

Materials, Resources and Sustainability series

Reading time: ~20 minutes



The air-conditioning industry



Introduction

This paper is part of a series on **materials and resources**. In this series we ask how we can use risk management approaches, techniques and tools to improve the way we source, develop, use and dispose of the materials, resources and products that power our modern economy, and to support everyone involved in their value chains. The series uses [the United Nations Sustainable Development Goals](#) (the SDGs) as a common thread to discuss diverse sustainability and risk aspects and elements to each subject.



The importance of air-conditioning around the world

The world is heating up

A wealth of scientific evidence is advising us that climate change is happening, and that temperatures around the world are increasing. ¹

A growing proportion of the world's population are living in cities. In July 2019, research was published that estimated almost 80% of 520 cities around the world will experience major changes to their climate in the next three decades – with a warming climate being a key focal point. ² Dense built environments retain heat in hot weather, exacerbating the effects of hot weather.

In January 2020 the management consultants McKinsey released an in-depth report that describes some of the key socioeconomic impacts of climate change, and a warming planet. ³ As the world's population continues to grow, and more people are lifted out of poverty, many of whom will live in cities, the demand for cooling systems in the places where they live and work will surely increase.

Is air conditioning here to stay...?

The need for cooling is here to stay. Today, air conditioning plays an often unassuming yet important part in the way we live our lives. It helps to keep us cool in hot conditions, and it keeps our immediate environment indoors dry when it is humid outside. It is an important enabler of our modern economy and it is ubiquitous. We use it in our homes, in the entertainment centres and shopping centres we visit, the offices and places where we work and study, and in the forms of transport we use to get to and from all of these places. In wealthy countries, most people tend to take it for granted that it will be there to keep them cool.

Air conditioning can literally transform economies in hot and humid climates. Lee Kuan Yew, the first prime minister of independent Singapore, called it “one of the signal inventions of history” that was central to the rapid modernisation of his new nation state (your author was based in Singapore in 2015 and 2016, and can attest to the value and importance of good cooling solutions in The Lion City).

To give you an idea of its prevalence today, it is estimated that there are currently over one billion single-room air conditioning units whirring away around the world – and this number is forecast to grow. ⁴ Projections and forecasts vary, but it is thought that by 2050 there could be *some 4.5 billion such units in operation*. ²⁶ For general comparison purposes, there are currently about 1.4 billion cars on the road around the world (bear in mind also that an increasing number of these cars are equipped with air conditioning).

Standard air conditioning technology consumes a lot of electricity – which anyone who has used it for extended periods of time will know from their electricity bills. To give you an idea of typical power consumption, a small unit in a single room consumes more power than four standard-sized fridges. A central air conditioning unit to cool an average-sized house uses roughly the power of 15 fridges.



On a country-wide basis, the US currently uses as much electricity for air conditioning annually as the UK uses electricity for all purposes. ⁴

In developing countries air conditioning is increasingly sought after, but many people in such countries are not able to afford solutions that are environmentally optimised. As the IEA has outlined in a report on Cooling published in June 2020, of the 35% of the world’s population living in countries where the average daily temperature is above 25°C, only 10% own an air conditioning unit. Demand is expected to grow in the next decade, as rising living standards, population growth, and an increase in temperature and heatwaves occur. The number of air conditioners installed could increase another two-thirds by 2030. ³⁴

This global situation has major implications on our collective ability to achieve the UN Sustainable Development Goals (SDGs) – for example on good health & wellbeing, clean energy, responsible consumption and production, and climate change. If in future countries such as India, Bangladesh and China use the equivalent amount of air conditioning as the US does today, and especially if they use a lot of inefficient technology, what will that mean for global CO₂ emissions?

As the world progressively moves towards similar levels of air conditioning to those seen today in the US, air conditioning could in due course account for between 10 and 15% of all electricity use worldwide. This will likely produce about two billion tonnes of CO₂ a year – that’s about the same total amount as India, the world’s third-largest emitter, currently produces annually. ⁴

It is clear that air conditioning provides many benefits to us. Given the forecast growth in its use, a key question for the world is – how can we be more sustainable with it, and to our overall approach to cooling the environments we live and work in? Is it the right approach for people to install increasing amounts of air conditioning using the basic technology that have been used for decades and all the CO₂ emissions that come with it, or are there alternative solutions to help us stay cool and comfortable in our surroundings in a more environmentally friendly way?

Also, what role does air conditioning and cooling play as the world adjusts to changes brought about by the COVID-19 pandemic? For example, amongst the many considerations that building owners all around the world are now taking into account are potential changes to the configuration of air-conditioning and ventilation systems.



The origins of air conditioning

Air conditioning was originally invented to reduce humidity. Its creation coincided with the refrigeration industry – the founding principles of which continue to influence how air conditioning works today.

[Willis Haviland Carrier](#)⁵, an American engineer at a heating and ventilation company, is credited with its invention.⁴ In 1902 he was tasked with finding a way to reduce humidity in a Brooklyn, New York, printing factory – to prevent humidity curling sheets of paper and smudging printing ink, which was impacting the factory’s productivity and economic performance. Carrier’s task was to find a way to reduce humidity, not just to reduce heat in the factory. According to the Carrier company, Willis Carrier found inspiration for a solution to the problem while he was standing at a train station one day in Pittsburgh, staring through the mist on the platform: what if he could dry air by passing it through water? Could he control the amount of moisture in the air? Within a year, he had built his invention to control humidity – the chief component of modern air conditioning.⁶

Carrier’s air conditioning design hasn’t changed much in over 100 years up to the present day. It works by drawing in warm air, passing it across a cold surface, and emitting cooler, drier air.

The invention was an immediate commercial success with industry as it helped them improve productivity (as seen with the Brooklyn printing factory that Willis Carrier was asked to help). Key public buildings in Washington (such as the White House and the Senate) had it installed in the late 1920s (a reduction of hot air in politics is always welcome). For its first 50 years of existence, air conditioning was kept mostly to factories and selected public spaces, and the primary market was the US.

The global prevalence of air conditioning that we see today was not “a given”. As recently as 1990, there were about 400 million air conditioning units in the world, and most of these at that time were in the US.⁴ The rise in its global adoption has coincided with the global growth of electricity generation, and countries in tropical environments becoming more prosperous, with buildings that have been designed and constructed with air conditioning in mind as a form of cooling, rather than traditional cooling methods that had been used for centuries before. The use of air conditioning in vehicles (such as cars, buses, trains and metro systems) around the world has also increased dramatically in the last 20 years.

As this change has taken place, air conditioning has gone from being a “luxury item” to an expected feature in developed economies, as one of the first things we think about, and want, in hot climatic conditions. The situation is different in developing countries, where millions of people do not have access to air conditioning to protect them during events such as a heatwave. However, as mentioned earlier, demand in developing countries is increasing. In November 2019, Sustainable Energy for All reported that the lower-middle class in developing countries are purchasing cheap, inefficient air conditioners, which could lead to a spike in energy demand, a rise in greenhouse gas (GHG) emissions, an increase in urban heat and a further push of global temperatures higher.⁸



How big is the air-conditioning industry today?

The air conditioning industry is an important subset of the overall cooling industry. It is a large industry with a vast number of customers, direct and indirect.

Industry players in the global air conditioning market include Carrier Corporation (part of UTC Climate, Controls & Security), Daikin Industries Ltd., Electrolux AB, Hisense Electric Co., Hitachi Ltd., LG Electronics Inc., Midea Group, Mitsubishi Electric Corporation Panasonic Corporation, Samsung Electronics Ltd., and Sharp Corporation. ⁹ Many have been in the market for decades.

Some people in the industry think that Chinese manufacturers will likely become increasingly prevalent in the years to come.

It is important to keep in mind that the installation of air conditioning is also a large employer around the world, with many businesses, large and small, undertaking this activity.

According to Zion Market Research, the market was valued US\$135.2 billion in 2018. This makes it larger than the global coffee market. ¹⁷ It is a large industry, and it is expected to reach around US\$293 billion by 2025, which is a Compound Annual Growth Rate of approximately 11.7% from 2019 to 2025. ⁹

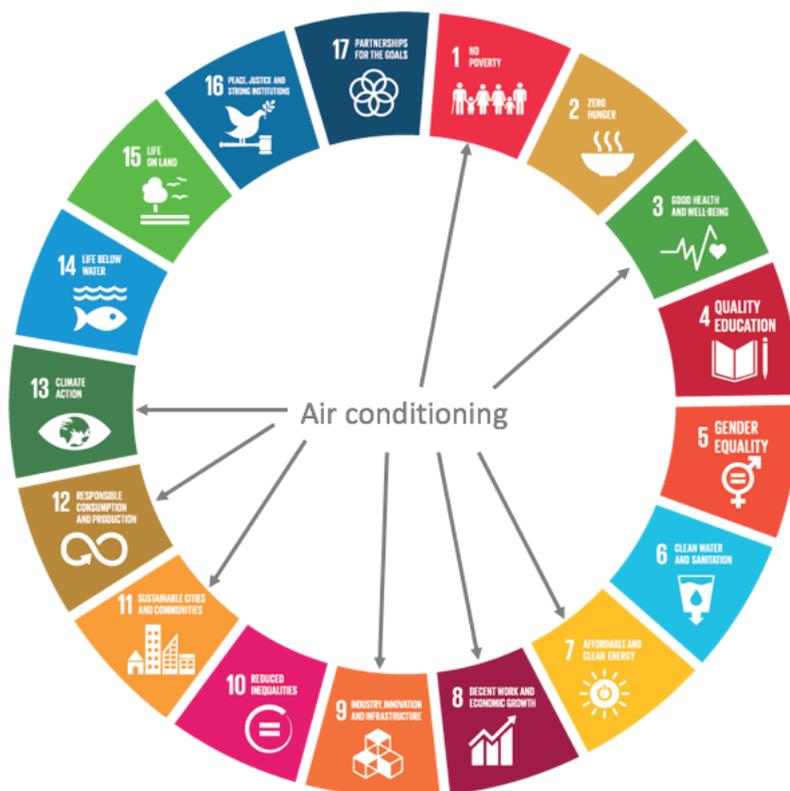
As Zion Market Research state, the global air conditioning market is likely to grow significantly in the coming years, due to improving economic conditions and rising per capita income. This poses a risk of increasing global pollution levels.

According to Zion Market Research, the Asia Pacific and Middle East & Africa regions in particular will experience substantial growth in the coming years. They believe that both residential and commercial sectors will grow, especially in places like China and India. ⁹ Indeed, Chinese manufacturers, with lower priced systems, will pose a competitive threat to established manufacturers. Japanese manufacturers are investing in green light, HVAC, and BAS technology to reduce carbon footprints and save energy.

Our air conditioning footprint

Here are a few points to consider about air conditioning, seen through the lenses of the SDGs. Looking at the air conditioning industry through the SDGs helps to give a balanced snapshot. We know that air conditioning benefits many people, in many ways. However, it has detrimental impacts on the environment. As we look at air conditioning with the SDGs, we see many interlinkages, and pros and cons.





1. No Poverty

The impact, current and potential, of air conditioning on SDG#1, Poverty, links closely to SDG#3, Good Health & Wellbeing. Per the report titled “Chilling Prospects: Tracking Sustainable Cooling for All 2019” by Sustainable Energy for All ⁸, the “urban poor” living in cities who often lack reliable access to electricity are at a high risk from a lack of access to cooling. It is estimated that in 2019 as many as 680 million people living in urban slums found themselves with little or no cooling to protect them in a heatwave – a rise of 50 million people from 2018. There are also some 365 million people living in poor rural areas around the world who are also at high risk. ⁸ Air conditioning can clearly be a major benefit to people living in these areas.

3. Good Health & Wellbeing

Air conditioning (along with other forms of cooling) plays an important role in keeping people healthy.

As the world grapples with the COVID-19 pandemic, what impact and role does air conditioning have in helping to ensure good health and wellbeing?

Research is being undertaken into how air conditioning might potentially play a role in spreading the SARS-CoV-2 coronavirus. Some early studies, such as the early release study published in the Emerging Infectious Diseases Journal of the Center for Diseases Control (CDC), about a case involving nine people in Wuhan, Hubei Province, China ²⁸, have been conducted as we learn about the possible effects.



Advice is being given by authorities and experts about how best to use air conditioning systems, including air filtration recommendations and air flow, system commissioning and operation, air flow rates and maintenance. ^{28, 29, 30, 31}

What about general health improvements from well-ventilated buildings? Pollution and poor air quality leads to many health problems. Good quality air conditioning and cooling can help to mitigate the effects of air pollution around the world, which is worsening in many places for various reasons and harming the eco-system and the people who live in and visit these environments.

High levels of heat (which is exacerbated by humidity) have significant impacts on our health. As the Earth heats up, we are seeing increasing general temperatures and an increasing number of heatwaves around the world. Sleep, which is known to be important to our health, can be badly affected by inhospitable conditions of heat and humidity. Good quality air conditioning and cooling can help significantly to combat all of these problems.

However, it should be noted that a badly maintained air conditioning unit, and also a poorly designed one, can give rise to health problems. The process of cooling hot air creates moisture and condensation, and if an air conditioning system does a bad job of this, because of poor design, commissioning or maintenance, it can become a breeding ground for bacteria and fungi. It is therefore imperative that air conditioning systems are designed as fit for purpose, installed properly and maintained to the highest quality.

7. Affordable and Clean Energy

As mentioned earlier, air conditioning is a major consumer of electricity, and its consumption of electricity is forecast to grow. Some forms of air conditioning are more efficient than others, which is one area to focus on for sustainability.

Where the electricity is sourced from to power air conditioning is an important aspect to consider. Can renewable energy cope with demand, particularly spikes in demand in periods of hot weather?

Technological advancements in developing countries are helping to drive changes in the global air conditioning market. ⁹ As we work out how to improve our use of air conditioning as a cooling technology, we need to increase its efficiency and ensure we keep energy bills for people affordable and also work out how best to source the energy we use for it, and what we can do with by-products of using air conditioning.

8. Decent Work & Economic Growth

The air conditioning industry is a large employer around the world, with many production and retail centres (and innovation centres), and many contractors who run businesses installing air conditioning systems. Businesses in the industry can therefore provide decent work for people around the world.

In the developing world, good solutions for cooling have the potential to provide significant employment and economic opportunities.



9. Industry Innovation & Infrastructure

Various aspects are driving the direction of the global air conditioning market, and major manufacturers around the world are investing in technology improvements to make air conditioning more sustainable and cleaner for the environment.

However, the current relatively high cost of air conditioning systems may hinder the growth of the best, most sustainable solutions, especially in the developing world. A key challenge for air conditioning manufacturers will be to make systems that are cheaper and more effective, cleaner and more sustainable than before, so that everyone can benefit from such sustainable solutions.

An example of cross-industry innovation is the *Global Cooling Prize*, set to be awarded in early 2021. In late 2018 the Rocky Mountain Institute, the Government of India and a group of partners launched this scheme to spur innovation in air conditioning.^{4, 26} They are offering up to US\$3m to the winner of the inaugural *Global Cooling Prize*. The competition aims to incentivise the development of a residential cooling technology that will have at least five times less climate impact than current standard air conditioning units. The winning technology could potentially prevent up to 100 gigatons of CO₂ equivalent emissions by 2050.

Since the Prize was launched, over 2,100 participant registrations from around the globe have been submitted – by innovators, start-ups, research institutes, universities, and industry manufacturers from over 95 countries. A shortlist of eight entries have been selected to review in detail, and an award ceremony is scheduled to be held in March 2021.²⁶

11. Sustainable Cities and Communities

There are some major challenges to achieving SDG#11, and air conditioning for our built environments in cities and in the communities where we live must surely play a part. As climate change continues to take effect, the demand for cooling in cities will continue.

As mentioned earlier, some parts of the world face major challenges to dealing with extremes of heat. In the Persian Gulf region, for example, scientists have warned that heat waves beyond the limits of human tolerance could become routine by the end of this century.²³ In the resource-rich nation of Qatar, authorities have even begun air conditioning the outdoors environment. Air conditioning will likely play a key role in how Qatar handles the FIFA World Cup event scheduled to be held in 2022.

By using air conditioning to make our environment temporarily cooler, we end up making our overall environment hotter because of the increases it causes in greenhouse gas emissions from power plants we need for our electricity, the vehicle fuel consumption when we switch it on in our cars, and refrigerant production to fuel the air conditioning units we buy.



Authorities responsible for urban development around the world are increasingly (and rightly) requiring that cities and urban environments are developed in a responsible and sustainable way. City authorities around the world are demanding that large buildings reduce their emissions – and better air conditioning can play a major part in achieving this. ⁴ Increasingly, we are seeing technical specifications and requirements in building specifications for “green technology and design” to be adopted.

There are some good examples around the world of large real estate developments that have integrated efficient cooling methods into their design, construction and operation. Such examples range from hot and humid geographies such as South East Asia to more temperate climates such as Northern Europe.

A vital challenge to overcome is how sustainable cooling solutions can be made cost-effective for cities and communities in developing parts of the world. Can the policies and regulations of cities make cooling technologies affordable for the poor? In developing geographies, the urban poor who live in cities frequently lack reliable access to electricity. They are at a high risk from a lack of access to cooling, and they can only afford to buy cheap, inefficient and energy-intensive air conditioning units. This is what initiatives such as the Global Cooling Prize hope to find solutions for.

12. Responsible Consumption & Production

Some large clients who buy air conditioning are driving a change to better sustainability. From the construction industry to vehicle manufacturers, retailers and industrial organisations, the design of their facilities and products is being done with greater awareness of the need to be more sustainable (as part of a broader focus on sustainability and Environment, Social & Governance – ESG – responsibilities).

This is of course welcome, but a challenge remains for how we can help the lower-middle class in developing countries – a group of over two billion people. Can air conditioning for this group of people be made environmentally friendly and cost effective to prevent a rise in CO₂ emissions?

13. Climate Action

As mentioned in the discussion about SDG#11, it is an unfortunate irony of air conditioning that, by making our specific environment temporarily cooler with these machines, we make it hotter in the long run because of greenhouse gas emissions from our power plants that provide us with the electricity to power them, the increased fuel consumption in vehicles that use it, and from industry outputs such as refrigerant production for the units themselves. The challenge of requiring / demanding air conditioning is a microcosm of the overall climate crisis we face. ⁴



Can we change our approach to cooling our air?

An important point to consider is that for the air conditioning industry to change in a responsible and sustainable way, there needs to be a collective and coordinated effort with various stakeholders. Whilst different initiatives and efforts are taking place, there needs to be a collective will to ensure that long-term change can and should happen.

One aspect that has been discussed earlier in this paper is air conditioning’s role in ensuring good health. The matter of “health” can be applied to buildings directly, and this includes how we adjust the way we live in response to the COVID-19 pandemic.

According to Professor John D Macomber of Harvard University, co-author of a recently released book, Healthy Buildings, the importance that people now attach to preventing the spread of infectious disease will “make it easier than ever to invest in the basics of a healthy building, notably around ventilation, air quality, water, moisture, and security.”³³

Consider one of the studies contained in the book. Through scientific, double-blind studies of workers in offices with various levels of air quality and flow, in which the workers were compared with themselves to gauge differences in personal performance, the authors of Healthy Buildings quantified the effects. Across all nine dimensions of cognitive function, which include things like “strategy,” “focused activity level,” and “crisis response,” performance was dramatically improved when study subjects worked in optimal conditions (with high rates of ventilation and low concentrations of carbon dioxide and other harsh compounds).³³

Essentially, it was found that by increasing the amount of air brought into an office, there were quantifiable benefits to how people were able to perform their activities (though the authors note that productivity involves so many different factors which are important to recognise and appreciate).³³

Will change to how we work spur a change to our use of air conditioning?

The impact of the COVID-19 pandemic has led to many in-depth reviews about “the future of work”, including where many people can and will work from in future – remotely from home (if their roles permit it), or from reconfigured offices and other facilities. Whilst not everyone can work from home, there may be some structural changes to the world of work, with an increasing number of people choosing to work from home more often. What impact could such change have on overall air conditioning use? Will we see an increase in modern and efficient home air conditioning systems, and will the use of air conditioning in workplaces stay the same, rise or fall?



What are scientists and technologists working on?

The Global Cooling Initiative mentioned earlier concerns small-scale air conditioning units. Proposed innovations from the short-listed finalists include the use of solid organic “plastic crystal” materials in place of refrigerant gases, a form of high-efficiency vapor compression system, a “moisture storage battery”, and an evaporative cooling technology with a membrane system that is able to independently cool and dehumidify room air. To read more, visit their website. ²⁶

On an industrial scale, research and actual installations using natural refrigerants for cooling have taken place. Ammonia has been successfully used in large-scale installations of air conditioning, and it has been seen to provide cost-benefits with better sustainability. ²⁷ An installation in a government building in Queensland back in 2011 proved very successful. The Logan City administration highlights the energy efficiency it is achieving on its website, saying, “the system is highly energy efficient with a coefficient of performance of 5.79, radically reducing energy costs.” ²⁷

The system was designed with safety in mind, particularly to address the risk of an ammonia leak. It has a very low ammonia charge (0.03-0.05 kg/kW or .25-.39 lbs/TR), and the plant room is located on the roof and has significant ventilation, mitigating the risk of a potential release of ammonia.

However, ammonia chillers are not, it seems (not yet, at least) seen as a replacement for synthetic refrigerant-based systems used for air conditioning. There are tens of thousands of large commercial chillers used for building air conditioning around the world, and making such a change is not easy or simple.

Some researchers are looking at radically different and new options for air conditioning, thinking outside of the box. One such example looks at technology for air conditioners that can *extract* carbon dioxide out of the atmosphere, rather than add to it.

Geoffrey Ozin of the University of Toronto, and co-author on a paper published in April 2019, “Crowd Oil, Not Crude Oil” describes how research is going into technology that could turn air conditioning units into machines that capture and transform CO₂ into fuel for powering vehicles that are difficult to electrify – such as large cargo ships. The concept is called “crowd oil”. “Everyone can have their own oil well, basically.” Ozin says. ¹⁹

The idea is to create a decentralised synthesis of hydrocarbon fuels based on CO₂ by retrofitting air conditioning systems (such as those in houses, apartments and office buildings) with technology to capture CO₂ and H₂O. Electrolysis of H₂O can produce hydrogen (H₂), which, when combined with captured CO₂ can produce hydrocarbon fuels via a technique called “Fischer-Tropsch catalysis”, or similar approaches in modular conversion systems.

The paper’s authors believe that it would not be difficult to add a CO₂ capture functionality to an air conditioning system, and that an integrated DAC (Directly from Air) unit should demonstrate positive economics.



In fact, this technology has been patented for lowering the energy requirements for air conditioning in buildings bringing reality to the vision of “crowd oil”.²⁰

As an example, studies found that the Frankfurt Fair Tower in Germany (a landmark building in the city, with a total volume of some 200,000 m³) could capture 1.5 metric tons of CO₂ per hour and produce up to 4,000 metric tons of fuel a year. An apartment building with five or six units could capture 0.5 kg of CO₂ an hour with this proposed system.^{19, 22}

The proposal still needs further research before it may become an economic proposition. To retrofit an air conditioner to capture CO₂ and turn it into fuel requires an overhaul of its components. Across the industry supply chain, this is no simple matter. It won't be a simple retrofit onto existing units. It will require a filter to absorb CO₂ and water from the air, an electrolyser to strip the oxygen molecule from H₂O to get H₂, to combine with CO₂ to get hydrocarbon fuels.

Whether or not this idea turns into a mass-use solution, perhaps it may lead to other ideas and solutions being found to make air conditioning more sustainable.

Another problem with air conditioners is that they emit heat. The heat island effect of cities is well known, and air conditioning contributes to heating up the built environment – thus we use more air conditioning to keep cool, in a vicious cycle. An ongoing challenge is to work out how air conditioners can be made to emit less heat.^{19, 20}

International public policy

The United Nations has a Green Cooling Initiative (GCI) as part of its Sustainable Development Goals Partnerships Platform (SDG Action# 12029).¹⁴ Green Cooling comprises three elements: (1) promoting natural refrigerants, (2) maximising energy efficiency, and (3) helping a sustainable approach to private and commercial energy consumption. It aims to contribute towards a sustainable reduction of fossil fuel consumption. One aim of GCI is to establish a global Green Cooling Network, which will accelerate the transfer of environmentally friendly technologies in the refrigeration and air conditioning sectors to and within developing countries.

The UN Environment Programme in October 2019 covered news of new model guidelines for air conditioners¹⁷, which is voluntary guidance by United 4 Efficiency to assist governments in developing and emerging economies that are considering a regulatory or legislative framework for minimum energy performance standards and energy labels.¹⁸

Ahead of the Climate Change Conference (UNFCCC COP 26) which was going to take place in late 2020 but was postponed due to COVID-19, a facility has been launched to help developing countries build energy-efficient, climate-friendly cooling programmes into the next round of Nationally Determined Contributions (NDCs).²⁴

The new Facility will advance cooling solutions in a way that complements the Kigali Amendment, which aims to phase down the use of hydrofluorocarbons (HFCs).²⁵



Air conditioning industry associations

Many different regional and country-specific associations exist around the world, and they describe how they are working on various initiatives to achieve greater sustainability.

For example, the International Council of Air-Conditioning, Refrigeration, and Heating Manufacturers Associations (ICARHMA) is comprised of national and regional trade associations that represent a significant share of the HVACR market.¹⁵ They have a stated Policy Statement on Refrigerants and Responsible Use.¹⁶

Businesses in the cooling industry

Businesses in the industry, large and small, are working on improvements. Many of them are launching positive action plans, supported by their investors and also government policies, and recognising the expectations of their customers and environmental campaigners. Here are just a few examples (many others exist):

- Daikin has a major research centre dedicated to environmentally advanced buildings¹¹. Daikin also describe how their actions relate to specific SDGs in their Sustainability Report, and they have endorsed the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD).^{11, 12}
 - Through its research, Daikin is aiming for a zero energy building. 70% energy saving was achieved in 2015 by using various technologies. A 100% energy saving is targeted to be achieved in 2020.³⁵
- United Technologies, owners of Carrier, have published their 2020 Sustainability strategy.¹³

NGOs and Environmental campaigners

An example of how NGOs play a valuable role dates back to 1992, when the Greenpeace team in Germany developed a refrigerator prototype that was efficient and good for the environment, the ozone layer and the climate. It became known as GreenFreeze.²¹

GreenFreeze revolutionised the domestic refrigeration sector and helped to generate similar developments in commercial refrigeration and air-conditioning. In 1998, Greenpeace received an award from the United Nations for making GreenFreeze open source and freely available to the world. The major manufacturers organise discussions with different stakeholder groups, including NGOs.

Financiers and Investors

From an investor standpoint, there is increasing evidence that investors want to see evidence of well-thought-out plans to reduce carbon emissions, and to tackle all other aspects of sustainability.

Investors in the industry, and in all industries where air conditioning is used, will want to see action on more responsible use of solutions to provide sustainable cooling.



How can Risk Management help people to use air conditioning sustainably?

Risk Managers and Risk Advisors can play a valuable role in working out how their organisation can achieve their sustainability objectives, and how to take and manage risks to do so. Risk professionals can be trusted advisors who help people to work through different options and informed decision-making using good tools and techniques (such as workshops, scenario analysis, risk appetite, decision trees and controls tools such as bow-tie analysis).

How can this apply to how organisations use air conditioning? Risk Managers and Risk teams can work with their colleagues in Sustainability and Operations to think through, for their organisation’s particular circumstances, how their involvement with air conditioning should be thought through carefully as part of achieving broader sustainability objectives. This type of effort is valid for any size of business, large or small.

Below are a couple of general pointers that could be considered. When it comes to specific organisations, context to their situation is key. Using good Risk tools and thinking carefully through the nature of operations and the business can help you to determine what options are feasible and impactful for all stakeholders.

Consideration	Ideas and thoughts for consideration
1. What exactly do you do, and where?	<ul style="list-style-type: none"> • What does your business do, and how does it use air conditioning and cooling to help it achieve what it does? • For example: <ul style="list-style-type: none"> ○ If your business is in the property and construction industry, you may be a procurer of air conditioning solutions for projects, as well as using them in your own offices. ○ If your business is in IT, perhaps you own or lease / use data centres, where the need to keep such facilities cool is vitally important. How is this achieved? Do you know how much air conditioning you use to run your centres, and what sustainability measures are in place for them? ○ If you are a retailer, you will have air conditioning installed in your retail outlets. Do you know how much air conditioning you use? ○ If you are a vehicle producer, you will install air conditioning in your vehicles. ○ If you are a professional services company, you will have air conditioning in your offices. Do you know how much air conditioning you use?



Consideration	Ideas and thoughts for consideration
2. Where do you operate in the world?	<ul style="list-style-type: none"> Do you operate in hot, and/or tropical parts of the world where air conditioning is vital to staying cool? Wherever you operate, do you have sustainable cooling solutions in place, with environmentally friendly cooling technology? Have you looked at different cost-benefit analysis of different solutions?
3. Do you directly procure air conditioning / cooling systems?	<ul style="list-style-type: none"> How large is your business real estate portfolio, and what is your air conditioning footprint? Do you have any real estate projects coming up, in which you can see if you can use sustainable forms of air conditioning, and building design for intelligent cooling? Are you able to minimise the amount of air conditioning that you need, by using different types of cooling techniques through building design? Can and do you influence your supply chain in its use of air conditioning?
4. Do you know what proportion of energy use air conditioning accounts for in your buildings and infrastructure?	<ul style="list-style-type: none"> Do you know how much air conditioning costs your business, as part of your energy bills? Do you optimise your use of air conditioning with your Building Management Systems (BMS)? Are you pushing for innovation, not just “accepting traditional ways”? Do you know how much CO₂ your air conditioning emits? If not, can you find out, and are there things you can do to procure solutions that emit the lowest amount of CO₂ possible? Have you thought about engaging a specialist in cooling systems to advise on the best sustainable cooling options available to you?
5. Have you researched the health aspects of air conditioning?	<ul style="list-style-type: none"> It is commonplace to use air conditioning to keep us cool. Have you looked into how to avoid the problem known as “sick building syndrome”?
6. Do you provide practical advice on the use of air conditioning to your staff in your locations?	<ul style="list-style-type: none"> Do you provide helpful tips and guidance on sustainable use of air conditioning in your buildings, such as the difference in energy use and CO₂ emissions between different levels of power?
7. Are you involved in research into new technology for	<ul style="list-style-type: none"> Depending on the industry you are in, are there any opportunities for you to get involved in innovation and



Consideration	Ideas and thoughts for consideration
cooling and air conditioning?	<p>research into cooling initiatives for your operations, in one way or another?</p> <ul style="list-style-type: none"> • If so, could this help you with your overall sustainability strategy?
8. Can sustainable air conditioning play a part in your investor requirements and expectations for sustainability performance?	<ul style="list-style-type: none"> • Are you able to discuss ideas about sustainable air conditioning, as part of your overall sustainability discussions, with your investors, to show them the positive impact it can have for their funds?
9. Do you know how government policy is changing, and how it could affect what you do?	<ul style="list-style-type: none"> • Government policies around the world towards energy use are changing. Are you aware of the regulations that currently exist and how they could change? What risks – threats and opportunities – does this present for your organisation?



Conclusion

This paper has discussed an overview of the air conditioning industry, the forecast growth in air conditioning use (especially in developing countries), its impact on people and the climate around the world, and the challenges we face to ensuring sustainable cooling solutions are used whilst we tackle climate change.

New ideas for more sustainable cooling systems are being trialled. Organisations, large and small and across numerous industries, can play their part in improving how the world uses air conditioning and the cooling of our environment in a sustainable and responsible manner.

We can all play a part in the sustainable and responsible use of air conditioning, as we work out how to improve our cooling solutions for a planet that is already heating up due to climate change. Using risk management tools and techniques can help us to think through options and to make informed decisions on how our use of air conditioning and cooling can help us to achieve sustainability and “ESG” targets – from large workplaces through to the residential properties we live in. Doing so will be an important part of achieving CO₂ reduction targets that are vital to limiting global climate change, and to contributing positively towards achieving the UN SDGs by 2030.

Further suggested reading and watching

The Guardian piece, [The air conditioning trap: how cold air is heating the world](#), which is referenced in this paper, is an excellent overview of the history of air conditioning and considerations for the future.

The book, *Cool: How Air Conditioning Changed Everything*, by Salvatore Basile is well worth reading for an insight into how the air conditioning industry evolved. It is available through the usual online bookstores such as [The Book Depository](#) and [Amazon](#).

About the author

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