



COOL CONTRIBUTIONS

Fighting Climate Change

Project Highlights 2016–2021

GRENADA

**DREAMING
OF THE WORLD'S
FIRST HFC-FREE
ISLAND**

PHILIPPINES

**MABUHAY
GREEN
COOLING!**

COSTA RICA

**¡VIVAN LOS
HIDROCARBUROS!**

As a federally owned company, GIZ supports the German Government in achieving its goals in the field of international cooperation for sustainable development.

Published by

Deutsche Gesellschaft für
Internationale Zusammenarbeit
(GIZ) GmbH

Registered Offices

Bonn and Eschborn, Germany
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany

T: +49 6196 79-0
F: +49 6196 79-11 15

E: info@giz.de, proklima@giz.de

www.giz.de/proklima
www.green-cooling-initiative.org

Project

Cool Contributions fighting Climate
Change (C4) / Proklima

Responsible

Philipp Munzinger (GIZ Proklima)

C4 Project Team

Curlan Bholá, Adolfo Córdoba,
Philipp Denzinger, Marion Geiss,
Vanessa Knies, Maraida Licerio,
Leonie Moos, Philipp Munzinger,
Julia Schabel, Lara Teutsch,
Anika Zwiener

Design

Ellery Studio for Creative Strategy

Photos

Title: © Shutterstock / Supermop

Disclaimer

The information in this report, or upon which this report is based, has been obtained from sources the authors believe to be reliable and accurate. While reasonable efforts have been made to ensure that the contents of this publication are factually correct, GIZ GmbH does not accept responsibility for the accuracy or completeness of the contents and shall not be liable for any loss or damage that may be occasioned directly or indirectly through the use of or reliance on, the contents of this publication.

URL links

This publication contains links to external websites. Responsibility for the content of the listed external sites always lies with their respective publishers. When the links to these sites were first posted, GIZ checked the third-party content to establish whether it could give rise to civil or criminal liability. However, the constant review of the links to external sites cannot reasonably be expected without concrete indication of a violation of rights. If GIZ itself becomes aware or is notified by a third party that an external site it has provided a link to gives rise to civil or criminal liability, it will remove the link to this site immediately. GIZ expressly dissociates itself from such content.

Maps

The maps printed here are intended only for information purposes and in no way constitute recognition under international law of boundaries and territories.

GIZ accepts no responsibility for these maps being entirely up to date, correct or complete. All liability for any damage, direct or indirect, resulting from their use is excluded.

On behalf of

German Federal Ministry for the Environment, Nature
Conservation and Nuclear Safety (BMU)
IG II 1 "Fundamental aspects of Chemical Safety,
Chemicals Legislation"
11055 Berlin, Germany

GIZ is responsible for the content of this publication.
Eschborn, 2021

On behalf of:



of the Federal Republic of Germany

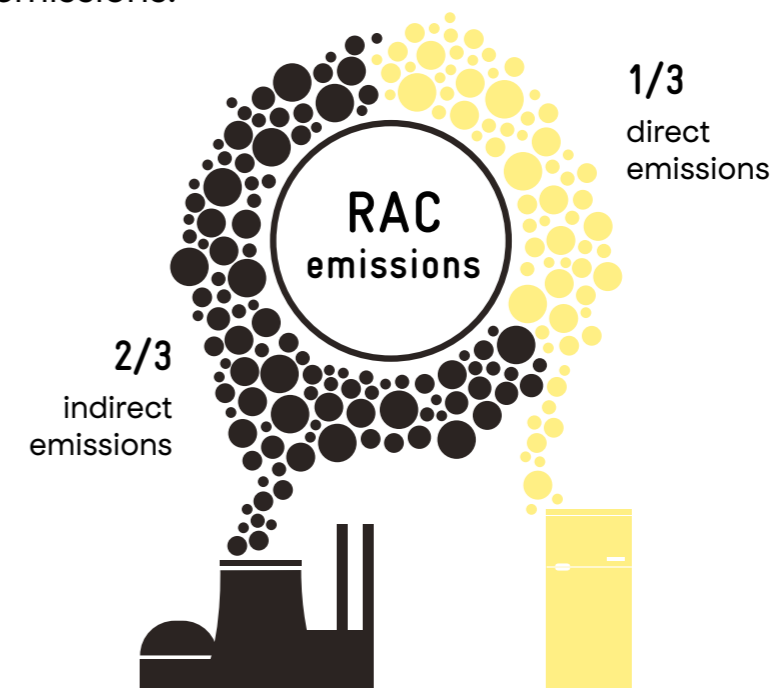
WHY COOLING MUST BECOME A HOT TOPIC

Cooling is an essential part of everyday life – from cold chains for fresh food and the safe storage of vaccines and medicines, to air-conditioned workplaces and schools where it can elevate productivity. Cooling provides a basic need for everyone.

The impact of the Kigali Amendment will prevent an up to 0.5 °C increase in global temperature by the end of the century.

UNIDO, 2020

The positive effects of cooling, however, come with a downside. The refrigeration and air conditioning (RAC) sector emits massive amounts of greenhouse gases. This results from appliances that are not energy-efficient and the high global warming potential of commonly used synthetic refrigerants. Many air conditioners, refrigerators and insulation foams contain substances which are up to 15,000 times more harmful to the climate than CO₂! When those fluorinated greenhouse gases, so-called F-gases, leak into the atmosphere they cause direct emissions. At the same time, running those appliances uses an enormous amount of energy resulting in high indirect emissions.



Rising global temperatures require more and more artificial cooling, making the sector one of the fastest growing industries in the world. The blame for the rising need cannot be laid at the door of global climate conditions and climate change alone. The world population continues to grow, and more and more people are moving to cities. Densely populated areas, modern construction methods and an improved standard of living demand more air conditioning. Moreover, a growing level of prosperity means that more and more people can afford a refrigerator or air conditioner in their homes.

The use of air conditioners and electric fans accounts for about a fifth of the total electricity in buildings around the world – or 10% of global electricity consumption.

IEA, 2018

And here is where we enter a vicious circle. The dramatically rising need for cooling, especially in emerging and developing countries, leads to increasing emissions which, in turn, further fuel global warming. Providing climate-friendly and energy-efficient cooling solutions is key to protecting the climate and catering to people's vital needs around the world. It's what makes Green Cooling so important.

The number of air conditioners worldwide is expected to increase from 1.6 billion in 2016 to 5.5 billion by 2050.

IEA, 2018

What is Green Cooling?

Green Cooling combines two principles: using natural refrigerants in combination with highly energy-efficient appliances and buildings. These two elements make Green Cooling the most environmentally friendly technology to keep us and our planet cool.

Ideally, the electricity for the cooling equipment relies on renewable energy sources.

Global energy demand from residential air conditioning will grow 33-fold between 2000 and 2100, mostly from developing countries.

IPCC, 5th AR

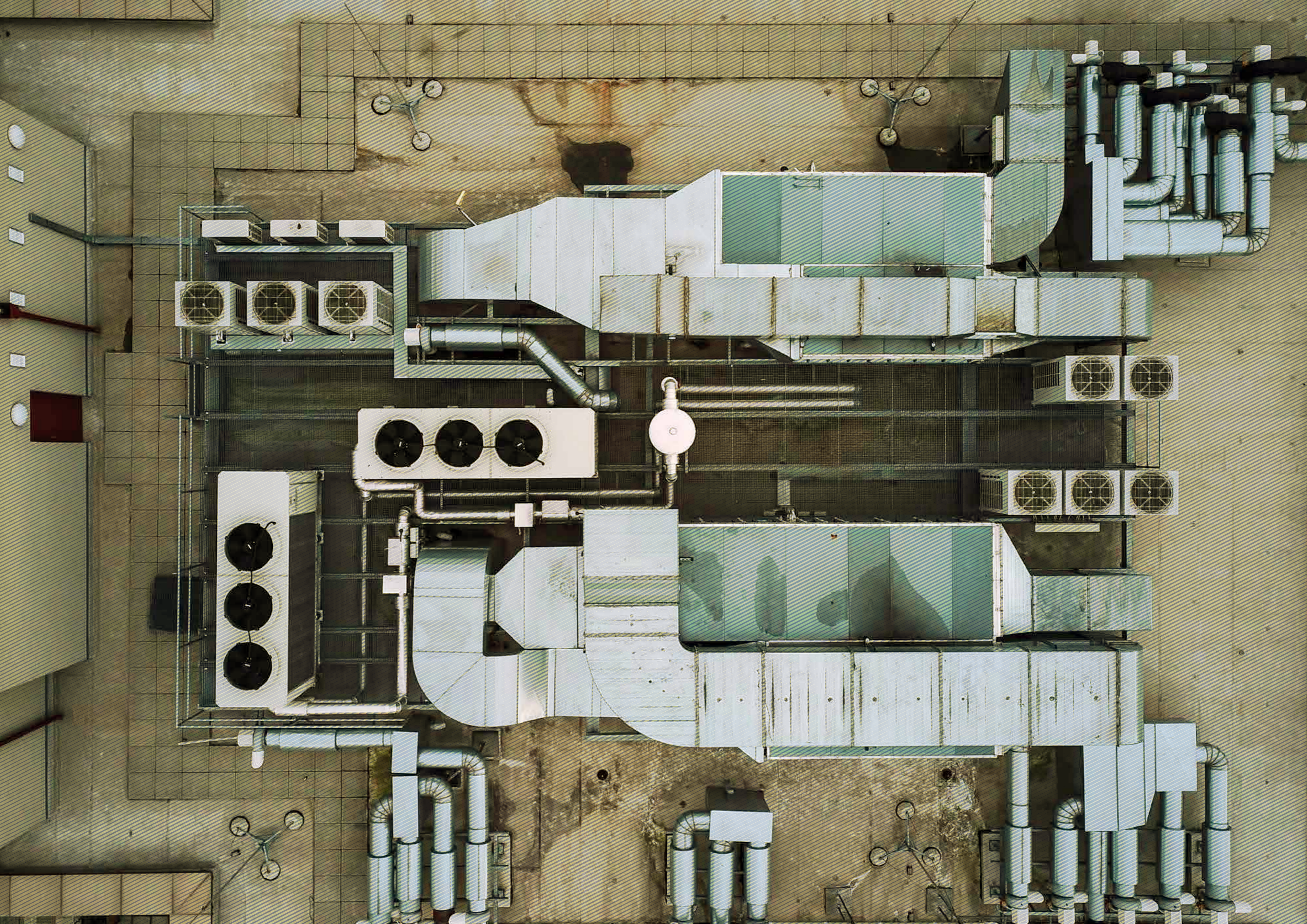
A number of applications, such as room air conditioners running on propane, already have high energy efficiency and natural refrigerants. However, political, economic, and capacity-related barriers hinder their widespread dissemination.

How's the political situation?

The Kigali Amendment to the Montreal Protocol regulates the global phase-down of hydrofluorocarbons (HFCs), the most commonly used F-gases. Preventing a lock-in of inefficient and climate-damaging technologies requires a stringent and timely phase-down. Signatory states have committed to cutting the production and consumption of HFCs by more than 80 percent by 2047. The phase-down will prevent more than 80 billion metric tons of CO₂-eq emissions by that date – equivalent to more than a decade of emissions from the entire U.S. economy (The White House, 2016). This makes the refrigeration, air-conditioning and foam blowing sector a significant area for immediate mitigation actions and a key component for national climate strategies.

“The technologies are available. They're well known. They're proven — though not at scale. So why aren't we moving?”

New York Times, 2012



THE NAME REFLECTS THE AIM:

COOL CONTRIBUTIONS FIGHTING CLIMATE CHANGE

The technological transition to Green Cooling requires a holistic view. GIZ Proklima is involved in many ways: We provide policy advice to political decision makers and government institutions, we accompany the technology transfer to Green Cooling and invest in capacity building through education and training. ‘Cool Contributions fighting Climate Change (C4)’ was launched on behalf of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and provides but one example of successfully implemented projects by GIZ Proklima to gradually overcome the barriers to implementing Green Cooling.

What is C4 all about?

C4 pursues an integrated approach to reducing climate damaging HFCs in combination with introducing more ambitious energy efficiency standards. The project’s goal lies in strengthening the cooperation among various initiatives and government units involved in cooling-related policy making.



“C4 is a prime example of successfully combining policy advice, technology transfer and capacity building in the refrigeration and air conditioning sector. C4 partner countries are now better equipped to take climate action on cooling as a contribution to their NDCs.”

Sebastian Schnatz, National Ozone Unit, BMU

This includes HFC regulation, energy efficiency policies and overall climate policy planning with regard to each country’s National Determined Contributions (NDCs). Since 2016, with the launch of C4, government units from these different domains have increasingly been working together to take the first steps towards establishing a policy framework for Green Cooling. By the time the project came to an end after five years in June 2021, the partner countries Costa Rica, Grenada, Iran, the Philippines, and Vietnam had successfully developed strategies to reduce greenhouse gases in the RAC sector.

What has been accomplished

Policy Advice: Assessing the status quo and defining Green Cooling policies

The Philippines, Costa Rica, Grenada, Iran and Vietnam developed and published RAC GHG inventories with C4 assistance, serving as a basis for RAC sector-specific NDC strategy development.

A RAC sector-specific NDC strategy focusing on room air conditioning was developed for the Philippines. Grenada published a National Cooling Action Plan with C4 support. All countries have increasingly reflected the cooling sector in their climate policies, respectively first and second NDC.



Technology Transfer: Piloting the latest technology

“Transitioning from low efficiency GWP refrigerant mini split ACs to high efficiency alternative ACs using R290 represents the measure with the largest GHG mitigation potential in the cooling industry globally,” C4 project lead Philipp Munzinger argues.

This is why C4 supported the procurement, installation and energy monitoring of more than 100 Green ACs in Costa Rica, Grenada and the Philippines to demonstrate Green Cooling in various fields of application.



Capacity Building: Making technicians fit for Green Cooling

C4 carried out a series of trainings for RAC technicians worldwide. Trainees gained in-depth knowledge on properly servicing and repairing cooling appliances using natural refrigerants.

In total, 105 trainers and technicians have been trained under C4.



C4's path to success

- We work on the **world stage** and have already shared our success stories at the Conference of the Parties (COP) of the UNFCCC, the Meeting of the Parties to the Montreal Protocol (MOP) and the related Open-Ended Working Group (OEWG).
- We were **cooperating with strong partners** like the German Environment Agency (UBA), shecco, UNEP's United for Efficiency Program, UNIDO and globally recognised producers of Green Cooling equipment.
- We pursued the **integrated Green Cooling approach**: From the start of the project, we brought together ozone, energy, environment and climate departments to join forces for designing a more sustainable cooling sector.
- We showed how Green Cooling technology proposed in **RAC-specific NDC strategies** works in practice, thereby transparently addressing reservations regarding safety aspects and the technological feasibility of Green Cooling.
- We worked with **various stakeholders**, from government officials and refrigeration technicians, the private sector, end-users and academia.
- We worked in an agile way: Proven methodologies used in cooling market analyses, GHG inventories and mitigation strategies helped us in identifying GHG, cost and energy saving potentials and address political, regulatory, technical and capacity-related barriers to unlock these potentials.

Important Publications

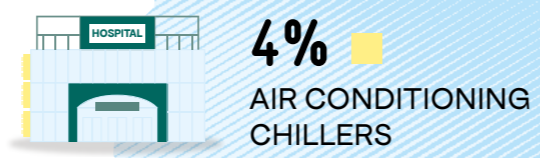
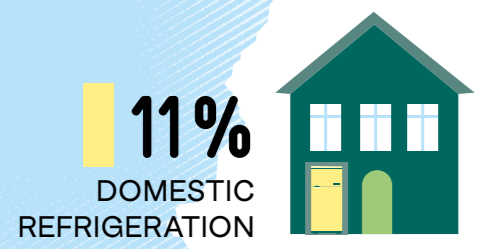
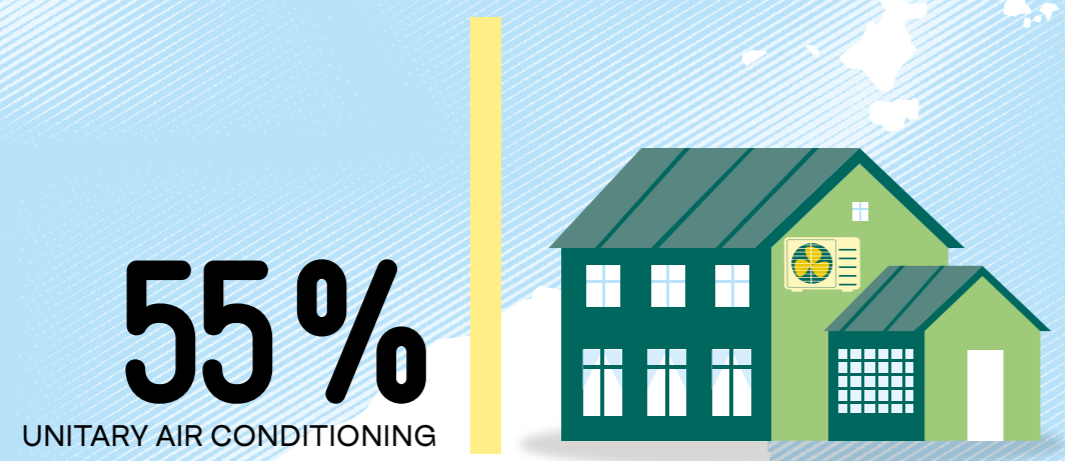
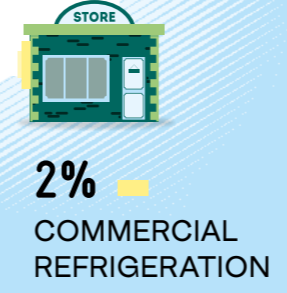
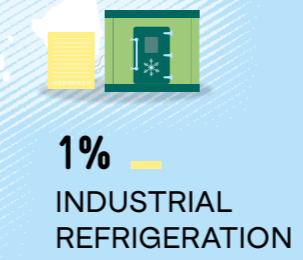
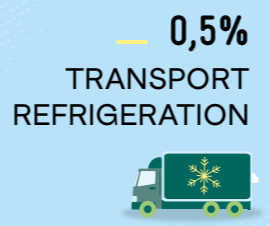
- 2016: Advancing nationally determined contributions (NDCs) through climate-friendly refrigeration and air conditioning
- 2016: Key pieces for climate-friendly and energy-efficient cooling
- 2018: Non-state action towards climate-friendly and energy-efficient cooling
- 2018: Coordinating finance for sustainable refrigeration and air conditioning
- 2019: R290 Split Air Conditioners Resource Guide
- 2021: COVID-19 and how to establish a sustainable and climate resilient vaccine cold chain
- 2021: Green Cooling in Public Procurement
- 2021: Handbook for measurement, reporting, and verification of greenhouse gas emissions in the refrigeration and air conditioning sector





GRENADA

DREAMING OF THE WORLD'S FIRST HFC-FREE ISLAND



Total BAU GHG emissions for Grenada's RAC sector by subsectors in 2015

INHABITANTS
112,519 (2020)

CAPITAL
St. George's

LANGUAGES
English

AVERAGE ANNUAL TEMPERATURE
28°C

ESTIMATED NUMBER OF INSTALLED ACs
23,000 (2020)

RATIFIED THE KIGALI AMENDMENT IN
2018

CFC/HCFC PHASE-OUT BY
2030

HFC PHASE-DOWN
2029-2044



Harmful to the environment
– and to your tongue.
Try pronouncing these
synthetic substances:

CFCs

Chlorofluorocarbons

HCFCs

Hydrochlorofluorocarbons

HFCs

Hydrofluorocarbons

White sandy beaches lined with palm trees, colourful coral reefs in turquoise blue water and tropical temperatures all year round: at first glance, the Caribbean island nation of Grenada looks like a dream destination out of a glossy travel magazine. Tourism and investment in real estate are growing steadily, bringing foreign currency to the island, and so more and more people in Grenada have enough money to treat themselves. Air conditioners in particular are in high demand given the year-round hot temperatures.

However, many of the new cooling devices contain refrigerants that harm the ozone layer and/or the climate, namely CFCs, HCFCs or HFCs. If these substances enter the atmosphere, they are up to 15,000 times more harmful than CO₂. In addition, many of the air conditioning systems currently in use con-

sume a great deal of electricity, most of which relies on fossil fuels. Technical studies undertaken by C4 estimate that artificial cooling is responsible for at least half of the greenhouse gas emissions in Grenada's building sector.

Leslie Smith heads the National Ozone Unit on the island. For more than 20 years, he has been advocating for a shift in the cooling sector to natural and energy-efficient, ozone- and climate-friendly refrigerants and wants to “make Grenada the first HFC-free island in the world.” But how?

Analysis of the Status Quo

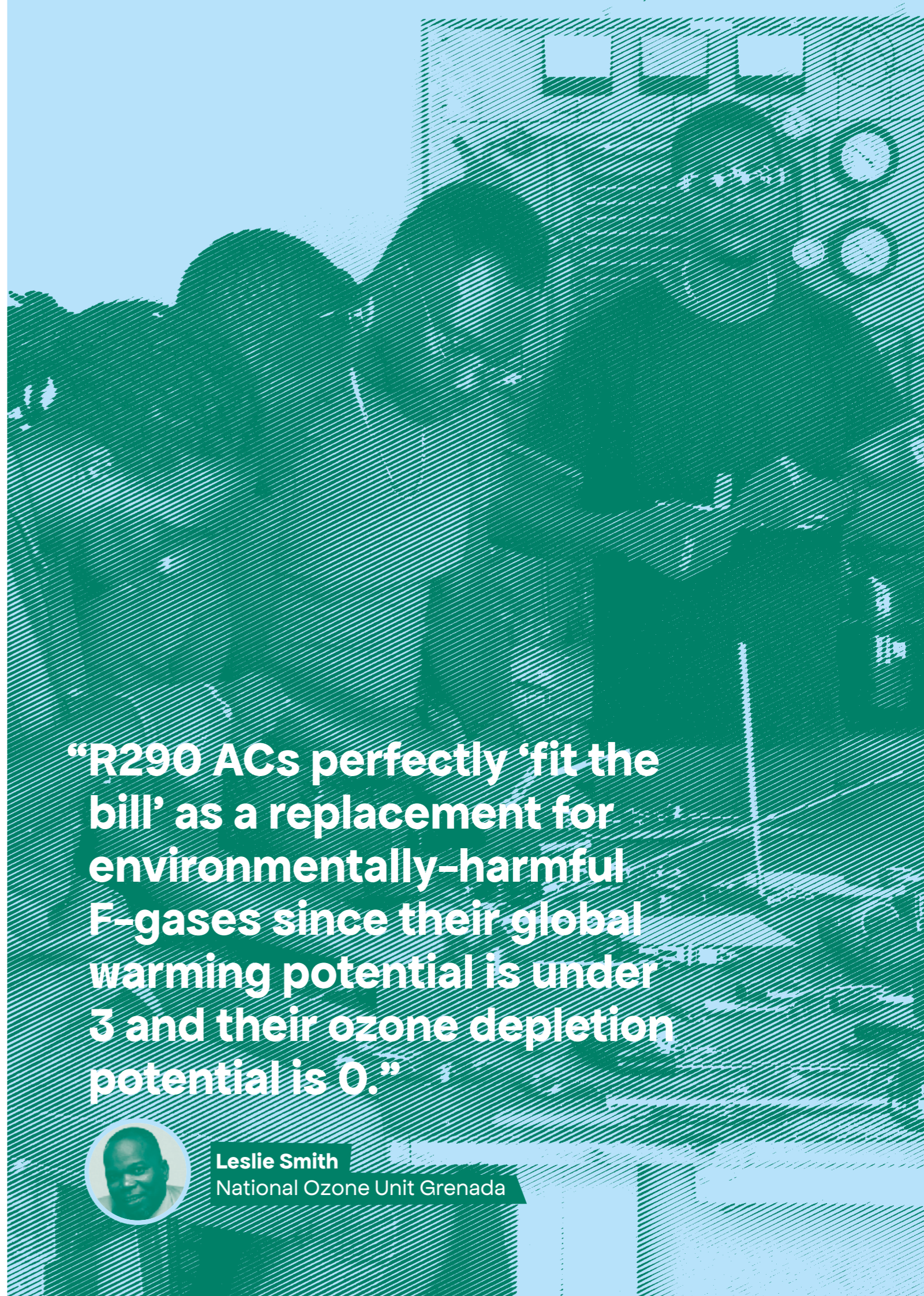
The C4 project team first took stock of the current situation: How many cooling units are distributed across the island? How much electricity do they consume? What refrigerants do they contain? And how will demand develop over the next few years?

The results are clear: the data shows that it is both technologically and economically feasible to reduce greenhouse gas emissions from Grenada's refrigeration and air conditioning sector by up to 25 kt CO₂eq by 2030 and achieve energy savings of about 27 GWh annually. Around 62% of these reduced emissions can be

“R290 ACs perfectly ‘fit the bill’ as a replacement for environmentally-harmful F-gases since their global warming potential is under 3 and their ozone depletion potential is 0.”



Leslie Smith
National Ozone Unit Grenada



Grenada's Green Cooling Roadmap

2021



Phase-out of HFC refrigerants in domestic refrigeration and 30% increase in the use of natural refrigerants in unitary air conditioning.

2030



Setting up restrictions on HFC refrigerants with a GWP above 150 in domestic refrigerators, chillers and commercial refrigeration.

2040

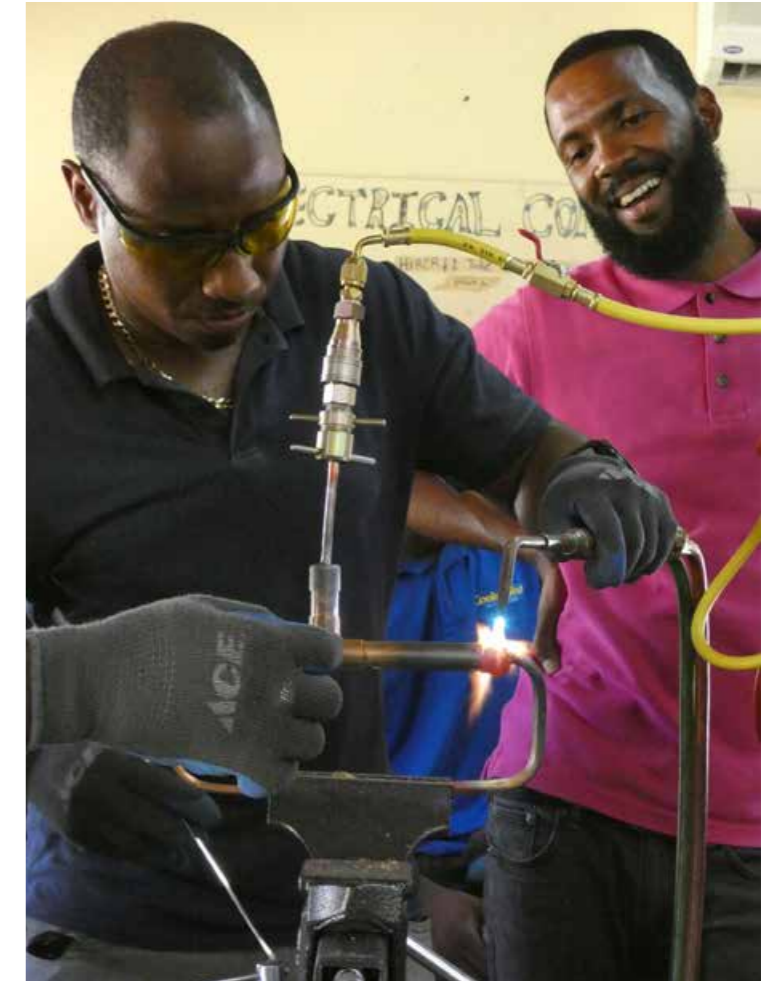


Banning all refrigerants with GWP above 10. Instead, solely natural refrigerants should be used (hydrocarbons for domestic and commercial refrigeration; CO₂ and NH₃ for commercial refrigeration).

2050



Fit for splits: Local refrigeration technicians practise using natural refrigerants and install R290 split ACs in selected buildings.



25_{kt}

CO₂-eq can be saved by 2030 through transitioning to Green Cooling

62%

Emission savings through energy efficiency improvements

38%

of reduced emissions can be attributed to the transition to natural refrigerants

attributed to energy efficiency improvements and 38% to the transition to natural refrigerants.

Based on this research, the National Ozone Unit of Grenada and C4 developed a strategy with specific actions, the so-called “National Cooling Action Plan”. One of the central messages of the document: a shift to natural refrigerants, especially propane, in the country’s room air conditioning sector is key to reducing emissions.

“R290 ACs perfectly ‘fit the bill’ as a replacement for environmentally-harmful F-gases since their global warming potential is under 3 and their ozone depletion potential is 0,” states Leslie Smith. “Moreover, it’s in the design, technology and energy performance of these units where significant energy and climate benefits lie and that clearly demonstrates that this is the best long-term solution currently available for Grenada.”

Head of the C4 project Philipp Munzinger says about the unique opportunities and challenges of implementing the project in Grenada: “Given the island’s geographic features and aspirations, we are convinced that it is perfectly suited to act as a front runner in Green Cooling, not only among island states.”

In addition to the political component, C4 also supported Grenada in the training of RAC technicians and trainers, as the handling of natural refrigerants requires special knowledge. Through setting up a comprehensive infrastructure for supporting the implementation of natural refrigerants, the island has one of the highest percentages of trained technicians. Over 80% of technicians in Grenada are now proficient in natural refrigerant technologies.

Moreover, training institutes received technical equipment, and climate-friendly room air conditioners with propane have been installed in selected public buildings. Measurements of the energy consumption of the installed ACs showed that the systems are up to 70% more energy-efficient compared to the old systems, resulting in cost savings of approximately \$100 per month. Since 2019,

“Given the island’s geographic features and aspirations, we are convinced that Grenada is perfectly suited to act as a front runner in Green Cooling, not only among island states.”



Philipp Munzinger
C4 project leader



stores in Grenada have been selling climate-friendly ACs, which is not yet possible in any other country in Latin America or the Caribbean, making Grenada yet again a front runner in Green Cooling. The financial savings from low energy consumption will interest consumers, in addition to the aspect of climate protection. Grenada has also launched a major advertising campaign for natural refrigerants to raise awareness among the public, including a radio jingle and a TV commercial.

In November 2020, the country reached another milestone: Grenada integrated the refrigeration and air conditioning sector into its Nationally Determined Contributions (NDC), the climate targets set under the UNFCCC. The Caribbean country has thus officially declared its political commitment to climate-friendly cooling. GIZ will continue to support Grenada in its ambitious goals to become the world's first HFC-free island.



Grenada Milestones

JAN 2016

C4 project starts in Grenada

JUL 2018

Introduction of national refrigerant label (R290/propane)

SEP 2019

Pilot project with 30 Green Cooling ACs

OCT 2019

Publication of the „Greenhouse Gas Inventory of the RAC Sector in Grenada“
→ [Download](#)

APR 2020

Development of Green Loan concept with Coop Bank

APR 2021

Participation in Virtual Technology Roadshow, where Grenadian companies demonstrated their Green Cooling portfolio
→ [Watch all company videos](#)

MAY 2021

Grenada emphasises its commitment to natural refrigerants at the Global „Green Cooling Summit“ → [Video](#)

AUG 2021

Grenada's „National Cooling Action Plan“ officially released → [Download](#)

**THE FUTURE?
FIRST HFC-FREE ISLAND
IN THE WORLD!**

FUN FACTS

Grenada produces many spices and is therefore also called “Island of Spice”. The island has only 3 traffic lights.

You can find additional publications about Grenada by scanning this QR-Code:



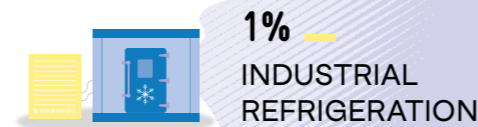
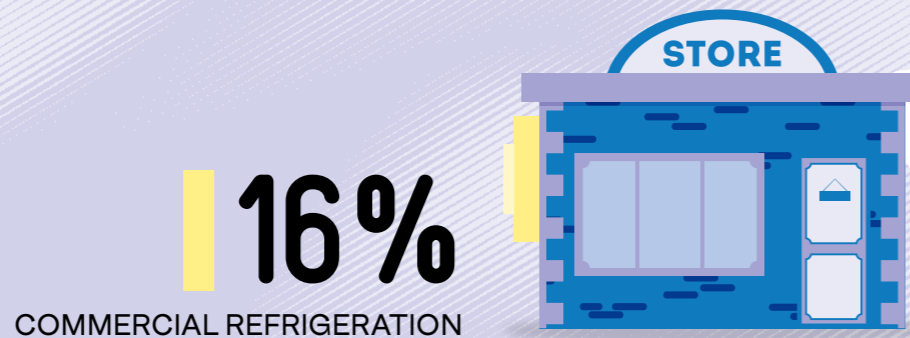
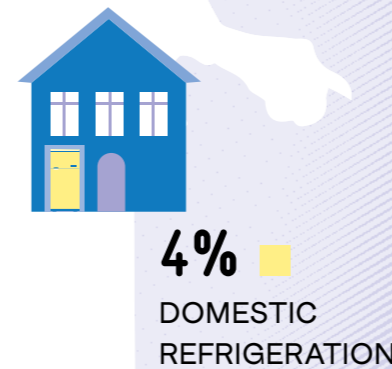
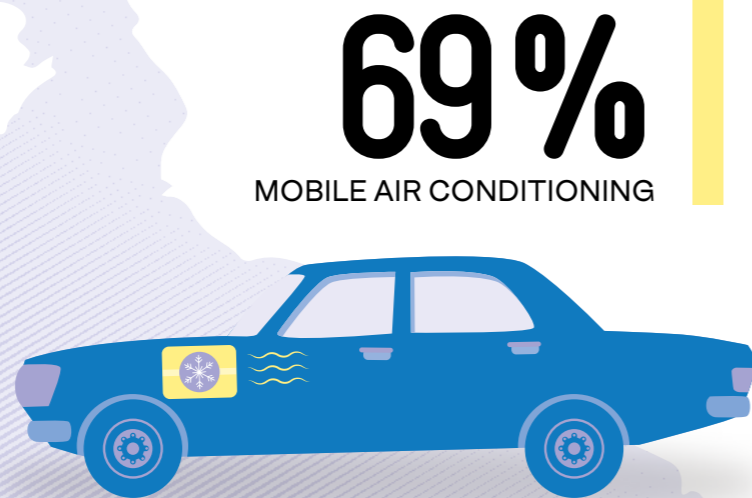
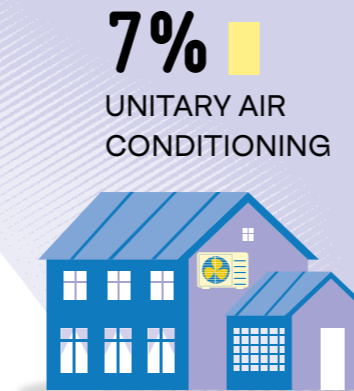
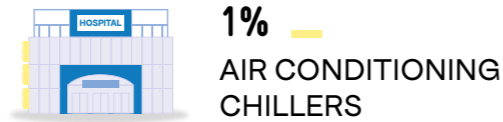
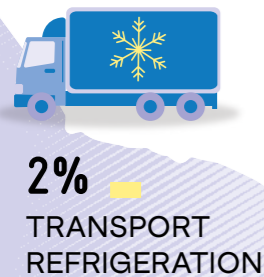
Blog of the National Ozone Unit of Grenada:



COSTA RICA

¡VIVAN LOS HIDROCARBUROS!

Total BAU GHG emissions for
Costa Rica's RAC sector by
sub-sectors in 2015



INHABITANTS
5.1 million (2020)

CAPITAL
San José

LANGUAGES
Spanish

AVERAGE ANNUAL TEMPERATURE

12°-27°C

ESTIMATED NUMBER OF INSTALLED ACs

334,100 (2020)

RATIFIED THE KIGALI AMENDMENT IN

2018

CFC/HCFC PHASE-OUT BY

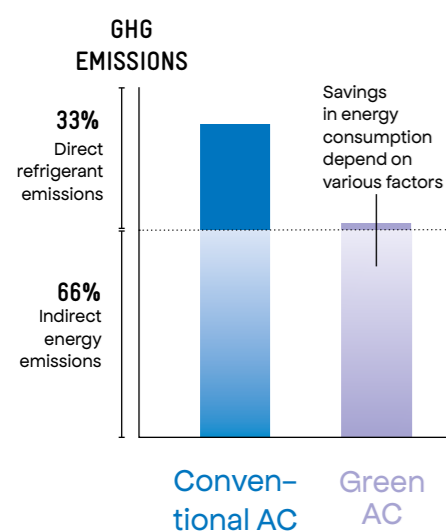
2013-2030

HFC PHASE-DOWN BY

2028-2044



Green Cooling ACs can save both direct and indirect emissions. Energy savings depend on various factors such as equipment efficiency, user behaviour and the electricity mix. Especially in countries like Costa Rica, where energy comes primarily from renewable sources, emissions can be saved mainly through the choice of refrigerant.



Costa Rica gains its reputation as a green country not only from its lush rainforests and its many national parks. The country also wants to become completely climate-neutral by 2050. A switch to hydrocarbons in cooling systems can help Costa Rica take a major step in this direction.

Costa Rica, considered one of the happiest and greenest countries in the world, is also a global leader in sustainability. Around 95–98% of the country's energy has come from renewable sources since 2014. Quite an achievement, considering almost the entire population has access to electricity. By 2050, the Central American country wants to completely decarbonise its economy. Converting to climate-friendly and energy-efficient refrigeration and air conditioning technology could make an important contribution to this.

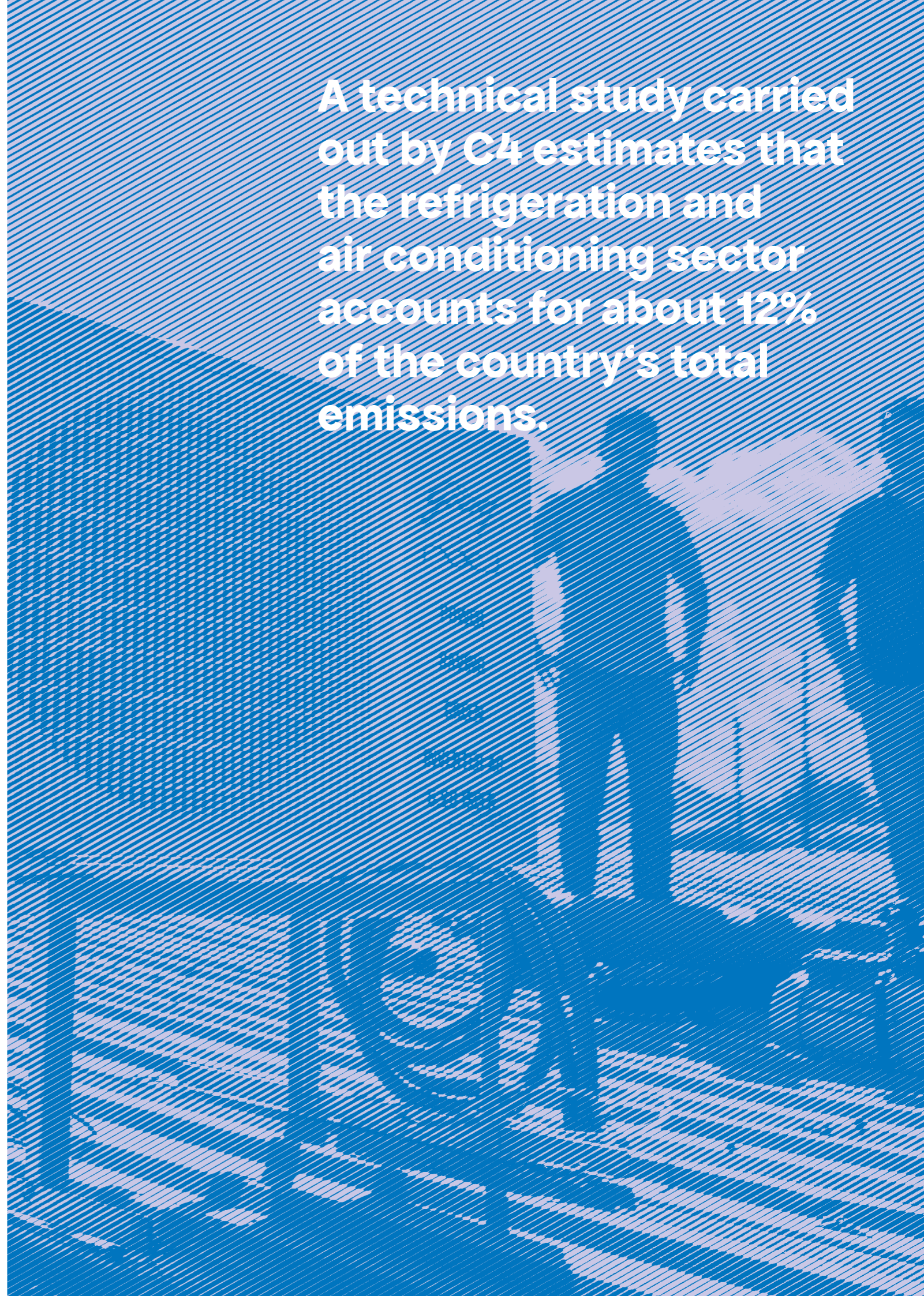
Due to the growing standard of living, as well as the year-round hot temperatures in the plains and along the coasts, the demand for cooling is increasing steadily in Costa Rica. A technical study carried out by C4 estimates that the refrigeration and air conditioning (RAC) sector accounts for about 12% of the country's total emissions.

Where do the emissions in Costa Rica's cooling sector originate?

Mitigation actions focus on two sources of emissions: direct and indirect emissions. Indirect emissions relate to the fossil fuel-based energy consumption of appliances. On a global scale, they represent roughly two-thirds of the total cooling emissions. Indirect emissions can be reduced by increasing the energy efficiency of a product or by decarbonising electricity generation. Since most of the energy in Costa Rica already comes from renewable energy sources, the indirect emissions from the cooling sector are much lower compared to other countries. However, improvements in energy efficiency are indispensable in order to meet the growing energy demand in the sector and not put unnecessary strain on the power grid.

Direct emissions relate to the refrigerants found in cooling appliances. These emissions occur with the release of refrigerants

A technical study carried out by C4 estimates that the refrigeration and air conditioning sector accounts for about 12% of the country's total emissions.





Knowledge sharing across borders: 98 trainers and technicians from 11 countries were trained during the project period



The installed R290 ACs consume at least 20% less electrical energy than conventional reference units installed in the same buildings.

into the atmosphere. This mostly happens during installation or maintenance of the units, when charging or refilling the refrigerant or when dismantling a unit at the end of its life. Although the quantity of a refrigerant ranges from grams to a few kilograms, the high global warming potential of these gases makes them a threat to the environment.

Like many developing countries, Costa Rica still uses HCFC-22 in room air conditioners, which contributes to both ozone depletion (ODP = 0.055) and global warming (GWP = 1,810). The Montreal Protocol aims to phase out HCFCs (watch out, tongue twister: hydrochlorofluorocarbons) globally by 2030. In addition, Costa Rica established a ban on imports of HCFC-containing equipment which started in early 2020. As an importing country with no domestic production of refrigerants, it strongly depends on the availability of refrigerants in the international market.

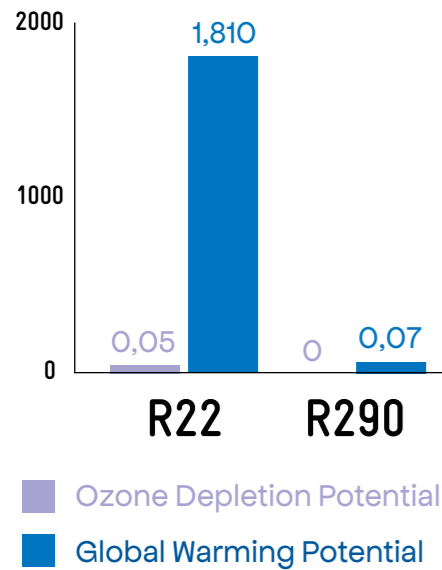
Which cooling sub-sectors should we watch out for in Costa Rica?

C4's technical experts see commercial refrigeration experiencing the biggest growth in the coming years. This includes applications such as refrigerated counters in supermarkets and display cabinets or bottle coolers in bars and restaurants. Those appliances still mainly use HFC-134a and, to a smaller but still significant extent, HFC-404A. Both are highly climate-damaging. However, in recent years, the hydrocarbon R290 (propane) has been imported in small quantities. Room air conditioning and mobile air conditioning (ACs in cars) will peak around 2025 but remain steady from then on. C4 compiled these findings in a major study which formed the basis for further cooperation with the Ministry of Environment and Energy (MINAE) and the Central American Integration System (SICA). Jointly, they wanted to pave the way for natural refrigerants based on a set of first measures.

Train the trainers: spreading knowledge in eleven Latin American countries

One of the first activities, a training programme, helps national and international technicians from different institutions to develop skills in handling equipment with hydrocarbon refrigerants, in this

In comparison: Environmental impact of R22 and R290



case R290 and R600a. In December 2018, an instructor from the Indian manufacturing company Godrej conducted the first training. In cooperation with the EU SPODS project and the 4E project, 98 trainers and technicians from 11 countries were trained between 2018 and 2019. Many of the participants were technicians or trainers from training centres or experts from the private sector. They can now pass on their newly acquired knowledge to their students, colleagues, and others. This will enable hundreds of people in the region to receive further training, increasing their employability and creating green jobs.

Demonstration of 100 high efficiency R290 room air conditioners

Although 99% of the energy production in Costa Rica relies on renewable energy sources, a split AC emits an average of about 4 tons of CO₂ eq. over its lifetime of 10 years, two-thirds of which are direct emissions due to refrigerant leakage. This corresponds to three flights from Costa Rica to Europe. C4 together with the GIZ partner project 4E donated 100 energy-efficient and climate-friendly single split air conditioners using the low-GWP refrigerant R290 to training centres, public institutions and a hotel in Costa Rica. Through an energy monitoring programme, the eco-efficient R290 units were found to consume at least 20% less electrical energy than conventional reference units installed in the same buildings. Furthermore, due to the use of propane as a refrigerant (GWP= 0.072 over 20 years), the new units cause almost no direct greenhouse gas emissions.

Cooling in Costa Rica's national climate targets

The numbers don't lie – the emissions saving potential of natural refrigerants is significant, and the benefits are obvious. But how can the transition also be supported at the political level? Since 2015, Costa Rica has included an overall goal to reduce energy demand by improving energy efficiency in its Nationally Determined Con-

“Conventional air conditioners release an average of about 4 tons of CO₂ equivalent during their lifetime. In contrast, air conditioners with natural refrigerants emit only 0.5 tons of CO₂ equivalent. In addition, natural refrigerants also have excellent energy efficiency properties and do not harm the ozone layer or the climate.”



Mrs. Shirley Soto Montero
Head of the Directorate of Environmental Quality Management (DIGECA)

tributions (NDCs). Against this background, minimum energy performance standards have been introduced. In addition, appliances must be labelled with their GWP and a training curriculum for the correct handling of natural refrigerants has been developed.

In 2020, Costa Rica updated its NDCs and, for the first time, included the RAC sector individually. This success can be attributed in part to C4's RAC sector NDC strategy and inventory of current and future greenhouse gas emissions from the cooling sector. The inclusion of refrigeration and air conditioning underlines Costa Rica's far-reaching strategy for climate action. Even though it is a small country – every contribution counts. In the words of Costa Rican former President and Nobel Peace Prize laureate Oscar Arias: “We do this with the hope that, eventually, we will be able to show the world that what ultimately needs to be done, can be done.”



Costa Rica Milestones

JAN 2016

C4 project starts in Costa Rica

FEB 2019

Demonstration project with 100 climate-friendly split ACs

MAY 2019

Publication of the “Greenhouse Gas Inventory for the RAC Sector in Costa Rica” → [Download](#)

JAN 2020

Ban on imports of equipment containing HCFC

NOV 2020

Study on leakages in split ACs was published → [Download](#)

JUL 2021

Publication of the brochure “Introducing Eco-Efficient Split Air Conditioners with R-290 in Costa Rica” → [Download](#)

AUG 2021

Publication of the brochure “Refrigeración y Aire Acondicionado Verde en el Sector Hotelero en Costa Rica” → [Download](#)

OCT 2021

Installation of R290 monoblock air conditioners in various training centres and hospitals

**THE FUTURE?
A CARBON-NEUTRAL
ECONOMY BY 2050!**

FUN FACT

Every radio station plays the country's national anthem at 7 am every day.

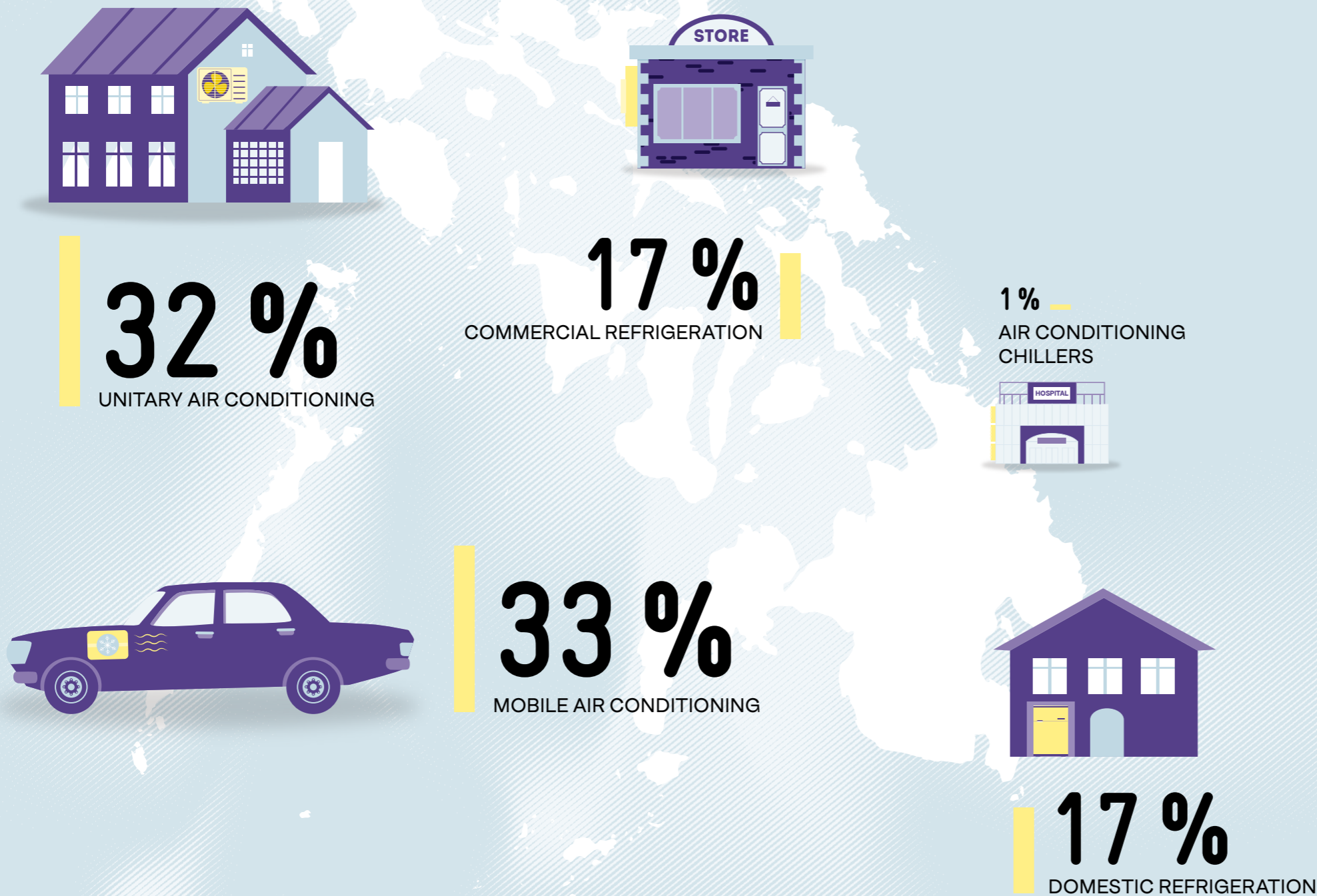
You can find additional publications about Costa Rica by scanning this QR-Code:



PHILIPPINES

MABUHAY GREEN COOLING!

Total BAU GHG Emission for the Philippine RAC sector by subsectors in 2017



INHABITANTS

109 million (2020)

CAPITAL

Manila

LANGUAGES

Filipino, English

AVERAGE ANNUAL TEMPERATURE

21°-32°C

ESTIMATED NUMBER OF INSTALLED ACs

7 million (2020)

CFC/HCFC PHASE-OUT BY

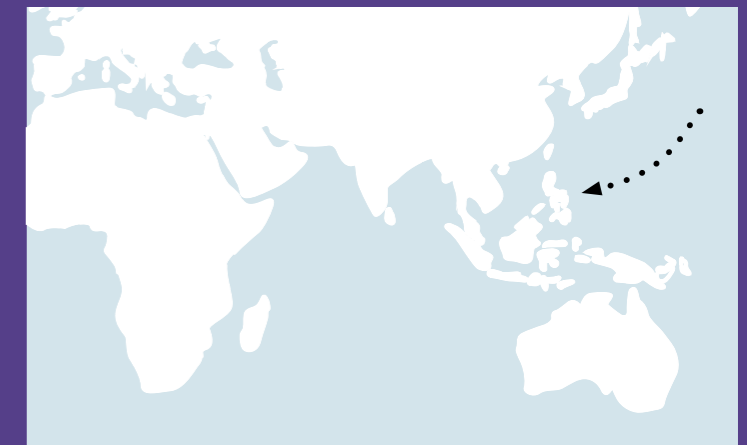
2010/2040

ELECTRICITY MIX

20% RE, 20% Natural Gas, 60% Coal

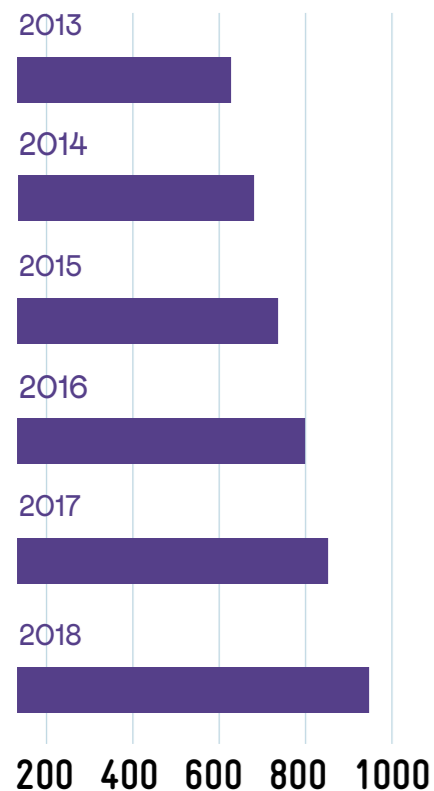
ANNUAL GROWTH RATE OF SPLIT ACs

5%



Philippines AC Demand

Sold ACs in thousands,
Source: JRAIA, 2019



The Philippine archipelago consists of more than 7,000 islands located in a tropical climate. It is home to world renowned natural wonders like underground rivers, rice terraces and an incredibly rich biodiversity. The country's wealth is also increasing with a population that is expected to grow from 109 million inhabitants today to about 142 million by the middle of the century. This trend combined with a growing middle class and progressing urbanisation results in a surge in the demand for cooling.

Due to its huge number of sunshine hours around the year and its geographical profile, especially decentralised PV-based cooling has a huge potential.

Where do the emissions in the Philippines cooling sector originate?

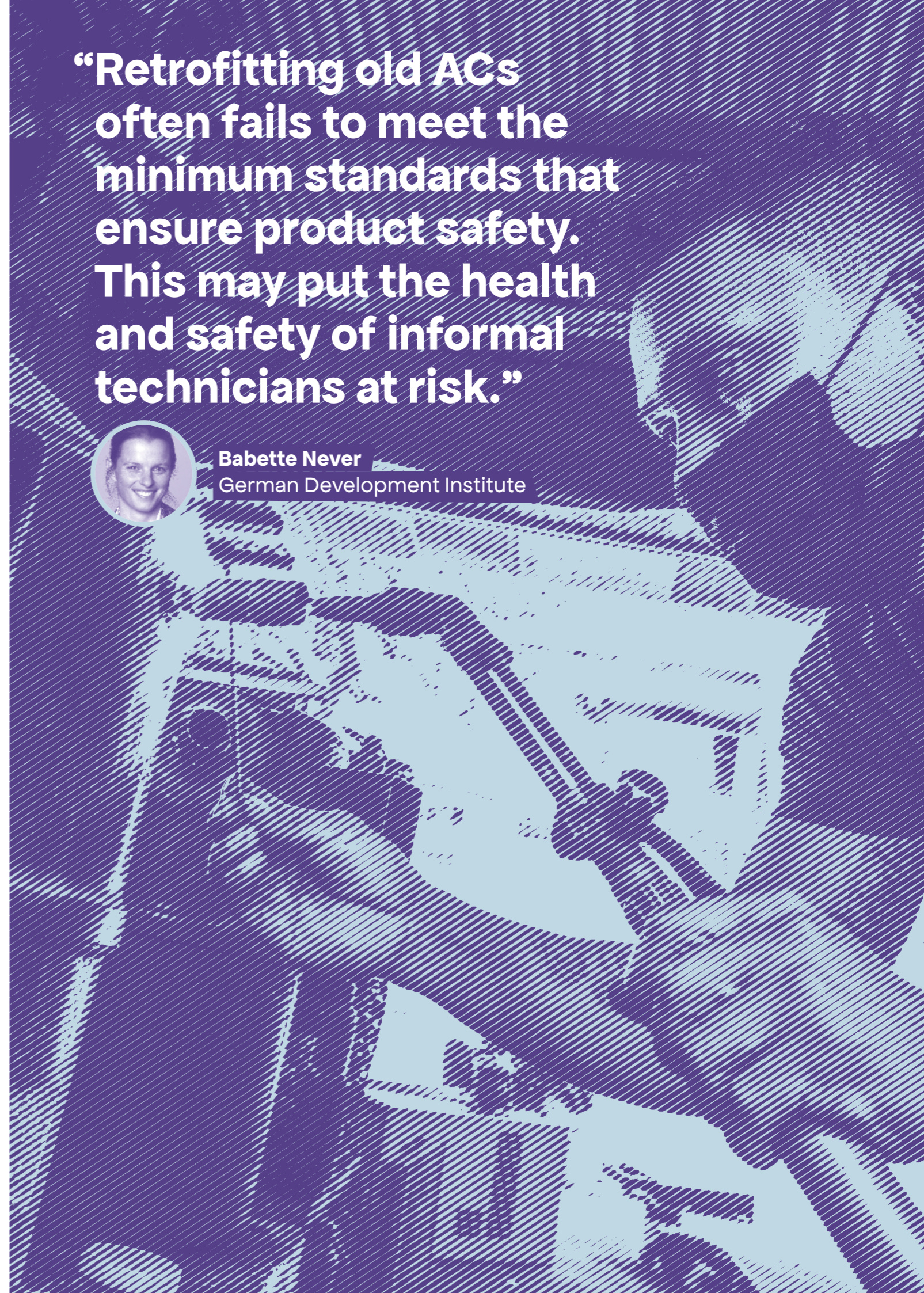
If you want to take mitigation action in cooling, you have to look at two areas: direct and indirect emissions. Indirect emissions are related to the energy consumption of appliances. On a global scale, they represent roughly 2/3 of the total cooling emissions. Indirect emissions can be reduced by increasing the energy efficiency of a product or by decarbonising electricity generation. Since most of the Philippine energy mix is still largely based on fossil fuels, the indirect emissions from the cooling sector make up the lion's share with about 2/3. The Department of Energy is fully aware that progressive minimum efficiency standards and labelling in combination with an increasing share in renewable energy are the key measures for the coming decade to decouple the CO₂ emissions from the growing cooling demand.

Direct emissions are related to the refrigerants found in cooling appliances. These emissions occur when refrigerants are released into the atmosphere. This mostly happens during installation or maintenance of the units, when the refrigerant is charged or re-filled or when a unit is dismantled at the end of its life.

“Retrofitting old ACs often fails to meet the minimum standards that ensure product safety. This may put the health and safety of informal technicians at risk.”



Babette Never
German Development Institute





In particular, replaced air conditioners usually end up in the informal sector which makes a business out of the reusable and residual parts of the equipment.

A study of the end-of-life (EOL) market of ACs in the Philippines as part of C4 found that an estimated 20% of all ACs purchased replace an old one, 70–80% of which subsequently end up on the second-hand market. Often, these units still use the ozone-depleting R22 as refrigerant and are refilled and resold with the same or another refrigerant with a high GWP.

These practices do not adhere to minimum standards that ensure product safety and compromise the safety and health of the informal technicians.

According to C4-partnering researcher

Babette Never from the German Development Institute this trend is thriving. The increase in the volume of ACs reaching its EOL stage corresponds with the increase in new AC sales.

Which cooling sub-sectors are most critical in the Philippines?

According to the RAC GHG inventory, the Philippine unitary AC sector is the most important RAC sub-sector with regards to the future growth of cooling-related emissions.

In 2019, GHG emissions from ACs used in buildings were responsible for approximately 14 MtCO₂-eq – 9% of national GHG emissions. Furthermore, cooling accounts for up to 70% of the total energy demand in buildings. Window-type and split-type ACs dominate space cooling in buildings.

The Philippines with the rest of Southeast Asia is a market with rapidly increasing sales in unitary AC due to the emerging middle class with rising incomes and rising temperatures attributed to climate change. Data from a study by the think tank CLASP in 2019 reported a 5% annual increase of AC sales in the Philippines.

The COVID-19 pandemic restrictions did not affect this growth. Sales of AC units among households even increased due to quarantine rules. Working from home forced middle class homes to purchase AC units together with equipment for remote working. The shift towards climate-friendly AC in a post pandemic recovery effort represents a great opportunity for the AC sector to become more sustainable.

Demonstration of high efficiency R290 room air conditioners

With support from C4, ten “top efficiency” R290 split AC units were imported for the training of trainers at the Green Technology Centre of the Technical Education and Skills Development Authority (TESDA) with a demo unit installed for energy performance monitoring in one of its offices.

Of the ten, one R290 test unit was given to the Lighting and Appliance Testing Laboratory (LATL) of the Department of Energy (DOE) which supervised the energy performance measurement in test chambers recognised by the government. The test resulted in performance levels that go beyond the 5-star range of the AC energy label for available models in the Philippine market, demonstrating a greater mitigation potential for indirect emissions.

Despite high electricity costs the Philippine AC market is the only market in the region with a stable large share (70% market share) of low energy-efficient, non-inverter-based window-type ACs, mainly relying on high-GWP and ozone-depleting refrigerants. These appliances are compact (the evaporator and condenser are packaged in one unit), lack long exterior pipes and





therefore have smaller refrigerant charges. Thanks to all of these characteristics, they are perfectly suited for R290 and the installation process is even more convenient than that of R290 split ACs.

Given this market challenge, C4 developed and tested a prototype R290 window-type AC in collaboration with DOE-LATL.

“Window-type ACs still dominate the AC market in the Philippines, resulting in large F-gas emissions,” said Isagani Soriano, Chief of the Lighting and Appliance Testing Division. “The Department of Energy’s Lighting and Appliances Testing Laboratory considers propane (R290), among others, as a promising refrigerant for window-type

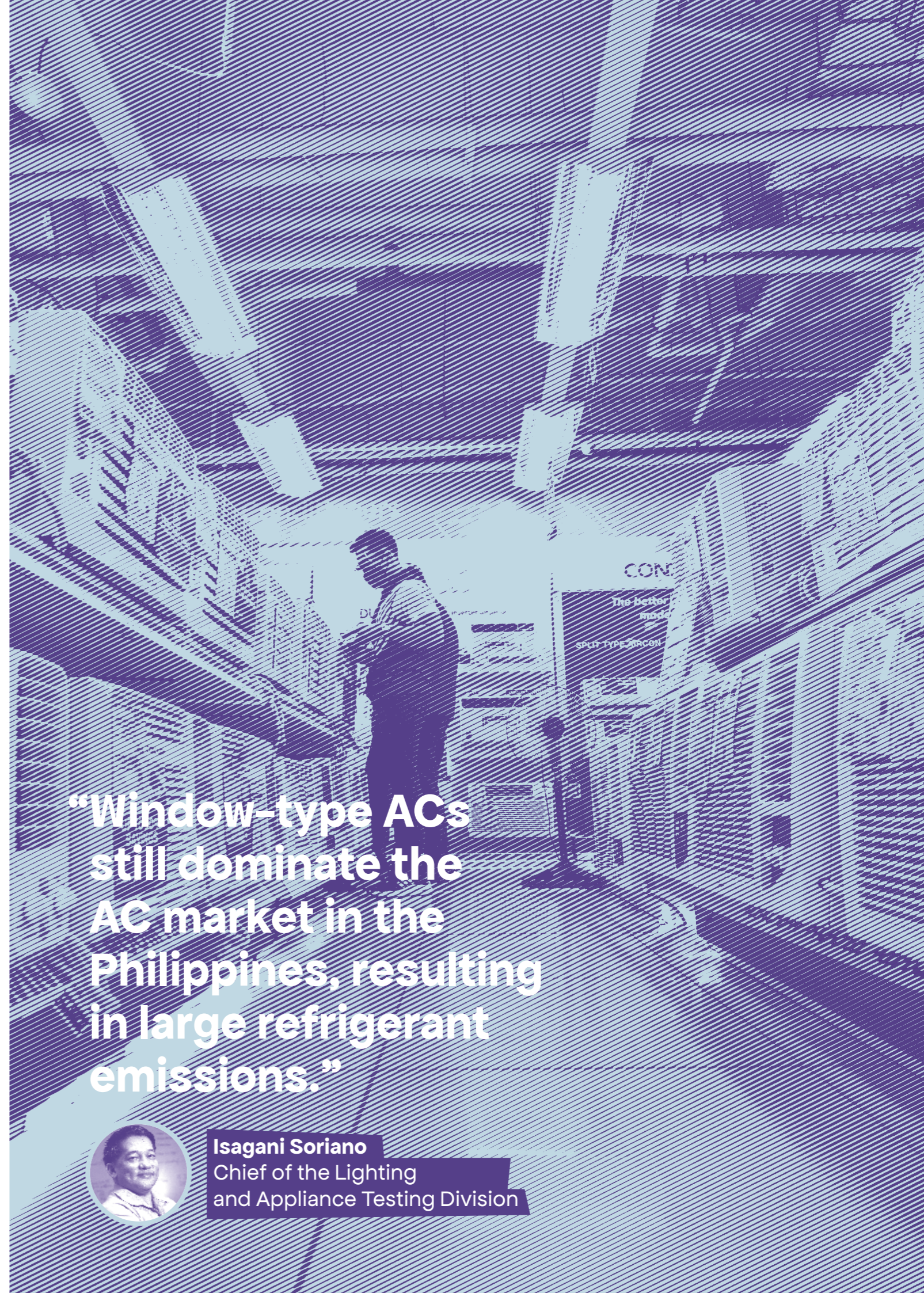
ACs with benefits for the climate. That is why we decided to do some research and development in this regard.”

Educating RAC trainers on proper handling of Green Cooling appliances

In cooperation with the Technical Education and Skills Development Authority (TESDA) of the Philippines, the C4 project undertook a series of train-the-trainer sessions for 32 refrigeration and air conditioning (RAC) training professionals covering the proper use of these new energy-efficient and climate-friendly technologies.

C4 supported the updates in the TESDA training regulation by integrating specifications of safety standards in the training curriculum. As a next step, these RAC trainers will cascade what they have learned to their students in TESDA training centers throughout the archipelago.

One trainer trains approximately 50 RAC technicians every year. This two-stage training process laid the ground for further development of the market for clean and efficient space cooling in the Philippines.



“Window-type ACs still dominate the AC market in the Philippines, resulting in large refrigerant emissions.”



Isagani Soriano
Chief of the Lighting
and Appliance Testing Division

Development of an integrated cooling strategy in contribution to the Philippine's NDC

Taking the RAC GHG inventory as a basis, C4 facilitated a series of consultations involving:

- DOE being responsible for the efficiency standards and labelling of cooling appliances. C4 also provided inputs on the update of the building guidelines for energy-conserving design
- Department of Environment and Natural Resources (DENR) being responsible for refrigerant policies in the context of the Montreal Protocol
- Climate Change Commission overseeing national climate policy formulation
- Department of Trade and Industry (DTI) on international safety standards for refrigeration and air conditioning

Bringing together these decision-makers enabled the development of a comprehensive strategy on the mitigation of GHG resulting from air conditioning in buildings that contributes to the country's climate target. The strategy looks at how enhanced building efficiency can go hand in hand with improved appliance efficiency and the transition to sustainable refrigerants to maximise climate benefits in a holistic way.

These joint efforts resulted in first integrated policy measures: In the process of revising the minimum energy performance standard and labelling of ACs and domestic refrigerators in 2020, the GWP of the refrigerant in use was included in the new AC and refrigerator energy label.



Philippines Milestone

- JAN 2016**
C4 project starts in the Philippines
- JAN 2020**
Ban on imports of HCFC-22 based air conditioners
- APR 2018**
Import and installation of top efficiency R290 split ACs for demonstration and training purposes
- JUL 2019**
Start of training series for TESDA RAC trainers from all over the country
- JUL 2019**
Greenhouse gas inventory for the RAC sector in the Philippines → [Download](#)
- MAR 2020**
Finalization of RAC-specific NDC strategy
- MAY 2020**
Integration of refrigerant GWP in energy label of room air conditioners and domestic refrigerators
- APR 2021**
Integration of RAC-specific targets in sectoral plans and NDC documents

**THE FUTURE?
NATURAL REFRIGERANT
TRAINING HUB!**

FUN FACT

The country is made up of 7,641 islands, only 2,000 of these islands are inhabited and nearly 5,000 still unnamed.

You can find additional publications and news about Philippines by scanning these Qr-Code:





Teamwork makes the dream work

The project team would like to thank all its partners for their hard work, commitment and enthusiasm: from the National Ozone Units to energy and climate departments, training centres, trainers and technicians, companies and scientists. We are especially grateful to be able to continue promoting Green Cooling on behalf of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. Keeping it cool – naturally!

www.green-cooling-initiative.org

Sources

UNIDO (2020). Kigali in Action.
https://www.unido.org/sites/default/files/files/2020-04/UNIDO-brochure_Kigali_in_Action.PDF

International Energy Agency (2018). The future of cooling. Opportunities for energy-efficient air conditioning.
<https://www.iea.org/reports/the-future-of-cooling>

JRAIA (2019). World Air Conditioner Demand by Region.
https://www.jraia.or.jp/english/World_AC_Demand.pdf

IPCC (2014). Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.
<https://www.ipcc.ch/report/ar5/syr/>

New York Times (2012). Relief in Every Window, but Global Worry Too.
<https://www.nytimes.com/2012/06/21/world/asia/global-demand-for-air-conditioning-forces-tough-environmental-choices.html>

GIZ (2019a). Greenhouse Gas Inventory for the RAC Sector in the Philippines.
<https://www.green-cooling-initiative.org/news-media/publications/publication-detail/2019/07/01/greenhouse-gas-inventory-of-the-rac-sector-in-the-philippines>

GIZ (2019b). Greenhouse Gas Inventory for the RAC Sector in Costa Rica (2012-2016).
<https://www.green-cooling-initiative.org/news-media/publications/publication-detail/2019/05/31/greenhouse-gas-inventory-for-the-rac-sector-in-costa-rica-2012-2016-es>

GIZ (2020). Greenhouse Gas Inventory for the RAC Sector in Grenada.
<https://www.green-cooling-initiative.org/news-media/publications/publication-detail/2020/05/01/ghg-inventory-for-the-rac-sector-in-grenada>

GIZ (2021). National Cooling Action Plan for Grenada.
<https://www.green-cooling-initiative.org/news-media/publications/publication-detail/2021/08/13/national-cooling-action-plan-for-grenada>

Photo Credits

Cover Photo:
 Shutterstock / Supermop

Page 5:
 Shutterstock / KeongDaGreat

Page 9-10:
 Shutterstock / Light poet

Page 11:
 Adobe / v_sot

Page 15-16:
 Shutterstock / Matyas Rehak

Page 47 - 48:
 Andrii Zhezhera

All other pictures:
 GIZ Proklima

The number of air conditioners worldwide is expected to increase from **1.6 billion** in 2016 to **5.5 billion** by 2050.

Green Cooling is the most viable way to meet the growing cooling demand and protect our climate at the same time. It is based on two principals: using natural refrigerants and highly energy-efficient appliances. Ideally, the energy comes from renewable sources.

Improving the energy efficiency of cooling equipment and restricting the use of climate-damaging refrigerants **could prevent an up to 0.5 °C increase in global temperature** by the end of the century.

Cool Contributions fighting Climate Change (C4) provides but one example of **successfully implemented projects** by GIZ Proklima to gradually overcome the barriers to implementing Green Cooling.