CITIES ACTION

Cool Coalition

ON EFFICIENT, CLIMATE-FRIENDLY COOLING

This guide outlines the opportunity for cities to advance efficient, climate-friendly cooling.

1.INTRODUCTION

Cooling is central to our nutrition, health, prosperity, and the environment. It can be provided passively (e.g. through cool building design) or actively (e.g. via air conditioning and refrigeration), and a combination of both. Applications range from space cooling for buildings and vehicles and cooling of industrial processes to cold chains for food and medicines. Affordable, efficient, climate-friendly cooling for all underpins all Sustainable Development Goals (SDGs) and represents an opportunity to avoid substantial greenhouse gas emissions.[i]

Cooling demand is growing rapidly. However, cooling can be highly polluting due to the combination nature of many active strategies, demand needs to be addressed through passive strategies. Most active cooling is currently highly polluting due to the use direct emissions of high global warming potential (GWP) refrigerants and the indirect emissions from the electricity used to run appliances such as air conditioners and refrigerators. Existing emissions need to be mobile and off-grid cooling currently primarily runs off diesel. Existing emissions from cooling need to be cut urgently and booming demand for cooling met more sustainably, complementing the Kigali Amendment to the Montreal Protocol that phases sets a timeline for the phase-down of HFC refrigerants. The Cool Coalition has come together to accelerate affordable, efficient, climate-friendly cooling through a unified effort of governments, businesses, industry and civil society. It takes a cross-sectoral approach to cooling, including behavioural change, building design, energy efficiency, renewables, and thermal energy storage.

Ensuring we meet cooling needs affordably, efficiently, cleanly and innovatively, including for the 1.1 billion people who lack access to basic energy services, is a big responsibility for cities. Delivering efficient, climate-friendly cooling can offer a host of benefits to cities and their citizens by reducing the effects of climate change as well as the demand for cooling. It enables a more reliable and resilient energy system, reduced urban heat islands, cleaner air, better health, and higher productivity for society. Yet, the needle on affordable, efficient and climate-friendly cooling for all is moving slowly:

- Historically it has been a blind spot in the low-carbon transition.
- In most countries and cities, the regulatory framework that would allow the widespread deployment of sustainable cooling solutions is not in place; neither are the market signals that would drive the development of dramatically more sustainable solutions.
- The sector has responded to the regulatory framework and market signals that do exist resulting in decades of incremental innovation and cost optimization.
- There is a lack of awareness about to the cooling challenge in many public spheres.

Cities need to collaborate with businesses, research institutions, community groups, regional, and national governments to set and reach ambitious targets. This guide is one in a series that is also being disseminated to governments, businesses, investors and civil society to help elevate cooling as an inclusive, impactful, profitable opportunity. It:

- Sets out the case for cities action
- Introduces a framework for action by cities
- Outlines the types of actions that can be taken
- Highlights case studies of cities cooling action
- Recommends next steps, resources, and contacts

2. THE CASE FOR CITIES ACTION

2.1 Cooling demand is growing rapidly

Over the past decade, we have witnessed a record in the frequency and temperature of heat waves that are severely affecting the functioning and health of cities and their citizens. Rising temperatures mean that 1.6 billion people could face average summer temperature highs of 35°C by 2050, approximately 1.4 billion more people than today. Around 970 more cities could be affected by 2050, which is 620 more than today.[ii] Rising temperatures not only increase the demand for cooling but have negative impacts contributing to issues such as heat-related deaths, reduced workforce productivity which is estimated at 2.2% of working hours worldwide, or 80 million full-time jobs lost as a result of higher temperatures by 2030[iii], and poor air quality which disproportionately affect the poorest communities.

To meet cooling demand, since 1990, annual sales of air conditioners (ACs) have more than tripled with about 1.6 billion units currently in use and this is predicted to rise to 5.6 billion by 2050.[iv] Growth continues to be driven by rising incomes, lower prices for products, electrification, urbanisation, and a warming world.[v] AC sales in many emerging high population economies with a relatively low stock of ACs such as Brazil, India, and Indonesia, are growing at 10-15% per annum.[vi]

2.2 Cities are critical to deliver cooling solutions

Housing an estimated 68% of the world population by 2050, cities are key to implementing cooling initiatives to improve the quality of life of citizens.[vii] Cities currently represent more than 70% of global energy demand and are on average 5 to 9°C warmer than rural areas[viii]. This is due to a phenomenon known as the urban heat island (UHI) effect, caused by anthropogenic activities and heat absorption particularly in roofs, pavements and streets.

As a result, cities will need to adapt to a changing climate at the same time as taking action to reduce the demand for cooling, for example through increased nature based solutions and passive cooling actions, and while making active cooling cleaner and more efficient.

Municipal authorities understand the local context including the opportunities and barriers as well as having an ability to exert influence in their role as a planning authority and facilitator.

Cities are already implementing ambitious actions to reduce emissions and increase climate resiliency. These range from large-scale district cooling initiatives, for example, seen in Toronto whereby cooling is extracted from deep in Lake Ontario which has resulted in an 87% reduction in cooling costs for the city[ix], to simple surface cooling solutions such as cool roofs and green landscaping. Cities can use building codes to limit future cooling demand and control what clean solutions are used to meet that demand in the built environment.

By implementing clean cooling strategies, cities can not only reduce the demand for cooling but align their policies with other areas of significant importance to cities such as air quality, public health and well-being and energy resilience. Traditional techniques such as narrow roads and inner patios in ancient medinas in Marrakech and wind catchers in the Middle East and Egypt have served cities well alongside newer solutions such as implementing cool solar reflective roofs and surfaces or green vegetative solutions, such as trees for shade. Some U.S. cities have recorded a reduction in average ambient air temperature of 2 to 4°C.[x] This makes the city more liveable and can lead to healthier populations whereby the effect of urban heat islands can be nearly or entirely cancelled.

In the U.S. an average of 400 deaths a year are directly related to heat.[xi] Other indirect health issues can be worsened by higher temperatures, such as respiratory illnesses, cardiopulmonary disease, diabetes, renal disease, and more. Ozone or 'smog' is formed more rapidly on hot days and is a contributing factor to respiratory problems. The World Health Organization predicts that respiratory illnesses will be the third leading cause of death by 2030. Air quality is also affected by fossil fuel use and clean cooling initiatives can therefore lead to a reduction in indoor and outdoor air pollution.

Renewables and electrification could play significant roles in the transition for a clean cooling. As room air conditioner powered by electricity dominate current and future' cooling solution, renewable-sourced electricity, geothermal for district cooling, and other hybrid renewable cooling solutions should be considered in the long-term transition. Further benefits of clean cooling can be seen in the reduction of carbon intensity through the incorporation of both on-site and district-based renewable energy and low carbon solutions for cooling.

3. FRAMEWORK FOR CITIES ACTION

The Cool Coalition takes an inclusive view of cities action to promote efficient, clean cooling for all. To help elevate cooling as an inclusive, impactful and profitable opportunity, the Coalition welcomes ambitious action that:

- Is transformational on mitigation or adaptation, in terms of novelty or scale;
- Brings sustainable development co-benefits;
- Is replicable and can be scaled up;
- Is measurable, especially in terms of GHG and particularly carbon pollution reduction, and deliverable in 3 – 5 years;
- Is innovative, in terms of technology or approach, and visibly inspiring for others looking to take action.

Our framework for cities action on cooling highlights how cities can act within the diverse cooling sector. It ensures city actors can use their levers to act on cooling by categorizing city action and roles into four categories of intervention[xii]:

- **Regulators & planners** – targets setting, integrated urban planning, regulation/building codes/policy enforcement
- **Financier** – leverage public sector investment, subsidies and municipal green bonds
- **Producers & consumers** – generating or procuring energy services and aggregating urban demand
- **Advocates and facilitators** – Influence behavioral choices and promote knowledge sharing

4. EXAMPLE OF ACTIONS

We encourage cities to commit to ambitious action on efficient, clean cooling and to raise awareness of the need for action by others, including other cities, businesses, governments, investors and civil society – not only domestically but also in collaboration with regional and international partners.

The examples set out in the table below illustrate some of the actions that cities can take. Other actions may be appropriate and better suited to individual cities needs and/or contexts. Where additional solutions that meet the scale of the challenge are identified, we encourage cities and other actors to advocate them, and to contact the Cool Coalition for partnership opportunities.

We encourage cities to quantify the outputs of these actions to the extent practicable and to monitor progress against these actions.

CATEGORY	TYPE	EXAMPLE ACTION
REGULATORS & PLANNERS	Target setting within a long-term energy/ cooling strategy	• Develop a city-wide cooling strategy with passive (reducing cooling demand) & active (energy efficiency etc.) cooling measures and targets • Design and develop a clear and ambitious energy strategy which sets targets for GHG emission reduction with a cooling strategy aligned with energy decarbonisation • Have a long term roadmap in place to communicate clearly to private stakeholders when and how performance standards will be raised to allow for preparations to be made • Develop specific targets for implementing clean cooling solutions such as targets for public buildings and district energy integration - temperature reduction targets, tree canopy as a % of land-use targets • Undertake a city energy mapping exercise that analyses factors such as energy demand, sources and locations of heat assets to help identify opportunities for district cooling and non-conventional or low carbon sources of cooling • Develop a thermal GIS map of cooling demand loads and supply and use to inform zoning policies, codes etc. (combined with heat island map and tree canopy assessment) • Inventory existing programs and practices across agencies to determine their positive or negative effect on heat resiliency and cooling.
	Building and zoning policy, codes and standards	• Implementing building codes that require developers to reduce the thermal demand and promote the use of efficient and renewable energy-based solutions for new buildings and refurbishment works to prevent solar heat gains and minimise the need for active space cooling in all buildings • Implement a cooling hierarchy prioritising buildings that are designed to not need cooling, to reduce the demand for cooling with passive measures (e.g. cool/green roof regulations), to connect to district systems, and lastly to install a private high efficiency active system • Enact policy that encourages district cooling developments and special development zones to encourage heat resilient design and implementation. • For district energy schemes, cities can develop regulation which allows mandating district cooling connections • Incentivise connection through density bonus and streamlined permitting • Where cities have limited control over building regulation or there is limited understanding of clean cooling, they can perform opportunity audits to assess the business case for cool solutions including urban greening and cool roofs • Building control to ensure buildings meet the requirements set by policy and integrate cooling into urban planning documents • Develop cool neighbourhoods by encouraging nature based solutions with appropriate articulation of public green spaces • Support traditional techniques e.g. wind catchers, stepwells, which have often been lost from copying modern building designs • Refrigerants with high Global Warming Potential are phased out and pipework standards, alarms and containment systems made a requirement to reduce refrigerant leakage with reporting of refrigerant leakage to underpin future policy with data
FINANCIER	Fiscal incentives and financing[xiii]	• Limited tax base can make tax exemptions challenging – cities can provide capital grants, subsidies and low-cost financing for feasibility assessments, projects and retrofitting • Peak-valley time of use tariff could reduce the operation cost of electric district cooling, heat pumps and other electric cooling solutions • Facilitate debt provision, loan guarantees (and underwriting), bonds to signal commitment for capital intensive infrastructure such as district scale systems • Facilitate on tax-financing and/or on-bill financing • Facilitate the aggregation of smaller projects into a larger investment portfolio, to achieve the scale required to attract low cost finance • Quantify and consider the broad spectrum of economic benefits resulting from cooling including reduced credit risk and borrowing costs. • Reduce cooling demand with incentives, for example, to increase greening on buildings/private land, cool roofs rebates etc.
	Mandates and incentives	• Local authorities with stakes in municipal utilities can specify the use of renewable/recovered heat in district energy networks
	Demonstration projects	• Pilot emerging technologies/policies and undertake feasibility studies to leverage private sector finance • Pilots of programs piggybacking and upgrading existing low-tech cooling solutions, like fans and adiabatic cooling. • Collaboration with universities and housing organisations to define solutions that address equity challenges (affordability) • Implement energy efficient retrofitting and high end cooling options in cultural heritage buildings as cities often have direct control
PROVIDERS & CONSUMERS	Investment and procurement for public buildings and infrastructure projects	• Ensure new public buildings employ surface cooling solutions which are often cost-effective and simple • Procure climate friendly cooling for all public building/ set requirements for climate friendly cooling in procurement laws • Consider investing directly into district cooling infrastructure (e.g. networks). • Where cities have control over technology and procurement decision for long-term infrastructure projects, cool solutions can be incorporated into the business case (e.g. thermal-barrier coating for cool pavements) – see above
ADVOCATES AND FACILITATORS	Raising public awareness	• Support demonstration project to disseminate knowledge and raise public awareness. • Promote awareness campaigns and establish public outreach through education and media outlets by identifying champions and messengers that can reach and influence populations, particularly poor communities. • Publish cities plans and targets with clear messaging on the benefits of clean cooling and practical guidance on implementation • Commit to training and improving access to training resources for architects, engineers, urban planners, businesses, financiers and the wider public
	Leadership	• Promotion to higher levels of government to support local, regional and national policies and fiscal policies • Engage with a broad set of stakeholders including city network platforms such as C40 Cities Climate Leadership Group • Demonstrate municipal leadership by piloting innovative technologies and incorporating disruptive design practices to reduce costs and increase capacity in the private sector to do the same
	Engagement strategies	• Define strategies to trigger stakeholders' commitment via social engineering: mentorship, behavioural change via peers behaviours comparison, competition and reward etc.

5. CASE STUDIES OF COOLING ACTION

Using the four category framework, we have set out below a few examples of the many actions and initiatives already taking place in cities to support efficient, clean cooling:

Case Study 1: Dubai, United Arab Emirates

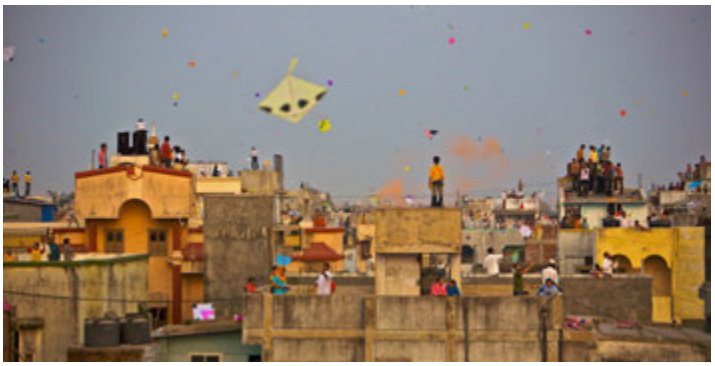
Dubai has developed the world's largest district cooling network to meet the city's cooling demands.

Currently in Dubai air conditioning accounts for approximately 70% of the city's electricity consumption. This has led to the development of the world's largest district cooling network which is predicted to meet 40% of the city's cooling demand by 2030. It is expected that the initiative will result in 50% reduction in electricity use compared to other forms of cooling. District cooling has been driven by rising energy costs and rapid urban development, forcing developers to incorporate district energy systems into new infrastructure projects. The system uses treated sewage effluent (TSE) as opposed to freshwater. However, the use of TSE might pose a challenge as it is also used for agriculture in the area.[xiv]

Case Study 2: Ahmedabad, India

Leading by-example is catalyzing action and resulting in healthier populations.

As the first city in South Asia to implement a Heat Action Plan, Ahedabad has demonstrated how local actions can initate transformational change at national and international levels. Following the cities 2010 heat wave, the plan was developed to detail simple actionable measures including the use of cool roofs, awareness-raising and cooling stations. Since 2013, it is estimated that more than 1,100 deaths have been avoided in the city each year after its implementation[xv]. It has acted as a blueprint for 30 cities in India who have now released or are developing their own plan, while action has been catalysed in other South South Asian countries.



Case Study 3: Phoenix, United States of America

Deploying novel solutions to tackle UHI effect.

Phoenix City Council has implemented policies such as the Green Construction Code and a Climate Action Plan. Despite successes, there has been slow action in the private and residential sectors, which the council is addressing through initiatives such as Tree and Shade Master Plan to educate the public on the benefits and achieve an average 25% shade canopy coverage for the entire city[xvi]. In addition, the city has implemented a demonstration project to highlight the viability of innovative technologies through the installation of double glazed collectors on Arizona's Desert Mountain High School serving as an example of how individual buildings can contribute to municipal efforts. During the summer months, the solar cooling system meets the entire cooling demand of the school, while during the school year the supply is supplemented by the old electric chillers. As a dedicated energy service company owns the solar cooling system the innovative business model of selling cooling as a service has been tested. In addition, subsidies per metered unit of energy are granted by the local utility company to compensate for the savings from deferring grid investment.[xvii]

Case Study 4: Medellin, Colombia

Medellin combines district cooling with nature-based solutions.

Medellin is looking to nature-based solutions to lessen the impact of UHIs and reduce cooling demand. Mayor Federico Gutiérrez planted 30 green corridors, focusing on areas which lacked green spaces. This has resulted in a temperature reduction of 2°C. The city has also established a district cooling project which includes several public buildings led by Empresas Publicas de Medellin (EPM) and the National Ozone Unit. It is estimated that the buildings receiving air conditioning through the project will have a 15-20% reduction in energy consumption.[xviii]

Case Study 5: Copenhagen, Denmark

Pioneering technologies and public support in rolling-out smart energy systems has ensured the status of Copenhagen as a world leader.

To achieve the goal of becoming the world's first CO2-neutral capital by 2025, the city set the CPH 2025 Climate Plan in 2009 and is transitioning to renewable energy supplies, retrofitting buildings and investing in public infrastructure. A critical part of this has been enacting policies supporting citywide district heating systems and increasingly low-carbon technology by retrofitting CHP plants from coal to biomass. To ensure end-users who are mandated to connect are not disadvantaged, district heat companies are regulated. Today 98% of the cities heat demand is met with district heating. The first two district cooling networks became operational in 2010 and 2013 based on free cooling from seawater, compressor cooling and abstraction cooling. In addition, municipally-owned utility companies have invested in a new CHP-plant based on wood flak, and are expected to invest DKK 8bn in wind power toward the CO2-neutrallaty coal in 2025.

Other initiatives promoting green roofs for municipal buildings, and since 2011 a zoning policy has been enacted to require new buildings with suitable roofs to have green roofs or roof gardens. To ensure the expanding city grows carbon neutral neighbourhoods, Copenhagen has built a full-scale smart city energy lab in Nordhavn which demonstrates how electricity and heating, energy-efficient buildings and electric transport can be integrated into an optimised system.

6. NEXT STEPS

6.1 About the cool coalition

The Cool Coalition is a global multi-stakeholder network that connects a wide range of key actors from government, cities, international organizations, businesses, finance, academia, and civil society groups to facilitate knowledge exchange, advocacy and joint action towards a rapid global transition to efficient and climate-friendly cooling. The Cool Coalition promotes an 'avoid-shift-improve-protect holistic and cross-sectoral approach to meet the cooling needs of both industrialized and developing countries through urban form, better building design, energy efficiency, renewables, and thermal storage as well as phasing down HFCs. Cool Coalition members are collaborating on science, policy, finance and technology to meet growing demands for cooling in a comprehensive manner, all aimed at raising climate ambition in the context of the Sustainable Development Goals while complimenting the goals of the the Kigali Amendment to the Montreal Protocol and Paris Climate Agreement.

The overall approach is to:

- **REDUCE** where possible the need for mechanical cooling through better urban planning and building design, and the use of nature-based solutions such as green public spaces and green roofs and walls.
- **SHIFT** cooling to renewables, district cooling approaches, solar powered cold chains, etc.
- **IMPROVE** conventional cooling by increasing the efficiency of air conditioning and refrigeration equipment and demand response measures.
- **PROTECT** vulnerable people from the effects of extreme heat and consequences of unreliable medical and agricultural cold chains.
- **LEVERAGE** cooperation between different actors active in cooling to achieve a greater collective impact.

6.2 Get in touch

The Cool Coalition already has more than 80 leading organisations driving change in the cooling sector. Please reach out to *unep-coolcoalition@un.org* to find out more about how you can engage including on how to join, actions, and events.

6.3 Commit to cooling action

Cities are critical actors in addressing the cooling challenge. Adoption of the actions and case studies outlined above can catalyse much needed progress and position businesses as innovators and climate leaders.

An endorsement form to join the cool coalition and commit to action is enclosed at the end of the document. Please complete and send back to *unep-coolcoalition@un.org*. Join us and showcase your leadership!

A range of additional resources is set out below to help cities to find out more about the importance of cooling and how to take action.

For more information, visit our website: *www.coolcoalition.org*

FURTHER RESOURCES

The following organizations provide information and or technical assistance for efficient, clean cooling:

- Green Cooling Initiative https://www.green-cooling-initiative.org/
- Heriot Watt and Birmingham Universities' Clean Cooling Landscape Assessment is a comprehensive online resource of data and research on efficient, clean and affordable cooling from multiple perspectives
- IEA's report on the Future of Cooling provides a compelling assessment of the risk of a 'cold crunch' from growth in space cooling demand in the decades ahead, and how it can be avoided.
- IRENA's work on Heating and Cooling, Renewable Energy Policies and cities,:
- Kigali Cooling Efficiency Program's Resources page
- Rocky Mountain Institute's report on Solving the Global Cooling Challenge focuses on room AC and the role of innovation
- SEforAll's report: Chilling Prospects: Providing sustainable cooling for all provides an overview of the development risks from a lack of access to cooling, and sets out pathways to providing sustainable solutions.
- United for Efficiency https://united4efficiency.org/resources/accelerating-global-adoption-energy-efficient-air-conditioners/
- Climate Group EP100 https://www.theclimategroup.org/project/ep100
- Basel Agency for Sustainable Energy's Cooling as a Service initiative
- C40 Cities https://www.c40.org/
- District Energy in Cities: Unlocking the Potential of Energy Efficiency and Renewable Energy http://www.districtenergyinitiative.org/publications

ENDNOTES

i A Cool World: Defining the Energy Conundrum of Cooling For All, University of Birmingham 2018 https://www.birmingham.ac.uk/Documents/college-eps/energy/Publications/2018-clean-cold-report.pdf

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COMMON STATEMENT AND ENDORSEMENT FORM

Cool Coalition

By joining the Cool Coalition, we recognize that efficient and climate-friendly cooling can make a huge difference in the fight against climate change and pollution, sustainably provide essential cooling to hundreds of millions more people, and bring huge financial savings.

The Cool Coalition is a unified front to seize this opportunity, linking the Kigali Amendment to the Montreal Protocol, the Paris Agreement on Climate Change, and the Sustainable Development Goals. It is a coalition of proactive governments, businesses, and civil society organizations that aims to inspire ambition, identify solutions, and accelerate progress toward efficient and climate-friendly cooling.

The Cool Coalition takes a cross-sectoral and holistic approach to reducing emissions from the cooling sector by looking at a broad range of solutions, ranging from urban form, building design, district cooling to nature-based solutions to highly efficient and climate-friendly cooling technologies that use low- or zero GWP refrigerants.

As members of the coalition, we commit to act boldly to get the best cooling solutions adopted at scale and within a meaningful timeframe. To that end, we will:

- Advocate: Raise awareness on efficient and climate-friendly cooling
- Collaborate: Actively participate in a community that breaks down silos and promotes cross-cutting actions for efficient and climate-friendly cooling
- Act: Help secure and/or make commitments on efficient and climate-friendly cooling

☐ **Name of city:**

The organization is a:

○ City, Local Government	○ Other:

I [Mayor/Deputy Mayor/Local Government Representative of _____] **confirm our involvement in the Cool Coalition, endorse the Cool Coalition Common Statement and hereby** agree to pursue the following action(s) to promote efficient and climate-friendly cooling: *[Include here one or more actions that align with the aims of the Cool Coalition.]*

Last Name:	First name:
Website:	
Email address:	Phone:

Please briefly describe the nature of your contribution to efficient, climate-friendly cooling:

Signature:	Date:

Please attach your organization's logo when returning this form to *unep-coolcoalition@un.org*

SUBMIT FORM