CLIMATE & CLEAN AIR COALITION
TO REDUCE SHORT-LIVED CLIMATE POLLUTANTS

Cool Coalition

UN environment programme

SUSTAINABLE COOLING IN SUPPORT OF A RESILIENT AND CLIMATE-PROOF RECOVERY

DISCLAIMERS

PRODUCTION

Cool Coalition and Climate and Clean Air Coalition (2021). Sustainable Cooling in support of a Resilient and Climate Proof Recovery. Paris.

The electronic copy of this report can be downloaded at ***www.coolcoalition.org***.

SUGGESTED CITATION

Cool Coalition and Climate and Clean Air Coalition (2021). Sustainable Cooling in Support of a Resilient and Climate Proof Recovery. Paris

ACKNOWLEDGEMENTS

The Sustainable Cooling in Support of a Resilient and Climate Proof Recovery Brief was prepared by **Renilde Becqué**, Independent Consultant, with support from **Sophie Loran**, **Lily Riahi**, and **Irene Fagotto** from the United Nations Environment Programme (UNEP) for the Cool Coalition, and **Nathan Borgford-Parnell** from UNEP and **Clarisse Durand** from the Ministry for the Ecological Transition of France for the Climate and Clean Air Coalition's Efficient Cooling Initiative.

This brief builds on K-CEP and E3G ***report*** entitled: Building back better: How climate-friendly cooling can support a clean, resilient Covid-19 recovery.

The authors would like to thank the following members and partners who supported the development of this brief with their important contributions, input, comments and reviews:

Alessandro Peru, Sogesid Technical Unit, Italian Ministry for Environment Land and Sea Protection

Alexander Adamson, Department for Environment, Food and Rural Affairs (Defra), United Kingdom

Andrea Voigt, European Partnership for Energy and the Environment (EPEE)

Anna Zinecker, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

Antonio Di Cecca, Engie

Ben Hartley, Sustainable Energy for All (SEforALL)

Brian Holuj, United Nations Environment Programme (UNEP)

Cassie Southerland, C40

Christopher Beland, Energy Saving Trust

Clay Nesler, Johnson Controls

Craig Burnett, Ashden

Daniel de Graaf, German Environment Agency

Didier Coulomb, Institut International Du Froid / International Institute Of Refrigeration (IIF/IIR)

Duncan Gibb, Renewable Energy Policy Network for the 21st Century (REN21)

Fionnuala Walravens, Environmental Investigation Agency (EIA)

Giles Bristow, Ashden

Iain Campbell, Rocky Mountain Institute

Jennifer Calder, World Wide Fund for Nature, WWF

Jenny Corry Smith, CLASP

Jonas Loholm Hamann, Danfoss

Lara-Alexandra Teutsch, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

Larissa Gross, E3G

Manjeet Singh, The Energy and Resources Institute (TERI)

Marco Duran, United Nations Environment Programme (UNEP)

Maria del Mar Rojas, The Climate Group

Martina Bosi, Energy Sector Management Assistance Program (ESMAP)

Maxime Beaugrand, Institute for Governance and Sustainable Development (IGSD)

Naomi Keena, Yale Center for Ecosystems in Architecture

Nick Novelli, Yale Center for Ecosystems in Architecture

Nora Steurer, Global Alliance for Buildings and Construction (GlobalABC)

Patrick Blake, United Nations Environment Programme (UNEP)

Philipp Denzinger, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Philipp Munzinger, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Rana Adib, Renewable Energy Policy Network for the 21st Century (REN21)

Rikke Skou Melsen, Danfoss

Romina Picolotti, Institute for Governance & Sustainable Development (IGSD)

Sneha Sachar, Alliance for an Energy Efficient Economy (AEEE)

Toby Peters, University of Birmingham

Yunyeong Yang, Green Climate Fund (GCF)

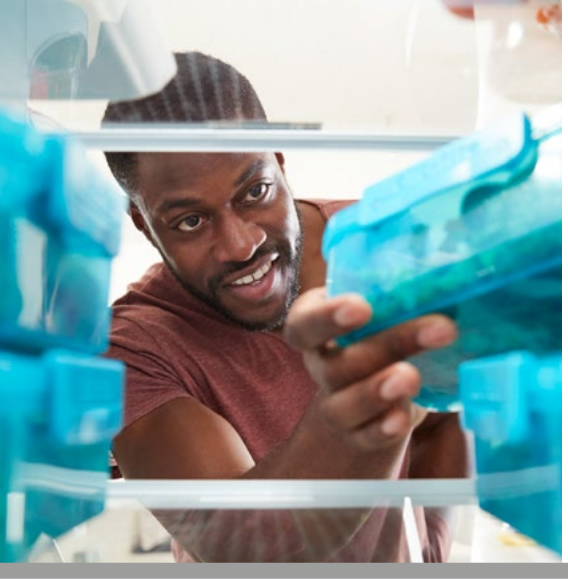


TABLE OF CONTENTS

CONTEXT

The COVID-19 pandemic has triggered the largest global economic shock since World War Two. The global economy is expected to shrink 5.2 percent in 2020, while up to 150 million people could be pushed into extreme poverty by 2021 – the first increase in extreme poverty since 1998 (***World Bank, 2020***). The global response to the pandemic has also highlighted the importance of space cooling and refrigeration as essential services to support people's wellbeing during lockdowns, and facilitate local delivery and storage of COVID-19 vaccines.

To overcome the economic and social impacts of the COVID-19 pandemic, governments are marshalling unprecedented levels of fiscal stimulus. It is crucial to seize this unique opportunity to facilitate the economic transition towards more sustainable development models, or, in other words, to "Build Back Greener". This includes using this temporary period of expansionary economic policies to accelerate long-term progress on access to efficient, climate-friendly cooling in order to support a move to a resilient, low-carbon and equitable world.

Cooling underpins the ability of societies to function effectively and reduce wastage by keeping food, medicines and vaccines at the right temperature, while enhancing people's productivity and comfort at home, school and work in hot and humid climates and during periods of intense summer heat in more temperate climates (known as space cooling). It also helps us stay connected online by cooling data centres. These services have become even more critical during the pandemic.

Intermittent lockdowns to curb the spread of COVID-19 have forced people to stay at home for long periods, with up to 54 per cent of the world's population subject to lockdown during the first wave of the pandemic ***(IEA, 2020).*** Nonetheless, of the 2.8 billion people living in the hottest parts of the world, only 8 per cent have access to space cooling (***IEA, 2018***). If cooling appliances were to be provided to all who need it, the world would see an almost four-fold increase in such appliances to 14 billion units by 2050, from an estimated 3.6 billion in use today (***University of Birmingham, 2018***). Moreover, effective ventilation and reduced recirculation of indoor air are important factors in preventing COVID-19 from spreading indoors (***WHO, 2020***), making cooling considerations and technologies key control strategies to prevent transmission (***McKinsey, 2020***).

As countries chart a way out of the COVID-19 pandemic, many have set their hopes on vaccines. As GAVI (the Vaccine Alliance) data show, if temperature-sensitive vaccines have to be quickly deployed around the globe, the lack of cooling quickly becomes a major impediment; only 10 per cent of the world's medical facilities have access to modern cold chain equipment (*GAVI, 2019*), and at least 3 billion people lack access to a cold chain to handle vaccines (*Hinnant and Mednick, 2020*). As a result, the World Health Organization (WHO) estimates that nearly 50 per cent of freeze-dried and 25 per cent of liquid vaccines are wasted each year, with disruption in the cold chain one of the largest contributors to this wastage (*WHO, 2005*). This would mean that COVID-19 vaccines, particularly those that have to be stored at very cold temperatures, could be out of reach for a major part of the world population, limiting its effect on global immunity, and reinforcing existing structural inequalities.

Cooling is therefore one of the critical intervention areas, both during and after the COVID-19 pandemic, that can help serve short-term emergency needs and support long-term economic recovery, while contributing to sustainable development and building greater resilience to future shocks.

Cooling, particularly in the form of air conditioning, already accounts for 20 per cent of the total electricity used in buildings, and energy demand for cooling is anticipated to triple by 2050 (*IEA, 2018*). Reducing the consumption and production of hydrofluorocarbons (HFCs) – which are frequently used as refrigerants in cooling appliances such as air conditioners – in accordance with the provisions of the Kigali Amendment to the Montreal Protocol can avoid up to 0.4°C of global warming by 2100. Improvements in energy efficiency in refrigeration and air-conditioner equipment during the transition to alternative refrigerants with low Global Warming Potential (GWP) could double the climate benefits of the HFC phase-down (WMO and UNEP*, 2018*).

Moreover, providing improved access to sustainable cooling can greatly improve the lives of up to several billions of people. Today, 30 per cent of the world population are exposed to deadly heatwaves for at least 20 days a year, and this percentage is projected to increase to up to 74 per cent by 2100 (*Mora et al, 2017*). Of the one billion people living in informal settlements worldwide, a significant part lives in the tropics and subtropics (*UN, 2019*). They often lack the financial means for space cooling or food refrigeration, making them more vulnerable to extreme heat. Improved cold chains in Africa alone could help households and smallholder farmers save USD 4 billion worth of food each year (*IRENA, IEA, and REN21*). In addition, 1.5 million people a year die from preventable diseases – COVID-19 not included - due to the ineffective distribution of vaccines (*WHO, 2015*).

By actively incorporating efficient, climate-friendly cooling across sectors in their stimulus packages, countries can increase their ability to weather the pandemic storms, but deliver on the Paris Agreement, the Sustainable Development Goals (SDGs), and the Kigali Amendment.

This brief presents how – in multiple critical economic sectors or systems (buildings, appliances, urban environments, cold chains, and R&D) – national governments can reorient public policy and include cooling in their recovery packages. This would support efforts to halt the pandemic, spur economic recovery, create and protect jobs for vulnerable populations, help strengthen resilience, and accelerate the transition to efficient, climate-friendly cooling technologies and solutions.

AIR QUALITY CO-BENEFITS OF CLIMATE FRIENDLY AND EFFICIENT COOLING

According to the World Health Organization, approximately 7 million people die prematurely every year due to poor air quality and air pollution (***WHO, 2014***). Numerous studies have linked exposure to air pollution to an increased risk of COVID-19 severity (e.g. ***Wu et al, 2020***).

According to the International Energy Agency, in 2015 power plant emissions due to space cooling accounted for nearly 10 per cent of particulate matter (PM2.5) emissions globally. Without further action, emissions related to the power generation for air conditioning could cause up to 9 per cent of all air pollution-linked premature deaths by 2050 (***IEA, 2018***). Applying available energy efficiency technologies in parallel with the Kigali Amendment phase-down could result in electricity savings exceeding a fifth of future global electricity consumption and reduce air pollution emissions by nearly 10 per cent (***Purohit et al, 2020***). By curbing energy consumption, the task of switching all cooling demand to renewable energy is manageable. Such energy savings can also help expand access to energy. In Uganda for example, applying energy efficiency could increase electricity access to 18 per cent of rural dwellers, or 6 million people (***de la Rue du Can et al, 2018***).

WORLD BANK SUSTAINABILITY CHECKLIST FOR COVID-19 FISCAL STIMULUS PACKAGES

The World Bank has developed a sustainability checklist to support governments as they establish fiscal stimulus packages for recovery. The checklist builds on the lessons learned during the 2008 financial and economic crisis and the need to give priority to "green solutions" (***World Bank, 2020***). One of the ***key lessons*** from the 2008-09 stimulus programmes was the failure to enact basic market reforms or policies, which placed many green projects at a disadvantage to incumbent technologies, or did not create the momentum to disrupt business-as-usual approaches.

The checklist includes key considerations for the short-term (job creation, boost to economic activity, timeliness and risk) and long-term (long-term growth potential, resilience to future shocks, decarbonization and sustainable growth trajectory). Recovery plans that directly or indirectly touch on current or future cooling demand and needs should be mindful of this framework to ensure win-win outcomes.

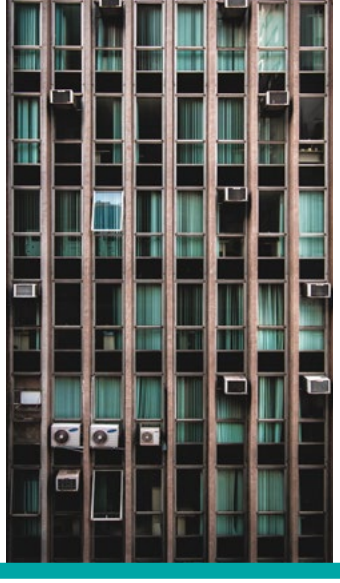
The following five sections provide a concise overview of efficient, climate-friendly cooling strategies by sector, which contribute to the short- and long-term considerations for green recovery that the Word Bank has set out. Governments can include them as part of their recovery plans to weather the COVID-19 pandemic, quickly boost economic activity, and pu their countries on a path towards long-term sustainable development for all. Case studies and examples are included where possible to showcase best practices.

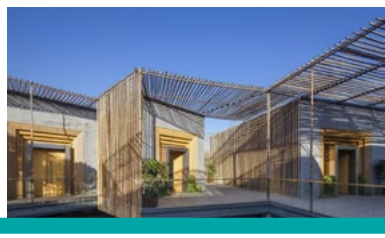
More details on how such policies can be shaped can also be found in a ***recent analysis*** by the Kigali Cooling Efficiency Program (K-CEP) in collaboration with think-tank E3G (***E3G and K-CEP, 2020***), which identified six high-impact opportunities where efficient, climate-friendly cooling could generate jobs, raise economic output and reduce emissions.

These are:

- Conditional bailouts for hard-hit sectors that support sustainable cooling. Funds to bail out hard-hit sectors to be tied to the adoption of climate-friendly cooling solutions.
- Rebates and incentives to promote cooling efficiency in the built environment, increase demand for efficient appliances and climate-friendly cooling technologies, create jobs and lower households' energy bills.
- Policy design to address resilient and responsive cold chain logistics for healthcare and food security. This measure is especially timely given the need to dispense COVID-19 vaccines globally.
- Supporting measures to encourage the implementation of cooling retrofits and passive cooling technologies such as passive design, building envelope renovation, and natural cooling and shading in buildings, with the benefit that these are usually labour-intensive activities which include local value chains.
- Expanding financing models to meet cooling needs, using funding to promote and support initial capital investment in order to realize future savings.
- Public and private financing investment in R&D for cooling, with grants and loans being able to sustain future innovation and deliver future improvements, offering innovative companies and countries a competitive advantage.





BUILDINGS

Worldwide, buildings account for about 40 per cent of energy-related CO2 emissions (***IEA, 2010***) and offer potential for carbon emission reductions at negative costs (***McKinsey, 2009***). The building sector has been hard hit by the pandemic, with workloads contracting and a quarter of projects put on hold. Many construction companies expect their headcounts to fall further in 2021 (***RICS, 2020***). The building sector, however, has often also been at the forefront of economic recovery plans: by boosting demand from the public sector, countries can support economic activity even while consumer demand is depressed.

GLOBAL ALLIANCE FOR BUILDINGS AND CONSTRUCTION (GLOBAL ABC) HIGHLIGHTS HOW BUILDING DECARBONIZATION IS LOSING MOMENTUM AND NEEDS TO STEP UP

The Global ABC's 2020 *Global Status Report for Buildings and Construction* shows how CO2 emissions from the building sector in 2019 were the highest ever. Its Buildings Climate Tracker found that annual building decarbonization progress has almost halved from 2016 to 2019. This is partly due to the increase in energy demand for cooling, with space cooling demand increasing by more than a third since 2010 (***Global ABC, 2020***).

In September 2020, the GlobalABC issued a *call to include building renovation and modernization in COVID-19 recovery plans* in the form of a massive energy efficiency renovation wave, spurred by tailored support mechanisms and designed with national and local stakeholders. The call highlights that large-scale building retrofits are essential for achieving the Paris Agreement Goals and should reach rates of 3 per cent of existing stock annually by 2030. COVID-19 stimulus packages provide a great opportunity to push towards this aim. To support stakeholders pursuing a zero-emission, efficient, and resilient buildings and construction sector, the GlobalABC has published both *Global and Regional Roadmaps* for Buildings and Construction outline key actions and steps. (***Global ABC, 2020***)

Many public (and private) buildings – including offices, schools, city halls and community centers – are likely to stay partly or entirely closed for some time. This provides building owners and managers, such as governments, with a unique opportunity to undertake retrofits (***ETC, 2020***). In the European Union alone, the estimated renovation investment opportunity amounts to EUR 243 billion per year until 2050 (***BPIE, 2020***).

Effective building retrofitting should prioritize reducing a building's cooling load through passive cooling design solutions, such as cool roofs and walls, better natural ventilation, thermal insulation, radiant cooling, and solar control. Remaining demand should be addressed by replacing inefficient cooling devices and equipment with more efficient ones, and eventually converting to renewable energy. These building retrofitting and equipment upgrading solutions can often be undertaken more rapidly than new building and infrastructure projects and provide an initial wave of demand for the sector when larger projects may not be shovel ready (***ETC, 2020***). Many of these can be achieved at low marginal cost while also helping to return workers safely back to work (***E3G and K-CEP, 2020***).

Whereas public buildings can fuel the first wave, energy retrofitting of a broader set of residential and commercial buildings can provide the second wave of demand. However this requires government-backed schemes to ease the upfront cost and achieve economies of scale in order to incentivise a wave of retrofits (***ETC, 2020***). Moreover, by lowering the operational costs of building energy provision, such measures can support governments – and companies – in the long term with returning to financial equilibrium (***ETC, 2020***). Energy efficiency can also be a job generator. Previous energy efficiency stimulus investments have produced USD 2 or more in direct energy cost savings alone for every USD 1 invested, and approximately 18 jobs per USD 1 million invested (***CUT, 2020***). This is considerably more than the average 3 jobs created for every USD 1 million invested in the fossil fuel industry (***McKinsey, 2020***).

Examples of countries taking action on this front abound, particularly in Europe. In Italy, the Ecobonus Scheme announced in May 2020 offers 110 per cent tax reductions for private installation of energy efficiency retrofits, including heat pumps, as part of cooling systems renovation, normally subject to 50 per cent tax deductibility. In the same month, the ***Danish government*** proposed funding for green renovations to social housing between 2020 and 2026 for a total investment of USD 4.74bn, including measures for enhanced thermal insulation. In June, Germany agreed to expand funding for their ongoing ***CO2-focused building renovation programme***, with an additional EUR 1bn in 2020 and 2021 taking the annual totals to EUR 2.5bn. In July, the ***UK*** started implementing a GBP 2bn "green homes grant" voucher scheme to fund home efficiency improvements , as well as a GBP 2bn programme to make public buildings greener and more energy efficient.

The French recovery plan (***France Relance***) includes EUR 6.7 billion in total on buildings' energy renovation, with improving thermal insulation considered essential to decrease cooling and heating needs. Out of the EUR 6.7 billion, EUR 4 billion will be for the renovation of public buildings, including by using passive building design measures. In October, the European Union unveiled a new strategy to boost renovation called "***A Renovation Wave for Europe – Greening our buildings, creating jobs, improving lives***" that aims at doubling annual energy renovation rates in the next ten years. This will reduce Europe's greenhouse gas emissions and create up to ***160,000 additional green jobs in the construction sector***.

Moreover, India's state-run super ESCO "EESL" in mid-2020 announced the RAISE initiative (Retrofit Air-conditioning to improve Indoor air quality for Safety and Efficiency), which is aimed at accelerating the adoption of cost-effective energy efficiency measures, particularly cooling, in buildings, while improving indoor air quality (***The Economic Times, 2020***).

Case study:

PROCUREMENT AND SUSTAINABLE COOLING

Recovery packages can support a transition to more efficient and climate friendly cooling technologies. One way is by providing guidelines for the procurement or replacement of cooling technologies. The replacement of older ACs is, in fact, more economic than upgrading the energy efficiency of new ACs.

In Morocco, a ***Buyers Club for Room AC Replacement*** has been created with the support of IGSD to aggregate demand for super-efficient ACs using lower GWP refrigerants. This helps lower purchase price and achieves economy of scale in manufacturing, distribution, and installation. The campaign saves money and provides jobs in manufacturing, distribution, installation and service. The University of Maryland, with the help of IGSD, recently concluded the energy efficiency test at Bank of Africa's branches in Marrakech and will be publishing the report soon. IGSD has continued to work with the Moroccan Agency for Energy Efficiency (AMEE) and the Bank of Africa throughout the COVID-19 pandemic.

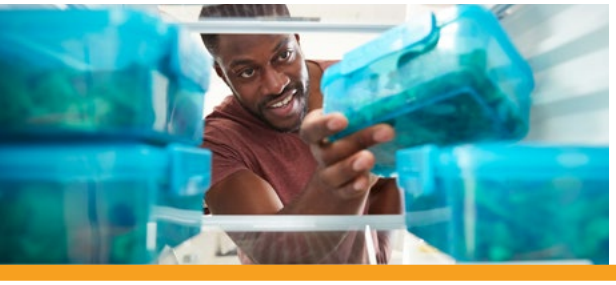
In the United States, IGSD and the Sustainable Purchasing Leadership Council have created a procurement tool kit to implement public and private policy to avoid high GWP refrigerants while demanding high energy efficiency. As states are passing legislation regulating or banning high-GWP refrigerants, this toolkit guides implementation and ensures a greener recovery (***IGSD, 2020***).

Upgrading passive and active cooling features and equipment for individual buildings or even entire districts also directly supports the creation and preservation of many green jobs, with numerous projects in the energy sector having stalled and local skilled staff and equipment sitting idle. In the USA alone, by August 2020 nearly half-a-million (490,300) clean energy employees remained out of work, representing 14 per cent of the US industry's workforce (***E2, 2020***). By the end of 2020, clean energy employment had barely crept up with still a 13 per cent decline in jobs versus pre-pandemic levels (***E2, 2020***). These staff can be (re)deployed by boosting the retrofit sector, particularly targeting government-owned buildings.

Moreover, building efficiency spending has been identified as offering one of the best combinations of high economic multipliers with positive climate impact, as part of COVID-19 fiscal recovery policies (***Hepburn et al., 2020***). Deployment of innovative financing models – such as e.g. ESCOs, Energy Services Agreements, Property Assessed Clean Finance, On-Bill Financing, and Cooling as a Service (CaaS) – as well as the provision of incentives, from tax incentives to direct rebates, can help overcome the upfront cost hurdle while paying for themselves through long-term energy cost reductions.







APPLIANCES

We are spending more time than ever at home. It is therefore no surprise that more households considered buying a cooling device such as a room air conditioner (AC) in the summer of 2020. And in uncertain economic times, consumers are even more likely than usual to buy a low-cost generally inefficient AC (*ET Energy World*, 2020).

With many countries, including those who will drive a large proportion of near-future AC demand, having either no or weak Minimum Energy Performance Standards (MEPS) for (room) ACs, cheap but inefficient ACs can still readily enter the market. The same situation applies to refrigeration equipment. Apart from the burden of high electricity bills on consumers, this can result in rapid increases in local energy demand, locking cities and countries into high energy consumption paths (*U4E AC Policy Guides*, 2017).

As part of green recovery efforts, governments have an opportunity to set ambitious long-term goals for AC efficiency, and to announce the introduction or tightening of AC MEPS, preferably in combination with energy efficiency labels. Particularly in markets where manufacturers have AC models much more efficient than the current average readily available – which holds true for a large number of countries – governments can make a clear case for frontloading some of the incremental MEPS stringency improvements (*IGSD, 2019*). Tools like the *United for Efficiency Model Regulations Guidelines* are ready-to-use to assist governments to design regulatory or legislative frameworks for MEPS and energy labels for cooling (*U4E, 2019*).

In addition, governments may want to combine this with an incentive policy, such as a tax incentive or rebate, that creates a strong stimulus for people considering purchasing their first AC, or those already owning an AC to buy or upgrade to a more efficient one, while returning old AC units through a collection and dismantling scheme. Such incentive measures are relatively easy to administer and can be combined with, for instance, on-bill financing (*E3G and K-CEP, 2020*). This helps boost consumer demand in a depressed economy and creates low-to medium-skilled jobs. It can also avoid lower-income households purchasing cheap but highly inefficient models as well as prevent people holding on to their old ACs or to start reselling them as second-hand and keeping them in circulation (*CLASP & IGSD, 2020*).

Incentives can cover commercial users and public offices. For example, Germany's federal government strategies established in 2009 to recover from the 2008 economic crisis included infrastructure investments in federal government buildings. This allowed for financing the replacement of older cooling systems with a new cooling plant with significantly higher energy efficiency and using climate- and ozone friendly refrigerants at the offices of the German Federal Ministry for the Environment in Bonn, Germany. The installation of a state-of-the art cooling system at the 2,000m^2 Al Salam supermarket in Amman, Jordan, shows how efficient cooling is worth the higher up-front investment. Thanks to this technology, energy consumption was cut by 40 per cent (*CCAC, 2018*), resulting in a quick payback time. Such cooling efficiency interventions can be incentivized through stimulus programmes.

Case study:

GLOBAL LEAP RESULTS BASED FINANCING MECHANISM

Global LEAP works to catalyse the development of commercial markets for off- and weak-grid appliance solutions, which tend to be nascent and under-resourced. It has run initiatives such as the Global Leap Awards Off-Grid Refrigerator Competition, the Global LEAP Procurement Incentives Program, and the Off-Grid Cold Chain Challenge. The Global LEAP+RBF is an initiative that couples product quality verification with bulk procurement incentives for manufactures and off-grid solar distributors, that partner to distribute large quantities of quality verified products identified through the Global LEAP Awards. *Global LEAP+RBF* seeks to scale up markets and reduce prices for super-efficient, off- and weak-grid appropriate products, support technological innovation, and improve sector coordination.

Case study:

GREEN COOLING IN COSTA RICA

Through three subsequent German Development Agency (GIZ) *projects*, Germany and Costa Rica have collaborated on introducing energy-efficient and climate-friendly single split air conditioners, using the low GWP refrigerant R290 (propane). These cooling technologies emit just one-third of the GHG emissions and use 50-80 per cent of energy compared to previously installed conventional ACs.

Introducing green technologies is not only beneficial from a cost and climate perspective, but can support job creation and labour skills. *Trainings* have been provided through GIZ to 100 trainers and technicians on installing and servicing ACs using low GWP refrigerants from 11 countries in the Latin-America & Caribbean region. This will allow for further training of hundreds of others in the region, increasing their employability (*GCI, 2020*).

Finally, several hard-hit industries – such as the hotel/tourism, automobile manufacturing, and (cargo) aviation industries – have a large demand for space cooling and/or refrigeration. With such industries asking for bailouts in many countries, and more likely to follow, governments have an immediate opportunity to accelerate the transition towards higher efficiency and low or zero GWP cooling technologies and systems. Not only does this provide countries with long-term greenhouse gas reduction benefits that help them meet their Nationally Determined Contributions (NDCs) towards the Paris Agreement, it also reduces the operating costs of hard-hit businesses, and potentially lowers the costs of future bailouts (***E3G and K-CEP, 2020***).

More manufacturers are already stepping up to the challenge, such as ENGIE Solutions, a company that recently announced its objective to cut by a factor of five the GHG emissions of refrigerants by 2030 (ENGIE, 2020), or ***Danfoss***, which announced the ambition to make its operations CO2 neutral by no later than 2030. By supporting clean cooling through their stimulus packages, countries are raising ambition in the markets and creating a more level playing field for frontrunner companies.

Although companies may argue that in the current economic context limited budget is available for such capital upgrades while their ability to borrow has been equally affected, governments can underwrite and offer credit lines to banks and retailers to catalyse the growth of Pay-As-You-Save (PAYS) financing, on-bill repayment, and Cooling as a Service (CaaS) models in the commercial and even residential market. Multilateral Development Banks also have a role to play as a potential source of funding for cooling capital equipment upgrades. This will allow companies and households to upgrade with no or limited upfront cost (***E3G and K-CEP, 2020***).

URBAN ENVIRONMENTS

Urbanization in combination with population growth is adding an estimated 2.5 billion urban citizens by 2050, with close to 90 per cent of this increase concentrated in Asia and Africa (*UN, 2018*). Already the top 30 of hottest cities in the world are located in developing and emerging countries, which also host most of the world's megacities (*UN, 2014*). Many of these cities experience the 'urban heat island effect'[1], which is primarily caused by the replacement of natural surfaces with asphalt and concrete surfaces, such as roads and other paved areas, and roof tops. All of these are relatively dark and absorb large amounts of solar radiation (*Getter et al., 2007*).

Together with the prevailing urban geometry, this heat island effect can result in an increase in temperatures for a city with one million or more inhabitants of as much as 4-7oC in comparison with adjacent vegetated areas (*Wolf and Lundholm, 2008*). On a clear, calm night, this temperature difference can even reach 12°C (*USPA, 2008*). A rapid increase in the use of AC can further exacerbate urban temperatures, particularly at night. If we allow carbon emissions to continue to rise, almost three-quarters of humanity could be exposed to deadly climatic conditions associated with heat by the end of the century, with densely populated, tropical humid regions being the most affected (*Mora et al, 2017*).

In many cities, informal workers and people in dense low-income neighbourhoods are most likely to suffer from heat stress, which can result in productivity losses during hot weather of up to 60–70 per cent (*Kjellstrom et al., 2014*). In countries like South Sudan, the Central African Republic, and Chad, nearly *9 out of 10 urban residents* live in crowded informal settlements, with population densities in some of the largest communities exceeding over 75,000 people per square kilometre (*Commins, 2018*). These are the same urban citizens that are likely to suffer greatly from the economic effects of the pandemic, often lacking the resources to sustain a living without defying social distancing orders and other restrictions.

While in many cities green urban spaces have proved an invaluable asset during lockdowns, our cities also stand to benefit from tree planting in terms of heat and air pollution (particulate matter) reduction. Stimulus measures that focus on expanding a city's green assets are a win-win from a health and employment perspective, and are likely to receive broad citizen support. It has been found that investing less than USD 4 annually per resident on tree planting along streets in 245 cities studied around the world could improve the health of many millions of people and reduce high temperature-related mortality in the assessed cities by 2.4-5.6 per cent. The biggest calculated returns on investment were in South Asia and Africa, as a result of high pollution levels, warm climates, and relatively low labour cost (*The Nature Conservancy, 2016*).

Greening programmes can also bring training, employment and integration opportunities, which will be crucial as cities endure the economic consequences of the pandemic. For example, a 'green corridors' scheme in the ***Colombian city of Medellin*** has not only lowered temperatures by up to 3oC – it has also supported marginalized communities, including displaced people and former combatants. They have received workplace training and earned qualifications by taking part in an apprenticeship scheme, run in partnership with the city's botanical gardens.

Case study:

CLIMATE-PROOF URBAN INNOVATION IN OVERSEAS TERRITORIES OF FRANCE AND IN THE UK

Where relevant, stimulus packages should prioritize infrastructure investments in buildings that reduce energy use (and thus operational costs) while increasing access to cooling benefits for its users. Plenty of low-cost passive design measures exist, many of which are rooted in traditional design.

Bioclimatic buildings, like the ***Boueni High School on Mayotte Island***, an overseas department and region of France, are perfect examples of such investments. Located in an area subject to major climatic hazards, the building was built using a construction method that allows for natural ventilation, resistance to seismic forces, and facilitation of surface rainwater management. On the island of La Reunion, France, the construction of the "***Ecoquartier Coeur de Ville La Possession***" will create 400 new jobs a year during construction. Here, residential buildings will have a low energy consumption (maximum 20 kWh/m^2 of floor area/year) and will be built in a way that makes maximum use of the local breeze, allowing a high comfort level without AC.

In the UK, the "***GreenSCIES – Green Smart Community Integrated Energy System***" project will deliver a detailed design blueprint and roadmap for building a smart energy system that integrates new low carbon energy technologies across cooling, heating, power and mobility. The distributed smart energy grid will help provide affordable thermal comfort, and lower local air pollution. This initiative, currently under development in 3 different UK locations, has a clear path for replication.

A recent survey of 231 central bank officials, finance ministry officials and other economic experts from G20 countries on the relative performance of a set of post-COVID recovery policy measures, in combination with evidence from literature, also found that natural capital investment was considered a clear winner, offering a fast-acting policy opportunity with high economic multipliers and positive climate impact (***Hepburn et al., 2020***). This isn't just relevant to cities in the Global South: planting just three shade trees per building in US cities, while making roofs and pavements reflective could decrease the country's cooling demand by 20 per cent (***Cox, 2016***). Furthermore, the UK Office of national statistics (ONS) showed that the cooling shade of trees and water saved the UK GBP 248 million in 2017 by maintaining productivity and lowering air conditioning costs on hot days (***ONS, 2019***).

Cities around the world are starting to recognize the value of greening urban environments as an effective tool to reduce urban heat and increase quality of life for their citizens. In Toronto, Canada, a ***2009 bylaw*** that made green roofs mandatory on large new buildings is estimated to have created 1,600 jobs in their construction and 25 jobs annually to maintain them. In Madrid, Spain, the newly announced "***El Bosque Metropolitano***" (the urban forest) will help decrease urban heat by planting half a million trees in the city perimeter within 10 years. In Australia, researchers from Sydney and Melbourne have released ***a roadmap*** to grow more plants on building roofs, walls and facades to increase existing urban greening efforts and help mitigate summer heat.

A second low-cost and shovel-ready investment opportunity governments can apply to support their vulnerable citizens are high albedo or 'cool' roofs and pavements. Changing as little as one fifth of a city's roofs and half of the pavements to 'cool' versions could lead to cost savings 12 times the cost of installation and maintenance (*Estrada et al., 2017*). On a typical sunny summer afternoon, a clean white roof that reflects 80 per cent of sunlight will stay about 30°C (55°F) cooler than a grey roof that reflects only 20 per cent of sunlight (*LBNL n.d.*), and can bring down temperatures inside by 3 to 8°C (*Gadgil, 2017*). Cool roof and cool pavement programmes, such as the *Million Cool Roofs Challenge*, also create jobs for low-skilled workers, as worker training requirements are low, many projects have minimal planning and procurement requirements, and most aspects of the work meet social distancing requirements (*Hepburn et al., 2020*).

Case study:

COOL ROOFS AS A LOW-COST, HIGH IMPACT SOLUTION TO CURB HEAT

The cities of Seoul and Busan in South-Korea have been leveraging a combination of municipal budgets and volunteers to promote cool roofs and paint people's roofs white for free. The programmes are particularly targeting socially marginalized groups and community centres for senior citizens in Busan (*McGuinness, 2017*), and young as well as elderly citizens living in 'rooftop slums' in Seoul (*Seoul Metropolitan Government, 2015).* In South-Africa, the Cool Surfaces Project, has also been targeting low-income housing – particularly those without access to electricity – to conduct demonstration projects for cool roofs and pavements (*SANEDI, 2016*).

Another compelling example comes from Ahmedabad as part of its Heat Action Plan. The plan, which was first initiated after a deadly 2010 heatwave, has dedicated content on cool roofs to increase community awareness, partnered with local businesses to run pilot projects, and recruited student volunteers to paint the roofs of low-income families white. It also has put white tiles on the walls of select government buildings while it leads by example by applying cool roofs to municipal and other publicly owned buildings, as well as by including cool roofs in their procurement criteria (*NRDC, 2017*).

If cities, districts or national governments plan longer-term infrastructure investments as part of their recovery plans, the development of district cooling systems can be an effective way to provide efficient and climate friendly cooling to urban communities. District cooling has been rapidly taking off, for instance in the Middle East, although district energy systems can be found around the world. In 2015, UNEP studied several models for implementing district energy systems, providing comprehensive implementation guidance as well as identifying a set of 'champion cities' *(C40, 2015*).

COLD CHAINS

Cooling ensures that fresh (and frozen) produce, life-saving vaccines and temperature-sensitive medicines are kept within an optimum temperature band to avoid spoilage and wastage. Worldwide, an estimated 40 per cent of all foods are refrigerated at some point, with this number rising to 70 per cent for industrialized countries (*IIR, 2019*).

Pre-COVID, more than 800 million people globally were considered malnourished. At the same time, it is estimated that 1.3 billion tons of food (*FAO, 2013*), representing a third of the total food production for human consumption, is lost or wasted every year, of which about 475 million tonnes due to insufficient or absent cooling, enough to feed nearly a billion people a year (*IIR, 2019*). If food loss and waste were a a country, it would be the world's third biggest GHG emitter after the USA and China (*The Carbon Trust, 2015*). The lack of a (continuous and reliable) cold chain also hampers the effective distribution of vaccines – access to which can prevent more than two million deaths a year in developing countries (*The Carbon Trust, 2015*).

The pandemic and resulting disruptions in supply chains as well as loss of demand has resulted in an increase in food being thrown out. For example, 14 million litres of milk a day were being dumped in the US alone in the first two months of the pandemic lockdown, resulting in a carbon footprint of about 1.6m tonnes of CO2e (*Bazjelj, 2020*). In Uganda, the milk value chain weathered the lockdowns well, with its dairy industry, featuring a large number of smallholder farmers, having collectively invested heavily in well-functioning milk cold chains and storage facilities that prevent it from spilling quickly. Its fish value chain on the other hand rapidly collapsed due to the absence of a cold chain, in part the result of a lack of cooperatives (*Oxford Martin School, 2020*).

Meanwhile, estimates suggest that economic hardship as a result of COVID-19 restrictions may result in up to 130 million people being at risk of starvation by the end of 2020 (*WFP, 2020*). The pandemic is therewith greatly exacerbating global inequality, widening the gap between the haves and the have-nots, and pushing up to an extra 150 million people into extreme poverty by 2021 (*World Bank, 2020*) adding to the roughly 700 million already there prior to the pandemic (*UN University, 2020*).

Reducing global food wastage by 50 per cent, if replicated worldwide, could at least theoretically solve food insecurity and malnutrition by feeding over a 1 billion people (*Swain, 2016*), with some countries losing as much as 35 to 45 per cent of their domestic food production due to poorly functioning cold chains. Fast intervention to enhance the reach, continuity and reliability of sustainable cold chains, including cold storage pre- and at consumer level, can contribute to food security worldwide. This doesn't have to translate in costly investments however, in a time that governments are already faced with having to leverage unprecedented levels of recovery funds.

Many low-cost as well as off-grid solutions exist, from simple evaporative coolers to a variety of cooling box innovations, solar refrigeration, and fridges that work with ice banks. In addition, several solutions can already be found on the market that provide entire communities with shared cooling solutions.

Case study:

FARM TO FORK COLD CHAIN SOLUTIONS IN INDIA, NIGERIA AND GHANA

In India, Danfoss has partnered with the Confederation of Indian Industry (CII) and local stakeholders to strengthen cold chain infrastructure for ***banana production*** in Tamil Nadu. The region produces 9 million tonnes of bananas per year, but given a lack of effective cold management, about one-third is lost post-harvest. The introduction of good cooling practices, including pre-cooling and ripening chambers, extend the shelf life and quality of the bananas, better serving the demands of the market. The resulting enhanced farmers' income has driven farmers to employ more people, while still lowering costs for end-consumers.

In Madhya Pradesh, TERI has developed a decentralized biomass-based ***Vapor Adsorption System*** to minimize a local farm's waste, and increase revenue and shelf life of the harvested produce. The biomass-based decentralized cold room is cheaper than diesel generators and lets the farmer make seven times more profit than he would have otherwise made.

To provide cold storage at local community markets, start-up ColdHubs in Nigeria is providing an easy-to-set-up, modular, walk-in cold room for off-grid storage. The cold room is powered by solar panels that can be mounted on a roof or awning. With this solution, fruits and vegetables can be kept fresh for up to 21 days rather than merely a few days, and local farmers' post-harvest loss is cut significantly (***Global LEAP, 2020***). ***ColdHubs*** is currently receiving funding from UKaid via the Efficiency for Access R&D Fund to further improve the efficiency and affordability of their cold storage solution.

Bringing cold chain deeper into 'last mile' communities may require smaller, more affordable versions of existing technology. In India, ***Promethean Power Systems*** and ***Ecozen*** offer innovative and sustainable cold storage solutions – milk chilling in the case of Promethean, while Ecozen provide solar cold storage rooms and associated services. Through Ashden's Fair Cooling Fund, the organizations are developing and trialling smaller versions of their technology. Backed up with servicing support and microfinance options, these products will appeal to a greater range of customers, including those on lower incomes.

Cold chain development can also enhance progress towards development goals, such as empowering women. In Ghana, ***PEG Africa***, another fund beneficiary, is trialling the marketing of affordable off-grid refrigerators and freezers to women in fishing communities. Access to cold storage allows them to replace fish salting, and improve their incomes (***EforA, 2020***).

Many of the solutions that have the potential to effectively tackle community-level cooling gaps and needs are offered by start-ups. In general, start-ups already are more likely to face challenges in terms of access to capital (*Calvino et al. 2020*) – especially where it concerns service offers such as e.g. Cooling as a Service and Pay as You Go. These solutions lower the upfront investment for consumers, making them accessible to people across all income groups, with the supplier still incurring the upfront capital costs. For instance, of the total serviceable market for solar powered agricultural cold chain technologies in Sub-Saharan Africa, comprising nearly 6.5 million farmers, only 3.5 per cent can afford a USD 825, 100-litre fridge and solar power system (*IFC, 2019*).

The pandemic has created greater access to finance barriers for small- and medium-sized enterprises (SMEs), putting the survival of start-ups offering community-level cooling solutions at greater risk (*Calvino et al. 2020*). Governments have an opportunity to intervene by extending dedicated credit lines and revolving loan funds to private financers, such as local banks, with the aim of on-loaning the money at favourable terms to specific green SME investments, or by providing risk mitigation guarantees – all financial instruments that have proven their worth in the (access to) energy sector (*ESMAP, 2014*).

Case study:

STRENGTHENING THE COLD FOOD VALUE CHAIN THROUGH GREEN RECOVERY PLANS – NIGERIA'S ECONOMIC SUSTAINABILITY PLAN

In response to the challenges posed by the COVID-19 pandemic, the *Nigerian Federal Executive Council* approved the Nigeria Economic Sustainability Plan (NESP) on 24 June 2020. The NESP focuses on concrete programmes designed to promote local production, local services and innovation, economic stimulus and job creation, particularly catering to vulnerable populations. One of the key pillars of the NESP is a Mass Agriculture Programme, which is focused mainly on smallholder farmers and aims to strengthen the agricultural value chain from 'farm to table' while creating millions of job opportunities.

Even before the onset of the pandemic, the lack of reliable and adequate cold chain facilities in Nigeria and sub-Saharan Africa had been identified as one of the main causes of food wastage, with such losses estimated to constitute about 25-30 per cent for animal products (meat, eggs, and dairy) and 40-50 per cent for roots, tubers, fruits and vegetables. To address this issue, the Mass Agriculture Programme seeks to partner with the private sector to implement strategies to increase yield per hectare, including through outgrower schemes that link networks of unorganized smallholder farmers with domestic and international buyers, knowledge transfer protocols, and greater access to energy for production and refrigeration.

Case study:

INNOVATIVE START-UPS HOLD THE POTENTIAL TO GREATLY EXPAND COLD CHAIN ACCESS

In recent years, start-ups have brought various new innovations to the market, targeted at low-income or off-grid communities. Examples are the CoolFinity fridge, which can handle long power outages of up to 24 hours due to its ice bank (***Swain, 2016***). SureChill also provides fridges, at various sizes, that keep contents cool at a steady 4°C for days or even weeks without power (***Schieber, 2014***). Coolar has developed an electricity-independent fridge for food or medical use, cooled by adsorption cycle technology and powered by solar-heated water.

Moving on to cooling boxes, the ChotuKool in India, a 45-liter insulated portable plastic container, can cool food to around 8 to 10 °C on a 12-volt battery, using a thermoelectric or solid state cooling system (***WIPO, 2013***). Somewhat similarly, the Evaptainer system uses evaporative cooling (water and solar energy) to cool a 60-litre portable container, keeping produce cool for up to 12 hours. (***Markham, 2015***).

Continuous cold chains are fundamental in ensuring COVID-19 vaccines can be equally and universally distributed, with most vaccines requiring a cold chain (with temperatures between +8 to -80 °C) to remain viable (***IIR, 2020***). High vaccination wastage rates in lower-middle and lower income countries are in large part due to a lack of high quality cold chain logistics. Inadequate cold chains can lead to a complete or partial loss of vaccine potency, which in turn can lead to increased mortality rates or extra strain on health services.

The lack of reliable grid electricity for instance is in many countries a major threat to the continuity of the medical cold chain, while the main conventional alternatives are plagued by problems with gas supply interruptions, low efficiency, poor temperature control, and frequent maintenance needs (***McCarney, S. et al., 2013***). Existing medical cold chains are already under unprecedented strain as a result of the public health response to the pandemic. It is likely that the poor could face significant challenges in accessing a vaccine. Delivering sustainable and continuous cold chains will be key to ensuring equal and fair access to a COVID-19 vaccine (***SEforAll, 2020***).

As part of short- and medium-term recovery efforts, governments should focus on enhancing universal access to quality vaccines through supporting the rapid expansion of last-mile solutions (***E3G and K-CEP, 2020***). Transport is the component where most frequently the vaccine cold chain breaks down. This can be overcome by last-mile solutions that improve the quality and duration of cooling while using off-grid transport or which shorten the supply chain. An example of the latter is Zipline (***Walcutt, 2017***) which operates a drone delivery system to send urgent medicines to patients, delivering in under 30 minutes from dedicated distribution centres, negating the need for refrigeration.

This doesn't take away the urgency for governments to invest in expanding the reach and quality of their medical cold chains to ensure not only the effective delivery of COVID-19 vaccines but also other crucial medical supplies to support those falling sick with the virus (or other diseases). Cold chains consume as much as 80 per cent of the total cost of vaccination programmes (***VBI Vaccines, 2014***), stressing the importance of selecting energy efficient, low GWP equipment. Tools governments can use include ***PATH's[2] operating costs tool***, which helps users understand the costs of purchasing and maintaining cold chain equipment over time, and ***Gavi Alliance's Cold Chain Equipment Optimization Platform***.

Case study:

THE WORLD BANK'S COMMITMENT TO CLEAN ENERGY AND COLD CHAINS IN ITS RESPONSE TO THE COVID-19 CRISIS

The World Bank's Energy Sector Management Assistance Program (ESMAP) has led the development of a strategy for supplying reliable electricity to the healthcare sector in developing countries' COVID-19 response. A reliable energy supply is a key aspect of the ***World Bank's commitment to deploy USD 160 billion*** over a 15-month period to help countries respond to the pandemic's immediate health consequences and bolster their economic recovery. Of this amount, ***USD 18 billion*** is dedicated to the purchase and distribution of COVID-19 vaccines, tests, and treatments, including cold chain infrastructure, and seeks to embed energy efficiency measures in the cold chain and related logistics.

R&D IN SUSTAINABLE TECHNOLOGIES





To effectively reduce carbon emissions, clear policy signals are essentual, as well as a much stronger focus on R&D in sustainable technologies. Technological improvements often quickly become public goods that may allow developing and emerging economies to leapfrog current commonly applied carbon-intensive technologies, thereby building a more decarbonized economy from the ground up (***Let's Fund, 2019***). By shaping and supporting research in efficient and climate-friendly cooling, governments can steer innovation to solve major public goals (***Mazzucato, 2020***), using both innovation policies – including incentives that can accelerate their actual adoption – and targeted investments to strategically enhance economic competitiveness, strengthening regional innovation clusters, creating jobs, and supportinger social and environmental well-being (***Coalition for Urban Transitions, 2019***).

Nonetheless, the R&D budget of many organizations, including universities and businesses, has been hit hard by the pandemic's economic impacts (***Ayming, 2020***). Increased government debt could also mean further cuts to R&D budgets and innovation policies. Innovation prizes — such as the Rocky Mountain Institute's ***Global Cooling Prize*** or the ***CaaS Initiative***'s Global CaaS Prize — can stimulate R&D for more efficient, climate-friendly cooling in the short term. However, the pace of innovation, essential to meeting current and future cooling needs sustainably, is at risk and without further action could potentially take a long time to recover (***E3G and K-CEP, 2020***).

Moreover, even without the pandemic, R&D in sustainable technologies can be considered an overlooked tool to curb global carbon emissions. Globally around USD 20 billion a year is spent for on sustainable energy R&D, a number that has hardly changed in past years (***IEA, 2019***). For comparison, USD 600 billion is spent on the military in the US alone (***Roberts, 2019***).

Nonetheless, innovations in climate-friendly and efficient technologies and business models are a major driver of economic growth. These innovations can take the shape of thermal efficient and passive cooling designs, hyper-efficient cooling technologies, novel refrigerants, renewable energy powered and off-grid cooling solutions, and as nature-based cooling solutions. Stimulus packages can champion the development and early deployment of such innovations. R&D investment also comes at a relatively low cost, as the scale of investments required is considerably lower than investing in expanding power generation to keep up with growing cooling electricity demand (***Energy Transitions Commission***, 2020). In fact, spending on R&D has been identified as one of five post-COVID fiscal recovery policies that are considered to have the highest economic multipliers combined with a high positive climate impact (***Hepburn et al., 2020***).

The Energy Transitions Commission has suggested three major types of policy interventions for R&D in climate-friendly and efficient technologies for governments to include in their stimulus packages. These are (***ETC, 2020***):

- Innovation support to bring green technologies to market, with a focus on early-stage development and industrial-scale demonstration;
- Public financial support mechanisms, like loan guarantees, dedicated to new green technologies to de-risk and lower the cost of capital for early deployment;
- Regulations and mandates to create demand at scale for new products over the next decade, including a ratchet-up mechanism which will tighten obligations over time. MEPS are a clear example of these.

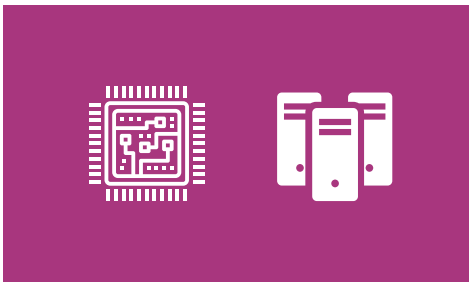
An additional suggestion is the establishment of and support for 'cooling centres of excellence' – such as those recently created in ***India*** and proposed in ***Rwanda*** – in partnership with universities, in order to support longer-term innovation and R&D cycles for climate-friendly and efficient (access to) cooling (***E3G and K-CEP, 2020***).

Finally, raising the bar for AC efficiency through more stringent MEPS, energy efficiency rating systems, and by increasing consumer demand for more efficient AC models can in turn also spur companies to invest more in R&D. Research from the US has shown that between 2003 and 2010, new commercial cleantech segments produced substantial job gains. Moreover, roughly 26 per cent of all clean economy jobs created in the country were found in manufacturing, compared with just 9 per cent in the broader economy, with many green technologies being quite manufacturing-intensive, providing valuable jobs for low- and medium-skilled workers (***Muro, Rothwell and Saha, 2011***).

Some countries are acting on the call, with the UK Government in September 2020 announcing a GBP 15 million (USD 20 million) sustainable cooling innovation fund as part of a new GBP 50 million Clean Energy Innovation Facility. The fund will provide R&D[4] support to developing countries to pilot innovative sustainable cooling technologies, in partnership with IFC (***UK Government, 2020***).







Case study:

INDIA'S SUPER ESCO IS STIMULATING INNOVATION IN COOLING

In response to the increasing demand for ACs, Energy Efficiency Services Limited (EESL), a Super ESCO[3] set up under India's Ministry of Power, has shown success in unlocking the energy efficiency market in India through more efficient fans and the distribution of LED lighting. Its ***Super-Efficient Air Conditioning programme*** focuses on super-efficient cooling systems with a minimum 5.2 (5 star) rating as per India's energy efficiency rating running from 1 (worst) to 5 (best) stars. This with the aim of providing ACs that are at least ***40 per cent*** more energy efficient than the best in class AC currently available in the Indian market.

A key component of EESL's strategy is to aggregate demand for ACs under a performance based contracting ESCO model, as well as issuing Requests for Proposals (RfP) to spur innovation and create demand, while bringing down the price of the new AC units (***USAID, 2017***). Through this programme, customers of BSES Rajdhani Power Limited in Delhi have purchased air conditioners that consume 20 per cent less energy than the best available five-star units, making them the equivalent of seven-star air conditioners, for a 30 per cent lower cost than the market price of five-star units (***The Economic Times, 2019***).

Case study:

EFFICIENCY FOR ACCESS RESEARCH AND DEVELOPMENT FUND

Launched in November 2018, the ***Efficiency for Access Research and Development Fund***, with anchor funding from UKaid, aims to accelerate innovation in off-grid and weak grid appliance technologies. Specifically, it is investing funding into R&D projects to accelerate the availability, affordability, efficiency and performance of a range of low energy inclusive appliances. The Fund also works with the wider appliance ecosystem to accelerate R&D activity in the sector to support technology innovation, as well as raising awareness with donors. Over 45 organizations have been supported through the Fund.

In 2019, the Fund launched a ***cooling call***, with a particular focus on refrigeration, cold chain and fan technologies. To date, the Fund has supported nine projects focused on refrigeration and a further seven on cold chain focused projects. The ***first refrigeration*** R&D project concluded in December 2020.

UN CLIMATE CHANGE CONFERENCE UK 2021
IN PARTNERSHIP WITH ITALY

MAKING IT HAPPEN

ACTING ON COOLING BEYOND A GREEN RECOVERY, TOWARDS NET-ZERO EMISSIONS COOLING FOR ALL IN 2050

The efforts needed to make efficient, climate-friendly cooling for all a reality cannot stop with recovery packages. Long-term planning is needed beyond shovel-ready interventions in the likes of the ones described in this brief. More structural and systematic solutions need to be rolled out, including holistic cooling assessments and policy mapping through ***National Cooling Action Plans***, the development of deep decarbonization strategies, structural technology investments, such as district cooling networks and efficient and low-carbon and renewable energy systems, and the set-up of effective policy standards and market transformation mechanisms.

Countries can use their NDCs and their long-term strategies to commit to comprehensive action, and track progress through the 2023 ***Global Stocktake*** of the Paris Agreement's implementation. Long-term efforts can align to the newly developed ***Pathway to Zero*** Greenhouse Gas Emissions for Cooling as a collaboration between K-CEP, Cool Coalition, Carbon Trust and COP26 High-Level Champions. The Pathway outlines a vision and associated milestones to get to net-zero cooling for all, simultaneously reducing up to 260 GtCO2e and enhancing access to much needed cooling services by 2050. The private sector can align its efforts with the challenge put forward by the ***Race to Zero*** and the ***Race to Zero Breakthroughs***, which call for 20 per cent of global AC manufacturers to bring to market affordable residential AC units that have 5x lower climate impact than today's units by 2025.

At the global level, international cooperation remains fundamental to accelerate the transition to sustainable cooling for all. Continued collaboration at the global scale and across sectors is essential to deliver fully on the climate mitigation potential of the transition to low-GWP and energy-efficient cooling. In addition to ratifying the Kigali Amendment, countries can join one of many international initiatives to accelerate action. Initiatives include the ***Cool Coalition*** – which offers a platform for governments, private sector, and civil society to promote and act collectively on the transition to efficient, climate-friendly cooling – and the ***Efficient Cooling Initiative*** of the Climate and Clean Air Coalition, which brings together governments, intergovernmental organizations, and the private sector to build high-level political leadership and facilitate collaboration to enhance energy efficiency in the cooling sector. Countries can commit to action by joining the 2019 ***Rome Declaration*** On The Contribution Of The Montreal Protocol To A Sustainable Cold Chain To Reduce Food Losses and the ***Biarritz Pledge*** for Fast Action on Efficient Cooling, which aims at coordinating efforts to improve the energy efficiency of cooling equipment in parallel to the phase down of HFCs.

For accelerated action on cooling energy efficiency, countries are called to participate to the ***Super-Efficient Equipment and Appliance Deployment*** (SEAD) initiative of the Clean Energy Ministerial, which aims at making it easier for governments and the private sector to adopt cost-effective appliance efficiency policies and programmes. To enhance regional and global coordination on product efficiency and access, the UK and IEA launched a Product Efficiency Call to Action as part of the COP26 Energy Transition Campaign, behind which countries can join forces to enhance their cooling commitments.

CONCLUSION

The COVID-19 pandemic and subsequent economic crisis represents a dramatic shock to the global economy. How we choose to recover is likely to affect humanity's progress on climate change for decades to come. The biggest near-term driver of impact on whether we put our societies on a path to long-term low-carbon, resilient, and equitable development is through fiscal stimulus and recovery packages and plans, as well as through the reorientation and redesign of critical policy pieces.

The fiscal measures that governments are putting in place now and in the next 6 to 18 months, when well-planned and designed, have the ability to significantly decouple economic growth from GHG emissions. This while mitigating existing and rapidly exacerbating inequalities as a result of the pandemic, as well as increasing the resilience of our economies to external shocks (***Hepburn et al., 2020***). Research from the ***C40 Global Mayors COVID-19 Recovery Task Force*** further confirms that stimulus funding can play a mayor role in supporting a green and just recovery, with the potential to keep global warming below 1.5°C , while reducing air pollution by as much as 29 per cent in this decade compared to a return to business-as-usual (***C40, 2020***). However, the ***Green Stimulus Index (GSI)***[5] developed by Vivid Economics shows us that only a fraction of fiscal stimulus packages so far has been directed towards "green" measures, (***Gulati et al., 2020***).

The COVID-19 pandemic and the resulting lockdowns have both increased the need for and importance of (access to) cooling. However, a poorly managed, rapid increase in cooling capacity can lock countries, companies, and households into an expensive, energy-inefficient and high emission future. The lack of affordable, climate-friendly and efficient access-to-cooling solutions also increases the gap between the haves and the have-nots. Moreover, the lack of proper cold chain solutions puts the effective and widespread delivery of COVID-19 vaccines at risk.

Climate-friendly and efficient cooling, while decarbonizing its energy supply, provides a massive opportunity to put us on a path to Build Back Greener. By encouraging the use of climate-friendly refrigerants in place of high global warming HFCs, the Kigali Amendment alone will avoid up to 0.4°C of global warming by 2100 (and potentially the double with energy efficiency improvement), as well as improve indoor comfort, labour productivity, and food security across supply chains and at consumer level for the at least 1 billion people who lack access to climate-friendly and efficient cooling. This is even more important in light of the up to 150 million additional people that are being pushed into extreme poverty due to the COVID-19 pandemic. Adopting the 'shovel-ready' recommendations in this brief provides governments with an impactful first step to set their countries up for a green and prosperous recovery.

[1] Urban Heat Island (UHI) effect is the term given to localized higher temperatures that are experienced in urban environments compared with the temperatures of surrounding green spaces

*[2] PATH is a nonprofit organization working to accelerate health equity. They advise and partner with public institutions, businesses, grassroots groups, and investors to solve the world's most pressing health challenges. Learn more at: **https://www.path.org***

[3] An entity that is established by government and functions as an ESCO for implementing projects in public facilities and supports capacity building and project development activities of existing private ESCOs

[4] RD&D refers to Research, Development & Deployment

[5] The Green Stimulus Index (GSI) provides a method to gauge the current impact of the COVID-19 responses, to track countries' progress over time, and to identify and recommend measures for improving the greenness of those responses. It assesses the effectiveness of the COVID-19 stimulus efforts in ensuring an economic recovery that takes advantage of sustainable growth opportunities. This work was undertaken by the Finance for Biodiversity Initiative (F4B) and funded by the MAVA Foundation. Available at: https://www.vivideconomics.com/wp-content/uploads/2020/06/200605-Green-Stimulus-Index-1.pdf

SUSTAINABLE COOLING IN SUPPORT OF A RESILIENT AND CLIMATE-PROOF RECOVERY

CLIMATE & CLEAN AIR COALITION
TO REDUCE SHORT-LIVED CLIMATE POLLUTANTS

Cool Coalition

UN environment programme