Guidance on Incorporating Efficient, Clean Cooling into the Enhancement of Nationally Determined Contributions

KIGALI
COOLING EFFICIENCY PROGRAM

Contents

Glossary

Cold chain is a temperature-controlled supply chain, consisting of a sequence of refrigerated production, storage, and distribution activities, along with associated equipment and logistics, which maintain a desired low temperature range. It is used to preserve and to extend and ensure the shelf life of products.

Cooling efficiency refers to the energy efficiency of cooling technology. It can be achieved through equipment (such as motor, inverter, and compressor) performance but also through refrigerant efficiency. The energy efficiency gains from equipment efficiency are generally larger than from refrigerant efficiency. Efficient cooling can also be achieved through thermal comfort solutions, such as improved building and urban design, behavior change, and management of peak energy demand.

Efficient, clean cooling is cooling which is energy efficient, uses low or no-GWP (climate-friendly) refrigerants, and maximizes the use of renewable energy.

F-gases, or fluorinated gases are used as refrigerants in cooling technologies such as air conditioners and fridges. The most common F-gas refrigerants are hydrofluorocarbons (HFCs), which are alternatives to ozone depleting substances. While not ozone depleting substances themselves, HFCs are greenhouse gases which can have high or very high global warming potentials (GWPs), ranging from about 12 to 14,800.**

Global Warming Potential (GWP) is a measure of the warming impact that a gas has in the atmosphere relative to the impact of CO2, which has a GWP of 1.

Kigali Amendment to the Montreal Protocol represents an agreement to phase down global production and consumption of HFCs. The agreement entered into force in January 2019.*

Minimum Energy Performance Standards (MEPS) are standards which contain energy efficiency performance requirements for an appliance category, which effectively limits the maximum amount of energy that may be consumed by those appliances.†

National Cooling Plans (NCPs), also known as cooling action plans, or roadmaps, are national plans for a country's cooling sector. NCPs integrate consideration of commitments under the Montreal Protocol and Kigali Amendment, as well as energy efficiency and access to cooling as a development priority.

Refrigerants are chemicals which are used in cooling technologies such as air conditioners and refrigerators. The vast majority of those refrigerants in use today are human-made gases with significant global warming potential, for example hydrofluorocarbons (HFCs).†

Short lived climate pollutants (SCLPs), such as Hydrofluorocarbons (HFCs), are powerful climate forcers that remain in the atmosphere for a much shorter period of time than carbon dioxide (CO2), yet their potential to warm the atmosphere can be many times greater.‡

* Definitions taken from SEforALL's report: Chilling Prospects: Providing sustainable cooling for all
** Definition draws on OzonAction Fact Sheet: The Kigali Amendment to the Montreal Protocol: HFC Phase-down
† Definitions draw on IEA's report: The Future of Cooling - Opportunities for energy efficient air conditioning
‡ Definition taken from Climate and Clean Air Coalition website

Introduction

AN OPPORTUNITY TO HARNESS THE BENEFITS OF EFFICIENT, CLEAN COOLING

The world is facing an unprecedented growth in cooling demand, which poses a massive threat to development and a stable climate. A global effort is underway to ensure that the growing need for cooling is met with energy efficient and climate-friendly technologies. At least 27 countries have developed or are working on national cooling plans, while industry is responding with more sustainable, climate friendly technologies, cooling services, and innovative space cooling approaches that are less dependent on energy-intensive electrical cooling.

Getting ahead of the cooling demand curve will have major climate and development benefits. Early movers can claim those benefits in their upcoming climate commitments and can inspire others with concrete examples. In addition countries can look forward to enhanced productivity in workplaces and schools, improved health outcomes during heatwaves, reduced food waste, enhanced energy security and grid resilience among other benefits.

ABOUT THIS GUIDANCE NOTE

Since this is a new area, not every government speaks the same "cooling" language or calculates these benefits in the same way. To overcome that communication barrier, K-CEP has prepared a guidance document to help countries bank the maximum climate benefits from their efficient, clean cooling strategies. We hope that it is helpful and we welcome comments and feedback since this is a dynamic area that will be shaped by substantive actions on the ground.

This guidance note is intended to support policymakers in considering the role of efficient, clean cooling in their Nationally Determined Contributions (NDCs) ahead of the 2020 round of NDC revisions. Efficient, clean cooling is an area where mitigation potential is not yet fully realized, which could be used to enhance the overall mitigation ambition of NDCs, and/or to strengthen specific implementation strategies. Many countries have already included cooling (such as space cooling and refrigeration) in their original NDCs, and this note is intended to support those countries to strengthen these existing cooling actions, as well as to support countries that wish to include efficient, clean cooling for the first time.

The Paris Climate Agreement requires all Parties to present their national mitigation plans through NDCs, and that these should be strengthened in the future. Every 5 years, the UNFCCC conducts a global stocktake to assess the collective progress towards achieving the purpose of the Paris agreement.[1] The guiding principles for NDC revisions are progression and highest possible ambition.[2]

The UNFCCC requests all Parties to submit the next round of NDCs (intended to be new NDCs or updated NDCs) by 2020 and every five years thereafter (e.g. by 2020, 2025, 2030).[3] 2020 therefore presents the first opportunity for parties who have not yet done so in their initial NDCs to integrate the energy efficiency of cooling – referred to as "cooling efficiency" –into their NDCs in order to strengthen their implementation plans and to consider raising their mitigation ambition in an effective way. These cooling efficiency measures can go hand in hand with the F-gas phase down (see Section 2 for further explanation). Given work already underway to help countries integrate F-gas mitigation in NDCs (see for example WRI's working paper *Strengthening Nationally Determined Contributions to Catalyze*

1 https://unfccc.int/resource/bigpicture/

2 https://unfccc.int/files/focus/application/pdf/ndc_cycle_webinar2.pdf

3 https://unfccc.int/process/the-paris-agreement/nationally-determined-contributions/ndc-registry#eq-2

Actions that Reduce Short-Lived Climate Pollutants)[4], this paper focuses primarily on cooling efficiency, though some mentions of F-gas mitigation measures are also included. The broader term "efficient, clean cooling" is used to encapsulate both cooling efficiency and F-gas management.

Given the findings of the Intergovernmental Panel on Climate Change (IPCC) Special Report on Global Warming of 1.5 °C on the brief window of time available to limit global warming to 1.5 °C,[5] the 2020 round of NDCs is a particularly timely opportunity for as many countries as possible to show moral leadership and climate ambition.

There is no requirement from the UNFCCC that NDCs need to include any particular level of ambition, or information on particular measures or sectors. The recommendations in this document set out best practice, and the associated benefits, when it comes to considering cooling efficiency in revised NDCs.

The importance of efficient, clean cooling for national climate strategies

THE COOLING SECTOR IS A POTENTIAL TICKING CLIMATE "BOMB"

Electrical cooling, for example space cooling by air-conditioning, and cooling of products such as food or medicines by refrigeration, is highly emissions intensive. There are both direct emissions from the refrigerant chemicals used, and indirect emissions from the electricity needed to run cooling appliances and systems (see Figure 1).

Direct emissions: The majority of current cooling technologies, such as air-conditioning and refrigeration, rely on human-made F-gases as the refrigerant, some of which are almost 10,000 times more potent than carbon dioxide in causing global warming. Left unchecked, F-gases could account for nearly 20 percent of climate pollution by 2050,[6] which is why the Kigali Amendment to the Montreal Protocol, a global agreement to phase down HFCs (one of the super-pollutant F-gases) is such an important and historic agreement.

Indirect emissions: Cooling also uses huge amounts of electricity. This energy is often derived from high-carbon fossil fuels, and is therefore a critical carbon emissions reduction challenge, particularly as the demand for cooling increases.

According to the IEA's *Future of Cooling* report, the energy used for space cooling has more than tripled since 1990, while running the 1.6 billion ACs in use today requires 2.5 times the total electricity consumed by Africa. IEA projects that the energy demand for space cooling will triple by 2050.[7]

Electricity infrastructure is squeezed by cooling demand, as increased AC loads particularly influence peaks in demand (AC users tend to turn them on/up at the same time when it gets hot) (see Figure 2).

Improving the efficiency of appliances is critical, as most consumers are buying ACs with average efficiencies less than half of what is typically available on the shelf for purchase.[8]

4 Ross, K., T. Damassa, E. Northrop, A. Light, D. Waskow, T. Fransen, and A. Tankou. 2018. "Strengthening Nationally Determined Contributions to Catalyze Actions That Reduce Short-Lived Climate Pollutants. Working Paper. Washington, DC: World Resources Institute. Available online at www.wri.org/publications/reducing-SLCPs

5 https://www.ipcc.ch/sr15/

6 http://wedocs.unep.org/bitstream/handle/20.500.11822/8014/-HFCs_%20A%20Critical%20Link%20in%20Protecting%20%20Climate%20and%20the%20Ozone%20Layer-20111072.pdf?sequence=3&isAllowed=y

7 https://webstore.iea.org/the-future-of-cooling

8 IEA, ibid.

Figure 1 — Breaking down the climate impact of the cooling sector

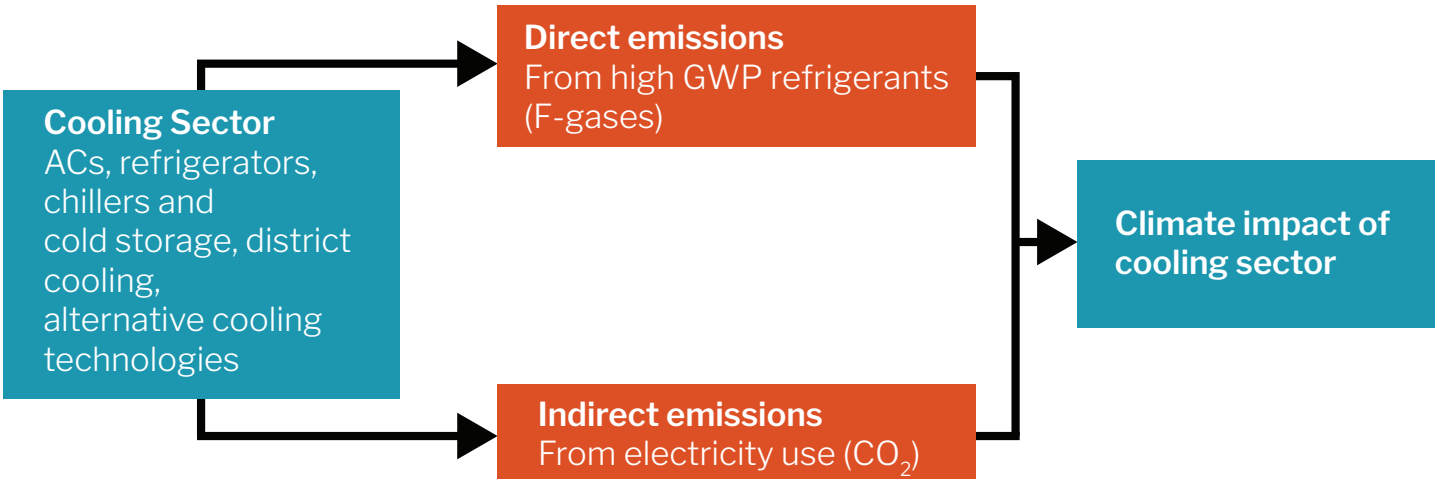
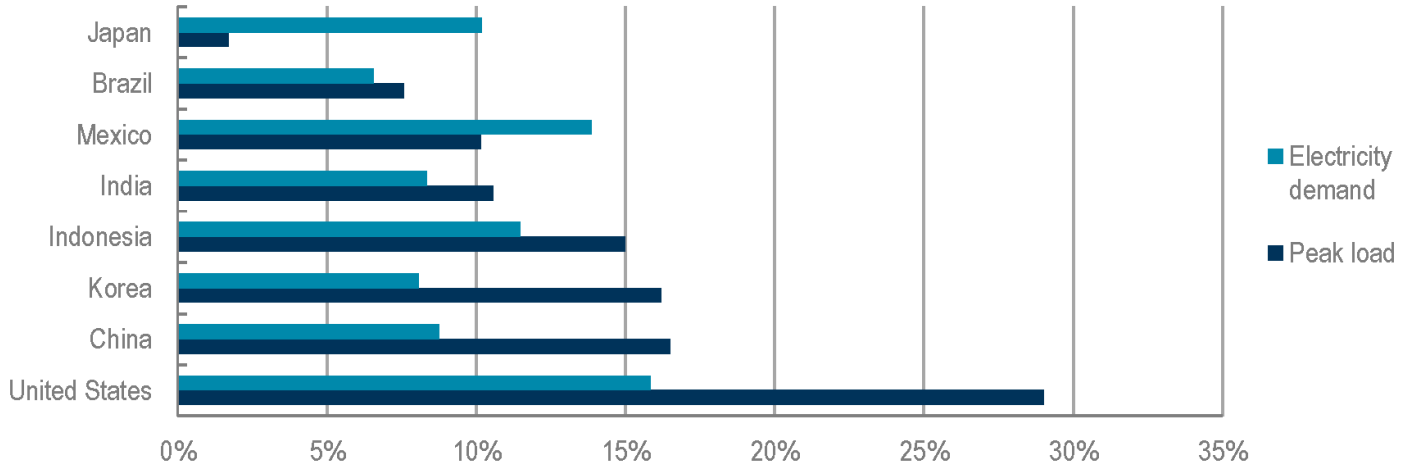


Figure 2 — Share of cooling in peak load and total electricity demand by country/region, 2016



Source: IEA, The Future of Cooling, 2018. Note: The share of cooling in national peak load has been calculated for the moment in the year at which the overall peak in total electricity demand occurs; the contribution of cooling to local peak load in towns and cities can be much higher. IEA estimates that space cooling accounted for around 10% total energy demand on average. In many countries, peak load from AC is much higher than overall energy demand from AC, posing a costly challenge to grid infrastructure which must meet brief, but steep peak demands.

COOLING IS AN INTEGRAL PART OF ADAPTING TO CLIMATE IMPACTS AND ENSURING DEVELOPMENT

Human-caused climate change is increasing global mean temperatures as well as temperature variability, in turn increasing the frequency and intensity of extreme heatwaves.

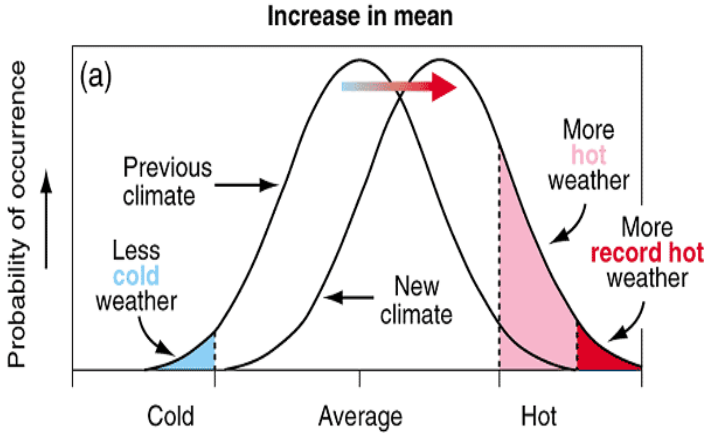
The increase in hot and record-hot weather is disproportionately worse in developing countries, which tend to have more annual cooling degree days (CDD), or the number of degrees that a day's average temperature is above 18 ˚C, and people begin to use air conditioning to cool buildings. The 30 hottest cities in the world can be found in developing countries. These countries share the greatest burden when it comes to heat stress as a result of their existing climatic conditions and the onset of climate change, and therefore have the needs around access to cooling.

Cooling is often overlooked as an urgent development issue. As the SEforALL report *Chilling Prospects* highlighted, more than 1 billion people lack access to energy and face heat related risks.[9] Yet only 0.1 percent of total Overseas Development Assistance is directed to cooling solutions.[10] The economic and social costs of not ensuring sustainable and affordable cooling access for all are poorly understood and not widely disseminated. As a result, countries may be heading towards costly, high-carbon, energy-inefficient cooling pathways by default.

EFFICIENT, CLEAN COOLING AS A PATHWAY FOR COUNTRIES TO MEET THEIR MITIGATION GOALS

As explained above, radically improving the efficiency of cooling appliances, in addition to working towards low-GWP refrigerants, has significant mitigation benefits, as well as multiple development co-benefits. It is therefore valuable for countries to include efficient, clean cooling strategies in revised NDCs as a means to meet mitigation and adaptation climate goals.

Figure 3 — Schematic showing the effect on extreme temperatures when both the mean and variance increase for a normal distribution of temperature.



Source: IPCC Third Assessment Report: Climate Change 2001. Working Group I: The Scientific Basis. An increase in global average temperatures means a shift of the temperature bell curve towards hotter temperatures (the curve shows how likely different temperatures are to occur). This entails less probability of the coldest weather, a higher average temperature, and an increase in hot weather and record hot weather (heat waves).

Measures to ensure efficient, clean cooling, such as national minimum energy performance standards (MEPS) for air conditioning or refrigerator appliances, or national cooling plans, can be included in NDCs as a way to strengthen implementation plans. They can add more specificity on a sectoral level as to how a country will plan to achieve their economy-wide decarbonization targets. Where new and more ambitious measures are planned, (such as raising the ambition of MEPS) they may play a part in raising or enhancing the overall mitigation ambition as set out in NDCs, particularly if MEPS were included in the existing NDC. Further information on such measures is set out in the next section.

Options for inclusion of cooling in NDCs

As previously mentioned, cooling has two climate aspects – direct emissions from F-gases, and indirect emissions from carbon emissions associated with electricity use. This means that when considering where to place cooling measures in NDCs, there are two main approaches. The first is to split out the impacts of cooling by greenhouse gas (GHG). The measures tackling the refrigerant transition (phase down of F-gases) would fall under a section on short-lived climate pollutants (SLCPs). Cooling efficiency measures could then be included in a section on carbon dioxide. WRI's working paper *Strengthening Nationally Determined Contributions to Catalyze Actions that Reduce Short-Lived Climate Pollutants* provides options for ensuring that targets, policies and actions on SLCPs are adequately considered in NDCs and reflected appropriately.

However, this approach of splitting out measures to reduce the climate impact of cooling by GHG does not take into account the fact that several measures will target both the refrigerant transition and energy efficiency at the same

9 https://www.seforall.org/sites/default/files/SEforALL_CoolingForAll-Report.pdf

10 http://conf.montreal-protocol.org/meeting/mop/mop30/presession/Background-Documents/TEAP_DecisionXXIX-10_Task_Force_EE_September2018.pdf

time. For example, the retooling of manufacturing lines can address both the F-gas transition as well as efficiency improvements, or initiatives to improve maintenance of appliance both reduce refrigerant leakage and have major operating efficiency benefits.

Therefore another, more strongly recommended, option is to take a sectoral approach. Cooling efficiency is relevant to a range of sectors of varying scales. The following table sets out examples of relevant sectors, along with example cooling efficiency initiatives which could be included under the section of the NDC for that sector. Most of these initiatives will have associated F-gas transition benefits as well. The first step countries undertake should be considering what existing commitments in the sectors below intersect with efficient, clean cooling. Then they should consider what goals are on the table, and what the stretch goals would be (perhaps conditional on finance). Further details and links to external resources are provided in Section 4 - Further information on content suggestions, and Section 5 - Examples of efficient, clean cooling in existing NDCs.

Table 1 — Example clean, efficient cooling initiatives by sector, along with example content (indicative, not from real NDCs) and co-benefits

Economy-wide	• High level F-gas transition or cooling efficiency policies are included into economy-wide GHG mitigation targets • National Cooling Plan	• X GtCO2e additional mitigation benefit from F-gas phasedown in compliance with the Kigali Amendment, and from MEPS for room ACs and refrigerators policies	• Air quality • Economy and jobs • Energy security and grid reliability
Agriculture and food	• Cold chain efficiency	• 50% increase in capacity of renewably powered agricultural cold storage, including off-grid renewables • 50% of supermarket cooling systems to use low-GWP, highly efficient technology, coupled with best practice display chiller design (e.g. doors on cabinets)	• Reduced food waste (and associated methane emissions) • Reduced hunger and food poverty
Health (may be part of other sectors	• Vaccine cold chain efficiency • Cooling of medicines, blood • Cooling of hospital buildings • Bulk procurement programs	• 50% of all vaccines cooled using efficient, low-GWP technology, achieved by replacement or roll out initiatives	• Improved health outcomes, infant mortality reduced • Reduced waste of pharmaceuticals • Energy and cost savings
Transport	• Cooling in mass transit • Cold chain refrigerated vehicles	• 60% of new fleet of urban mass transit cooled using efficient, low-GWP mobile AC • Incentive mechanism for mobile AC efficiency linked to miles per gallon usage [11]	• Improved thermal comfort and productivity (commuters) • Reduced food waste (and associated methane emissions) • Reduced hunger and food poverty

11 https://www.theicct.org/publications/mobile-air-conditioning-cbe-20190308

Cities and buildingsgreen	• Passive cooling technologies and design such as cool roofs, ventilation and insulation • Urban planning and greening • District cooling • Cooling as a service models (e.g. leasing schemes) • Bulk procurement programs (e.g. supermarkets, hotels) • Behavioral approaches, (e.g. consumer campaigns) • Thermal energy storage and other demand side management technologies	• Policies to produce well-designed, adaptive urban environments, including allocating 60% more green space in urban areas • Building standards or codes for new buildings and retrofits to include passive cooling design such as cool roofs (solar reflective coatings) • Join UNE's District Energy in Cities Initiative and launch district cooling pilot in X cities by 2025. • Behavior change campaigns to promote 25˚C set point for residential and commercial AC	• Save money for the consumer • Aesthetics and wellbeing • Vegetation as carbon sink • Workplaces and schools: increased productivity and educational benefits
Industry	• Manufacturing sector efforts to improve compressor efficiency – including R&D support and demonstration funds • Servicing and maintenance initiatives • Data center cooling	• Policies to raise both the floor and ceiling of efficiency of manufactured cooling appliances, for example MEPS and X% of highest-efficiency product lines being affordable rather than luxury • 50% of all industrial cooling to be renewably powered and high efficiency	• Can be combined with industrial conversion for the F-gas transition • R&D promoted • Increased lifespan of products so reduced embodied emissions • Increased productivity
Power supply	• Systems for energy efficiency schemes to be able to bid into capacity markets • Support for demand side management and demand response programs	• Energy efficiency schemes, for example implemented via energy service companies (ESCOs), linked to the electric grid	• Grid stability and reduced blackouts or brownouts • Lower costs of energy service provision
Energy efficiency (appliance specific)	• Minimum energy performance standards (MEPS), with long-term plan or goal for enhancement • Compliance and spot testing • Labeling • Market measures and financial mechanisms (incentives, rebates, on-bill financing schemes etc.) • Import standards	• MEPS for ACs and refrigerators passed at 20% improved efficiency with intention to ratchet over time, in conjunction with labeling and compliance schemes • Energy standards passed alongside the promotion of low-GWP refrigerants (many efficient units use low-GWP refrigerants as default) • Ban on import of second-hand appliances • Alignment with United for Efficiency's model regulations for domestic refrigerators and residential air conditioners, especially for countries without existing or with out-of-date energy performance standards.	• Consumer trust • Affordability and access to cooling • Climate benefits in export markets

Further information on content suggestions

This section provides further content on some of the clean, efficient cooling actions included in Table 1 above which countries should consider for inclusion in their revised NDCs. Initiatives included in an NDC should be able to be described and reported on as part of the enhanced transparency framework under the Paris Agreement.[12] This means

12 https://unfccc.int/process-and-meetings/transparency-and-reporting/the-big-picture/what-is-transparency-and-reporting

cooling efficiency initiatives should be should be brought under the umbrella of a policy, plan or set of investments (if they are not already) in order to be integrated into the NDC. National cooling plans are a coherent way to bring together multiple such initiatives.

It is recommended that the agency drafting the NDC update systematically conducts outreach to relevant counterpart ministries (such as Energy, Finance or Industry) in order to identify which of the below initiatives are currently undertaken or planned and so might be incorporated into the NDC.

Undertaking the exercise of inter-ministerial coordination across ministries can have benefits in drafting the specific measures to be included in the revised NDC and in promoting more effective implementation of the measures identified.

POLICIES, STANDARDS AND PROGRAMS

- **Minimum energy performance standards (MEPS)**: National or regional level MEPS for air conditioning or refrigerator appliances are usually set by the energy ministry or the ministry with control over national adoption and use of standards (e.g. economy ministry). By setting an efficiency floor, ambitious MEPS form the core of an effective national strategy on cooling efficiency. MEPS are also an important tool for countries to avoid unwanted environmental dumping, alongside import standards (see below).[13] Countries which already have MEPS could add a timeline and goal for enhancing them. A good example of this is Japan's Top Runner Program, where time-bound energy efficiency targets for appliances are set based on the most efficient model available (the "Top Runner").[14] Model regulations, for example those developed by United for Efficiency, set out a preferred baseline level of ambition.
- **Labels**: energy and environmental performance labels allow consumers to identify higher performing products, and can be paired with procurement and incentive programs, or inform the specifications of buyers' clubs. The higher tiers from United for Efficiency's model regulations are good target levels for the specifications of procurement or incentive programs.
- **Compliance and testing**: Compliance and testing programs help to safeguard against energy inefficient appliances that do not comply with national energy performance standards from entering the market. These programs may require coordination between the ministry setting MEPS and national standardization bodies. This addresses products manufactured in country.
- **Import standards**: For products being imported, this is a key factor to avoid sub-standard products entering the market. Environmental dumping of sub-standard appliances by manufacturing countries (which may have higher domestic standards) must be safeguarded against. Relevant regional trade alliances should also be considered. Some trade areas share testing facilities or have common standards.

NATIONAL COOLING PLANS

The 2016 Kigali Amendment to the Montreal Protocol mandates an F-gas phase-down, which entails a freeze from 2024 and phase-down schedule from 2029 for the fast phase-down developing countries (Article 5, Group 1 in Kigali Amendment terminology). Therefore the climate benefit from the F-gas transition will accrue reasonably close to the 2030 timeframe of NDC targets. However, many developing countries have not included F-gas phasedown actions or Kigali Amendment commitments in their initial NDCs, and it is worthwhile for them to include their plans for

13 https://delpf.law.duke.edu/article/defining-the-legal-and-policy-framework-to-stop-the-dumping-of-environmentally-harmful-products-andersen-vol29-iss1/

14 https://www.iea.org/policiesandmeasures/pams/japan/name-21573-en.php

compliance in their NDC revision.[15] All countries, whether they included action on F-gases in their initial NDC or not, should consider including cooling efficiency measures in this round.

National cooling plans (NCPs) and roadmaps can integrate the Montreal Protocol mandated F-gas transition plans with plans to improve cooling efficiency and access to cooling. They can be standalone or integrated into existing climate, energy or development plans. For specific examples, see China's Green Cooling Action Plan or India's Cooling Action Plan.[16,17] General information can be found in the K-CEP brief Principles for National Cooling Plans.[18] NCP content such as roadmaps and timetables to adopt enhanced MEPS for cooling appliances, existing energy policies and refrigerant transition plans (HPMPs and future HFC phasedown plans), can be referenced in NDCs. Committing to developing a national cooling plan, which is integrated into the NDC, would be a major and positive step toward a country integrating considerations on cooling into their national development and climate priorities, while emphasizing their commitment to uphold their obligations under the Montreal Protocol. National cooling plans can also include paired industrial conversion work, where retooling of appliance manufacturing lines to comply with the refrigerant transition (often funded by the Multilateral Fund of the Montreal Protocol) is used as an opportunity to also redesign manufacturing for improved efficiency (e.g. compressor efficiency).

COLD CHAINS

Measures to provide efficient, clean cold chains are important for reducing food loss and waste, as well as losses in other products which are temperature sensitive (notably vaccines). This area has particular development co-benefits. Solving this issue can be logistically challenging and often involves collaboration between agriculture departments, agribusiness and the cooling industry, or for health cold chain, different health agencies and actors.[19] Logistics management such as digital connectivity may be used to ensure that cooling infrastructure is sized to need. Every stage of the food cold chain which is mechanically cooled should be efficient and use low-GWP refrigerants – from cold warehouses/community storage for farmers or fishers, to refrigerated transport, to warehouses and supermarket cooling. Demand reduction measures should also be considered, such as food packaging, thermal energy storage, and adjusting temperature controls to product needs. For vaccines, efficient and low-GWP refrigerators should be rolled out. Where possible, cold storage should be renewably powered, and freight electrified and renewably powered. The Global Cold Chain Alliance offers advice and a range of best practice guides.[20]

ALTERNATIVE COOLING TECHNOLOGIES AND REDUCING THE NEED FOR COOLING

In cities in particular, there are opportunities to reduce the need for refrigerant-based cooling in the first place. Measures to minimize the urban heat-island effect, such as cool roofs and pavements, and greening of urban spaces, can reduce urban temperatures by up to 4 °C. This reduces the number of cooling appliances needed, as well as reducing the amount of time they need to be running, saving indirect emissions from electricity use. For further information, see C40's *Cool Cities Good Practice Guide*.[21] District cooling can provide efficiency gains from scale and in some cases can tap into water sources to provide F-gas free cooling. Useful case studies are available at UN

15 For more information on whether Kigali Amendment implementation could be considered part of business as usual mitigation, or would count as an additional emissions reduction, see the 2017 Emissions Gap Report (UN Environment), Section 3.3.3 – Impact of the Kigali Amendment. https://wedocs.unep.org/bitstream/handle/20.500.11822/22070/EGR_2017.pdf?sequence=1&isAllowed=y

16 http://www.ndrc.gov.cn/zcfb/zcfbtz/201906/t20190614_938745.html

17 http://ozonecell.in/wp-content/uploads/2019/03/INDIA-COOLING-ACTION-PLAN-e-circulation-version080319.pdf

18 https://www.k-cep.org/wp-content/uploads/2019/01/Principles-for-National-Cooling-Plans.pdf

19 https://www.seforall.org/sites/default/files/SEforALL_CoolingForAll-Report.pdf

20 https://www.gcca.org/cold-chain-standardsregulations

21 https://c40-production-images.s3.amazonaws.com/good_practice_briefings/images/4_C40_GPG_CCN.original.pdf?1456788797

Environment's District Energy in Cities Initiative.[22]

Energy efficient building codes and building retrofit plans are a key policy tool for minimizing cooling loads. These can include requirements for insulation, ventilation and passive cooling designs such as highly reflective cool roof coatings.

Demand response systems such as smart thermostats reduce electricity demand and there are even battery storage technologies which can interact with the electric grid to shift load peaks from AC. Thermal energy storage is another way to shift load peaks, where cold is stored at low-demand times (e.g. at night) and used to offset AC needs during the heat of the day. These systems can be paired with distributed renewables such as roof top solar.

Alternatives such as ice-based refrigerators, liquid air technology, fans and some traditional techniques can also avoid the need for electrical, refrigerant-based cooling. This is particularly important for remote, off-grid communities.[23] Alternative technologies may benefit from demonstration or pilot projects which can ensure that communities gain knowledge about the technology and that it delivers multiple benefits to communities.

Promoting a shift in behavior change is a key part of cooling demand reduction, both at individual and community or business level. This includes defaults (such as shifting default set points for room AC), and campaigns, such as Japan's annual Cool Biz program to encourage short sleeved attire for office workers during the summer.[24]

MARKET MEASURES AND INCENTIVES

Financial mechanisms increase the market share of efficient, clean cooling technologies, displacing the purchase of inefficient and climate-polluting appliances and so helping to avoid emissions. By making efficient appliances more widely affordable, they also increase access to cooling and provide the associated development benefits. Examples of financial mechanisms include: on-bill financing schemes, consumer rebate programs, incentives to retire old equipment, demonstration funds, cooling as a service models (including leasing schemes),[25] bulk procurement programs (including public sector procurement standards and requirements), and shared savings energy performance contract models.

For further information, United for Efficiency (U4E)'s *Policy Guides Accelerating the Global Adoption of Climate-friendly and Energy-efficient Refrigerators* and *Accelerating the Global Adoption of Climate-friendly and Energy-efficient Air Conditioners* both contain chapters on "Finance and Financial Delivery Mechanisms."[26,27] See also K-CEP's *Cooling Efficiency Finance Case Studies*.[28]

Examples of efficient, clean cooling in existing NDCs

Some developing countries have included well thought-out energy efficiency targets and/or F-gas reduction measures in their initial round of NDCs. This section provides some excerpts as examples of what integrating cooling efficiency and the F-gas transition into an NDC might look like.

22 http://www.districtenergyinitiative.org/

23 Ibid.

24 https://www.eesi.org/articles/view/the-japanese-cool-biz-campaign-increasing-comfort-in-the-workplace

25 https://www.k-cep.org/wp-content/uploads/2018/07/Cooling-as-a-service-Knowledge-brief-6.7.2018_Final_online_v1.pdf

26 https://united4efficiency.org/wp-content/uploads/2017/11/U4E-RefrigerationGuide-201801-Final-R1-1.pdf

27 https://united4efficiency.org/wp-content/uploads/2017/06/U4E-ACGuide-201705-Final.pdf

28 https://www.k-cep.org/wp-content/uploads/2018/04/Cooling-efficiency-financing-case-studies_final-edited03.pdf

Ghana's NDC has one of the most concrete examples of including F-gas reduction in an NDC, referencing its Green Africa Cooling Initiative on abatement of fluorinated-gases (HFC-22 and HFC-410) from stationery air conditioners. The NDC does not specifically mention cooling or appliance energy efficiency.

INDC POLICY ACTIONS	PROGRAMME OF ACTION	SUPPORTING NATIONAL POLICY & MEASURES	STATUS	INVESTMENT NEEDS	CO-BENEFITS
Green Cooling Africa Initiative	Abatement of fluorinated-gases (HFC-22 and HFC-410) from stationery air-conditioners	• National ODS phase-out programme • Management of ODS and product regulation, 2005 (LI. 1812)	Conditional	$ 0.3 mil	Phase-out ozone depleting substances

Palau's NDC reports a clear target of a 35% economy-wide energy efficiency improvement by 2025 (compared to 2005) and associated actions to meet it, alongside a 2025 for the share of renewable energy. Both are clearly linked to its overall and energy sector emissions reduction target. Palau also reports the impact of energy efficiency measures to date. The NDC splits its energy efficiency work into current and future actions – which encompass efficient, clean cooling – and sets out a broad spectrum of interventions for energy efficiency in the buildings.

PALAU'S NDC REPORTS A CLEAR TARGET OF A 35% ECONOMY-WIDE ENERGY EFFICIENCY IMPROVEMENT BY 2025

"Current [...] energy efficiency policies and measures include:

- A Home Energy Efficiency Program at the Palau National Development Bank
- Prepaid metering at Palau Public Utilities Corporation
- Distribution of CFL light bulbs
- Government building retrofits, and,
- A pilot Energy Audit program for large commercial buildings.

To implement the Energy Efficiency target, Palau will [in future]:

- Increase the Energy Retrofit Program
- Institute a Tropical Energy Efficiency Building Code
- Adopt the Energy Star Appliance Standard
- Implement an Energy Labelling Scheme
- Significantly expand our Cool Roof Program
- Expand Energy Audit program to include all government and non-government buildings
- Enhance the Building Managers Working Group; and
- Improve Wastewater Infrastructure.

Uruguay captures the main features of its existing Energy Efficiency Action Plan in its NDC. Air-conditioning efficiency is situated within a range of actions to reduce energy demand in the appliances and buildings sectors. In addition, it sets out a series of actions to take the Action Plan further, conditional on funding, technology transfer and capacity building support from developed countries. Its presentation of other energy sector mitigation measures, as well as actions in the transport and industry sector, agriculture and land use, and waste, is similarly structured.

UNCONDITIONAL	CONDITIONAL
"Implementation of the 2024 Energy Efficiency Plan, which includes, among others, the following measures:	"Renewal and consolidation of the Energy Efficiency Plan, which includes, among others, the following measures:
Replacement of current equipment with efficient equipment: 4 million incandescent light bulbs replaced in the residential sector, and 30% of LED lights in public lighting by 2025.	Replacement of current equipment with efficient equipment: 80% of built-in LED luminaires in public lighting by 2025.
Mandatory energy-efficiency labelling in household devices by 2025: lamps, water heaters, air conditioners and refrigerators.	Mandatory labelling of energy efficiency in household devices: other household appliances, gas-burning appliances and wood-burning appliances by 2025.
Regulation of energy-efficiency labelling in new homes and buildings by 2025.	Implementation of energy-efficiency labelling program in used and non-residential buildings by 2025.
Implementation of the Pilot Program for the Improvement of Energy Efficiency in housing, in Montevideo.	Extension of the Pilot Program for the Improvement of Energy Efficiency in 5% of homes throughout the country by 2025.
Implementation of Energy Efficiency Certificates in all consumer sectors. Its monetary value will be determined by annual targets and funding available, which includes at least 0.13% of the previous year total energy sales.	Consolidation of smart grids including household appliances and smart meters in two neighborhoods or towns by 2025.

Further considerations

In addition to the surveying of counterpart ministries for relevant efficient, clean cooling initiatives, there are other parameters that should be considered when including information in the NDCs. Some of these are necessary considerations in order to ensure the robustness of efficient, clean cooling initiatives and to avoid any unforeseen negative effects.

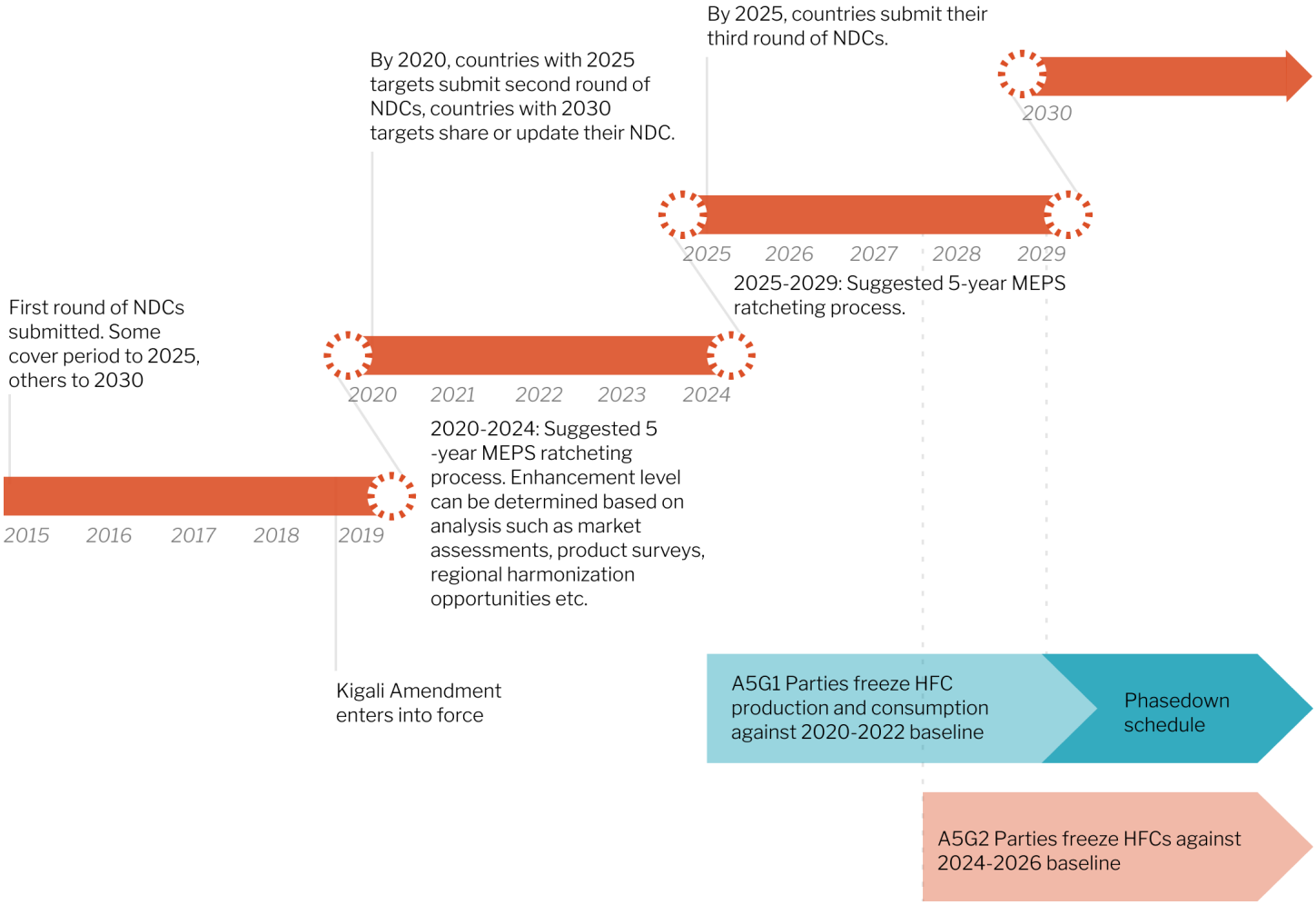
RATCHETING OF STANDARDS AND HARMONIZING TIMELINES

When looking at appliance standards such as MEPS, consider what the percentage energy improvements are (for example, improvements in energy efficiency of 20%) – what could be done to raise the ambition (and therefore climate benefits) further? Another consideration is ratcheting timelines, where MEPS policies build in regular revision and raising of the standard every few years (this is discussed in Section 4 above). This can be built into the national cooling plan, or aligned with the 5-year timescale for ratcheting ambition on NDCs. The NDC ratcheting cycle can in turn be aligned with the F-gas phase down timelines under the Kigali Amendment.[29]

The NDC revision is also an opportunity to set a long-term target for energy efficiency for refrigerators and air conditioners. United for Efficiency is developing model regulations for refrigerators and air conditioners (forthcoming) which could form the basis for setting this kind of long-term target, and which would recognize that progress on energy efficiency is most effective when incorporating continuous improvement and innovation. Likewise, strong long-term efficiency standards planning could also catalyze NDC revision cycles.

29 http://www.unep.fr/ozonaction/information/mmcfiles/7972-e-Path_from_Kigali_HFC_timeline.pdf

Figure 4 — Aligning NDC and MEPS ratchet mechanisms



The Paris "ratchet mechanism" is designed to steadily increase climate ambition over time. Countries could also seek to align their MEPS enhancements with the Paris timeline, ensuring that MEPS which were once ambitious do not fall behind the pace of technological progress and that MEPS continue to be effective tools to improve the efficiency of products on the market. Source: adapted from Carbon Brief '"Timeline: the Paris agreement's "ratchet mechanism"' https://www.carbonbrief.org/timeline-the-paris-agreements-ratchet-mechanism

ENVIRONMENTAL PROTECTION

Effective, environmentally safe disposal of old appliances is necessary in order to prevent leakage of climate polluting F-gases. Measures to avoid second and third-hand markets of old appliances (which are less efficient and have higher refrigerant leakage rates) should also be considered. E-waste can also contaminate water and soil. Circular economy regulations for product design and reuse, as well as producer responsibility regulations, can help reduce e-waste.

SUSTAINABLE DEVELOPMENT GOALS (SDGS)

Access to cooling and development co-benefits are an important consideration throughout, both for adaptation and mitigation. Table 1 above gives some examples of development co-benefits, but all of the SDGs intersect with the need for efficient, clean cooling.[30] Many NDCs will consider links with SDGs and the cooling efficiency elements should also do so. Measure which will increase access to cooling which is not highly efficient should be avoided, as this will increase overall emissions and entail lock-in of the inefficient appliances for 10-15 years.

30 https://www.birmingham.ac.uk/Documents/college-eps/energy/Publications/Clean-Cold-and-the-Global-Goals.pdf

CONDITIONALITY

Most developing countries' initial NDCs included conditions, meaning emissions reductions will be achieved only if certain conditions are met. Conditionality is most often linked to international climate finance to support implementation of the NDCs, however some conditions are linked to other issues such as collective ambition of other Parties. In many cases the conditional emissions reductions contributions are alongside unconditional contributions, however some contributions are completely conditional.

Countries with conditional contributions in their NDCs could incorporate cooling efficiency measures, including a high level of specificity about the measures (for example, MEPS for domestic and commercial refrigerators, conditional on $X investment needs). This may help with future climate finance opportunities, in the event that the Green Climate Fund (GCF) or other climate finance bodies use submitted NDCs as part of their funding criteria.

Further resources

The following resources provide further information and support for policymakers:

- Understanding INDCs, NDCs and long-term strategies – this section of the UNFCCC's "Climate – Get the Big Picture" website provides a starting point for newcomers to NDCs to get a high level overview of NDCs and how they fit into global efforts to combat climate change.
- *Institutional capacities for NDC implementation: a guidance document*. Bakhtiari, F., Hinostroza, M., and Puig, D. (2018). This document by the UNEP DTU Partnership provides an overview of the NDC process and recommendations for how countries can target capacity gaps in six areas key to successful NDC implementation, including coordination, integration of NDC priorities into sectoral programs, training of staff, stakeholder consultations, regulatory framework revision, and monitoring and reporting of progress.
- WRI Working Paper: *Strengthening Nationally Determined Contributions to Catalyze Actions that Reduce Short-lived Climate Pollutants*. This paper aims to help policymakers understand the importance of incorporating and strengthening actions to reduce short-lived climate pollutants into new or updated NDCs by 2020, along with the multiple benefits of doing so.
- GIZ's Guidance for policymakers: *Advancing nationally determined contributions (NDCs) through climate-friendly refrigeration and air conditioning* (Version 1.0). This guidance assists policymakers to design national mitigation strategies for their RAC&F (refrigeration, air conditioning, and foam) sector to meet the increasing ambition levels expected in revised NDCs.
- SEI's Initiative on Low Emission Development Pathways has resources on integrated analysis and planning for the mitigation of air pollution and greenhouse gases, including short-lived climate pollutants, with the goal of achieving multiple benefits.
- The NDC Partnership has over 100 members, including developed and developing countries in all regions of the world. They use a country-driven approach that helps governments set priorities and connect them to available resources on NDCs. Find out if your country is a member, or submit a letter of interest on their website.
- 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.

KIGALI
COOLING EFFICIENCY PROGRAM

ABOUT K-CEP

The Kigali Cooling Efficiency Program (K-CEP) is a philanthropic collaboration launched in 2017 to support the Kigali Amendment of the Montreal Protocol and the transition to efficient, clean cooling solutions for all. K-CEP's program office, the Efficiency Cooling Office, is housed at the ClimateWorks Foundation.

Hex Picot was the lead author of this report.