in consumer preferences	Shifts in end-products of our value chains	Low – Industrial Gases are involved in almost all manufacturing processes.	High – strong increase of industrial gas uses across geographies and decarbonization paths.
Stigmatization of sector	Chemicals stigmatization	Low – Air Liquide's advocacy strategy integrates science-based pedagogy for a sector necessary to all scenarios.	
Increased stakeholder concern & negative feedback	Investor coalition or NGO concerns	Low – Air Liquide has specific structures to entertain a constructive dialogue with either Group.	High – strong stakeholder alignment capability ensured through specific structures.

[43] Climate-related transition risks were assessed following the categories and examples from the Task Force on Climate-related Disclosures (TCFD) Final Report, 2017

Details on these assessments can be found in Appendix 3 – Transition risks assessment.

2. Climate physical risks

Climate physical risks refer to the potential financial, economic, and social impacts resulting from the physical effects of climate change. These risks arise from acute (i.e. event driven risks that occur with little warning and include extreme weather events such as hurricanes, flood, wildfires) and chronic (i.e. longer term shifts in climate patterns that occur gradually over time, such as rising sea levels, increasing temperatures, and prolonged droughts) changes in the natural environment.

Managing physical risks related to Climate Change means preparing for a high emissions scenario, where the world does not follow a 1.5°C pathway. In 2021, Air Liquide restructured its risk universe with a specific "climate-related physical risks" category (i.e. risks related to the physical impacts of climate change). In 2022 a scoping study was conducted by the Sustainability team, leading to an in-depth analysis in 2023.

Air Liquide identified 10 event types in its risk universe and singled out the most significant ones (Drought, Extreme Weather, Fire, Flood, Heat, Precipitation and Temperature).

Leveraging an external expert data platform, an exposure analysis on the 500 main production assets then mapped the peril faced by each of these in two well-defined climate scenarios (intermediary IPCC scenario – SSP 4.5 leading to an average 2.7°C temperature increase by 2100, and worst case IPCC scenario – SSP8.5 leading to an average 4.4°C temperature increase by 2100). Crossing this geographical exposure with the potential high impacts on assets yielded four priority risks for Air Liquide, depending on geographies: temperature (acute temperature rise), heat (change in temperature pattern), fire and drought.

The Group is now developing vulnerability assessments to capture the actual net impacts such climate-related events may have on assets (direct damages, decrease of production, business interruption). This will form the backbone of the future risk management process, allowing the Group to better identify climate-related risks and opportunities and put in place mitigation plans where relevant. They will follow best practices already in place for specific climate hazards (e.g., hurricanes on the United States Gulf Coast).

Risk management will also cover future investments as prospective sites will evaluate their exposure to each of the 10 identified risks and conduct a vulnerability assessment whenever they are high.

Our climate governance and accountability

1. Stakeholder engagement
2. Monitoring mechanisms and executive accountability
3. Board oversight, skills and experience
4. Climate policy engagement

A strong ambition can only be achieved if it is backed with proper governance and accountability mechanisms. To that end, Air Liquide has instituted robust internal processes and structures.

1. Stakeholder engagement

A first key element of the Group's governance is its attention to on-boarding all its stakeholders on its climate transition plan.

As a result of a 2020 consultation of its stakeholders on Sustainable Development topics, Air Liquide adjusted its sustainable development strategy to focus on priority themes, with addressing climate change becoming one of its highest priorities.

Then the Group established its sustainability commitments and roadmap, which were publicly disclosed in March 2021. Prioritization of the Group's efforts is being reassessed in 2024 through the CSRD[44] double materiality assessment. This assessment considers the interest and views of affected stakeholders and users of the Group's sustainability reporting.

The transition to a carbon-neutral economy can also have important social and societal implications. It is thus imperative that such transition be a "just" transition. The Group reports on how it addresses this question in its Just Transition statement[45], a key feature of which is Air Liquide's attention to accompanying its employees' competencies. It promotes cross-functional mobility, deploying action plans per area of expertise (e.g., creation of an electrolyser product line in its engineering and construction business unit) and developing diverse training modules. For example, over 1,000 employees are trained on Climate and Energy Transition topics every year.

Air Liquide also has dedicated procedures and resources to engage in constructive dialogues with all stakeholders. Good examples are the MyVoice engagement surveys for employees, transversal task forces for investors, investor coalitions and Non Governmental Organizations (NGOs), a sustainable procurement team for suppliers, and a corporate team dedicated to customers satisfaction and experience. These programs aim to make the most out of Air Liquide's interactions with Group stakeholders.

2. Monitoring mechanisms and executive accountability

Keenly aware of the importance of efficient monitoring and accountability mechanisms for ambitious targets to be met, Air Liquide has instituted various internal procedures aimed at delivering on its commitments. They can be grouped as (i) forward planning, (ii) investment monitoring and (iii) operational monitoring.

First, the Group has established a **long term strategy** to reach carbon neutrality by 2050, with critical short and mid-term milestones. This global view has been cascaded to all countries and operations in a structured way, starting with the creation of a network of Climate Champions with a representative in each geographical cluster (group of countries).

[44] Corporate Sustainability Reporting Directive.
[45] The Group's just transition statement can be found here.

They serve as the point of contact for the Sustainable Development Department on CO_2 topics and are accountable for local climate transition plans. They coordinate the development of roadmaps that define all the operational measures required to achieve it, and are responsible for monitoring the indicators, the roll-out of projects and reporting on process. Cluster decarbonization plans are then reviewed in yearly executive-level meetings with deep-dives on identified hurdles and growth opportunities, allowing periodical updates in our forward planning. More generally an internal committee oversees Air Liquide's sustainability strategy and regroups the Group CEO alongside several COMEX members, showing executive commitment. The present climate transition plan was reviewed by this committee.

Second comes **investment monitoring,** essential for mid to long-term target achievement, as new investments typically last for over 20 years. With respect to emission planning, annual Capex envelopes are complemented by 'carbon envelopes', corresponding to the emissions decrease foreseen 5 years down the road as a result of the year's investment decisions. The 'carbon envelope' is the result of a dialogue between the geographical clusters and the Group's Operations Control team so as to be compatible with the Group's objectives and allocated as a function of local contexts. The foreseen emission reductions are then taken into account in the Review of Investment Decisions: a very disciplined process that every material investment project has to go through. Accountability at this stage is ensured by executive supervision of Resources & Investments Committees.

Finally, for its **operational monitoring,** the Group relies on robust internal reporting procedures structured and controlled like financial reporting. Feedstock and energy consumption are collected at the operation level and submitted to relevant consistency checks and controls at various consolidation levels.

Emission evolutions are later analyzed through an internal variance analysis. This allows the Group to track cyclical changes and effort-based effects on a separate basis. Quarterly decarbonization analyses take place for each geography, with a formal review on a yearly basis to prioritize efforts.

As a result of this structured approach, reporting is governed through the Group Finance Department while the Sustainable Development Department is in charge of the definition and implementation of the plan. Two of the Group COMEX members therefore have direct responsibility for the climate transition plan and the associated commitments are cascaded throughout Air Liquide organization.

In addition to monitoring and planning mechanisms, accountability and environmental performance are incentivised through specific schemes. For instance, the Group CEO's performance on ESG objectives represent 10% of his/her annual nominal variable pay and 10% of the Group Long-Term Incentives plans are indexed on the Group climate objectives alignment for all beneficiaries (as regards the CEO, representing up to 40% of his/her total remuneration). This Long-Term Incentives scheme is the same for over 2,600 Air Liquide employees, ensuring the highest possible level of alignment in the organization. More broadly, 400 senior executives have 15% of their total variable pay indexed on ESG criteria and all employees receiving a variable pay have 10 to 15% of annual bonus linked to ESG achievements.

3. Board oversight, skills and experience

At the board level, the Environment and Society Committee (ESC) examines the Group's strategy and commitments in the field of sustainable development and reviews actions on climate-related topics. To this end, it is composed of selected Directors with appropriate skills and experience.

ESC Committee

Focus

As of today, the Air Liquide board's Environment and Society Committee is chaired by Dr. Annette Winkler, also Chair of the Renault S.A. Strategy and Sustainability Committee. The committee also features Monica de Virgiliis[46], cofounder and Chair of Chapter Zero France and Philippe Dubrulle, Transformation and Sustainable Development Director of Air Liquide Advanced Technologies, underlying the Group's effort to ensure appropriate expertise on climate related topics in its governing bodies.

In principle, the ESC Committee meets three times a year and reports on its work to the Board of Directors. The conclusions of the meetings of the Environment and Society Committee are presented to the Board of Directors by the Committee Chair either for discussion or, if relevant, in the form of recommendations to the Board of Directors. The Committee may also be assisted by external experts[47].

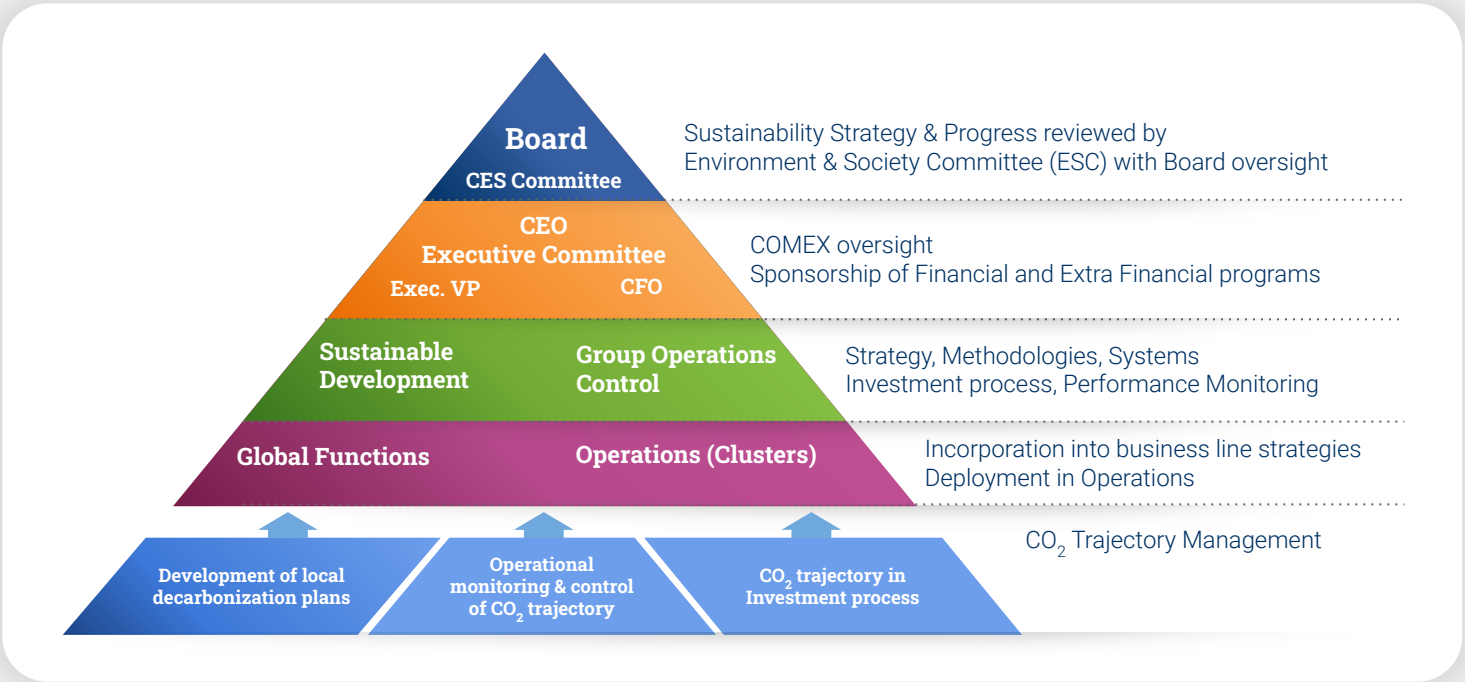
At each committee meeting, reports are made by the member of the Executive Committee in charge of sustainable development on strategy and implementation planning, along with the progress made.

A joint session with the Audit & Accounts Committee is also held once a year. This joint session allows for good interaction between the two Committees, particularly in terms of risk review, since the Audit Committee reviews the Group's risks and related control procedures, including environmental and societal risks, which are examined in detail by the Environment and Society Committee. The joint session makes it possible for the members to discuss subjects which concern both Committees. It also helps ensure a consistent approach, as reflected in the reconciliation of the financial and extra-financial data in the Integrated Management Report.

Overall board skills are also entertained by yearly training sessions. In particular, specific courses on the topic of Corporate Social Responsibility (CSR) were conducted in 2022 and 2023. To date, 86% of board members have functional CSR skills and 57% have sectoral energy skills. The present climate transition plan was reviewed by the ESC Committee that recommended to the Board to make it public.

[46] In collaboration with the World Economic Forum, Monica de Virgiliis founded Chapter Zero France, a non-profit association aiming to raise awareness of climate issues among non-executive Directors. She is its Chair, making her a precious contributor to Air Liquide's ESC committee.
[47] Extensive description of the committee and its activities can be found in Chapter 3 of the Group's 2023 Universal Registration Document.

The governance of climate related topics is therefore as follows:



4. Climate policy engagement

We believe our responsibility as a Group also extends to all our stakeholders and partners. Such is the spirit of the Group's climate policy engagement.

Financing partners and investment alignment

Following the announcement of the Group's sustainability objectives in March 2021, a Sustainable Financing Framework was implemented. This framework makes it possible to support the financing and refinancing of assets and projects intended to have a clear benefit for the environment and society. It is aligned with the "Sustainability Bond Guidelines 2018", "Green Bond Principles 2018", "Social Bond Principles 2020", "Social Loan Principles 2021" and the "Green Loan Principles 2021" overseen by the ICMA (International Capital Market Association), and validated by the Sustainalytics agency. This initiative reflects a threefold ambition for the Group:

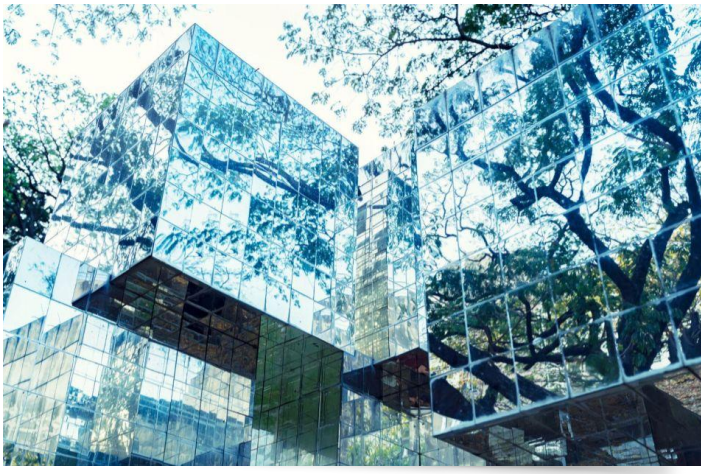
- align its financing strategy with its sustainability objectives;
- contribute to the development of sustainable finance;
- diversify its investor base.

The framework was updated in 2024 so as to focus around a few core categories of eligible projects[48].

This responsible and sustainable financing framework enables the Group to raise funds through bond issues, loans and any other instrument dedicated to financing sustainable development projects. This naturally strengthens Air Liquide's links with its impact-oriented financing partners. The same goes for its investor relations department's proximity with ESG investors and investor coalitions.

[48] Air Liquide's refreshed Sustainable Financing Framework was given a "Very Good" Sustainability Quality Score by Moody's Second Party Opinion.

As part of these “Sustainable Financing Frameworks”, the Group issued two 500 million euros green bonds in 2021 and 2024, to finance and refinance several sustainable development projects, most notably in hydrogen, CCUS and oxygen. Also, as part of the management of its cash



surpluses, Air Liquide now favors sustainable investment instruments, such as SRI-certified funds or funds promoting environmental and social objectives. While this allocation does not currently apply to the majority of its investments, the Group intends to support market dynamics by relying on a growing range of investment funds eligible under Articles 8 and 9 of Regulation (EU) 2019/2088 on sustainable development disclosures in the financial services sector (known as the “Sustainable Finance Disclosure Regulation”).

Finally, since 2020, ALIAD, Air Liquide’s venture capital fund, has strengthened its position in impact start-ups. With more than 25 million euros invested, including 15 million euros in the field of energy transition, ALIAD is thus contributing to the Group’s strategic ADVANCE program, which combines growth and a sustainable future.

Climate advocacy

Air Liquide actively contributes to the discussions, consultations and work of public authorities as well as with professional associations, Think Tanks and NGOs (non-governmental organizations), in its areas of expertise. The Group’s engagement relies on the belief that private actors bring expertise to the public debate by presenting arguments and assessments of the implications of policies to the policy makers, in particular when policy decisions may have consequences on the company's activities and on other external stakeholders, or could, for example, compromise the ability of industries to reach their decarbonization commitments.

The European and International Affairs Department, in conjunction with the various geographical operating entities and the Group’s Business Lines, covers the following sectors: energy/hydrogen transition, circular economy, innovation, technologies, digital and health. Regarding climate-lobbying issues, the Group’s main advocacy positions are published on its website:

- a clear positioning for low-carbon & renewable hydrogen
- establishing an adequate price on CO_2 emissions
- electrification and access to low-carbon electricity
- carbon capture, utilization and storage (CCUS)

As Air Liquide serves many industrial sectors in many different geographies and activities, the Group relies on and takes part in various trade association working groups. Air Liquide is regularly assessing the alignment of its main trade associations regarding climate issues with the objectives of the Paris Agreement and its own advocacy positions. The details of these activities and measures taken to ensure this alignment are described on the *Engagement with public stakeholders webpage.*

Appendix 1:
Annual inventory and verification

Nature	Name	Unit	2015	2021	2023	2025	2030	2035	2050
Commitment	**Scope 1 & 2 GHG emissions (restated)**	Mt CO_2e		40.1	37.6			26.9	*Carbon neutrality*
	Scope 3 emissions	Mt CO_2e							*Carbon neutrality*
	CO_2 intensity	tCO_2/ €EBITDA	7.3	5.5	4.9	5.1			
	% Top 50 customers committed to carbon neutrality by 2050	%			74%	75%		100%	
Ambition	**% zero-carbon electricity sourcing**	%		32%	37%				100%
	CDP grading	A to D-		A-	A-				
Key monitored metric	**Avoided Emissions *Air Liquide methodology***	Mt CO_2e	15	15	12				
	Active zero-carbon electricity sourcing	TW h	1.2	2.5	3.5				
	EU taxonomy Aligned vs Eligible CAPEX[49]	%		30	54.8				
	EU taxonomy Aligned vs Eligible OPEX	%		27.7	17.1				
	EU taxonomy Aligned vs Eligible Turnover	%		6.6	5.9				

Appendix 2:
Underlying assumptions

This Climate Transition Plan was built following widely recognized climate science and energy transition scenarios.

Mitigation pathways consistent with limiting global warming to 1.5°C above pre-industrial levels are derived from the International Panel on Climate Change *Special Report on Global Warming of 1.5°C*. In particular, the IPCC recognizes that such pathways require global cooperation and policies reflecting a high price on emissions to achieve cost-effective transition.

In this plan, Air Liquide also assumes its own mitigation efforts take place concurrently with the mitigation actions - by geographies and sectors - highlighted in the International Energy Agency's *World Energy Outlook* and *Net Zero Roadmap* (2023 updates). In these projections, a Net Zero Emissions scenario for instance requires a rapid decarbonization of the energy sector (88% of electricity production is renewable or nuclear by 2035 vs. 62% in announced pledges), on which decarbonization of the industry relies, alongside efficiencies, behavior adaptation and carbon capture and storage development. More details on underlying assumptions can be found within those publications.

[49] The EU taxonomy provides a useful metric to read a company's energy transition investments in a dynamic way. It should however be noted that it is not the ultimate source of truth on engagement in the energy transition. This is because (i) only a small % of Air Liquide activities, including for energy transition markets, are considered within the taxonomy (17% of 2023 turnover) and (ii) taxonomy alignment thresholds can differ from those of other local public policy incentive schemes. For instance, hydrogen production is considered aligned with the taxonomy when the carbon footprint is below $3tCO_2/tH2$ whereas the European Renewable Energy Directive (RED II) incentivises investments in hydrogen below $3.38tCO_2/tH2$.

Appendix 3:
Transition risks assessment

The main results of the net transition risk exposure analysis, presented in the "*Risks and opportunities*" chapter - *Managing risks and opportunities* derive from the following elements.

Policy and Legal Risks

These risks consist in governmental or legal action which could directly impact Air Liquide's activities. Mains drivers of this risk are energy transition policies such as CO_2 emissions pricing and mandates on Air Liquide's technologies (mainly low-carbon H2 and CCUS).

CO_2 emissions pricing is both a necessary step towards transition and an opportunity for the Group.
It should be implemented in a progressive way, give visibility to all stakeholders and be accompanied with adequate support. It should also cover the largest possible scope of the economy to avoid 'carbon leaks' and ensure a level-playing field. Such a policy would then provide a long-term incentive to decarbonize and substantially accelerate the shift to Air Liquide's low-carbon technologies, as described in the previous subsection.

Consequently, Air Liquide's customers would then face an arbitration between bearing high CO_2 prices (contractually re-invoiced to our customers) or a decarbonization cost. For instance, internal sensitivity studies show that, depending on the geography and the context, a carbon price in the range of 100 to 250 euros per tonne of CO_2 , consistent with a 1.5° trajectory, encourages the customer to decide toward the supply of low-carbon hydrogen. This CO_2 value can be explicit or integrated into regulatory obligations on the carbon footprint of end products.

Air Liquide could nonetheless be negatively exposed to CO_2 emissions pricing by three channels: (i) direct costs for its operations, limiting its competitiveness, (ii) indirect effects on its suppliers, increasing their prices and (iii) indirect effects on its customers' operations, impacting their needs and potentially jeopardizing their local activities.

On the first channel, as previously stated, Air Liquide's business model is such that its large customers would need to bear their carbon and energy costs themselves without Air Liquide's solutions. Most existing contracts already include carbon and energy cost pass through provisions, even in geographies with no current carbon pricing. In some instances where these prices are not passed-through, it results from customers being price-takers and associated costs do not represent a risk for the Group's activities.
Additionally, the Group's commitment to its targets does not come with additional financial exposure. Scope 1 emission reductions are not expected to require the dismantling of any units as decarbonization solutions for SMRs will be invested upon contract renewal where the premium for low-carbon products passed through to customers. On Scope 2, as the Air Separation Units (ASUs) are almost all electrified, they do not require any specific investment for the transition, apart from sourcing efforts for renewable energy. For those ASUs which are steam-driven, the local context is such that Air Liquide's customers are progressively converting to electrically driven units, in a timeframe compatible with the Group's targets. As a matter of fact, two such units will be fully electrified in 2024 and a third conversion was decided this same year.

On the second channel, the Group's main procurement exposure to emissions pricing is on electricity. Although, here again, at-risk price variations are passed through, the Group is also taking actions to shield itself from risks coming from an evolving regulatory environment. The Group's electricity procurement initiatives have been reinforced, in particular the procurement of renewable electricity, in order to reduce the Scope 2 emissions. In parallel, the Group is preparing itself to manage the effects of rising intermittency in power grids through programs such as AliveTM[49] and COGEN management. Expertise and best-practices are managed by a central Energy Management team through training, guidelines and control procedures. Other procurement activities are also embarked in a Procure to Neutrality roadmap, through which the Group's suppliers' carbon content will be closely managed and reduced[50].

Finally, as far as the customer channel is concerned, the Group's current assessment is the following. For those of its customers who need strong decarbonization efforts, and could see their operations jeopardized by high CO_2 prices, Air Liquide offers to partner, leveraging on its products, solutions and technologies portfolio to mitigate the customers risks. In this context, CO2 pricing for high emitting customers will rather be an opportunity than a threat as it will raise the interest to invest into decarbonization solutions. More widely, Air Liquide's customers are central in all energy transition scenarios – be it in the steel, chemicals or energy industries. Air Liquide's ability to accompany them in their decarbonization journey and market evolutions is further strengthened by its historical focus on customer intimacy. For instance, the Strategic & Key Accounts program has allowed the Group to develop a privileged relationship with leaders in their respective sectors, paving the way for new partnerships as their businesses evolve. Together with Air Liquide's extension into the whole hydrogen value chain, carbon capture, biomethane and electronics, this positions the Group to address evolution its customers evolving needs.

Focus

EU ETS

Air Liquide's assessment of its CO_2 pricing risk is well exemplified by the impact of the EU Emissions Trading Scheme (ETS). Since its implementation, and throughout the price variations in the previous years, it did not alter the Group's customer needs nor the profitability of its operations. It did on the other hand underscore the efficiency of Air Liquide's assets, with a higher than EU average of quotas freely allocated to the Group[51].

As for mandates on Air Liquide products and processes, they are expected to have a net positive impact on the Group's activities rather than the opposite in a 1.5°C scenario. This comes from the fact that the Group's business strategy is compatible with the spirit of the IEA Net Zero Roadmap (2023) which will require regulatory pushes to allow the right decarbonization pace. A good example of such pushes favoring the establishment of our new product and services' value chains is carbon capture utilization and storage (CCUS), as detailed in the following deep-dive.

Air Liquide is additionally engaged in an advocacy strategy which is aligned with the Paris Agreement, so as to promote science-based policy making and ensure its key solutions for climate can deliver their promises.

[49] Proprietary solution allowing Air Separation Units to store energy in a way that facilitates intermittency management and supports transition to renewable energy.
[50] More details in "*Our duty*" chapter, 2.b *Acting on our value chain*.
[51] The EU ETS partly allocates free quotas on a "merit" basis, with more efficient plants receiving more free quotas.

CCUS

Focus

Carbon Capture and Storage (CCS) and Carbon Capture Utilization and Storage (CCUS) are essential processes to meet climate goals worldwide (IEA, 2022). In line with the International Energy Agency, Air Liquide considers carbon capture as a necessary technology during a transition period, while other low-carbon technologies (such as electrolysis for hydrogen production) come to scale.

In such processes, CO2 is captured from point sources before being compressed, transported and either (i) permanently stored in deep geological formations, (ii) long-term stored in building aggregates or (iii) short-term stored in products such as urea, synthetic fuels and certain chemicals as an alternative to fossil CO2. Such processes help contain industrial emissions in the atmosphere. Additionally, if the original fuel is biogenic, CCS can help reduce the amount of atmospheric CO2 and lead to "negative emissions".

Air Liquide has developed a complete portfolio of solutions to capture CO2 for different industrial cases. In particular, its proprietary Cryocap™ technologies can allow up to 95% reduction of SMRs' Scope 1 emissions, resulting in low-carbon hydrogen (sometimes called "blue hydrogen") production. It can also provide customer emission abatement at competitive prices (e.g., in the cement & lime hard-to-abate industry). It will therefore play a growing role in both the Group's decarbonization trajectory and its wider participation in the energy transition by enabling significant reductions for customers.

The regulatory and market environment is rapidly evolving in favor of CCUS driven by (i) ETS carbon pricing notably in the EU and the UK, (ii) subsidies in the US (IRA extended 45Q grants) and (iii) monetary incentives and mature infrastructure along the transport and storage value chain in the the UK and the US. International and national strategies are also being enacted across the world. For instance, the European Union's Net Zero Industry Act (NZIA) sets out an annual storage injection capacity target of 50 Mt by 2030. France has also recently struck a bilateral storage agreement with Denmark. As a result, carbon capture opportunities are expected to gain momentum in the coming years.

A key element in this regard will be the policymakers' attention to transport and storage availability in various geographies, with Western countries already well-positioned (UK, US) or well-engaged on this point (EU).

Among other policy risks one can find geopolitical risks driven by a 1.5°C transition and the potential associated strain on resources. Because Air Liquide's operations and value chains are concentrated around its customers, this risk driver's direct effects are found to be of second-order. Its indirect effects (through customer operations) as well as indirect effects of mandates on customer activities would on the other hand translate as market risks, treated below.

Policy-related risks are therefore considered to be well monitored at Air Liquide, all the more given the fact that they are more often aligned than not with the Group's objectives. Financing programs in the form of subsidies or tax credits are for example implemented in Europe and the United States in order to support, during a transition period, the decarbonization of existing industrial assets and new units of production and make up for the temporary absence of low-carbon product mandates fostering the emergence of wider energy transition markets.

Technology risk

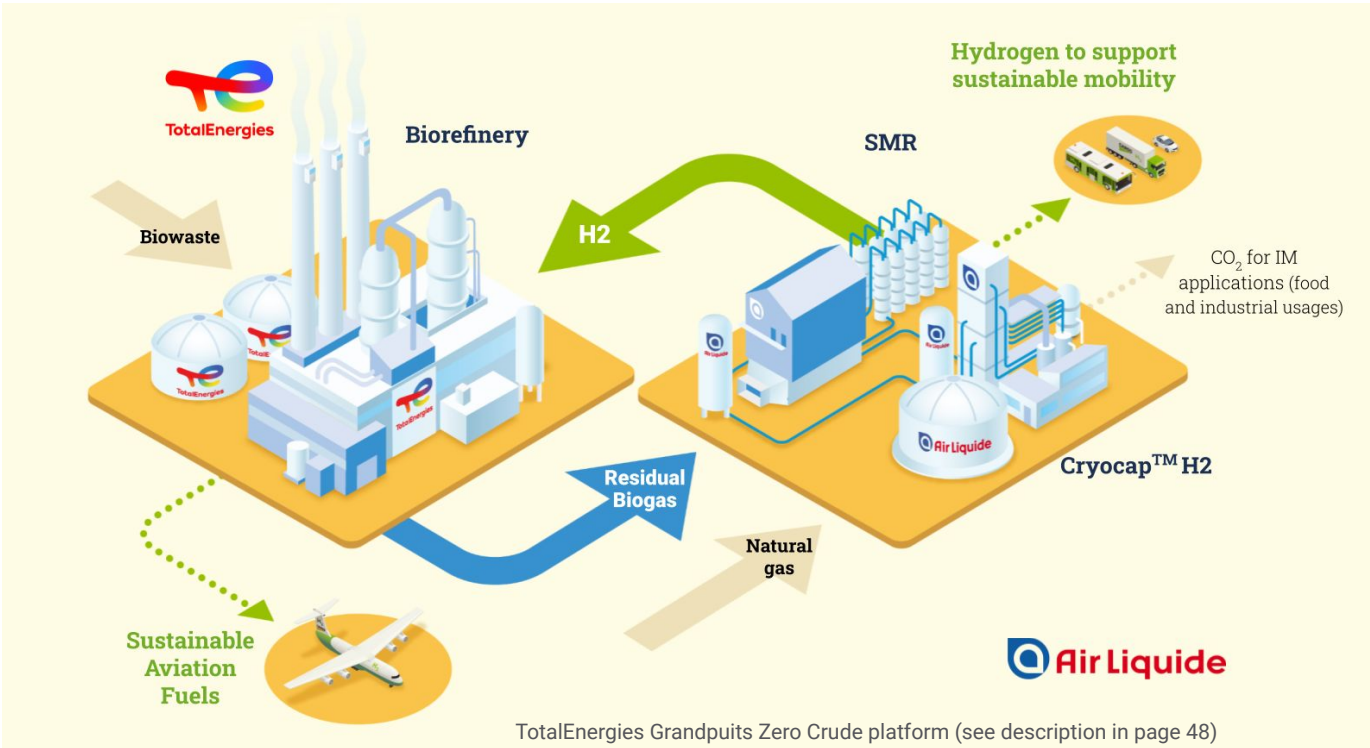
The innovation capacity and technological know-how of Air Liquide's teams enable the Group to offer ever cleaner and more sustainable solutions to reduce its own emissions and those of its industrial customers, putting the Group on the right side of this transformation journey, as it focuses on technologies for climate solutions and energy transition.

While on one hand, reducing its emissions is well within Air Liquide's know-how and economical reach in a transition pathway, on the other hand, the Group manages the risk associated with its investment in new technologies with a well structured process. Both points are described above in the *"Our duty"* chapter – Our actions to meet those needs.

Such a characteristic ensures long-term competitiveness of the Group's decarbonization in a 1.5°C pathway and guarantees, together with the ubiquity of industrial gases (see market risks below), that Air Liquide's activities are shielded from energy transition related substitution risks. It also signals the absence of any locked in emissions or identified stranded assets[52], given this study indicates that all can be decarbonized without CAPEX risks in a 1.5°C pathway.

Market risk

Market evolutions triggered by the energy transition are opportunities for Air Liquide, as detailed in the *"Our duty"* chapter. The demand for low-carbon industrial gas at a higher price is set to grow due to persistence of its use in its current end-markets transitions (e.g., essential sectors such as chemicals, energy or steel manufacturing) and its role in emerging technologies (e.g., electric vehicle manufacturing, electronics, low-carbon hydrogen manufacturing and mobility). All of which allows the profitability of the necessary investments for the decarbonization of Air Liquide's assets.



TotalEnergies Grandpuits Zero Crude platform (see description in page 48)

[52] Such stranded assets are assets that suffer from unanticipated or premature write-downs due to their incompatibility with energy transition pathways. Because the Group's high-emitting assets deliver essential products and can be decarbonized at a competitive price on a 1.5°C pathway (assuming the concordant implicit or explicit CO2 pricing), their emissions cannot be considered as *locked-in* and strandedness is not identified as a key risk for Air Liquide as of today.

Uncertainty however remains in timelines and value chain composition in Air Liquide's Energy Transition emerging markets. The Group monitors them with strong customer intimacy and actively advocates for science-based long-term stabilization of market signals.

Where the context is already favorable, Air Liquide is investing in such market transitions with its customers. The Grandpuits Zero Crude platform, in which the Group is innovating alongside TotalEnergies to produce low-carbon and renewable hydrogen for mobility purposes, is an example of such projects.

Among the sales which may nonetheless be at risk from climate-related market shifts are Air Liquide's hydrogen sales to refinery customers. The Group's assessment on these is the following: (i) a large share of its refinery customers are converting to biorefineries or low-carbon petrochemical refineries (e.g., for Sustainable Aviation Fuels production), thus driving decarbonization of the associated hydrogen sales, (ii) as these refineries are "legacy" refineries, they do not entail new Oil & Gas capacities and are compatible with the International Energy Agency's view of no new fossil fuel production capacity, (iii) for those aiming at decarbonization in a second wave, closer to 2035, they belong to the last to convert refineries for geographical and efficiency reasons.

As for those of our customers which may retire their higher emitting sites while embarking on their decarbonization journeys, Air Liquide's net exposure to their decisions remains low. This is due to contractual provisions ("take-or-pay" for examples) and a well-balanced geographical footprint allowing the Group to be part of the customers' greenfield energy transition investments elsewhere (asset repositioning).

Reputation risk

Air Liquide's strong climate commitments strengthen its reputation in the short and long run. The Group's leadership positioning within its sector, its Carbon Neutrality ambition and advocacy in its industry, as well as its pivoting towards key energy transition technologies, convey this point. This long-standing reputation also rests on Air Liquide's ability to engage in continuously renewed dialogues with its stakeholders, with sustainability representing an increasingly central topic in these discussions.

For instance, Air Liquide has specific procedures to engage in a constructive dialogue with investors, climate-focused investor coalitions and Non Governmental Organizations (NGOs). Each of them are transversal and tailored so as to make the most of those interactions. The Group's Public Policy Charter, mentioned in the *"Risks and opportunities"* chapter also ensures we systematically assess the alignment of the Group's engagements with the Paris Agreement as well as with Air Liquide's climate ambitions

Overall, the potential impacts of transition risks, as they have been analyzed in the context of the 2023 Group's Financial Statements, showed no significant negative impact. Be it on the useful life or on the value of its assets, on its client portfolio or on the cash flows generated by existing activities.

Published by
the Sustainable Development Department
of the Air Liquide Group,
75 quai d'Orsay, 75007 Paris, France.
Septembre 2024.

Photo credits in order of appearance:
p.17: Adrien Daste, p.19: Siemens Energy,
p.26: Adrien Daste, p.34: Adrien Daste,
p.36: GettyImages/Daniel Balakov,
p.42: GettyImages/Kundoy

Air Liquide