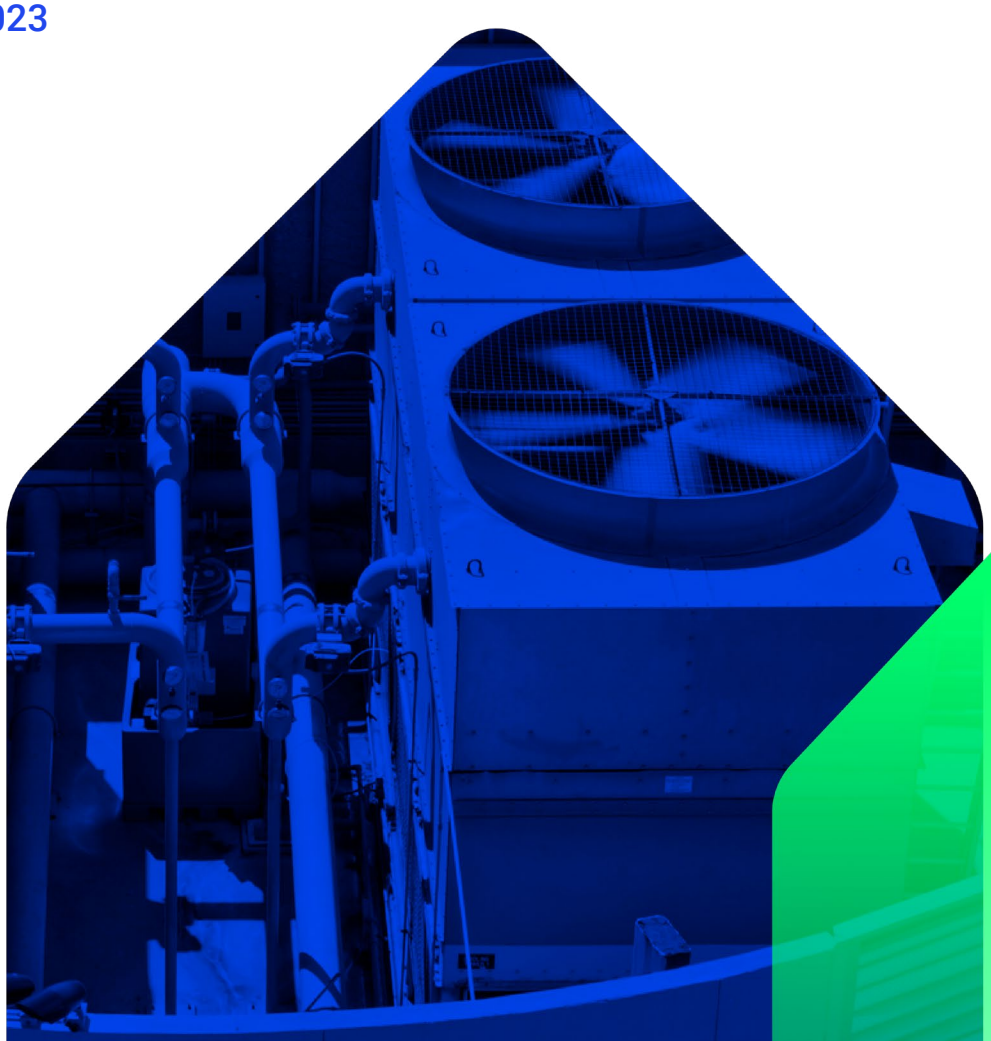
REPORT

Cooling suppliers: A stocktake on the path to Net Zero

2nd edition

December 2023



REPORT

About the report

This report is the second edition of our stocktake analysis of the progress being made by cooling suppliers towards Net Zero, building on our initial publication in 2021.[1] This iteration delves into the same set of companies, systematically evaluating their progress along the path to Net Zero, and investigates two additional companies, based on stakeholder feedback, as detailed in the methodology. The primary objective is to provide a detailed report on the progress towards achieving the sector's 2030 objectives, and the overall commitment to achieving Net Zero by 2050. In addition to the analysis of corporate progress, this report recommends how individual companies, and the cooling sector as a whole, can accelerate progress towards achieving Net Zero, fostering sustainability at a sector-wide level while empowering each company to enact impactful change.

Acknowledgements

The Carbon Trust wrote this report based on an impartial analysis of public information using secondary sources, by reviewing the annual sustainability reports of cooling suppliers and other external communications.

The Carbon Trust would like to thank everyone who has contributed their time and expertise during the preparation and completion of this report.

For the avoidance of doubt, this report expresses the independent views of the authors.

This report is aligned in purpose and outcome with the Cool Coalition's Global Cooling Watch released at COP28.

As the Cool Coalition states in the Global Cooling Watch 'Cooling currently accounts for one-fifth of global electricity consumption and is a top driver of generation capacity additions to meet peak power demand. Following current trends, the capacity of cooling equipment is expected to triple by 2050 and with the current slow pace of energy efficiency improvements, this would result in a more than doubling of electricity consumption'.

It therefore essential that the cooling industry builds and then sustains climate momentum that achieve Net Zero. This report provides an assessment of industry progress as of December 2023.

Who we are

The Carbon Trust's mission is to accelerate the move to a decarbonised future.

We have been climate pioneers for more than 20 years, partnering with leading businesses, governments and financial institutions globally. From strategic planning and target setting to activation and communication, we are your expert guide to turning your climate ambition into impact.

We are one global network of 400 experts, with offices in the UK, the Netherlands, South Africa, China, Singapore and Mexico. To date, we have helped set 200+ science-based targets and guided 3,000+ organisations in 70 countries on their route to Net Zero.

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[1] *'Cooling suppliers: Who's winning the Race to Zero? An assessment of cooling suppliers' climate action'*, 2021, is available here.

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Abbreviations

AC	Air Conditioning
CCAP	The Climate Action Pathway for Net Zero Cooling
ESG	Environmental, social and governance
GHG	Greenhouse Gas
GWP	Global Warming Potential
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
RtZ	Race to Zero
SBT	Science Based Target
SBTi	Science Based Targets initiative

Executive summary

Sustainable Cooling Challenges

Cooling is essential to our health, prosperity and the environment.
Cooling keeps our vaccines safe and food fresh, ensures we have comfortable buildings to live and work in, and is central to our industrial and transport infrastructure. However, cooling is typically energy intensive and highly polluting due to the emissions from the electricity that powers this equipment and the refrigerants and insulation foam gas used in it.

Cooling demand is increasing rapidly and needs to be addressed equitably and sustainably.
Cooling accounts for more than 7% of global greenhouse gas (GHG) emissions, and these emissions are growing fast.[2] This increase is driven by rising incomes, urbanisation, electrification, population growth and a warming world.[3] Energy consumption for space cooling has more than tripled since 1990. There are now roughly two billion air conditioning (AC) units in operation around the world, nearly 70% of which are residential units. This has made space cooling one of the leading drivers of rising electricity demand in buildings, and of additional generation capacity to meet peak power demand.[4] We urgently need to cut cooling emissions and meet increasing demand for future cooling, both equitably and sustainably.

Cooling suppliers have a key role to play.
Reducing cooling emissions will require widespread adoption of passive cooling measures, super-efficient equipment and appliances, and ultra-low Global Warming Potential (GWP) refrigerants and insulation foam gases.[5] Cooling manufacturers will be central to the shifts needed on super energy efficiency and ultra-low GWP refrigerants. They are essential to making sustainable cooling equipment and appliances available, affordable and easy to adopt, working alongside policymakers, financiers, businesses, innovators and civil society to unlock this transition.

Cooling Supplier Progress

This stocktake provides an overview of the cooling industry's climate commitments and progress.
Our analysis focuses on cooling supplier participation in the Race to Zero (RtZ) campaign[6] and/or Science Based Targets initiative (SBTi)[7] and the alignment of a company's products with the passive cooling, energy efficiency and refrigerant transition priorities highlighted above.[8] Fifty-five companies were assessed, based on a review of publicly available sustainability reports and related materials. Most

[2] *Optimization, monitoring, and maintenance of cooling technology* (2018) The Carbon Trust, International Institute of Refrigeration, ASHRAE and the Clean Cooling Collaborative (previously the Kigali Cooling Efficiency Program), available at: https://k-cep.org/wp-content/uploads/2018/03/Optimization-Monitoring-Maintenance-of-Cooling-Technology-v2-subhead....pdf
[3] *Assessment of commercially available energy-efficient room air conditioners including models with low global warming potential (GWP) refrigerants* (2017), Shah, NK; Park, WY; Gerke, B, available at: https://escholarship.org/uc/item/01h8g7zb
[4] International Energy Agency: https://www.iea.org/energy-system/buildings/space-cooling
[5] Climate Action Pathway for Net Zero Cooling (2020) The Carbon Trust, Cool Coalition, Clean Cooling Collaborative (previously the Kigali Cooling Efficiency Program), Oxford Martin School at the University of Oxford and RtZ, available at: https://ctprodstorageaccountp.blob.core.windows.net/prod-drupal-files/documents/resource/public/ES-cooling-pathway-Dec-2020.pdf
[6] https://racetozero.unfccc.int/system/race-to-zero/ RtZ is the world's largest coalition of non-state actors taking immediate action to halve global emissions by 2030. It has over 13,000 members including companies, cities, regions and financial, educational and healthcare institutions. Each is committed to the same overarching goal: reducing emissions across all scopes swiftly and fairly in line with the Paris Agreement, with transparent action plans and robust near-term targets.
[7] https://sciencebasedtargets.org/ The SBTi drives ambitious climate action in the private sector by enabling organisations to set science-based emissions reduction targets. The SBTi is a partnership between CDP, the United Nations Global Compact, the World Resources Institute (WRI) and the World Wide Fund for Nature (WWF). Over 2,000 organisations worldwide are leading the transition to a Net Zero economy by setting emissions reduction targets grounded in climate science through the SBTi.
[8] These three impact areas are explored in more detail in the CCAP to Net Zero materials available at https://www.carbontrust.com/our-work-and-impact/guides-reports-and-tools/the-climate-action-pathway-for-net-zero-cooling

companies are cooling equipment or appliance product manufacturers serving markets around the world, and the rest manufacture cooling refrigerants.

The cooling industry is raising its ambition and setting science based targets (SBTs) to tackle climate change.
The total number of cooling suppliers whose targets have been validated by the SBTi has nearly doubled over the last two years, from 16 to 31 companies. Most of these companies have set Scope 1&2 targets for 2030 emissions reductions that exceed the 2030 Net Zero target.[9] Almost all (28) of these companies have committed to 2030 Scope 3 targets. Ten of these companies have also committed to the RtZ, bringing the total number of participating cooling suppliers to 16. The engagement of cooling suppliers with SBTi in particular provides confidence that emissions reduction targets have not only been set but also independently validated to align with science-based principles.

Most cooling suppliers now have some form of commitment to address climate change.
Many of the cooling suppliers that do not have SBTi validated targets, or that have not signed up for the RtZ, have some form of non-binding or annual relative climate change commitment. Several also include decarbonisation technologies as part of their product portfolio. This shows a growing recognition of the need to act on climate change, even though the scale and speed of the responses are currently insufficient.

Cooling suppliers located in countries with legally binding Net Zero commitments remain more likely to have the strongest climate commitments.
Since the last assessment, Chinese, South Korean and European suppliers have made strong efforts to engage in climate action. Some have joined the RtZ and many more now participate in the SBTi. Cooling suppliers with headquarters in countries that do not have legally binding climate targets are less likely to engage in SBTi, although there are exceptions.

Pioneering cooling suppliers who have made the most progress towards Net Zero share three key features:

- **Set clear, verified targets:** They have set clear targets for 2030 and 2050, which are typically verified by SBTi or another independent validation.
- **Collaboration and communication:** They collaborate and communicate to support the cooling industry's transition to Net Zero. Suppliers including Trane Technologies, Electrolux, Schneider Electric, Johnson Controls, Arçelik and A-Gas have recognised the need to share experiences and learning with others inside and outside the industry to accelerate progress towards Net Zero.
- **Green finance:** They are transforming their business operations to manufacture sustainable cooling solutions, which requires substantial capital investment. These companies have reprioritised their capital investment frameworks to include climate targets and outcomes, and are making good use of green finance (e.g., green bonds, sustainability linked bonds).

Recommendations and Next Steps

Cooling suppliers who have not yet committed to climate action or have not communicated their climate commitments are encouraged to do so promptly. These commitments and communications are more credible when they are part of independent initiatives such as SBTi and RtZ. When committing to climate

[9] Bosch, Electrolux, Emerson, GEA, Hitachi, Johnson Controls, Panasonic, Sanden and Schneider Electric have each set targets that are between 17% and 57% higher than the 2030 Net Zero aligned SBTI target of 43%.

action, cooling companies are encouraged to recognise and use the language on Net Zero rather than carbon neutral[10] and to provide sufficient supporting information to qualify such commitments.

ACTION – BEST PRACTICE TO ACCELERATE INDUSTRY ACTION ON NET ZERO

The Carbon Trust will work with the cooling industry to consolidate their experiences and identify best practices and useful Net Zero tools. This knowledge will be used to create best practice guidance, enabling companies to benchmark their progress and inform future Net Zero planning.

Cooling suppliers need to accelerate the development and deployment of super-efficient equipment using ultra-low GWP refrigerants.

New more efficient cooling products that use lower GWP refrigerants have been released to the market. However, there is still considerable scope to ensure these products are the default choice. AC units purchased by consumers often have two-to-three times lower efficiencies than the top-of-the-class models[11] and some transition refrigerants still have relatively high GWP.[12] Net Zero cooling requires ultra-low GWP refrigerants and super energy efficient equipment. There needs to be stronger public commitments to this from cooling suppliers, including those who have signed up to SBTi or RtZ.

Focused action on Scope 3 value chain emissions is essential to decarbonising cooling.

Scope 3 emissions make up 90-99% of a cooling supplier's GHG emissions. It is vital that all suppliers take immediate and consistent actions to drive down Scope 3 emissions, particularly in categories 1 (Purchased goods and services), 11 (Use of sold products) and 12 (End-of-life treatment of sold products). Suppliers should explore industry cooperation and value chain collaborations to reduce the administrative burden of Scope 3 value chain emissions management, data gathering and reporting on themselves and their value chain suppliers, and improve information standardisation and quality.

ACTION – BEST PRACTICE ON SUPPLY CHAIN ENGAGEMENT AND MANAGEMENT OF SCOPE 3 EMISSIONS

The Carbon Trust will work with the cooling industry to establish a detailed map at a sector level of typical Scope 3 supply chain emissions hotspots, as well as gather examples of Scope 3 supply chain management best practices, and key drivers of, or barriers to, action. This knowledge will be used to create Scope 3 best practices and benchmarking guidance, enabling cooling companies to compare their progress with peers, and kickstart or accelerate Scope 3 emissions management in the supply chain.

[10] Net Zero and carbon neutral are similar, but distinct, concepts. The main difference is that Net Zero requires maximal decarbonisation with only ~10% of emissions offset using carbon credits. Also, our review suggests that when the phrase Net Zero is translated from another language into English, it may occasionally be translated as carbon neutral, rather than Net Zero.
[11] International Energy Agency: https://www.iea.org/energy-system/buildings/space-cooling
[12] For example, R32, which has a GWP of 675, is used as a common refrigerant gas in the AC industry.

Cooling suppliers need to collaborate to transform the industry and deliver Net Zero success.
The cooling industry can learn from other industries (e.g., offshore wind collaboration on cost reduction)[13] about working together on solutions to common barriers experienced by all cooling suppliers. For example, cooling suppliers can accelerate the development of non-competitive solutions used across the cooling industry (e.g., materials handling standards, cabling standards, ancillary equipment standards), and co-create or support the development of the enabling environment (e.g., standardise GWP refrigerant handling approaches including those to reduce leakage, common approaches to Scope 3 supply chain management, supporting policies that set ambitious energy performance standards).

Cooling suppliers can also help to stimulate customer interest in sustainable cooling solutions (e.g., bulk procurement initiatives to ensure there are clear customer demand signals for sustainable cooling technologies). New cooling initiatives are showing promise in this area. For example, the Global Cooling Efficiency Accelerator, co-founded by RMI and the Clean Cooling Collaborative, is working to bring together policymakers, manufacturers, industry and market experts, and buyers for next-generation air conditioners with five times lower climate impact than conventional units.[14]

ACTION – BUILDING A CASE FOR COOLING INDUSTRY COLLABORATION

The Carbon Trust will explore opportunities with the cooling industry and stakeholders (e.g., Cool Coalition, academia) to build the case for a collaboration accelerator to champion the removal of industry-wide barriers that are slowing or holding back the achievement of Net Zero targets.

We will explore areas where industry collaboration is material and additional to addressing barriers that are holding back Net Zero action. This will include: evaluating accelerator models; prioritising options with the right balance of impact, governance and cost-effectiveness; and progressing feasible high impact collaboration opportunities.

[13] For example, the Carbon Trust-led Offshore Wind Accelerator (OWA) brings offshore wind developers together to collectively address offshore wind cost reduction challenges. In its first ten years the OWA delivered more than 150 research, development and deployment (RD&D) projects, in partnership with nine leading offshore wind developers. Cost analysis shows that the innovations supported through the OWA in just a decade contributed to a 15% reduction in the cost of energy for an average offshore wind project, saving industry a total of £34bn against 2030 build out targets. https://www.carbontrust.com/our-work-and-impact/impact-stories/offshore-wind-accelerator-owa

[14] An introduction to the Global Cooling Efficiency Accelerator is available at: https://www.cleancoolingcollaborative.org/blog/introducing-the-global-cooling-efficiency-accelerator/

1. Introduction

1.1. Context and overview

Escalating global temperatures, with an increase of more than 1C above pre-industrial levels,[15] emphasise the urgent need to decarbonise the cooling sector. Current projections indicate a likely breach of the 1.5C limit by 2030-2040.[15] Rising incomes, urbanisation, electrification, population growth and a warming world are fuelling record demand for cooling, especially in residential AC. There are roughly two billion AC units currently in operation globally, contributing significantly to rising electricity demand. The energy consumption for space cooling has more than tripled since 1990, impacting electricity grids and GHG emissions, and exacerbating urban heat island effects. This trend is forecast to continue, with a further surge in demand primarily attributed to rising incomes and the heightened cooling requirements in Global South countries, contributing to nearly 90% of the expected expansion in AC stocks to 4.4 billion units in 2050.[16]

At COP26 and COP27 in 2021 and 2022 respectively, governments, businesses and civil society made commitments supporting sustainable cooling, with 53 governments including sustainable cooling in their Nationally Determined Contributions (NDCs).[15] However, challenges persist in achieving accessible, affordable and non-polluting cooling solutions. The existing built environment urgently needs to adapt to warmer temperatures, necessitating the deployment of efficient and environmentally friendly cooling approaches.

Without further planning, mitigation and coordination, future global cooling demand will outstrip the industry's incremental climate actions. The challenge of providing decarbonised cooling solutions in a warming world is well documented.[16] Cooling is used in a wide range of applications – from homes and offices to transport and industry – which makes cumulative, collective action even more important.

Since the release of the Climate Action Pathway for Net Zero Cooling[17] in 2021 in the run-up to COP26, significant strides have been made by many of the 55 cooling suppliers that were assessed. Although progress remains uneven, with variations across companies, regions, and technologies, the direction of travel is clear**.** The cooling sector has progressed on its journey towards Net Zero emissions. Many cooling suppliers are undertaking real and tangible Net Zero action, and embarking upon or accelerating their transformational actions.

This report aims to give a stocktake of progress on the cooling commitments pledged by cooling suppliers since 2020, aligned with the RtZ criteria and also a Net Zero pathway. This stocktake reassesses previously evaluated companies, incorporating new entrants where relevant. The purpose is to provide a current perspective on how well aligned cooling suppliers are with a Net Zero pathway, through examining the robustness of their cooling-specific ambitions and actions. Additionally, we examine what climate leadership in the sector looks like and present recommendations to encourage the

[15] Lizana, J., et al, 2022. Overcoming the incumbency and barriers to sustainable cooling. Buildings and Cities, 3(1), pp. 1075–1097.
[16] IEA, Space Cooling, 2023 https://www.iea.org/energy-system/buildings/space-cooling
[17] The CCAP provides a comprehensive vision, outlining three key impact areas and actions required to reach Net Zero by 2050. Alongside this vision, an Action Table highlighted key steps for different stakeholders to take by the years 2020, 2025, 2030 and 2040, as well as a Cool Calculator, which was the first of its kind to enable cooling industry stakeholders to explore how to get to Net Zero GHG emissions on cooling. The three key impact areas are: (1) passive cooling - widespread adoption of measures that avoid or reduce the need for mechanical cooling, including through smart and human-centric design and urban planning; (2) Super-efficient equipment and appliances – a 'race to the top' S-curve transformation where the norm is super-efficient cooling equipment and appliances powered by zero-carbon energy; (3) Ultra-low GWP refrigerants- market domination of ultra-low (< 5GWP) refrigerants across all cooling sectors and applications. See https://coolcoalition.org/climate-action-pathway-net-zero-cooling-executive-summary/

broader industry to increase its ambition and translate it into tangible cooling-specific actions this decade (e.g., by 2025 and 2030) and before 2050.

Our analysis broadly focuses on the following questions:

- To what extent have cooling companies progressed since COP26?
- What is getting in the way of companies' progress?
- Which companies are demonstrating exemplary 'leadership' practices, and what can others learn from their experiences?
- What actionable steps are required to expedite the race towards achieving Net Zero cooling across the industry?

1.2. Methodology

We analysed the publicly available sustainability information of 55 cooling suppliers, covering both cooling equipment suppliers (45) and refrigerant producers (10).[18]

This report serves as a global stocktake of cooling industry actions to address climate change before COP28, hosted in Dubai, the United Arab Emirates. We examined: company reports; sustainability reports; information submitted to the SBTi; and relevant press releases, to assess each company's climate commitments, cooling specific ambitions, and progress made towards relevant targets or pledges.[19]

There is a lack of publicly available climate information on some companies investigated in this stocktake. This limits the strength of the climate action assessment that can be made of these companies, and it may be the case that they are taking more climate action than is suggested in this report. Appendix 1 provides details on the suppliers analysed.

We seek to identify, evaluate and appraise the scale of climate action momentum that the cooling industry has built up over the two years between COP26 and COP28.

We consider company climate action momentum to be comprised of:

- Public recognition of the importance of tackling climate change
- A clear public commitment to act on climate change
- Creation of strategies and plans to decarbonise company operations and the value chain
- Recognition that carbon neutral is an important achievement, but only a midway point to Net Zero
- Setting decarbonisation targets, consistent with recognised decarbonisation pathways, which are independently validated
- Aspiration to manufacture super-efficient products that use ultra-low GWP refrigerants
- Recognition that climate action requires the transformation of business models
- Encouraging industry-wide collaboration to tackle climate change
- Transparent reporting of climate actions

[18] Analysis of the 55 suppliers was conducted in September and October 2023.

[19] We have not engaged one-to-one with every company, and welcome feedback on the findings of this report so that future assessments can provide more detail about each company's progress towards Net Zero. We encourage suppliers to publicly elaborate on their actions, particularly on key impact areas and how they feed into their Net Zero commitments. Without clear publications, it is difficult to uncover the strength of commitments and progress towards achieving them.

Achieving Net Zero by 2050 along a SBTi 1.5C degree pathway requires companies to achieve 43%[20] carbon emissions reductions by 2030 and a 90% reduction by 2050. The aspiration of the RtZ is a more ambitious 50% reduction by 2030.

We have explored company climate action by examining publicly available information through three analytical lenses, which are summarised in *Figure 1* below:

- **The 5 RtZ criteria**[21]: RtZ is a global campaign to rally leadership and support from businesses, cities, regions and investors for a healthy, resilient, zero carbon recovery that prevents future threats, creates decent jobs, and unlocks inclusive, sustainable growth. These five criteria enable this new analysis to be compared with our earlier 2021 analysis.[22]
- **Cooling Impact Areas**: The CCAP vision is that by 2050, there will be Net Zero cooling for all through a focus on three impact areas:
    - **Passive cooling**: Widespread adoption of measures that avoid or reduce the need for mechanical cooling, including reductions in cooling loads, smart and human-centric design and urban planning
    - **Super-efficient equipment and appliances**: A 'race to the top' S-curve transformation where the norm is super-efficient cooling equipment and appliances powered by zero carbon energy
    - **Ultra-low GWP refrigerants and insulation foam gases**: Market domination of ultra-low (<5 GWP) refrigerants across all cooling sectors and applications.
- **The SBTi**[23]: Science-based targets provide companies with a clearly defined path to reduce emissions in line with the Paris Agreement goals. More than 4,000 businesses around the world are already working with the SBTi. Importantly, SBTi inclusion requires mandated minimum levels of ambition and independent verification of company claims. Together these provide a reliable source of additional company information.

Using these three analytical lenses, we can assess the momentum that has been built by the cooling industry towards achieving Net Zero. We also incorporate insights from a recent industry interview programme targeted at learning key barriers to, and drivers of, action being experienced by the cooling industry.

[20] See Intergovernmental Panel on Climate Change Sixth Assessment Report (AR6): https://www.ipcc.ch/site/assets/uploads/2022/04/IPCC_AR6_WGIII_PressRelease_English.pdf; SBTi: https://sciencebasedtargets.org/
[21] See RtZ: https://unfccc.int/climate-action/race-to-zero-campaign
[22] See RtZ criteria: https://racetozero.unfccc.int/system/criteria/
[23] See SBTi: https://sciencebasedtargets.org/how-it-works

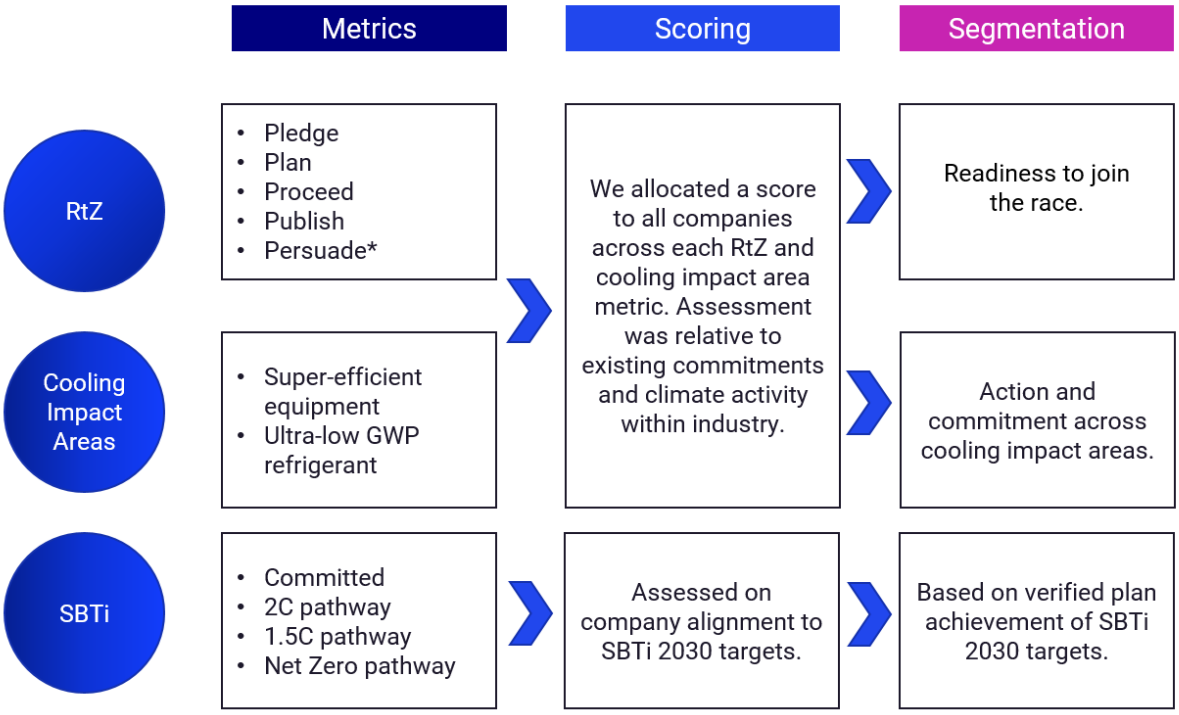

Figure 1*:* Analytical assessment framework

We used RtZ minimum criteria to assess cooling suppliers' Net Zero climate actions, and preparedness and readiness to join the RtZ. To join the race, suppliers have to pledge their Net Zero commitment and sign up to one of the partner networks of the RtZ. The minimum criteria for participating in the RtZ campaign requires that:

- The **Pledge** must be aligned with Net Zero by 2050
- A **Plan** has to include interim targets in line with the Net Zero pledge
- Companies must **Proceed** to act in line with their plan and Net Zero ambition
- Companies are also assessed according to their commitment to **Publish** annual reports on their progress

Since our previous analysis, a new criterion, **Persuade**, has been added to the minimum criteria. Members are required to align their external policy and engagement activities to the goal of halving emissions by 2030 and reaching Net Zero by 2050.[24] We scored suppliers against each of these metrics depending on the strength of their pledge, plan, actions (proceed), publications (disclosures), and alignment/engagement (persuade).

Two of the three CCAP vision impact areas are also metrics used to assess the climate ambition of cooling suppliers. We scored all suppliers on the movement towards super-energy efficient equipment or appliances and ultra-low GWP refrigerants to recognise how individual companies are investing in the development or deployment of sustainable cooling technologies, and to recognise the scope of action by industry.[25]

[24] See Climate Champions: https://climatechampions.unfccc.int/system/criteria/

[25] Given the product development focus of cooling suppliers, we did not assess suppliers' levels of ambition or action on passive cooling measures. Passive cooling is an important impact area for the sector, but action from cooling suppliers in this area might be limited to roles such as advising customers about passive cooling or integrating evaporative cooling technologies among other activities.

We use independently verified SBTi information to establish the alignment between each cooling supplier's verified SBTi 2030 target, and the preferred minimum SBTi 2030 target of a 43% reduction in baseline emissions and the RtZ 2030 target of a 50% reduction.

Alongside these three analytical lenses, our analysis also includes feedback from a sample of cooling suppliers. This helps us to understand real and tangible climate achievements that cooling suppliers feel should be recognised and potentially embraced by other cooling suppliers.

To present the outcomes of our analysis, we group cooling suppliers into one of four climate momentum categories:

- **Passives**: Companies who have yet to publicly communicate much commitment to action on climate change.
- **Embarkers**: Companies who have publicly communicated commitment to act on climate change, and have plans and actions in place to decarbonise operations. Often these companies are developing innovative products or services that support wider decarbonisation (e.g., breakthrough cooling technologies, new materials) and occasionally climate-positive business models.
- **Builders**: Companies who have publicly communicated commitment to act on climate change and have clear plans and actions in place to decarbonise. Companies have typically set climate ambitions aligned with a 'less-than 2C' or stronger pathway. Plans are typically independently verified by SBTi. These companies have ambitious decarbonisation initiatives that seek to influence value chain decarbonisation, and are manufacturing products with higher efficiency, or that make use of low or ultra-low GWP refrigerant gases.
- **Transformers**: Companies that have made strong public commitments to act on climate change and have clear ambitious plans to decarbonise. Companies have typically set climate ambitions aligned with 1.5C and Net Zero pathways. Plans are independently verified, typically by SBTi. These companies have ambitious transformation plans to support their clients in decarbonisation whilst encouraging broader industry climate action. Companies have strong value chain decarbonisation plans, are manufacturing products with higher efficiency or making use of low or ultra-low GWP refrigerant gases, and are proactively seeking to transform markets. They are also looking to transform the industry by finding paths forward.

WHAT ARE SCOPE 1, 2 AND 3 EMISSIONS?

GHG emissions are categorised into three groups or 'Scopes'. By measuring emissions across the different Scopes, organisations can identify emission hotspots in their supply chains and find energy efficiency and cost reduction opportunities.

Scope 1 covers direct emissions from owned or controlled sources, such as fuel combustion, company vehicles and fugitive emissions.

Scope 2 covers indirect emissions, such as purchased electricity, heat and steam.

Scope 3 emissions are all other indirect emissions that occur because of a company's operations, but from sources not owned or controlled by the organisation. Scope 3 emissions are divided into 15 categories. For cooling suppliers, Category 1 (Purchased goods and services), Category 11 (Use of sold products) and Category 12 (End-of-life treatment of sold products) are the most relevant categories, as it is expected that most of their Scope 3 emissions fall into these categories.[26]

2. The cooling industry is mobilising to tackle climate change

2.1. A majority of cooling suppliers are taking actions to address climate change and support the shift to Net Zero

Cooling supplier climate momentum progressed rapidly between March 2021 and November 2023. Out of the 55 cooling suppliers tracked in this study, an overwhelming majority have improved their climate ambitions, actions or plans**.** In *Figure 2* we present our assessment of these suppliers through the five RtZ criteria. We observe four distinct company groupings based on differing levels of publicly stated climate momentum: **Passives, Embarkers, Builders and Transformers** (see *Section 1.2* for definitions).[27]

Trane Technologies, Schneider Electric, Emerson, Electrolux, Fujitsu, Orbia, Danfoss, Johnson Controls and Arçelik are the nine members of the **Transformers group** (see *Figure 2*). All members are characterised by having publicly shared strong climate ambitions and are executing robust decarbonisation activities across their business operations and value chains. One has set an ambitious 2025 target that aligns with the SBTi 1.5C and RtZ pathways, seven have set equivalent targets by 2030, and are all members of the RtZ campaign. Each company is a strong advocate for accelerating climate action and transforming the cooling industry to be Net Zero. Each company is actively transforming their businesses to fulfil a Net Zero world.

[26] See What are Scope 3 emissions?: https://www.carbontrust.com/our-work-and-impact/guides-reports-and-tools/briefing-what-are-scope-3-emissions and Greenhouse Gas Protocol: https://ghgprotocol.org/corporate-value-chain-scope-3-standard

[27] Due to the scale of improvement in climate momentum, these new groups are not directly comparable with the groups outlined in the first report. There are similarities between Passive and Slow Starters, Embarkers and Gaining Speed, and collectively Builders and Transformers with Ready to Join and RtZ.

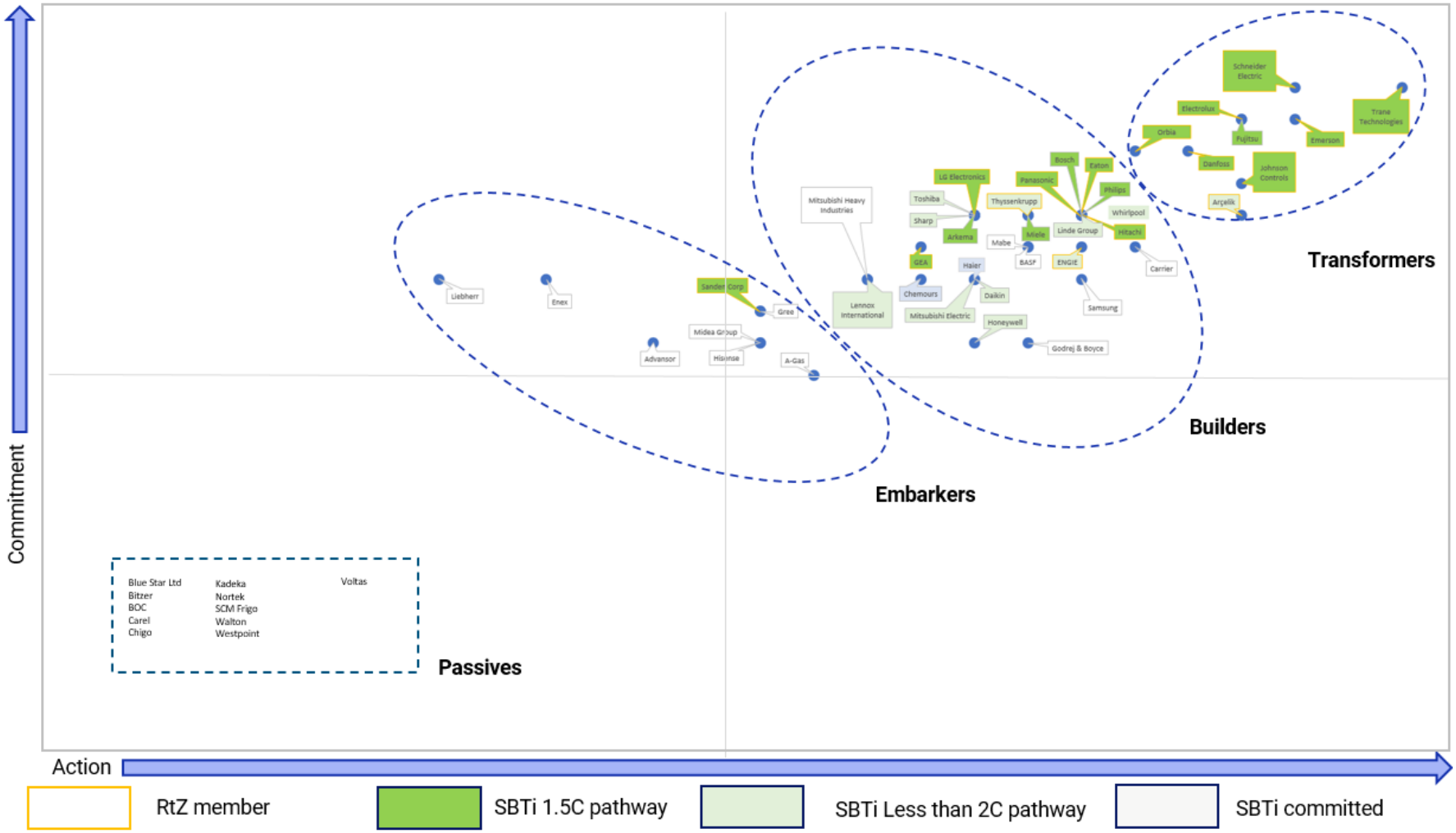

Figure 2: Cooling suppliers' climate momentum examined via the 5 RtZ criteria

Note: Each cooling supplier is scored between one and four points for each of the five RtZ criteria. Horizontal axis is an assessment of action criteria (plan, proceed, persuade). Vertical axis is an assessment of commitment criteria (pledge, publications). A high score implies a company's actions are consistent with those that could be reasonably expected to be observed by a company at this stage in their Net Zero journey, not that the company has achieved Net Zero.

The **Builders group** is the largest group, with 27 companies, and essentially did not exist in 2021, which evidences the climate momentum that has built over the past two years. This group includes seven members of the RtZ campaign, nine members who have set 2030 targets aligned with the SBTi 1.5C pathway, and nine members with 2030 targets aligned with the SBTi 'well below 2C' pathway. This group includes many of the companies actively developing the technologies that are needed to achieve Net Zero (e.g. Daikin with its partner Nikken Sekkei Ltd, and Gree Electric Appliances Inc. of Zhuhai and partner Tsinghua University, who both successfully tested a 5X lower climate impact air conditioner[28], while Samsung is improving the energy efficiency of leading models of seven major product categories including refrigeration, and has set a 30% improvement target for 2030[29]).

Two companies, Haier and Honeywell, showed good levels of climate momentum since 2021, jumping from the Passives into the Builders group, and achieving a level of activity which is likely to be consistent with RtZ campaign eligibility. They are characterised by demonstrating additional actions across all five RtZ criteria.[30] Honeywell has set a science-based target covering Scope 1&2 and partial Scope 3. Since 2021, Haier has set annual Scope 1&2 carbon reduction targets and increased publication of its carbon inventory through regular disclosure of its Environmental, social and governance (ESG) reports.[31,32]

Of the eight members of the **Embarkers** group, six have moved up from the Passives group since 2021 (Advansor, A-Gas, Enex Technologies, Gree Electric Appliances, Hisense, Midea Group). These companies are characterised by having publicly communicated, since 2021, climate ambition or developed technologies relevant to the sustainable cooling transition. The Midea Group, for example, had no publicly available climate related target in 2021. By 2023, it had set a green strategy to achieve 'carbon neutrality' through six pillars.[33] Whilst carbon neutrality is not Net Zero, it demonstrates how this company is building climate momentum. All these companies should be recognised for making positive steps forward, but also encouraged to further increase their climate ambitions and set independently validated Net Zero targets for 2030 and 2050.

The members of the **Passives** group are best considered to be companies where insufficient public information was found upon which to make an informed decision about their level of climate momentum**.** These companies are characterised by having made no or few climate pledges that are in the public domain. A company's allocation to the Passives group does not signal no climate action; rather, it signals no publicly available evidence upon which to draw conclusions.

Sixteen cooling suppliers have now joined the RtZ, up from five in 2021. This tripling of RtZ participation shows good Net Zero progress by the cooling industry. This achievement is reinforced by the members of the Builders group who would, very likely, meet the eligibility requirement for the RtZ, but who have not yet taken the final step and pledged, as can be seen in *Figure 3.* Significantly, RtZ inclusion is not the only way for cooling suppliers to showcase their sustainability and Net Zero climate ambitions. The SBTi has become increasingly relevant to cooling suppliers in the past two years, and is perhaps the preferred path

[28] See RMI: https://rmi.org/wp-content/uploads/dlm_uploads/2021/04/GlobalCoolingPrize_SolvingtheCoolingDilemma.pdf
[29] See Samsing Sustainability Report, 2022, https://www.samsung.com/global/sustainability/media/pdf/Samsung_Electronics_Sustainability-Report-2022_Executive_Summary.pdf
[30] **Pledge** must be aligned with Net Zero by 2050; a **Plan** has to include interim targets in line with the Net Zero pledge; companies must **Proceed** to act in line with their plan and Net Zero ambition; and companies are also assessed according to their commitment to annually **Publish** reports on their progress. **Persuade**, members are required to align their external policy and engagement activities to the goal of halving emissions by 2030 and reaching Net Zero by 2050
[31] Honeywell International, 2023 ESG Report, 2023: https://www.honeywell.com/content/dam/honeywellbt/en/documents/downloads/hon-esg-report.pdf
[32] Haier ESG Report, 2023: https://smart-home.haier.com/en/gpxx/esg/
[33] See Midea Group, 'Green Strategy' (Chinese Mandarin): https://www.midea.com.cn/Investors/Sustainable-development/Green/_0

through which many of them have chosen to evidence their Net Zero climate commitments, which we will return to later in this report (*Section 2.4*).

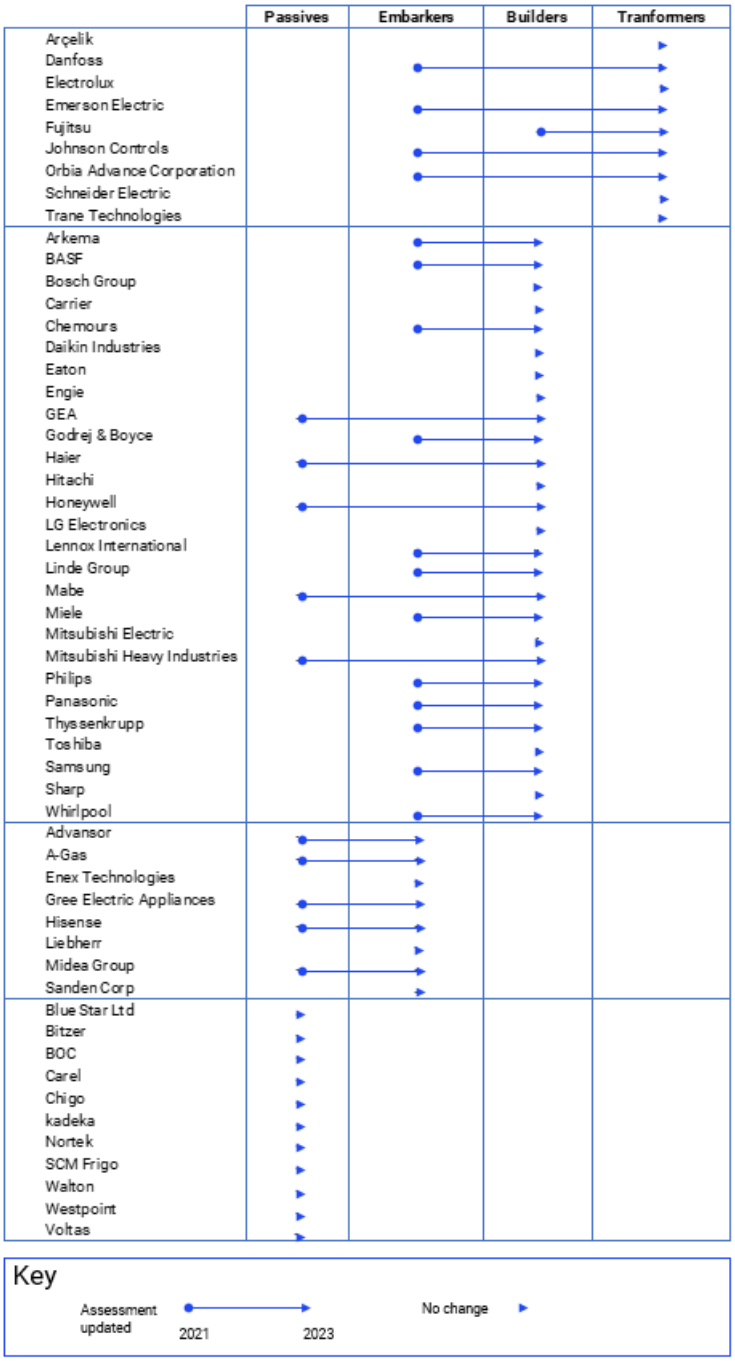

Figure 3**:** Comparison of assessed cooling supplier position in 2021 and 2023

2.2. Suppliers located in regions with strong climate commitments or ambitions continue to be more likely to have stronger targets

Since the 2021 *'Who's winning the Race to Zero?'*[34] report, more countries have set climate commitments, with an increasing number of countries turning carbon neutrality or Net Zero goals into legally binding

[34] See 'Cooling suppliers: Who's winning the Race to Zero?', available at: https://www.carbontrust.com/our-work-and-impact/guides-reports-and-tools/the-climate-action-pathway-for-net-zero-cooling.

commitments at a national level. *Figure 4* shows the geographic spread of the 55 assessed companies and where their headquarters are based. The companies and their headquarters are listed in Appendix 1.

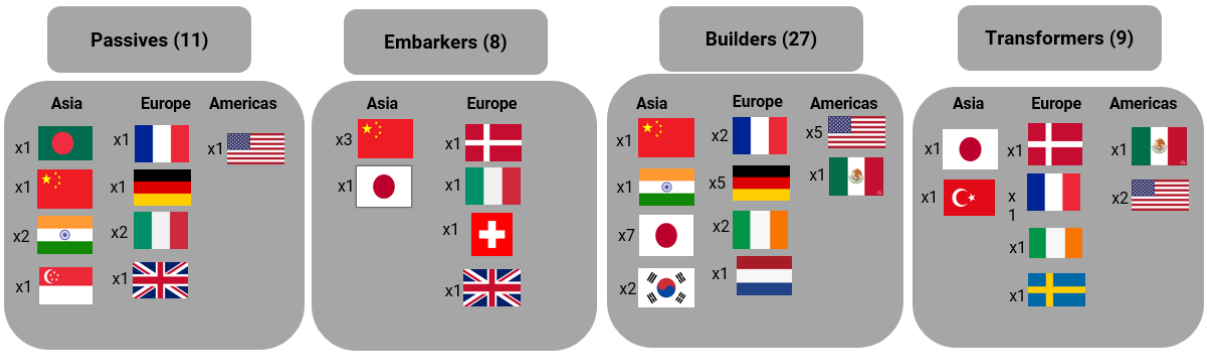

Figure 4: Geographic spread of cooling supplier headquarters by climate momentum group

Of the nine suppliers in the Transformers group, a majority of seven have headquarters in countries with legally binding climate commitments.[35] A similar majority is noted in the Builders group, where 24 out of the 27 suppliers have their headquarters located in countries with climate commitments in legislation.[36] In the Embarkers group, we observe three companies based in China, one company in Japan and four companies based in the European region. While China has a target to achieve carbon neutrality before 2060, this target does not yet have legal force, meaning it is not enshrined in legislation or in an administrative order.[37] Japan and the four countries in Europe do have their climate targets covered by law. In contrast with the Transformers group, the Passives group has eight out of 11 companies based in countries that do not yet have legally binding climate targets.[38] This trend suggests that companies from countries with strong climate legislation are positively influenced to address climate change and promote sustainability. While company action is influenced by a variety of factors and market trends, increased national awareness, climate-related policy frameworks and legal enforcement frameworks create momentum within that market for businesses to address their role in climate change.

A similar picture is seen with the RtZ campaign, with European cooling suppliers making up the largest share of members, followed by the USA and Asia (Japan, South Korea). There are two companies, Orbia (Mexico) and Arçelik (Turkey), who are headquartered in countries that have no legally binding climate commitments, who have set SBTis, thus showing their climate ambitions.

There is a widening gap in the response to climate change by cooling suppliers based in developed and industrialised countries such as the USA, Japan, countries within the European region, and companies based in developing countries, such as Bangladesh, China and India. Progress is positive overall for the sector, but as the low-hanging fruit solutions are implemented up until 2030, the greater decarbonisation shifts that require long-term investment horizons and planning will be challenging to implement further

[35] As of November 2023, the countries with Net Zero commitments written in law, which host companies within our scope of assessment are: Denmark, France, Ireland, Japan, Switzerland, South Korea, the United Kingdom and the USA. The companies in the **Transformers** group that have their headquarters in countries with legally binding climate legislation are Fujitsu (Japan), Danfoss (Denmark), Schneider Electric (France), Trane Technologies (Ireland), Electrolux (Sweden), and Emerson, Johnson Controls (USA).
[36] Excluding China and India, where the remaining companies in the **Builders** group have their headquarters based in countries with legally binding climate commitments: Japan: 7 (Daikin Industries, Mitsubishi Electric, Mitsubishi Heavy Industries Group, Toshiba, Sharp, Hitachi Ltd, Panasonic Holdings Corporation); South Korea: 2 (Samsung Electronics, LG Electronics); France: 2 (Arkema, Engie); Germany: 5 (BASF, Bosch Group, Miele, GEA, ThyssenKrupp AG; Ireland: 2 (Linde, Eaton); Netherlands: 1 (Philips); USA: 5 (Carrier, Chemours, Honeywell International, Lennox International, Whirlpool); and Mexico (Mabe).
[37] Net Zero Tracker, China, https://zerotracker.net/countries/china-cou-0019, (accessed 20/11/23)
[38] In the Passives group, as of November 2023, the countries that are observed as not having laws in place for their climate targets are: Bangladesh (Walton), China (Chigo), India (Blue Star, Voltas), Singapore (Kadeka) and Italy (Carel, SCM Frigo).

down the line. Companies that are not facing domestic regulatory pressure should still consider building resilience by investing and planning for emissions reductions. Raising awareness and encouraging action are crucial to reduce the number of companies in the Passives group. Taking action on sustainability will be important for the cooling sector to stay competitive as the industry transitions towards more efficient products and environmentally friendly services.

2.3. Cooling suppliers are moving towards more efficient equipment that uses low GWP refrigerants

We assessed cooling suppliers for specific actions and commitments against two of the three impact areas defined in the CCAP. Given the focus of this report is on manufacturers of cooling equipment and/or refrigerants, our assessment focused on analysing their actions towards developing super-efficient equipment and appliances and rolling out ultra-low GWP refrigerants (<5 GWP) or switching towards appliances capable of using these next-generation refrigerants. Both these cooling impact areas offer the biggest GHG emissions reduction potential for cooling suppliers.

Scope 3 emissions typically comprise 90-99% of a cooling supplier's GHG emissions. Within this Scope, Category 11 (Use of sold products) can be the source of more than 70% GHG emissions. To achieve Net Zero, suppliers need to be working towards maximising the efficiency of the products in their portfolio and removing from use all but ultra-low GWP refrigerants.

Notable improvements in cooling commitments and actions on product efficiency and/or use of low GWP refrigerants have been made by cooling suppliers who are in the Embarkers, Builders and Transformers groups (see *Figure 5*). More suppliers are offering equipment for sale with increased efficiency and/or which uses lower, low or ultra-low GWP refrigerants. **A key driver for this progress, apparent in sustainability and company strategy reporting, is the shift in customer product requirements and purchasing decisions as they expand their own sustainability efforts and climate actions**. Suppliers are responding and are offering products with improved energy efficiency and/or product variants that use lower, low or ultra-low GWP.

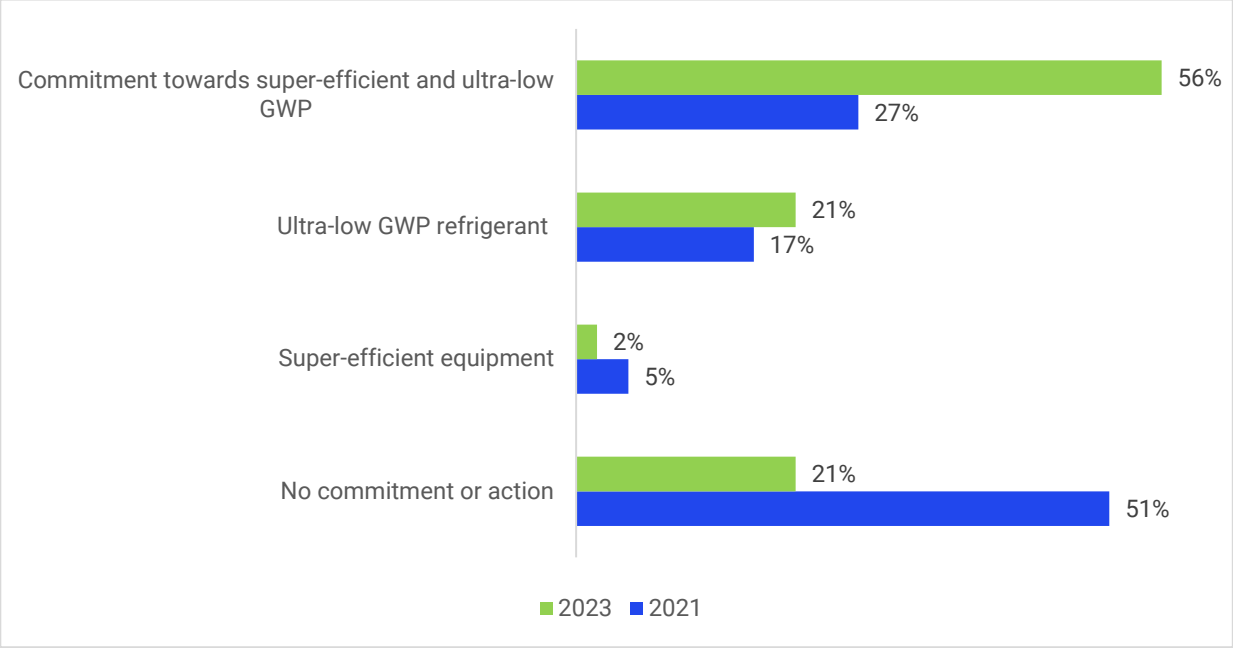

Figure 5: Cooling suppliers' commitment to super-efficient products that use ultra-low GWP refrigerants

As can be seen in *Figure 5*, between 2021 and 2023, the share of cooling suppliers who made no commitments to progressively improving energy efficiency (i.e., striving for super-efficiency) or adopting low GWP refrigerants (i.e., striving to use ultra-low GWP refrigerants) fell sharply from 51% of the suppliers tracked to 21%. At the same time, supplier commitments to both progressively improve product energy efficiency and adopt low GWP refrigerants more than doubled to 56%. When all commitments are included, four out of five cooling suppliers have committed to providing climate improved products.[39]

For example, white goods manufacturers such as Whirlpool, Electrolux and Arçelik are taking action. Whirlpool has committed through its Design for Sustainability programme to pursue increasing levels of energy efficiency, and has also set itself a goal of a 95% reduction of high GWP from refrigerants and foams by 2023[40]. Electrolux has committed to raising the bar on product efficiency around the world, and improved the energy efficiency of its global product offering by 1% in 2022. Electrolux converted its North American manufacturing plants to build refrigerator products that use low GWP refrigerants.[41] Arçelik has placed high priority on eco-efficient products and '*expects these to create a positive impact on revenue streams and meet growing customer demand*'. All three of these companies engage with industry stakeholders to encourage the development of product standards to improve product efficiency and reduce GHG emissions.[42]

Whilst evidence shows that the sustainable cooling transition is underway, much work remains to be done because climate innovations need time to flow through large product portfolios. If the Net Zero 2030 target is to be reached, then a strong push by all suppliers is needed to accelerate the introduction of a wider range of energy efficient products that use ultra-low GWP refrigerants.

2.4. Thirty-one cooling suppliers have now joined the SBTi

The SBTi has gained more attention from cooling suppliers: 31 have now set science-based targets, and 16 of these companies had their targets approved by the SBTi in the past two years. This is more than the cumulative target approvals from all previous years, with ten of them joining this year and five in the previous year.

To be in line with the Net Zero standard, suppliers need to set targets aligned with 1.5C. Eighteen of these suppliers have set near-term 2030 targets aligned with the 1.5C pathway. Of these companies, 14 are headquartered in countries with legally binding climate targets. Impressively, four companies have set long-term Net Zero targets (Fujitsu by FY2040, Emerson Electric by FY2045, Schneider Electric and Trane Technologies by 2050), and a further six have committed to setting SBT Net Zero targets (Toshiba, Eaton, Electrolux, GEA, Hitachi, and Panasonic). Those SBT-committed suppliers whose target is currently on the 'well-below 2C' pathways will need to increase their ambition to meet the 1.5C pathway to maintain SBTi certification when the time comes to revalidate.

[39] Note that some suppliers may only need to make one of the two commitments, e.g., refrigerants suppliers may only need to commit to provide low GWP products. Some suppliers who had made super-efficient commitment in 2021 expanded their commitment to also cover low GWP refrigerants – this explains a 3% drop in sole commitment.
[40] See Whirlpool Corporation, Sustainability Report 2022: https://www.whirlpoolcorp.com/2022SustainabilityReport/
[41] See Electrolux Sustainability Report 2022: https://www.electroluxgroup.com/en/electrolux-sustainability-report-2022-35296/
[42] Arçelik Sustainability Report 2022:https://www.arcelikglobal.com/en/sustainability-report-2022/overview/

Table 1: Cooling suppliers' 2030 SBTi targets

SBT	Organisation	Scope 1&2 reduction target	Scope 3 reduction target	Target Year		
				2025	2030	2040
1.5C (18)	Arkema	48.5%	54%		2030	
	Bosch	85%	15%		2030	
	Danfoss	46.2%	15%		2030	
	Eaton	50%	15%		2030	
	Electrolux	80%	25%	2025		
	Emerson Electric	90%	25%		2030	
	Fujitsu	42%	25%		2030	
	GEA	60%	18%		2030	
	Hitachi	100%	40%		2030	
	Johnson Controls	55%	16%		2030	
	LG Electronics	54.6%	20%		2030	
	Miele	50%	15%		2030	
	Orbia	47%	30%		2030	
	Panasonic	90%	30%		2030	
	Philips	75%	42%		2025	
	Sanden Corp	80.04%	27.5%		2030	
	Schneider Electric	76%	25%		2030	
	Trane Technologies	50%	55%		2030	
Well-below 2C (11)	Arçelik	30%	15%		2030	
	Daikin	25%	13.5%		FY2030	
	Engie[43]	55%	56%		2030	
	Honeywell International	50%	23%			2037
	Lennox	37.5%	30%		2034	
	Linde	35%	N/A			2035

[43] See Appendix 2: Science Based Targets for Engie's full target. For comparability, Engie aims to reduce 55% per MWh of electricity and heat generated by 2030 from a 2017 base year, which is assumed to cover up to 95% of the company's Scope 1&2 emissions as part of their commitment to a 'well-below 2C' pathway.

	Mitsubishi Electric	18%	15%	2030
	Sharp Corporation	33%	33%	2031
	ThyssenKrupp	30%	16%	2030
	Toshiba	28%	14%	2030
	Whirlpool	50%	20%	2030
(2)	Chemours	Committed to setting a near-term target.		
	Haier	Committed to setting a near-term target and Net Zero target.		

Appendix 2 provides a table with more detail on the different SBTs analysed.

Thirty-seven suppliers do not have independently verified decarbonisation pathways consistent with Net Zero. For the sector to achieve the 2030 target, these companies need to act now to prepare and validate climate action pathways that are consistent with Net Zero or, where they exist, national legally binding commitments.

About one in three cooling suppliers tracked for this study has set a target consistent with a Scope 1&2 Net Zero pathway. Of the 18 suppliers pursuing an SBTi 1.5C pathway, 17 have set a 2030 Scope 1&2 target which is more ambitious than the 43% reduction to achieve Net Zero by 2050. Some suppliers have set ambitious targets: Bosch, Electrolux, Emerson Electric, GEA, Hitachi, Johnson Controls, Panasonic, Sanden and Schneider Electric have each set targets that are between 17% and 57% higher than the 2030 Net Zero aligned target.

Philips hopes to achieve its target by 2025. Two companies pursuing a 'well-below 2C' pathway – Honeywell and Whirlpool – also surpass this 2030 target. The RtZ campaign has a more ambitious 50% 2030 Scope 1&2 emissions target, and 16 of these suppliers (including three on the 'well-below 2C' pathway) also achieve or surpass this ambition. A further one in six companies is on an SBTi 'well-below 2C' pathway and has set a 2030 climate target that, with a little more ambition, could achieve the 2030 Scope 1&2 target of 43%, particularly Arçelik, Engie, Lennox, Linde, Sharp, ThyssenKrupp and Toshiba.

Tackling Scope 3 emissions is critical to moving the cooling industry to Net Zero. An encouraging trend has emerged within the cooling industry, as well as the wider corporate landscape, in that an increasing number of companies are proactively addressing their Scope 3 emissions. The shift towards greater engagement with tackling Scope 3 emissions represents a positive development, indicative of a growing commitment to sustainability and environmental responsibility across the value chain by the cooling industry.

It is noteworthy that all the suppliers participating in SBTi have taken concrete steps by establishing SBTs that encompass Scope 3 emissions. Among these 31 suppliers, 15 have set comprehensive Scope 3 reduction targets, while the remaining 16 have chosen to concentrate on specific categories, such as Category 11, related to emissions resulting from the use of sold products, as part of their Scope 3 emission reduction strategy. This includes all SBTi companies – with the exceptions of Linde, Carrier and Haier, who have each set a Scope 3 emission target of between 13.5% and 55%. Scope 3 targets are encouraging, but caution needs to be taken in their interpretation as typically not all 15 Scope 3 categories are included within these targets.

The significance of Scope 3 emissions cannot be overstated. More than 90% of emissions, and in certain cases as high as 99%, fall within a cooling supplier's Scope 3 boundary. Therefore, the increased attention and action directed towards Scope 3 emissions by the industry is helpful. However, it is important to recognise that there remains much Scope 3 work to be done before the emissions from the cooling industry are reduced to levels consistent with Net Zero.

In the past two years, the cooling industry has accelerated its actions to address climate change and is moving towards a Net Zero pathway. More cooling suppliers have joined the RtZ and/or SBTi. More companies have also firmed up their understanding of what they are required to do to decarbonise. More than half of the cooling suppliers we tracked have set 2030 and 2050 emissions reduction targets.

2.5. The data quality to assess the cooling industry's Net Zero actions is improving

There has been a significant improvement in the quality and quantity of information provided by 38 of the 55 cooling suppliers tracked in this study since the last review was performed in 2021. Information that is provided includes sufficient detail to suggest that many companies have recognised the importance of acting on climate change, have formulated strategies and plans to address climate risks to their operations, are beginning to roll out more climate-smart solutions, and are engaging with their supply chains to address Scope 3 emissions.

Twenty-nine of the 55 cooling suppliers have their climate plans independently verified through the SBTi. SBTs offer a clear and defined course of action for companies to make significant reductions in their GHG emissions, in accordance with the goals of the Paris Agreement. These targets are considered science-based if they align with the latest climate science and are deemed necessary to achieve the Paris Agreement's objectives, which is to limit global warming to 1.5C above pre-industrial levels. These same companies typically provide more extensive climate-related information on their company websites and documents.

This improvement in data quality and quantity is welcomed, but there remain opportunities for improvement. Twenty-six cooling suppliers either don't report climate ambitions and targets, or report these as part of brief, consolidated ESG disclosures that provide limited information. Whilst a growing number of tracked companies provide independently verifiable standards (e.g., to SBTi), other companies provide very impressive and comprehensive climate information which highlights bold climate ambition yet fails to provide specific 2030, 2040 or 2050 climate targets tied to independent benchmarks that would permit informed judgement of their actions towards a Net Zero pathway. For example, Carrier provides detailed climate information that speaks to very strong climate ambitions, but does not provide climate targets that can be used to judge Net Zero progress. This makes it difficult to contrast Carrier's stated climate ambitions against the Net Zero pathway or the actions of its competitors.

3. Three learnings from cooling suppliers who have generated Net Zero climate momentum

Cooling suppliers who have generated climate momentum towards Net Zero have recognised the strategic importance of setting ambitious, independently verified climate targets for 2030 and 2050, are actively collaborating, cooperating and communicating to support the cooling industry's climate transition, and are using green finance to fund climate transformation across their business operations.

3.1. Ambitious independently verified climate targets for 2030 and 2050

Cooling suppliers who have built up Net Zero climate momentum have set clear targets for 2030 and 2050, which are typically verified by SBTi or other independent validation. These suppliers identify the specific decarbonisation pathway they are delivering against[44] for the achievement of short- and long-term targets, and the overarching decarbonisation approach they have adopted (i.e., carbon neutral, Net Zero). Cooling suppliers including Daikin, Electrolux, Engie, Miele, Panasonic, ThyssenKrupp and Trane Technologies[45] target carbon neutral outcomes by 2030 at the latest as a useful milestone on the way to Net Zero by 2050. Many of these companies also incentivise their leadership teams and employees to achieve the company's climate targets.

Importantly, these companies are transparent and report on their successes and also the areas for continued focus in their annual sustainability reports. Increasingly, these reports provide a wealth of climate information to evidence how companies are taking action, often sharing detailed examples to highlight specific decarbonisation projects. Report transparency further builds Net Zero climate momentum as it shows peers examples of success and also acknowledges that there will be setbacks.

These cooling suppliers have committed to consistently improving portfolio product efficiency (i.e., the energy efficiency of all the products they offer) and have also committed to using low GWP refrigerants in these products ahead of regulatory timelines. These commitments align with the need to develop and deploy super-efficient products that use ultra-low GWP refrigerants.

Tackling Scope 1&2 emissions remains at the core of cooling suppliers' climate momentum. It evidences a supplier's commitment to tackling climate change, giving them currency to engage with their supply chain and wider stakeholder base to encourage them to act on climate change, too. These companies are actively pursuing deep Scope 1&2 decarbonisation projects. A review of sustainability reports highlights a wide diversity of decarbonisation projects (e.g., renewable energy deployment[46,47], deployment of efficient equipment, sourcing of lower emissions steel[48]).

Leading cooling suppliers recognise the climate importance and commercial benefits of careful refrigerant selection and use. Cooling suppliers such as A-Gas, Arçelik, Carrier, Daikin Industries,

[44] e.g., SBTi 'Well-below 2C, SBTi 1.5C, SBTi Net Zero, International Energy Agency Net Zero Emissions
[45] See respective 2022 annual reports
[46] See for example ThyssenKrupp Sustainability Report 2022
[47] See Samsung Electronics Sustainability Report: https://www.samsung.com/global/sustainability/media/pdf/Samsung_Electronics_Sustainability-Report-2022_Executive_Summary.pdf
[48] See Trane Technologies Sustainability Report 2022: https://www.tranetechnologies.com/content/dam/cs-corporate/pdf/sustainability/annual/2022-ESG-Report.pdf

Electrolux, Godrej & Boyce, Honeywell, Mabe, Mitsubishi Electric, Trane Technologies, and Orbia[49], have decided to begin the transition to use low or ultra-low GWP refrigerants ahead of regulatory commitments.

These suppliers also recognise the importance of implementing best-in-class global systems for the control of the refrigerants under their management (e.g., through better product design, refrigerant reclamation processes) to reduce emissions from the installed base of equipment. They are investing in research and development to accelerate the deployment of new equipment that can use ultra-low GWP refrigerants.

Refrigerant lifecycle management of the installed base of equipment is another important focus. The installed base of hydrochlorofluorocarbons (HCFCs) and/or hydrofluorocarbons (HFCs) is equivalent to approximately 24 billion tonnes CO_2e.[50] Cooling suppliers such as A-Gas, Carrier and Trane Technologies, work with their customers to implement effective refrigerant lifecycle management with substantial benefits. For example, in 2022, Trane Technologies reclaimed 200k+ tons of refrigerant that would have otherwise entered the atmosphere as harmful GHG emissions.

A-GAS – ENSURING HARMFUL REFRIGERANTS ARE EFFECTIVELY MANAGED AT EQUIPMENT END OF LIFE?

A-Gas, a UK-headquartered world leader in lifecycle refrigerant management, provides solutions to one of today's key climate challenges: the recovery and reuse or destruction of harmful refrigerant gases that are ozone-depleting or GHGs. Whilst A-Gas is not formally part of the RtZ, it is beginning its commitment to SBTi, and its business operations align towards tackling climate action.

In 2023, A-Gas utilised its technology and expertise to help Mauritius Freeport Development, the largest logistics centre in the Indian Ocean, to recover nearly 6 tonnes of R22 (a powerful GHG with a GWP 1,810 times that of CO_2) without leakage, preventing 10,860 tons of CO_2e from being released to atmosphere. The recovered gas was safely transported to South Africa for reprocessing.

Effective end-of-life management of refrigerants, such as R22, is vital if the cooling industry is going to achieve Net Zero GHG emissions. Responsible refrigerant management, such as that provided by A-Gas, needs to be deployed at scale and pace by all nations to ensure effective national end-of-life management of refrigerant gases.

A-Gas is an example of a company whose impact on the climate will magnify as lifecycle refrigerant management continues to be part of the climate solution.

3.2. Collaborating, cooperating and communicating to transform the cooling industry to Net Zero

A consistent theme amongst cooling suppliers in the Transformers group, as well as the Builders and Enablers groups, is the need to collaborate, cooperate and communicate to stimulate, encourage and support the cooling industry's transition to Net Zero. Suppliers such as Trane Technologies, Electrolux,

[49] Based on statements made in the sustainability reports of these suppliers, or similar materials.

[50] See The 90 Billion Ton Opportunity: https://us.eia.org/wp-content/uploads/2022/10/Refrigerant-Lifecycle-ExecutiveSummary-6Spreads-PRINT.pdf.

Schneider Electric, Johnson Controls, Arçelik and A-Gas, have recognised this urgent need. They openly participate in, and share, experiences with others, inside and outside the industry, to accelerate learning that can be used by the industry to quickly align to climate pathways consistent with Net Zero.

During interviews with a number of these cooling suppliers, strong interest and enthusiasm was expressed in sharing real experiences of the challenges experienced in: the initial mobilisation efforts to create a team to manage company-wide climate action; the difficulties encountered in building effective GHG emissions modelling tools and operating these tools across multiple geographies and years; the need to normalise industry emissions accounting rules to simplify pan-industry reporting; and collective approaches to reducing Scope 3 emissions. For some companies, there was also recognition of the need to identify opportunities to work together to accelerate technology development in challenging innovation areas (e.g., application and management of ultra-low GWP refrigerant gases).

Deep and sustained supply chain engagement and decarbonisation is critical if cooling suppliers are to achieve their climate targets. Around 90-99% of a cooling supplier's emissions are Scope 3 emissions from their own suppliers. Because of this, many cooling companies have embarked on supply chain engagement programmes, such as Schneider Electric's 'The Zero Carbon Project', Arçelik's 'Supplier Sustainability Index', Electrolux's 'Responsible Sourcing Programme', Engie's 'Resilience & Sustainability' and Trane Technologies' 'Business Partner Code of Conduct'. These structured engagement programmes are focused on working collaboratively with supplier bases to inform, encourage and support their efforts to reduce their climate impacts.

DANFOSS – REACHING CARBON NEUTRALITY AT ITS LARGEST PRODUCTION FACILITY

In 2022, Danfoss – a Danish multinational and global provider of industrial products spanning multiple markets including cooling – reached carbon neutrality in Scope 1&2 at their largest production facility, the Nordborg campus in Denmark. Carbon neutrality in Scope 1&2 was achieved at this 250,000m^2 campus through reduction of energy consumption, reuse of excess heat from processes and data centres, and sourcing of green electricity. Unavoidable emissions from leakage of refrigerants and company cars were offset. Overall, energy consumption for heating has decreased by 78%, and electricity demand by 50%.

While Danfoss is still on the journey to global company-wide carbon neutral operations by 2030, it has achieved a tangible milestone by delivering carbon neutrality of this facility. This experience will help guide the transformation of its global business model to deliver carbon neutrality by 2030, including reducing Scope 1&2 emissions by 46.2%, positioning the company to be on the 2050 path to Net Zero.

BOSCH GROUP – ACTION ON SCOPE 3 EMISSIONS THROUGH SUPPLIER ENGAGEMENT

Bosch Group recognised that working closely with its supply chain is critical to reducing its Scope 3 emissions, which in 2022 were 352.5 million metric tonnes of CO_2. In 2022, BSH Hausgeräte GmbH (part of the Bosch Group) hosted its first 'Supplier Green Day' with the companies that supply it with the materials that have the largest contributing sources to its Scope 3 emissions.

The day focused on working with these suppliers to identify Scope 3 carbon reduction pathways for the refrigeration sector. It gave attendees from across a diverse range of material groups a day of open discussions and presentations, leading to a common understanding of the challenges encountered in addressing Scope 3 emissions. This helped attendees to develop and strengthen their cooperation on climate action, as well as learn more about circular economy principles.

One outcome of the day was to identify progressive measures that promote low carbon solutions. For example, BSH showcased their ongoing relationship with Salzgitter Flachstahl GmbH to source green steel for their products. Green steel has a 66% lower carbon footprint than traditionally sourced steel.

3.3. Using green finance to fund the Net Zero climate transition

Cooling suppliers who have embarked upon the fundamental transformation of their business operations to manufacture the new eco-products that will be used by their customers to deliver their path to Net Zero require substantial capital investment. These cooling suppliers have reprioritised their capital investment frameworks to include climate targets and outcomes, and also made good use of green finance (e.g., green bonds, sustainability linked bonds).

Green finance gives these companies access to commercial debt at more favourable interest rates on achieving specific sustainability outcomes, including climate or decarbonisation actions. As part of accessing green finance services, companies commit to report annually on the performance of these initiatives, ensuring external validation of their actions by these investors and other third parties.

For example, Schneider Electric has defined short- and medium-term financial investment priorities to set its course towards its SBTi validated Net-Zero commitment, and more broadly to meet its long-term commitments for climate and to preserve natural resources[51]. In 2020, Schneider Electric launched a convertible €650 million Sustainability-Linked Bond to help it deliver 800 megatons CO_2 emissions saved and avoided by its customers[52]. By 2022, Schneider Electric had helped customers save and avoid 440 million tonnes of CO_2e. Arçelik has raised about €500 million in green bonds and loans and helped its customers save more than one million tonnes of CO_2e between 2018 and 2021.[53]

ELECTROLUX – USING GREEN FINANCING TO TRANSFORM TO A SUSTAINABLE BUSINESS

Electrolux has invested SEK 6.8bn in green assets via its Green Financing Framework. In 2022, Electrolux issued five Green Bonds, worth a total of SEK 5bn, with tenors of two to five years. It uses these funds to support projects in five eligible categories:

- Be climate neutral and drive clean and resource-efficient operations
- Lead in energy and resource-efficient solutions
- Offer circular products and business solutions
- Eliminate harmful materials
- Supporting the UN Sustainable Development Goals and Climate Goals

Green financing is used to achieve: a 20%+ improvement in the energy efficiency of transformed manufacturing operations (delivering expected annual emissions reductions of 11.8kt CO_2e); the development of new product lines with energy efficiencies that are 15%+ better than the average fleet of products being replaced, which are forecast to deliver 240,000tonnes tCO_2e (lifetime) reductions; and replacement of harmful HFCs with alternatives with a GWP of 15 CO_2e or less, which is expected to deliver emissions reductions of 2 million tonnes of CO_2e each year.[54]

[51] See Schneider Electric Climate Report 2022: https:/www.se.com/ww/en/assets/564/document/396656/2022-climate-report.pdf
[52] See Schneider Electric Sustainability Linked Financing Framework: http://www.se.com/ww/en/assets/564/document/174194/schneider-electric-sustainability-linked-financing-framework.pdf
[53] See Arçelik Green Bond Allocation and Impact Report: https://www.arcelikglobal.com/media/6933/arcelik-2018-21-green-bond-allocation-and-impact-report.pdf
[54] See Electrolux Green Financing Impact Report 2022: https://www.electroluxgroup.com/wp-content/uploads/sites/2/2019/03/green-financing-impact-report-2022-final.pdf

4. Calls to action to accelerate the cooling industry's transition to Net Zero

4.1. Strategic actions to accelerate climate ambitions

Cooling suppliers who have not yet committed to climate action, or have not communicated their climate commitments, are encouraged to do so promptly. It is clear the cooling industry has embarked on the journey to mitigate climate change impacts. Cooling suppliers who have not yet taken action to evaluate and address climate risks will be left behind. We call upon all such companies – such as the companies in this review who have not embarked on their Net Zero journey – to act immediately on climate change and prepare Net Zero actions plans, and to submit these for independent security (e.g., independent validation to SBTi).

All cooling suppliers should set Net Zero targets and progress beyond carbon neutrality. The ambition of some cooling suppliers continues to be carbon neutrality rather than Net Zero, which hinders rapid decarbonisation. These suppliers often have bold and ambitious climate programmes, so the step from carbon neutrality to Net Zero is well within their grasp. Suppliers should act now to make the switch to Net Zero, and transition through carbon neutrality to Net Zero.

WHAT IS THE DIFFERENCE BETWEEN CARBON NEUTRALITY AND NET ZERO?

Carbon neutrality is determined by the PAS 2060 standard, which requires the quantification, reduction, and offsetting of GHG emissions. It means that over a specified period, there is no net increase in global GHG emissions related to a subject.[55]

The SBTi defines Net Zero targets for corporations as balancing substantial emissions reductions (e.g., 90%) throughout their value chain while offsetting any remaining modest, unfeasible emissions by removing an equivalent amount of atmospheric CO_2.[56]

Governments in all countries need to offer policies that enable Net Zero actions to be implemented. Cooling suppliers who are Net Zero leaders are experiencing deployment challenges in the nations in which they operate, due to the absence of enabling regulation or policy (e.g., regulation encouraging the use of renewable energy, providing a wider choice of low GWP refrigerants, encouraging clients to buy climate-friendly products, more ambitious minimum energy performance standards). Given the cooling industry is responsible for at least 7% of global GHG emissions, it is hard to see how governments will deliver on their Net Zero plans without working with their local cooling industries to identify and resolve barriers to Net Zero deployment.

A standard approach for the cooling sector to model GHG emissions will improve transparency and comparability across the industry. Industry has shared a desire to have common standards and benchmarks for GHG emissions modelling (e.g., common sources for accurate grid emissions factors for nations) to enable businesses to better measure, track and compare progress across peers.

[55] See PAS 2060 Carbon Neutrality: https://www.bsigroup.com/en-GB/PAS-2060-Carbon-Neutrality/
[56] See SBTI Net Zero: https://sciencebasedtargets.org/resources/files/foundations-for-net-zero-full-paper.pdf

SUPPORT ACTIVITY – BEST PRACTICE TO ACCELERATE INDUSTRY ACTION ON NET ZERO

The Carbon Trust will work with the cooling industry to consolidate their experiences and identify best practices and useful Net Zero tools. This knowledge will be used to create best practice guidance, enabling companies to benchmark their progress and inform future Net Zero planning.

4.2. Focused action on Scope 3 value chain emissions is essential to achieving cooling sector decarbonisation

Cooling suppliers must focus decisively on achieving Net Zero Scope 3 value chain emissions. Leaders recognise that Scope 3 emissions are the source of 90- 99% of their emissions. It is vital that all suppliers take immediate and consistent actions to drive down Scope 3 emissions, particularly in Categories 1 (Purchased goods and services), 11 (Use of sold products) and 12 (End-of-life treatment of sold products). Opportunities for industry collaborative engagements should be explored.

Suppliers should explore industry cooperation to reduce the burden of Scope 3 value chain emissions management, data gathering and reporting. Given the interdependency of cooling value chains, each cooling supplier is encouraged to explore industry-wide value chain collaborations to reduce the administrative burden on both themselves and their value chain suppliers, and also improve information standardisation and quality.

Suppliers must explore green metals and the circular economy. After maximum energy efficiency and adoption of ultra-low GWP refrigerants, the next largest upstream emission source is materials (e.g., steel). To ensure sustainable emissions reductions, companies should prioritise procurement of green metals, design for reuse, and re-use or repurpose old equipment.

SUPPORT ACTIVITY – BEST PRACTICE ON SUPPLY CHAIN ENGAGEMENT AND MANAGEMENT OF SCOPE 3 EMISSIONS

The Carbon Trust will work with the cooling industry to establish a detailed map at a sector level of typical Scope 3 supply chain emissions hotspots, as well as gather examples of Scope 3 supply chain management best practice, and key drivers of, or barriers to, action. This knowledge will be used to create Scope 3 best practices and benchmarking guidance, enabling cooling companies to compare their progress with peers, and kickstart or accelerate Scope 3 emissions management in the supply chain.

4.3. Cooling suppliers should explore industry cooperation to accelerate Net Zero technology deployment

Achieving Net Zero requires suppliers to outline a timeline for radically transforming equipment and appliances portfolios. Suppliers need to agree a common approach and timeline for when super-efficient equipment and appliances that use no or ultra-low GWP refrigerant products will be the only product solution available.

Suppliers must collaborate on science and technology development to accelerate Net Zero achievement. It is vital to learn from other industries (e.g., offshore wind) and collaborate on the development of solutions to common, often ancillary, barriers experienced by all cooling suppliers (e.g., use of ultra-low GWP refrigerants, designing out leaks, manufacturing processes). Delivering Net Zero cooling requires accelerated research and development at a pace greater than that typically created by academia or the industry's ecosystem, affording each cooling supplier a heavy innovation burden. As has been shown in other sectors, great success and industry accomplishment have been achieved through cooperation in joint innovation programmes focused on common research areas and ancillary activities.

CASE EXAMPLE – OFFSHORE WIND ACCELERATOR[57]

The Carbon Trust-led Offshore Wind Accelerator (OWA) brings offshore wind developers together to collectively address offshore wind cost reduction challenges. In its first ten years, the OWA delivered more than 150 research, development and deployment (RD&D) projects, in partnership with nine leading offshore wind developers.

The OWA's research is structured around five research areas where cooperation was achievable: cables; electrical systems; foundations; logistics and operations and maintenance; and yield and performance. Additionally, there have been 25 discretionary projects targeting ancillary technical challenges where it is more cost effective to collaborate than compete. Knowledge created is shared with those who invest in a project.

Cost analysis shows that the innovations supported through the OWA in just a decade contributed to a 15% reduction in the cost of energy for an average offshore wind project, saving the industry a total of £34bn against 2030 build out targets.

Public-private sector funding is needed to enable partnerships to demonstrate cooling innovations (e.g., magnetocaloric, thermoelectric, evaporative, absorption, and adsorption[58]) that promise breakthrough levels of performance but require innovation de-risking. The advancement of cooling technology is slow, and it is not always clear when 'known' new innovative technologies will be available to the market. Although many companies are aware of these advancements, none seems willing to take the first step. There is a significant lack of funding for such innovations, which is causing bottlenecks and delays.

[57] Carbon Trust website: https://www.carbontrust.com/our-work-and-impact/impact-stories/offshore-wind-accelerator-owa.

[58] Global Cooling Stocktake, Cool Coalition, 2023 (release in December 2023)

SUPPORT ACTIVITY – BUILDING A CASE FOR COOLING INDUSTRY COLLABORATION

The Carbon Trust will explore opportunities with the cooling industry and stakeholders (e.g., Cool Coalition, academia) to build the case for a collaboration accelerator to champion the removal of industry-wide barriers that are slowing or holding back the achievement of Net Zero targets.

We will explore areas where industry collaboration is material and additional to addressing barriers that are holding back Net Zero action. This will include: evaluating accelerator models; prioritising options with the right balance of impact, governance and cost-effectiveness; and progressing feasible high impact collaboration opportunities.

Appendix

Appendix 1: Companies Assessed

Company	Sector	HQ
Advansor	Refrigeration	Denmark
A-Gas	Refrigerants	United Kingdom
Arçelik	AC & Refrigeration	Turkey
Arkema	Refrigerants	France
BASF	Refrigerants	Germany
Bitzer	Refrigeration	Denmark
Blue Star	AC & Refrigeration	India
BOC	Refrigerants	United Kingdom
Bosch Group	Refrigeration	Germany
Carel	Refrigerants	Italy
Carrier	AC & Refrigeration	USA
Chemours	Refrigerants	USA
Chigo	AC	China
Daikin Industries	AC & Refrigeration	Japan
Danfoss	Refrigeration	Denmark
Eaton	AC & Refrigeration	Ireland
Electrolux	AC & Refrigeration	Sweden
Emerson Electric	AC & Refrigeration	USA
Enex Technologies	Refrigeration	Italy
Engie	District Cooling	France
Fujitsu	AC	Japan
GEA	Refrigeration	Germany
Godrej & Boyce	AC	India
Gree Electric Appliances	AC	China
Haier	AC & Refrigeration	China
Hisense	AC & Refrigeration	China
Hitachi	AC & Refrigeration	Japan
Honeywell	AC & Refrigeration	USA

Johnson Controls	AC & Refrigeration	USA
Kadeka	Refrigeration	Singapore
Lennox	AC & Refrigeration	USA
LG Electronics	AC & Refrigeration	South Korea
Liebherr	Refrigeration	Switzerland
Linde	Refrigerants	Ireland
Mabe	AC	Mexico
Midea Group	AC & Refrigeration	China
Miele	Refrigeration	Germany
Mitsubishi Electric	AC & Refrigeration	Japan
Mitsubishi Heavy Industries	AC & Refrigeration	Japan
Nortek	AC	USA
Orbia Advance Corporation	Refrigerants	Mexico
Panasonic	AC & Refrigeration	Japan
Philips	AC & Refrigeration	Netherlands
Samsung Electronics	AC & Refrigeration	South Korea
Sanden	AC	Japan
Schneider Electric	AC	France
SCM Frigo	Refrigeration	Italy
Sharp Corporation	AC	Japan
ThyssenKrupp	Refrigerants	Germany
Toshiba	AC	Japan
Trane Technologies	AC	Ireland
Voltas	AC & Refrigeration	India
Walton	AC & Refrigeration	Bangladesh
Westpoint	AC & Refrigeration	France
Whirlpool	Refrigeration	USA

Appendix 2: Science Based Targets

Science Based Target	Organisation	Target Year	2030 Targets
1.5C (18)	Arkema	2030	**Arkema** commits to reduce absolute Scope 1&2 GHG emissions 48.5% by 2030 from a 2019 base year, and absolute Scope 3 GHG emissions 54% within the same timeframe.
	Bosch	2030	**Robert Bosch Group (Bosch)** commits to reduce absolute Scope 1&2 GHG emissions 85% and absolute Scope 3 GHG emissions 15% by 2030 from a 2018 base year. Further, it also commits to increase annual sourcing of renewable electricity from 14% in 2018 to 100% by 2030. Bosch is the parent company of BSH Hausgeräte GmbH which is presented in this report.
	Danfoss	2030	**Danfoss** commits to reduce absolute Scope 1&2 GHG emissions 46.2% by 2030 from a 2019 base year, and absolute Scope 3 GHG emissions 15% within the same timeframe.
	Eaton	2030	**Eaton Corporation plc** commits to reduce absolute Scope 1&2 GHG emissions 50% by 2030 from a 2018 base year, and absolute Scope 3 GHG emissions 15% by 2030 from a 2018 base year.
	Electrolux	2025	**Electrolux** commits to reduce absolute Scope 1&2 GHG emissions 80% by 2025 from a 2015 base year, and absolute Scope 3 GHG emissions from use of sold products 25% within the same timeframe.
	Emerson Electric	2030	**Emerson Electric Co.** commits to reduce absolute Scope 1&2 GHG emissions 90% by FY2030 from a FY2021 base year, and absolute Scope 3 GHG emissions 25% within the same timeframe.
	Fujitsu	2030	**Fujitsu Ltd** commits to reduce absolute Scope 1&2 GHG emissions 42% by FY2030 from a FY2020 base year, and reduce absolute Scope 3 GHG emissions from purchased goods and services and use of sold products 25% within the same timeframe.
	GEA	2030	**GEA Group** commits to reduce absolute Scope 1&2 GHG emissions 60% by 2030 from a 2019 base year, and absolute Scope 3 GHG emissions 18% within the same timeframe.

	Hitachi	2030	**Hitachi Ltd** commits to reduce absolute Scope 1&2 GHG emissions 100% by 2030 from a 2010 base year, and absolute Scope 3 GHG emissions 40% over the same time frame.
	Johnson Controls	2030	**Johnson Controls International plc** commits to reduce absolute Scope 1&2 GHG emissions 55% by 2030 from a 2017 base year, and absolute Scope 3 GHG emissions from the use of sold products 16% over the same time frame.
	LG Electronics	2030	**LG Electronics Inc**. commits to reduce absolute Scope 1&2 GHG emissions 54.6% by 2030 from a 2017 base year and reduce Scope 3 GHG emissions from use of sold products 20% per functional unit sold by 2030 from a 2020 base year.
	Miele	2030	**Miele** commits to reduce absolute Scope 1&2 GHG emissions 50% by 2030 from a 2019 base year, and absolute Scope 3 GHG emissions covering the use of sold products 15% over the same target period.
	Orbia	2030	**Orbia Advance Corporation S.A.B.** commits to reduce absolute Scope 1&2 GHG emissions 47% by 2030 from a 2019 base year, and absolute Scope 3 GHG emissions from use of sold products and end-of-life treatment of sold products 30% within the same timeframe.
	Panasonic	2030	**Panasonic Holdings Corporation** commits to reduce absolute Scope 1&2 GHG emissions 90% by FY2030 from a FY2019 base year, and absolute Scope 3 GHG emissions from use of sold products 30% within the same timeframe.
	Philips	2025	**Royal Philips** commits to reduce absolute Scope 1&2 GHG emissions 75% by 2025 from a 2015 base year, and absolute Scope 3 GHG emissions from purchased goods and services, business travel, downstream transportation and distribution and use of sold products 42% by 2030 from a 2020 base year.
	Sanden	2030	**Sanden Corporation** commits to reduce absolute Scope 1&2 GHG emissions 80.04% by 2030 from a 2019 base year, and absolute Scope 3 GHG emissions 27.5% within the same timeframe. They also commit to increase annual sourcing of renewable electricity from 0.2% in 2019 to 100% by 2030.
	Schneider Electric	2030	**Schneider Electric** commits to reduce absolute Scope 1&2 GHG emissions 76% by 2030 from a 2021 base year, and absolute Scope 3 GHG emissions 25% within the same timeframe. They also commit to increase annual sourcing of renewable electricity from 82% in 2021 to 100% by 2030.

	Trane Technologies	2030	**Trane Technologies** commits to reduce absolute Scope 1&2 GHG emissions 50% by 2030 from a 2019 base year, and Scope 3 GHG emissions 55% per cooling ton from use of sold products within the same timeframe.
Well-below 2C (11)	Arçelik	2030	**Arçelik** commits to reduce absolute Scope 1&2 GHG emissions 30% by 2030 from a 2018 base year. Arçelik also commits to reduce absolute Scope 3 GHG emissions from the use of sold products 15% over the same timeframe.
	Daikin	FY2030	**Daikin Industries, Ltd.** commits to reduce absolute Scope 1&2 GHG emissions 25% by FY2030 from a FY2021 base year, and absolute Scope 3 GHG emissions 13.5% by FY2030 from a FY2021 base year.
	Engie	2030	**Engie** commits to reduce Scope 1&2 GHG emissions 55% per MWh of electricity and heat generated by 2030 from a 2017 base year. Engie also commits to reduce Scope 1&2 GHG emissions from fuel and energy related activities and investments covering all sold electricity and heat 56% per MWh within the same timeframe. Engie further commits to reduce absolute Scope 3 GHG emissions from purchased goods and services, capital goods, fuel and energy related activities, and use of sold product emissions of gas distribution by 32.5% within the same timeframe.
	Honeywell	2037	**Honeywell International Inc.** commits to reduce absolute Scope 1&2 GHG emissions 50% by 2037 from a 2019 base year, and absolute Scope 3 emissions 23% within the same timeframe.
	Lennox	2034	**Lennox International Inc.** commits to reduce absolute Scope 1&2 GHG emissions 37.5% by 2034 from a 2019 base year and to reduce Scope 3 GHG emissions 30% per product sold by 2034 from a 2019 base year.
	Linde	2035	**Linde plc** commits to reduce absolute Scope 1&2 GHG emissions 35% by 2035 from a 2021 base year.
	Mitsubishi Electric	2030	**Mitsubishi Electric** commits to reduce absolute Scope 1&2 GHG emissions 18% by 2030 from a 2016 base year, and absolute Scope 3 GHG emissions 15% by 2030 from a 2018 base year.
	Sharp Corporation	2031	**Sharp Corporation** commits to reduce absolute Scope 1&2 GHG emissions 33% by 2031 from a 2018 base year, and absolute Scope 3 GHG emissions from the use of sold products 33% by 2031 from a 2018 base year.

	ThyssenKrupp	2030	**ThyssenKrupp AG** commits to reduce absolute Scope 1&2 GHG emissions 30% by 2030 from a 2018 base year, and absolute Scope 3 GHG emissions 16% by 2030 from a 2017 base year.
	Toshiba	2030	**Toshiba Corporation** commits to reduce absolute Scope 1&2 GHG emissions 28% by 2030 from a 2019 base year, and absolute Scope 3 GHG emissions from the use of sold products associated with power supply 50% and reduce absolute Scope 3 GHG emissions from the use of sold products associated with power consumption 14% over the same timeframe.
	Whirlpool	2030	**Whirlpool Corporation** commits to reduce absolute Scope 1&2 GHG emissions 50% by 2030 from a 2016 base year, and absolute Scope 3 GHG emissions from the use of sold products 20% over the same timeframe.
(2)	Chemours	Committed to setting a near-term target. Commitment published in 2022.	
	Haier	**Haier Group** committed to setting a near-term and a Net Zero target. Commitment published in 2021.	

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