



REPÚBLICA DE PANAMÁ  
— GOBIERNO NACIONAL —



# PANAMA COOLING PLAN



**KIGALI**  
COOLING EFFICIENCY PROGRAM



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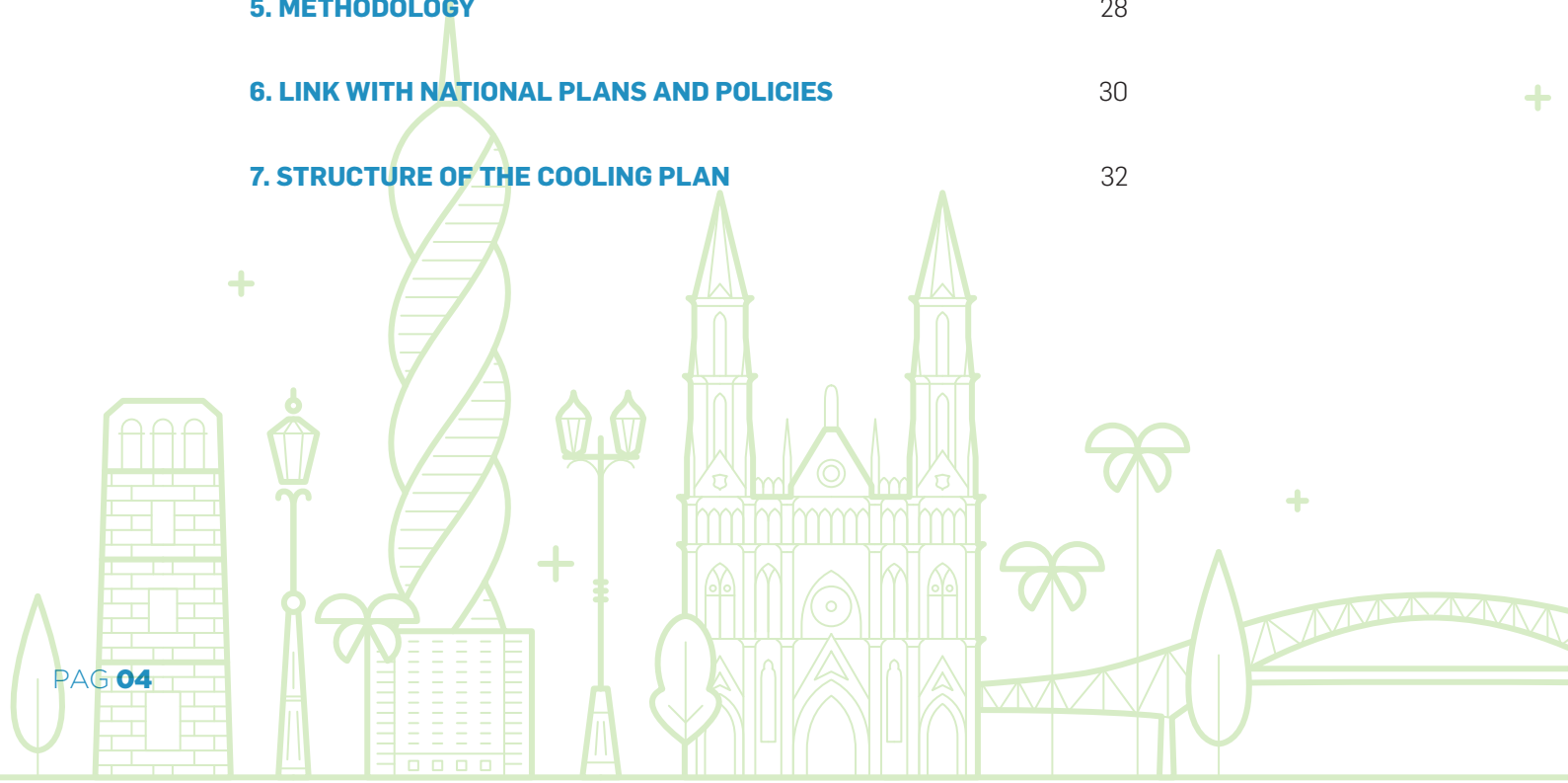


# PANAMA COOLING PLAN



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# ACRONYMS

ADAP	Car Dealer Association of Panama
ANA	National Customs Authority
ASEP	National Public Services Authority
BCBRP	Meritorious Fire Department of Panama
CAPAC	Panamanian Chamber of the Construction
CIEMI	College of Electrical, Mechanical and Industrial Engineers
UNFCCC	United Nations Framework Convention on Climate Change
NC	National Communication
COP	Coefficient of Performance
DGNTI	National Directorate of Regulations and Industrial Technology
GHG	Greenhouse gases
HCFC	Hydrochlorofluorocarbons
HFC	Hydrofluorocarbons
HPMP	HCFC Phase-out Management Plan
BUR	Biannual Update Report
IEA	International Energy Agency
INEC	National Institute of Statistics and Census
INGEI	National Inventory of Greenhouse Gases
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
ITSE	Specialized Superior Technical Institute
JTIA	Engineering and Architecture Technical Board
K-CEP	Kigali Cooling Efficiency Program
MAC	Mobile Air Conditioning
MEDUCA	Ministry of Education
MiAMBIENTE	Ministry of Environment
MICI	Ministry of Commerce and Industries
MINSA	Ministry of Health
MVC	Monitoring, Verification and Compliance
NDC	Nationally Determined Contribution
SDG	Sustainable Development Goals
ODP	Ozone Depletion Potential
PIB	Gross Domestic Product
GWP	Global Warming Potential
PGBC	Panama Green Building Council



PCP	Panama Cooling Plan
UNDP	United Nations Development Program
RAC	Refrigeration and Air Conditioning
EEAW	Electric and Electronic Appliance Waste
SBR	Sustainable Building Regulations
ODS	Ozone-Depleting Substances
SIN	Interconnected National System
NSE	National Energy Secretariat
NOU	National Ozone Unit
UREE	Rational and Efficient Use of Energy
UTP	Technological University of Panama







# **PANAMA COOLING PLAN**





# EXECUTIVE SUMMARY

**T**he Panama Cooling Plan is a key tool to consolidate the country's strategy given that it presents a series of activities in order for the refrigeration and air conditioning sector (RAC) to develop in a sustainable manner, incorporating energy efficiency and without affecting the environment.

The RAC sector is very important in Panama, as it accounts for most of the electricity consumption, and with a high demand to meet the needs of commercial, tourism, food and health activities, while providing comfort in homes. The demand for RAC in Panama is expected to increase, as part of the country's economic growth and development, so it is necessary to guide the evolution of the sector through a plan that identifies the issues that must be addressed with priority and guarantees an orderly execution.

## THE STRATEGY SEEKS THREE MAIN OBJECTIVES:

1. Establishing synergies between the cooling program and other programs and initiatives related to the environment and climate change.

In this sense, the country has already regulated issues regarding sustainable building, energy efficiency labeling and the imports of ozone depleting substances; however, it seeks to articulate the strategy, unifying criteria and improving coordination, to achieve greater impact.

2. Relating energy efficiency and the transition to low global warming potential refrigerants (GWP) under a holistic vision of political interventions aligned with economic growth.

The country's electricity consumption is largely related to RAC services (42% of the total electricity consumption), so the country must move towards a transformation of the sector, replacing inefficient equipment and promoting efficient equipment, designs and facilities. This must be complemented with properly trained professionals, which requires strengthening the country's technical training institutions.

Additionally, economic growth must go hand in hand with sustainable development, which provides access to the RAC services necessary to improve food preservation, access to medicines and to take advantage of the opportunities offered by new technologies to reduce the costs associated with energy use for RAC, and the impact on the environment (both by direct emissions of ODS with high GWP, and by direct emissions due to the burning of fuel for electricity generation).

3. Establishing a roadmap to accelerate the transformation of the RAC sector, integrating energy efficiency, the use of environmentally friendly refrigerants and climate protection, as well as people's health.



The PCP presents a series of specific activities that must be developed to achieve the country's objectives in terms of sustainable development, protection of the ozone layer and fighting against climate change.

The plan's structure consists of four (4) pillars and eighteen (18) thematic areas that serve as a guide to address priority issues.

TABLE A | **PILLARS AND THEMATIC AREAS OF THE PANAMA COOLING PLAN**

<b>1. MANAGEMENT AND REGULATIONS</b>	<ul style="list-style-type: none"> <li>1.1 Governance</li> <li>1.2 Regulations and Standards</li> <li>1.3 Technologies and Alternatives</li> <li>1.4 Monitoring, verification and compliance (MVC)</li> </ul>
<b>2. 2.ENERGY EFFICIENCY</b>	<ul style="list-style-type: none"> <li>2.1 Efficient equipment</li> <li>2.2 Building design</li> <li>2.3 Consumption preferences and patterns</li> <li>2.4 District cooling</li> </ul>
<b>3. 3.ENVIRONMENTAL SUSTAINABILITY</b>	<ul style="list-style-type: none"> <li>3.1 National Greenhouse Gas Inventories</li> <li>3.2 Environmental labeling</li> <li>3.3 Refrigerating material recovery and recycling</li> <li>3.4 Equipment disposal and recycling</li> <li>3.5 Communication</li> </ul>
<b>4. 4. RAC SERVICE SECTOR</b>	<ul style="list-style-type: none"> <li>4.1 Inclusion</li> <li>4.2 Training</li> <li>4.3 Certification</li> <li>4.4 Cold chan</li> <li>4.5 Mobile Air Conditioning (MAC)</li> </ul>



The plan emphasizes the sustainability of the transition process, the importance of the participation of the private sector and the general public, with a special emphasis on the inclusion of women and consideration of the needs of the most vulnerable populations, who do not have access to RAC services.

The success of the Panama Cooling Plan will depend on the commitment of all relevant actors in the execution of this strategy, effective coordination between government institutions, as well as international cooperation. This plan includes indicators to monitor and follow up on compliance.



# INTRODUCTION

*The national cooling plans are one of the key elements of the institutional strengthening strategy promoted by the Kigali Efficient Cooling Program (K-CEP), which is working with more than 25 countries on this issue.*

**T**he purpose of these plans is to improve energy efficiency and access to cooling, integrating the total elimination of hydrochlorofluorocarbons (HCFCs) and the gradual reduction of hydrofluorocarbons (HFCs) as refrigerant substances.

The National Ozone Unit of the Ministry of Health (UNO / MINSA), with the support of the United Nations Development Program (UNDP), obtained financial assistance from the K-CEP in December 2018 to develop the Panama Cooling Plan (PCP). In Panama, this plan has been conceived as a strategy for the sustainable development of the refrigeration and air conditioning sector (RAC), based on the unification of efforts aimed at protecting the ozone layer, and reducing GHG emissions and energy efficiency.

It is important to note that cooling is recognized as a development need that is related to the achievement of more than 10 sustainable development goals, mainly health and well-being goals (3), quality education (4), gender equality (5), affordable and clean energy (7), decent work and economic growth (8), industry, innovation and infrastructure (9), sustainable cities

and communities (11), responsible consumption and production (12), climate action (13), peace, justice and strong institutions (16) and partnerships to achieve the goals (17).

First, the background is described, highlighting three elements: (i) protection of the ozone layer, (ii) fight against climate change and (iii) the issue of energy efficiency. Sections 2 and 3 present the objectives of the plan, as well as the benefits of having a structured plan that clearly and systematically shows the actions to be followed.

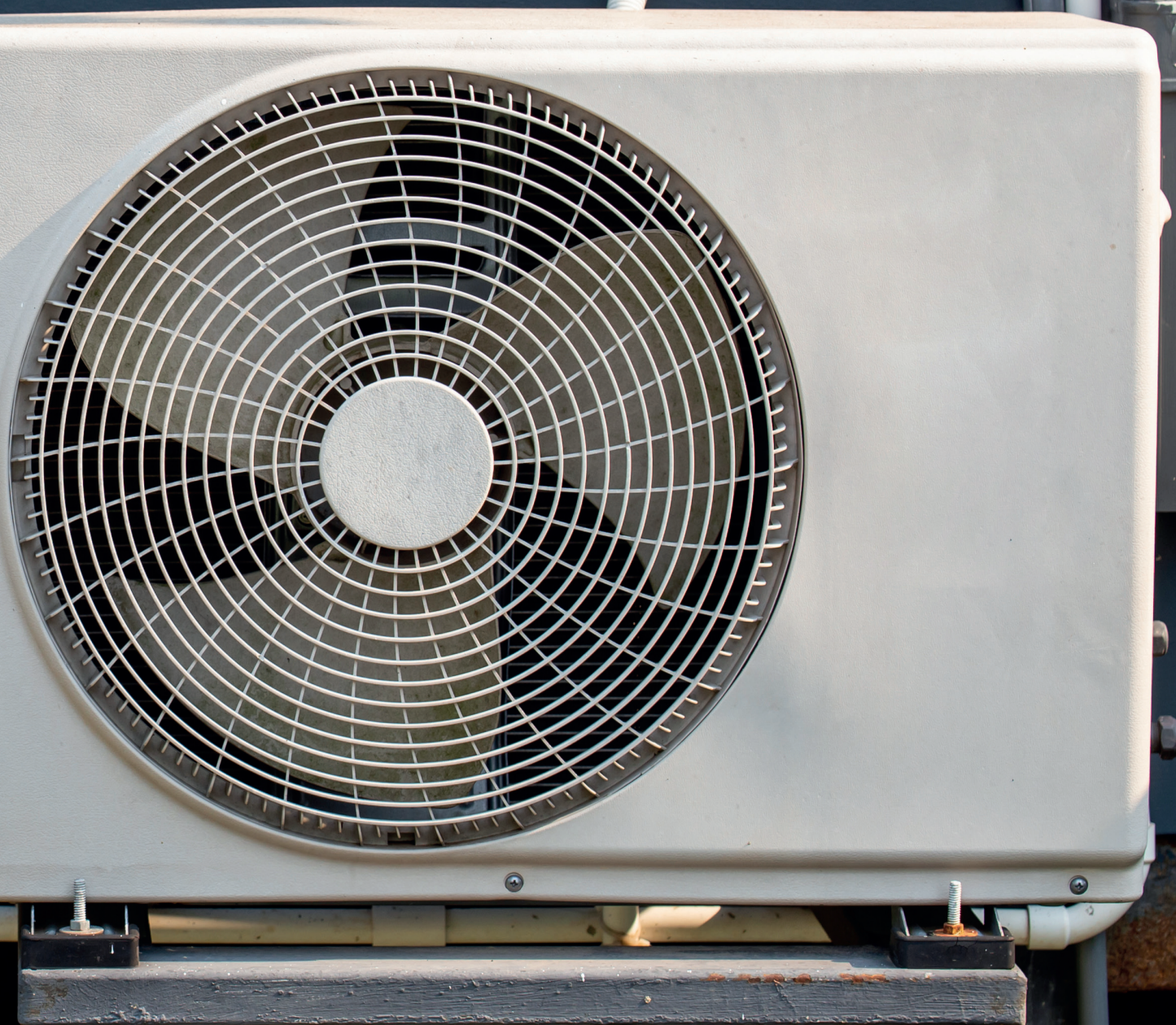
The methodology used in its elaboration process is described in section 4. Section 5 offers a brief description of the refrigeration and air conditioning sector; in this, the importance of this sector in the country's energy consumption is highlighted, as well as how the refrigerant gases imports has evolved.

The linkage of the Cooling Plan with national policies and plans is briefly presented in section 6, to give way to the structure of the plan and its content in sections 7 and 8.





FINALLY, ANNEXES 1  
AND 2 PRESENT THE  
PLANNING MATRIX  
WITH THE DETAILS OF  
THE INDICATORS AND  
THE LINK BETWEEN  
THE THEMATIC AREAS  
AND THE SDGS.





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# 1. BACKGROUND

*The human being, in his search for a better quality of life and as part of the continuous progress of civilization, has exerted pressure on the environment through the use of natural resources, which serve as a means to develop the technology and services that facilitate their activities. The impact that human activity has had on the planet has confronted humanity with great challenges and environmental challenges.*





**T**he use of technology for refrigeration and air conditioning, although recent in the history of mankind, has provided us with a very valuable service, facilitating the conservation of food, medicines

and other products that degrade with heat, providing thermal comfort in the home and work places. However, this technology has had a strong impact on the environment due to the use of refrigerant gases that deplete the ozone layer and / or contribute to global warming, as well as the intensive use of energy, which in many cases comes from burning fossil fuels. In response to these challenges, the international community organized and adopted in 1985 the Vienna Convention for the Protection of the Ozone Layer, followed by the Montreal Protocol on Substances that Deplete the Ozone Layer in 1987. Today recognized as the best example of global cooperation on environmental issues are the first universal environmental treaties, endorsed by the 198 nations of the world. Panama ratified the Vienna Convention and the Montreal Protocol through laws 2 and 7 of January 3, 1989, respectively.

The implementation of the Montreal Protocol seeks to facilitate the transition towards the use of substances that do not affect the ozone layer. In particular, the refrigeration and air conditioning (RAC) sector has adopted the use of new refrigerants, progressively abandoning the use of controlled substances under the Protocol. The main substitutes are hydrofluorocarbons (HFCs), which do not deplete the ozone layer, but with their use they propel global warming (GWP).

Faced with this situation, the member countries of the Vienna Convention adopted the Kigali Amendment

to the Montreal Protocol in October 2016, during the 28th Meeting of the Parties to the Montreal Protocol, for the gradual reduction of the production and consumption of HFCs. With the amendment, the countries assume a global commitment that will avoid more than 80 billion metric tons of equivalent emissions of carbon dioxide by 2050. Panama ratifies the Kigali Amendment in 2017, through Law 87 of December 19.

The amendment, which continues the work under the framework of the implementation of the Montreal Protocol, seeks to develop guidance regarding the costs associated with maintaining and increasing the energy efficiency of replacement technologies and equipment with low or no GWP.


In this sense, this amendment will contribute substantially to achieve the objectives of the Paris Agreement, the first binding global agreement on climate change; also ratified by Panama through Law 40 of September 12, 2016.

A significant part of the total GHG emissions from RAC systems are indirect and related to energy consumption (between 70% and 80%). The remaining are direct emissions from refrigerant leaks during installation, maintenance, operation, recovery and disposal services.

Improving the energy efficiency of RAC equipment and promoting the use of low global warming potential (GWP) refrigerants will have a comprehensive impact on the environment and the climate.

Panama, consistent with its commitment to reduce GHG emissions and ozone-depleting substances (ODS), is making progress in strengthening measures aimed at the adaptation and mitigation to climate change, as well as the protection of the ozone layer. The national





strategy for the progressive elimination of ozone-depleting substances, carried out by the National Ozone Unit of the Ministry of Health (NOU/MINSA); the Nationally Determined Contributions (NDC), led by the Ministry of the Environment (MiAMBIENTE), as well as the regulatory initiatives established by the National Energy Secretariat (SNE) to ensure efficient use of energy, are a proof of this commitment.

## **1.1 OZONE LAYER PROTECTION**

The Government of Panama has been emphatic in its intention to fight in favor of the protection of the ozone layer, being a signatory of all the related international agreements and amendments to date.

The National Ozone Unit (NOU), attached to the Ministry of Health's General Sub-Directorate of Environmental Health, is the body responsible for the implementation of the Montreal Protocol and its amendments in the country, counting on the United Nations Developing Program (UNDP) as the implementing agency. NOU/MINSA is responsible for the preparation and implementation of the different projects for the elimination of ozone-depleting substances (ODS).

Resolution No. 1236 of December 27, 2012, which regulates imports of ozone-depleting substances from Annex C, Group I (HCFC-22 and R-141b), establishes a registry of refrigerant importers and a system for awarding annual HCFC import quotas.

### **1.1.1 HCFC PHASE-OUT MANAGEMENT PLAN**

The parties to the Montreal Protocol agreed in 2007 to accelerate the elimination of the production and consumption of hydrochlorofluorocarbons

(HCFCs), for countries operating under Article 5 of the Protocol, which includes Panama. With funding from the Multilateral Fund of the Montreal Protocol, governments took urgent steps to achieve this goal.

The HCFC Phase-out Management Plan in Panama includes long-term strategies, designed to comply with the commitments that the country has assumed under the Montreal Protocol, taking as a baseline the average consumption of HCFCs over the years 2009 and 2010, to reach a reduction of 97.5% from the baseline in 2030 and the total elimination of HCFC consumption in 2040.

The HPMP is implemented by NOU/MINSA, with support from UNDP, and includes actions aimed at strengthening the country's capacities for proper management of ODS and the use of alternative substances without impact on the ozone layer. As part of the HPMP, equipment has been endowed, both to the National Customs Authority and to RAC technician training centers, to strengthen these institutions in their work of verification / import control and manpower training, respectively. In order to guarantee the sustainability of the education and training process, NOU has established alliances with educational centers to strengthen their capacities and for them to incorporate specific modules of good practices in the use of refrigerants into their study plans. Additionally, seminars and courses are held to promote the use of alternative substances and sensitize decision-makers, so as to accelerate the transition to the use of alternative substances.

## **1.2 FIGHT AGAINST CLIMATE CHANGE**

Panama recognizes that climate change is a major global threat in environmental matters that affects



the population, ecosystems and all productive sectors of the economy. Through Law 8 of March 25, 2015, which creates the Ministry of Environment, the State assumes, in collaboration with other institutions, a national strategy and initiatives to increase the country's resilience to the adverse effects of climate change and to promote national transition to low-carbon economic development.

The RAC sector is responsible for the most of the country's energy consumption and, as indicated, indirect GHG emissions from electricity use in the RAC sector represent more than 70%. Therefore, it is extremely important to link strategies and actions to combat climate change, with energy efficiency and the protection of the ozone layer.

### **1.2.3 NATIONAL COMMUNICATIONS ON CLIMATE CHANGE AND BIENNIAL UPDATE REPORTS**

The country ratified the United Nations Framework Convention on Climate Change (UNFCCC), through Law No. 10 of April 12, 1995. The UNFCCC establishes a reporting mechanism on progress related to climate change in each of the party countries that comprise it. The instruments used in this reporting mechanism are National Communications (NC) and Biennial Update Reports (BUR).

Currently, the Ministry of the Environment, with the support of the United Nations Development Program (UNDP), is leading the process of preparing the Fourth National Communication on Climate Change and the Second Biennial Update Report. It is important to highlight that part of the national effort that is carried out consists of the recalculation of a time series 1990-2019 of the National Inventories of Greenhouse

Gases (INGEI). Updating these INGElS will represent a valuable tool for decision-making and the formulation of public policies on climate change, based on robust, updated and transparent scientific information.

The 2006 Intergovernmental Panel of Experts on Climate Change (IPCC) guidelines for INGElS indicates that greenhouse gas emissions caused by industrial processes, due to the use of greenhouse gases in products and non-energy uses of the carbon contained in fossil fuels are addressed within the industrial process and product use (IPPU) sector. Specifically, it includes the use of substitute products for substances that deplete the ozone layer. It should be noted that the first BUR in Panama did not include GHG emissions from the use of alternative substances to ODS, in the RAC sector, fire fighting and foams.


Currently, coordination and arrangements are being made between MINSA and MiAMBIENTE to include in the INGEl the information from the registry of imports and use of refrigerant gases.

### **1.2.4 NATIONALLY DETERMINED CONTRIBUTIONS**

In April 2016, Panama presented its Nationally Determined Contribution (NDC) to the UNFCCC with the objective of supporting the global effort to keep the increase in global average temperature well below 2° C in comparison to pre-industrial levels.

The Panamanian State, through the General Environmental Law, recognizes that climate change is an important global threat in environmental matters that affects the population, ecosystems and all productive sectors of the economy, as well as recognizes their common but differentiated responsibility to participate in the stabilization of





the concentrations of Greenhouse Gases (GHG) in the atmosphere at a level that prevents dangerous anthropogenic interference in the global climate system.

Panama is committed to reviewing and updating its NDC before the end of 2020. The adoption of a Cooling Plan could strengthen the context of this NDC, as a relevant initiative that links the improvement of energy efficiency in the RAC sector with actions to the reduction of GHG emissions and the protection of the ozone layer. In the medium term, some PEN strategies could be the basis for broadening the NDC's ambition and incorporating specific contributions from the RAC sector.

### **1.3 ENERGY EFFICIENCY**

Energy efficiency is a strategic pillar in the formulation of projects and planning of the responsible government entities. Panama has made big steps in energy efficiency, including the approval of the Law of Rational and Efficient Use of Energy (UREE), Law 69 of October 12, 2012. In this law, the National Secretariat of Energy (SNE), the entity responsible for conducting the country's energy policy, has the responsibility of guaranteeing a competitive, sufficient, high-quality, economically viable and environmentally sustainable supply of energy resources.

Refrigeration and air conditioning are energy intensive, so promoting energy efficiency measures in this sector is key to achieving emission reduction targets and incentivizing clean technologies, including the use of alternative refrigerants.

#### **1.3.1 LABELING AND MINIMUM ENERGY PERFORMANCE STANDARDS**

Labeling is the first measure a country can establish to ensure the use of appliances that are efficient in the use of energy and refrigerants. This measure is accompanied by norms and minimum standards of energy performance as key elements to ensure the incorporation of high-efficiency products into the market. The activity, which seeks to support the consumer in making decisions when acquiring a good or equipment, considering energy savings, additionally contributes to leveling the competition and allows comparability between equipment, providing greater security and confidence about its performance. Equipment that exceed established minimum efficiencies could be candidates for programs that offer incentives.

As part of an effort to change the situation in Panama, a country where technology entered that was not allowed in countries with higher efficiency requirements, minimum import standards have been established. The process includes the determination of the minimum energy efficiency indices by a committee, made up of members of the public sector, academia and the Technical Board of Engineering and Architecture (JTIA), and their approval by a sector committee coordinated by the Ministry of Commerce and Industries (MICI), with the participation of the private sector (importers, distributors, Chamber of Commerce, Industries and Agriculture of Panama). Currently, Panama has approved 6 standards and technical regulations for air conditioning equipment, refrigerators and engines, as shown in table 1.



TABLE 1 | **REGULATIONS AND GUIDELINES OF ENERGY EFFICIENCY APPROVED IN PANAMA**

<b>EQUIPMENT</b>	<b>DOCUMENT</b>		<b>RESOLUTION</b>
<b>A/A Split Inverter</b>	Regulation	DGNTI - COPANIT 104:2017	N° 114 de 2017
	Standard	DGNTI - COPANIT 509:2017	N° 69 de 2017
<b>A/A Split ON/ OFF</b>	Regulation	DGNTI - COPANIT 103:2017	N° 115 de 2017
	Standard	DGNTI - COPANIT 508:2017	N° 65 de 2017
<b>A/C room / window</b>	Regulation	DGNTI - COPANIT 102:2017	N° 116 de 2017
	Standard	DGNTI - COPANIT 507:2017	N° 67 de 2017
<b>A/A central</b>	Regulation	DGNTI - COPANIT 101:2017	N° 117 de 2017
	Standard	DGNTI - COPANIT 506:2017	N° 119 de 2017
<b>Refrigerator</b>	Regulation	DGNTI - COPANIT 105:2017	N° 31 de 2018
	Standard	DGNTI - COPANIT 511:2017	N° 28 de 2018

### 1.3.2 SUSTAINABLE BUILDING REGULATIONS

Most of the Panamanian population lives in cities, where 70% of electricity consumption occurs in buildings. Construction activity has grown significantly, and is expected to continue growing. Due to this situation, the National Energy Secretariat, together with the JTIA, developed a Sustainable Building Regulation (SBR). The objective of this instrument is to establish the minimum requirements to promote high-performance buildings, as a strategy to reduce the impact that buildings have on the environment.

The SBR, approved by JTIA Resolution No. 35 of June 26, 2019, involves the SNE and the municipalities in the review and registration of the preliminary projects for new buildings. Buildings must reduce energy consumption by 15%, implementing passive measures that improve the envelope and a single active measure that establishes the minimum efficiency of the building's air conditioning, through the minimum values of Coefficient of Performance (COP).

### 1.3.3 ECO-PROTOCOL

The Eco-protocol is a voluntary certification for existing buildings at the municipal level, based on a standard developed by the Panama Green Building Council (PGBC), the Municipality of Panama and a specialized firm from Singapore, which includes both legal aspects (incentive and obligations) and technical (categories and credits), as well as a guide to methodologies and strategies to make the building more sustainable and a review in the field.

## 2. OUTLOOK OF THE REFRIGERATION AND AIR CONDITIONING SECTOR IN PANAMA

Panama has experienced great growth in the commercial and construction sector, with first-world infrastructures that seek to meet the demand for goods and services, and boost the country's economic development. Panama has become the country with the highest per capita income in Latin America.



This wealth, in a tropical country, has been manifested in the air conditioning of the interior spaces of a large number of buildings that make up the urban mass of the Panamanian isthmus.

The average GDP growth rate between 2007 and 2018 is 10.9%. Based on this average, it can be said that the year 2020 will have a slowdown in the country's economic growth with an increase in GDP of 5.5%.

One of the effects of economic growth, along with other factors such as credit facilities and the greater supply of equipment, has been the increase in the installed capacity of refrigeration and air conditioning

equipment. Chart 1 shows how the import of RAC equipment increased significantly between 2015 and 2018.

The increase in imports of spare parts for refrigeration and air conditioning equipment indicates that the service sector is having a lot of activity. This in turn implies a higher requirement for skilled labor for maintenance and repair work.

To assess where Panama is compared to the world in terms of indoor air conditioning,

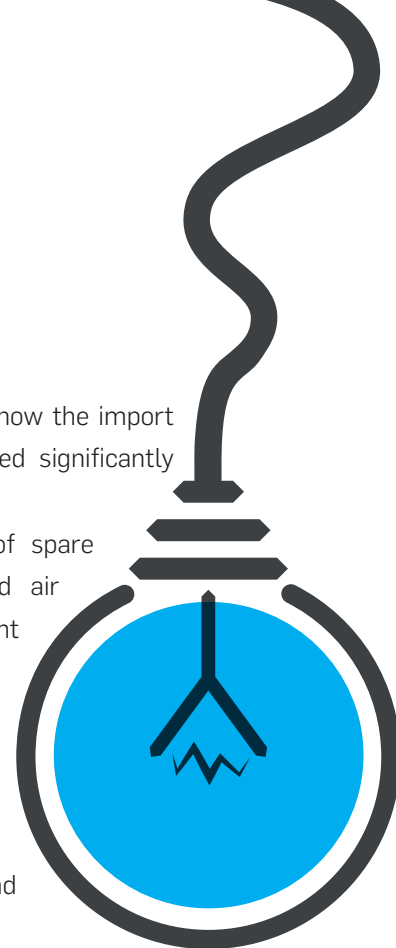
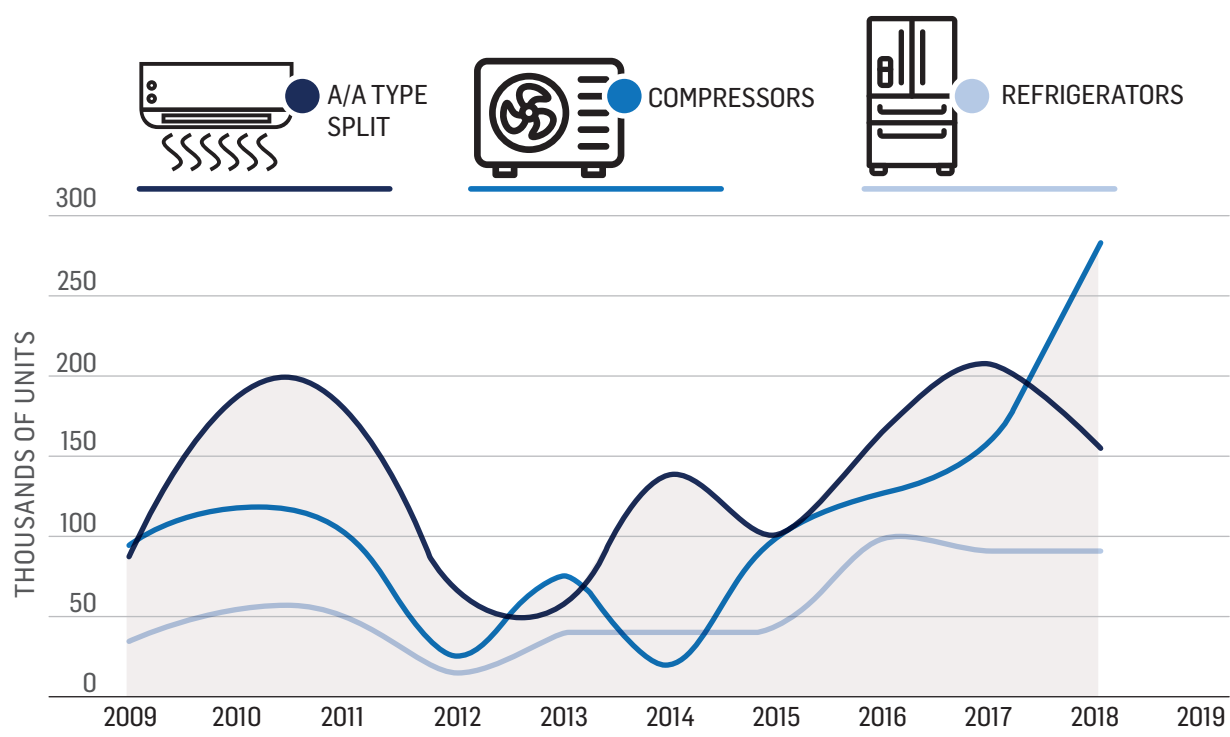


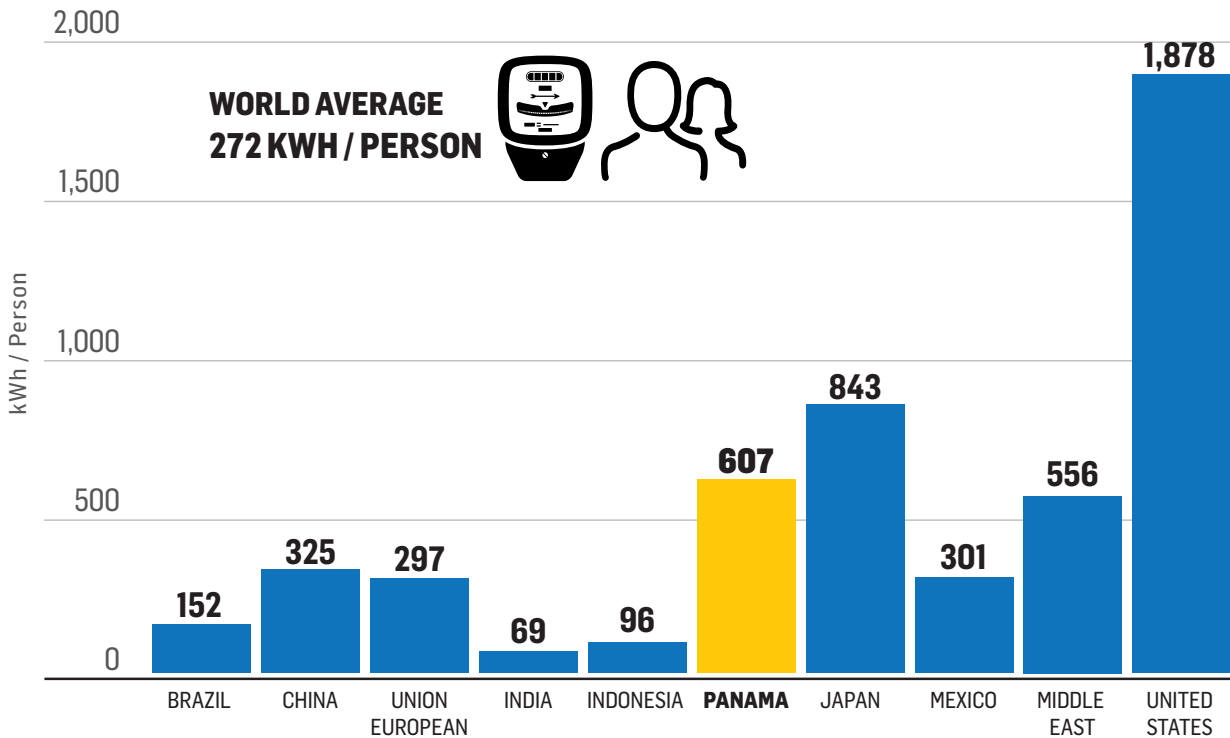
CHART 1 | **IMPORT OF SOME RAC EQUIPMENT 2009-2018.**



SOURCE: ANA AND UNO DATABASES 2009 - 2018



CHART 2 | **ANNUAL ENERGY CONSUMPTION FOR SPACE CONDITIONING PER CAPITA  
(KWH/PERSON)**



SOURCE: **DATA FROM THE FUTURE OF COOLING IEA 2018 AND STATISTICAL COMPENDIUM OF THE NATIONAL SECRETARIAT OF ENERGY**

energy consumption for space conditioning in Panama was calculated using data from the National Energy Secretariat and the information presented by the International Energy Agency (IEA) in "The Future of Cooling" (IEA, 2018) was used as a reference. International Energy (IEA) in "The Future of Cooling" (IEA, 2018). On chart 2, data indicate that the consumption of electrical energy for air conditioning in Panama is more than double the world average. From these results it can be concluded that the penetration of air conditioning equipment in Panama is high.

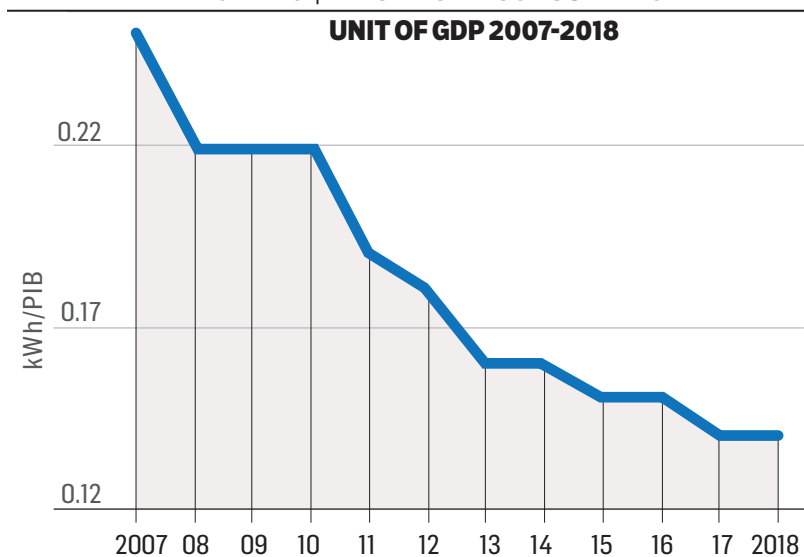
## 2.1 ENERGY CONSUMPTION

The energy consumption of a country is closely related to its economic development, since energy is a means of creating products and offering services. Similarly, as household income increases, more and/or larger equipment is acquired, which leads to an increase in energy consumption. Refrigeration and air conditioning require electrical power to operate, so taking energy consumption into account is critical to understanding the scale of RAC services, as well as the costs and opportunities it presents.



Graph 3 shows the intensity of electricity consumption in Panama, which is defined as the relationship between the consumption of electricity in a country and its economic development. The analysis of this indicator is relevant as it shows how many units of electrical energy are necessary to create a unit of wealth and can therefore be used as a measure of efficiency.

CHART 3 | **ELECTRICITY CONSUMPTION PER UNIT OF GDP 2007-2018**

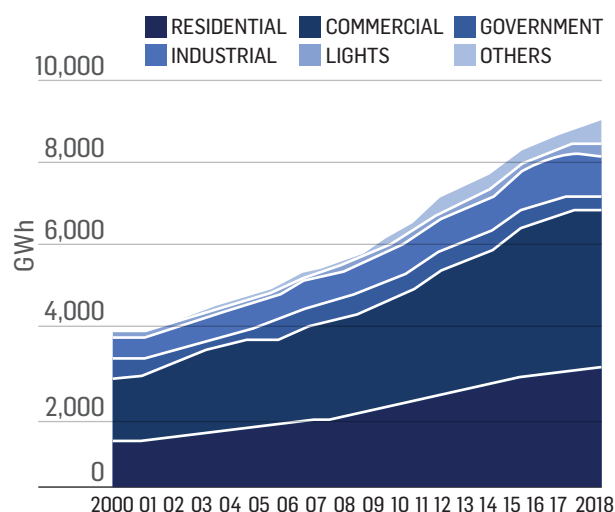


SOURCE: **STATISTICAL COMPENDIUM OF THE NATIONAL ENERGY SECRETARIAT**

In Panama, 70% of electricity generation comes from renewable sources, mainly hydroelectric. In general, the electricity generation matrix is quite clean and the country has made commitments to incorporate a greater number of renewable sources, such as solar and wind, to its installed generation capacity, as part of the NDC.

The electricity generation plant has significantly increased its capacity (72%) between 2012 and 2018, to face the increase in the country's electricity consumption, which has grown at an annual rate of 4% during this period. According to Graph 4, the country's electricity consumption increased 139% between the

CHART 4 | **ELECTRICITY CONSUMPTION 2000-2018**

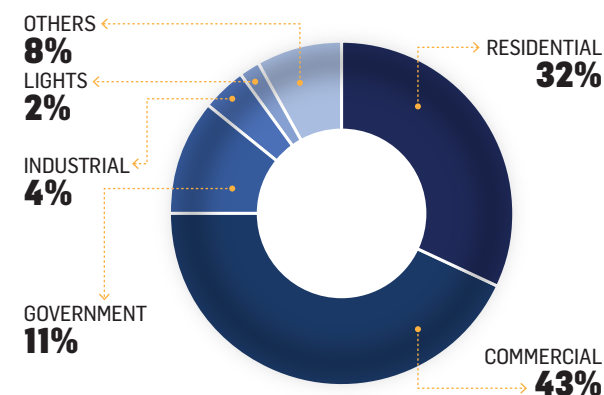


SOURCE: **STATISTICAL COMPENDIUM, NATIONAL SECRETARIAT OF ENERGY**

years 2000-2018, which has been directly linked to its economic growth.

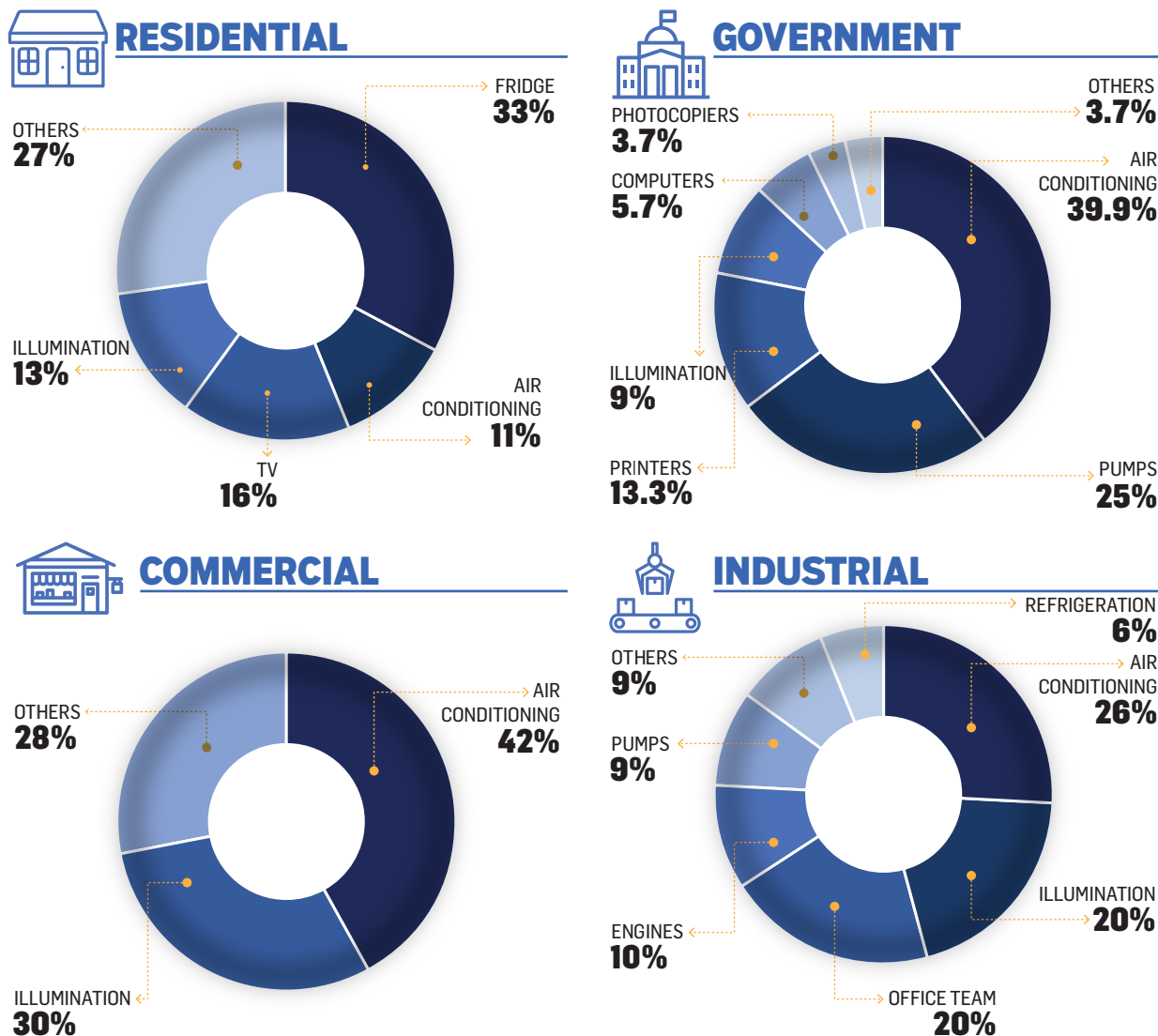
According to SNE data, currently, the national interconnected system (SIN) has 1,103,800 connected customers, with an average growth of 3.6% in the last 10 years. The commercial and services sector is the main consumer of electricity, followed by the residential sector, as shown in chart 5.

CHART 5 | **CONSUMPTION DISTRIBUTION PER SECTOR 2018**



SOURCE: **STATISTICAL COMPENDIUM, NATIONAL SECRETARIAT OF ENERGY**



CHART 6 | **ELECTRICITY CONSUMPTION IN THE PROVINCE OF PANAMA BY SECTOR AND FINAL USE: 2018**SOURCE: **STATISTICAL COMPENDIUM, NATIONAL SECRETARIAT OF ENERGY**

The 71% of electricity consumption is concentrated in the province of Panama. Graph 6 shows the electricity consumption of this province, according to use, for the four main consumption sectors: commercial, residential, government and industrial.

Data from 2018, represented in graph 6, indicate that the highest consumption of electrical energy is concentrated in the RAC sector for the four categories

of customers analyzed: residential (44.0%), commercial and services (42.0%), government (39.9%) and industrial (32.0%) in the province of Panama.

Using these percentages and the energy consumption of each of the sectors, a total of 3,449.18 GWh of electrical energy consumed by the RAC sector is obtained in 2018, which represents 53% of the total consumption of the province of Panama.



Based on this analysis, it is possible to state that changes in the efficiency of energy consumption in refrigeration and air conditioning are, and will be, key in the behavior of demand and will dictate the guidelines in any policy that is decided to adopt to reduce consumption electric power.

By projecting the growth of energy consumption in the residential, commercial, industrial and government sectors, for a horizon of 10 years and a prediction

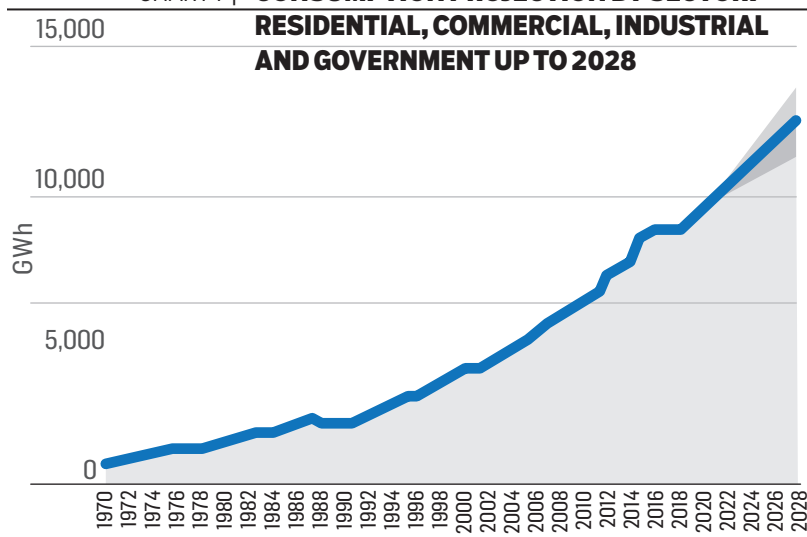
TABLE 2 | **REGULATED AVERAGE PRICE OF ELECTRICITY BY COUNTRY IN US CENTS / KWH (2012-2017)**

Country	2012	2013	2014	2015	2016	2017
Belize	21.1	24.2	22.6	19.5	18.4	18.9
Costa Rica	15.2	18.5	17	16.1	16.1	14.7
El Salvador	23	23.1	22.9	19.1	15.3	17.4
Guatemala	24.5	24.4	23	19.6	18.6	18.8
Honduras	18.5	17.7	17.3	15.2	13.9	14.5
Nicaragua	20.1	21.1	21.6	20.4	19.1	18.8
<b>Panama</b>	<b>17.1</b>	<b>18.9</b>	<b>18.8</b>	<b>19.9</b>	<b>16.2</b>	<b>17.3</b>

SOURCE: **STATISTICAL COMPENDIUM OF THE NATIONAL SECRETARIAT OF ENERGY**

by sector and range of consumption, the average price of electricity can be used to get an idea of the cost of RAC in the country. Under this premise, the energy expenditure for refrigeration and air conditioning in 2018 was 600 million dollars.

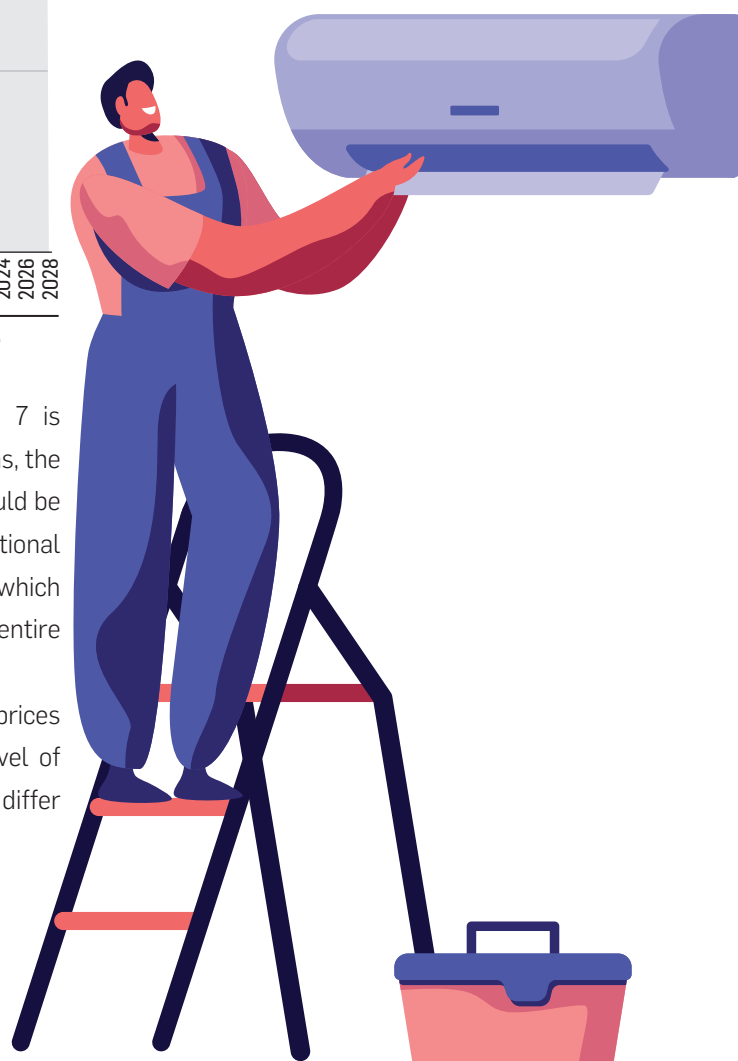
CHART 7 | **CONSUMPTION PROJECTION BY SECTOR: RESIDENTIAL, COMMERCIAL, INDUSTRIAL AND GOVERNMENT UP TO 2028**



SOURCE: **SNE ENERGY STATISTICAL COMPENDIUM 1970-2018**

interval of 90%, the scenario shown in graph 7 is obtained. If we assume that this behavior maintains, the total consumption for the RAC sector in 2028 would be 4,955.9 GWh. Compared to 2018, there are an additional 1,506.8 GWh that should be generated in 2028, which is equivalent to the annual consumption of the entire government and industrial sector together.

On the other hand, table 4 shows that electricity prices in Panama have remained competitive at the level of the Central American region. Although the rates differ







## 2.2 IMPORT OF REFRIGERANT GASES

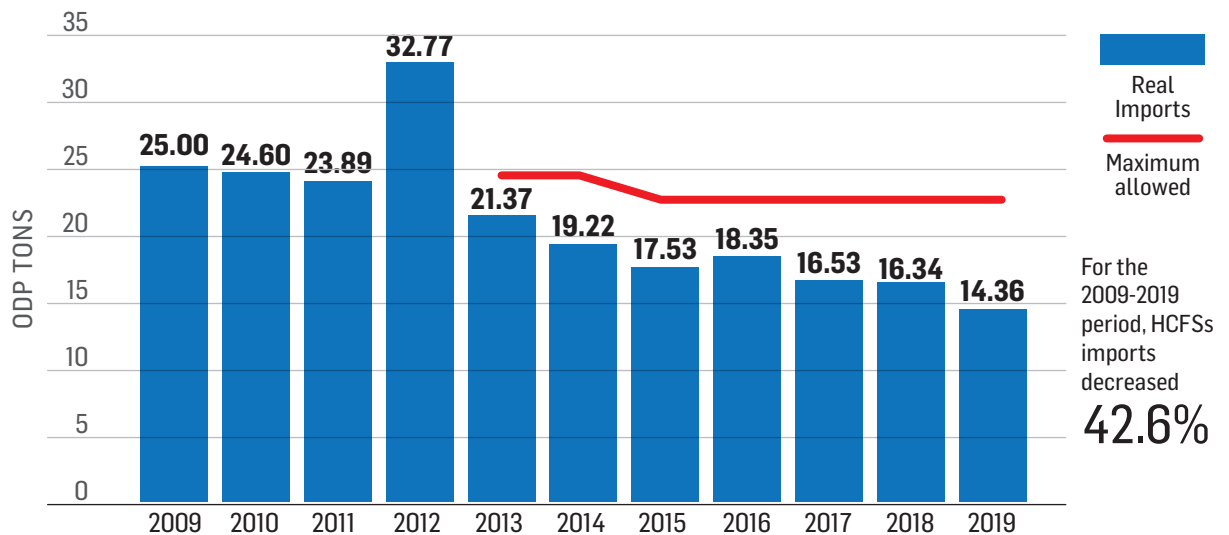
The Ministry of Health, through the National Ozone Unit, has implemented a HCFC import quota system, as part of the implementation of the Montreal Protocol and the HPMP. The objective of this measure is to control the introduction of ODS into the country, in accordance with the commitments assumed at the

international level.

The imports of HCFCs to Panama has decreased gradually, as can be seen in Graph 8. Import quotas came into force as of 2013, and the behavior of importers to increase their inventory in the previous year can be observed, preparing for reductions. The success of the HPMP implementation can be seen in the progressive reduction of HCFC imports.



CHART 8 | **HCFC IMPORTS IN ODP TONNES (2009-2019)**

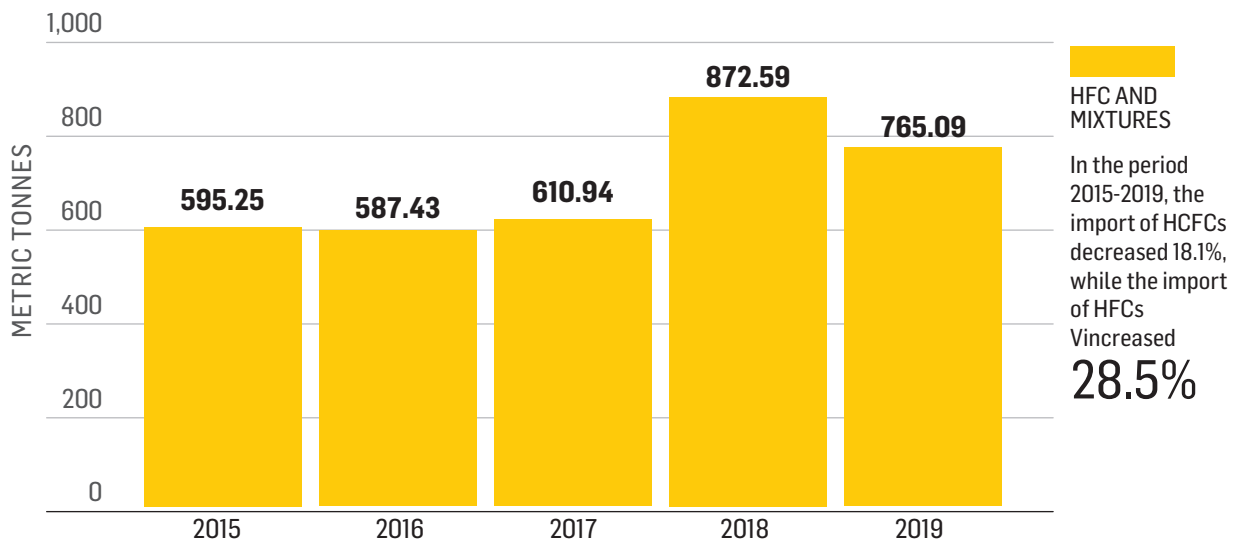


SOURCE: **NOU/MINSA IMPORT DATABASE, 2009-2019**

The gradual reduction of HCFC imports has led to replace these refrigerants with low Ozone Depletion Potential (ODP) substances, mainly to HFCs. Graph 9 shows the increase in imports of HFCs and HFC mixtures that contain it during the period 2015-2019. The increase in energy consumption and HFC imports,

as well as the proportional relationship between the consumption of HFCs and HCFCs for refrigeration and air conditioning, corroborate the importance of strategies for energy efficiency, climate change and protection of the ozone layer.

CHART 9 | **HFC IMPORTS (2015-2019)**



SOURCE: **DATA FROM NOU / MINSA IMPORT RECORDS**





### 3. BENEFITS OF A COOLING PLAN

The plan provides a roadmap for the industry to adapt to changes and plan its investments, while highlighting the importance of synchronizing the regulatory measures designed by the public sector on energy efficiency, mitigation of climate change and those related to the use of refrigerants.

#### **Developing a national cooling plan offers significant benefits for countries, including:**

- Optimization of resources in the implementation of initiatives by the public sector.
- Promotion of investments in the RAC sector, by clearly stating the objectives that will guide the development of policies and activities to be carried out.
- Identification of needs and opportunities to strengthen the sector and accelerate the transition towards sustainable development.

- Cost reduction through energy efficiency, for companies and consumers.
- Reduction of emissions that cause climate change, while creating a more resilient and sustainable energy system.
- Reduced food waste, improved human health and increased productivity through better access to cooling.

The Panama Cooling Plan (PCP) outlines the thematic areas, objectives and priority activities in the sector in an orderly manner, which opens the possibility for synergies to be forged among the various key actors. This tool makes it possible to link the implementation of comprehensive and cross-cutting policies in the country, maximizing environmental benefits and achieving the Sustainable Development Goals (SDG). Annex 1 shows the link between the thematic areas of the PCP with the SDGs.





## 4. OBJECTIVES

**The objectives of the Panama Cooling Plan are as follows:**

- Strengthen synergies between the cooling program and other programs and initiatives related to the environment and climate change.
- Relate energy efficiency and the transition to low global warming potential (GWP) refrigerants with a holistic vision of policy interventions aligned with economic growth.
- Establish a roadmap to accelerate the transformation of the RAC sector, integrating energy efficiency, the use of environmentally friendly refrigerants and climate protection, as well as people's health.

## 5. METHODOLOGY

The plan was developed with the participation and consensus of the main actors in the RAC sector, both government institutions, as well as companies and non-governmental organizations.

**The methodological process included:**

- A start-up workshop for the Panama Cooling Plan, held on October 25, 2019.
- The collection and analysis of data and relevant information from the RAC sector:
  - National Energy Plan 2015-2050.
  - Database of the electricity market of the SNE.
  - NOU/MINSA refrigerant import database.
  - Import database of RAC and refrigerant sector equipment from the National Customs Authority (ANA).



- Database of the National Institute of Statistics and Census (INEC) of the Comptroller General of the Republic of Panama.
- Interviews with actors in the RAC sector:
  - Distributors and importers.
  - End users.
  - Service and maintenance sector.
  - Importers of RAC equipment.
- A virtual workshop to validate the draft of the Panama Cooling Plan, held on April 16, 2020.

**A coordinating committee was created to review and validate the process, as well as the results.**

**This committee was made up of the following entities:**

- Ministry of Health
- Ministry of the Environment
- National Energy Secretariat
- United Nations Development Program.

In conjunction with the coordinating committee, 4 thematic tables were defined with relevant actors and institutions, as shown in table 2. The purpose of these tables was to identify the priority issues and the main opportunities for improvement for the sustainable development of the RAC sector.



TABLE 3 | **CONFORMATION OF THE THEMATIC TABLES**

REFRIGERANT CONSUMERS	IMPORTERS OF REFRIGERANTS AND EQUIPMENT	RAC SERVICES	STANDARDS AND REGULATIONS
<ul style="list-style-type: none"> <li>· ACP</li> <li>· ADAP</li> <li>· CAPAC</li> <li>· NATIONAL MARKETS PART OF THE COLD CHAIN</li> </ul>	<ul style="list-style-type: none"> <li>· GRUPO FRIOLÍN</li> <li>· DAIKIN</li> <li>· TRANE</li> <li>· JOHNSON CONTROLS</li> <li>· LG</li> <li>· PANASONIC</li> <li>· SAMSUNG</li> </ul>	<ul style="list-style-type: none"> <li>· ITSE</li> <li>· UTP</li> <li>· MEDUCA</li> <li>· CIEMI</li> <li>· COMPAÑÍA CLIMATIZADORA</li> <li>· COPANAC</li> </ul>	<ul style="list-style-type: none"> <li>· UNO</li> <li>· ASEP</li> <li>· SNE</li> <li>· MIAMBIENTE</li> <li>· PNUD</li> <li>· DGNTI</li> <li>· ANA</li> <li>· BCBP</li> <li>· JTIA</li> </ul>





## **6. LINK WITH NATIONAL PLANS AND POLICIES**

The National Policy for the Rational and Efficient Use of Energy (UREE) and the National Energy Plan 2015-2050, contemplate issues related to the PCP, such as energy efficiency standards for refrigerators and air conditioners, efficiency labeling, sustainable building and the management of waste from energy-consuming appliances.

Both the National Policy and the National Climate Change Strategy are closely linked to the PCP, since they identify and promote as climate benefits mitigation measures related to the introduction of new technologies and good service practices in the RAC sector.

Similarly, the PCP includes many of the HPMP topics, such as training, certification of competencies, capacity building of technicians and training institutes,





# PANAMA COOLING PLAN



recovery, recycling and regeneration of refrigerant gases, among others.

The National Waste Management Plan 2017-2027 and the Electric and Electronic Appliance Waste (EEAW) project of the Ministry of Health are also linked to the PCP in terms of the importance of managing waste from RAC equipment.

The Government Strategic Plan 2019-2024 emphasizes the strengthening of refrigerated transport services, and the importance of the Cold

Chain, as support, not only for the agricultural sector but also for the hospital infrastructure.

Finally, it is highlighted Panama's subscription to the environmental agreements of the Montreal Protocol, the Kigali Amendment and the Paris Agreement, as well as the adoption of the Sustainable Development Goals (SDG), all initiatives and commitments that are the basis of the PCP, as a comprehensive plan of the RAC sector, which contributes to the fulfillment of these.




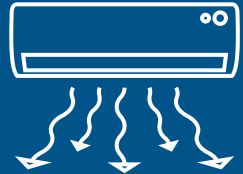




## 7. STRUCTURE OF THE COOLING PLAN

The Panama Cooling Plan has 4 pillars or priority themes. Each pillar contains several thematic areas,

18 in total, which are made up of specific activities, that indicate the steps to be followed and the level of priority that each one has.

<b>FIRST PILLAR: MANAGEMENT AND REGULATIONS</b>  	<b>SECOND PILLAR: ENERGY EFFICIENCY</b>  	<b>THIRD PILLAR: ENVIRONMENTAL SUSTAINABILITY</b>  	<b>FOURTH PILLAR: RAC SERVICES</b>  
<b>Thematic areas:</b> 1.1: Governance 1.2: Regulations and standards 1.3: Alternative technologies 1.4: Monitoring, verification and compliance	<b>Thematic areas:</b> 2.1: Efficient equipment 2.2: Building design 2.3: Preferences and Consuming patterns 2.4: District Cooling	<b>Thematic areas:</b> 3.1: National GHG Inventory 3.2: Environmental labeling 3.3: Refrigerant recovery and recycling 3.4: Equipment disposal and recycling 3.5: Communication	<b>Thematic areas:</b> 4.1: Inclusion 4.2: Training 4.3: Certification 4.4: Cold chain 4.5: Mobile air conditioning (MAC)





Rr13<sup>8</sup>/<sub>3</sub>

KILOWATTHOURS

## 8. PANAMA COOLING PLAN

### 8.1 FIRST PILLAR: MANAGEMENT AND REGULATIONS

The legal and regulatory framework, as well as the inter-institutional arrangements, are essential to implement the plan and achieve the proposed objectives. In the particular case of the RAC sector, several national institutions dealing with specific elements of the PCP will be part of its management framework. Also, as this is an intersectoral issue, the importance of involving the private sector, unions and associations is recognized.


The thematic areas of the management and regulatory pillar are presented below:

#### 8.1.1 GOVERNANCE [PRIORITY: HIGH]

The formalization of the framework for the implementation of the PCP and the strengthening of inter-institutional and intersectoral coordination are the most important goals to be achieved under this thematic area.

The implementation of the PCP will require the creation of a commission with the active participation of the private sector (importers of equipment and refrigerants, project developers, among others) that, together with the public sector, articulate the work plan for the execution of the activities of this plan.





The commission must empower itself and take ownership of this plan, taking responsibility for monitoring, periodically reporting progress, and evaluating the results. Additionally, this commission will be in charge of identifying and proposing adjustments to improve to the legal and regulatory framework of the RAC sector.

A solid governance structure will be of utmost importance to evaluate and propose projects, or initiatives that seek financial support and technical cooperation from multilateral and international agencies.

**Specific activities:**

- Creation of an inter-institutional commission responsible for executing the strategy.
- Development of a work plan and a mechanism for reporting progress and evaluating results.
- Updating and improving the existing legal and regulatory framework of the RAC sector.
- Creation of a public-private commission to coordinate efforts and monitor the implementation of the PCP.

**8.1.2 REGULATIONS AND STANDARDS**

**[PRIORITY: HIGH]**

Regulations and standards facilitate the development of activities, since they allow comparability, level the ground for competition between the various actors and create a clearer and safer environment for investors (importing companies, service provider companies, among others.) This thematic area aims to improve the competitiveness of RAC teams and services with clear regulations and standards, under a coordinated management among the relevant actors.

Although the RAC sector has advanced technology and highly trained professionals, there is also a lot of informality; people who apply unsafe and inappropriate methods, as well as equipment of dubious quality and efficiency. This situation must be addressed by establishing standardized criteria of quality, efficiency and safety for equipment, designs, installation, maintenance and disposal services, and even for technicians. Currently, the country has several regulations related to the RAC sector, however, these have been developed separately, without a link that maximizes its benefits.

The HPMP has made progress in this regard, supporting the technical training of professionals in the RAC sector, the adoption of safety regulations and the development of labor competence regulations. On the other hand, the SNE has worked on standards and technical regulations for energy efficiency, establishing minimum efficiency requirements and standardized methods for testing equipment.

**Specific activities:**

- Creation and updating of regulations and standards:
  - Energy efficiency of RAC equipment.
  - Safety for natural refrigerants.
  - Design of RAC systems.
  - Design of insulation for buildings.
  - Minimum design and construction criteria for district cooling systems.
  - Installation and maintenance of RAC equipment.
  - Procedure for disposing / discarding RAC equipment.
  - Certification of labor competencies.



### 8.1.3 ALTERNATIVE TECHNOLOGIES

#### [PRIORITY: HIGH]

With the objective of accelerating the transition of the RAC sector towards the use of clean and efficient technologies, this area proposes the identification and development of a system of incentives and benefits that directly affect the current offer available in the market.

Incentives should focus on having an implementation calendar that ensures clear conditions for investors and establishes the gradual reduction of incentives, as barriers are overcome and technology is able to position itself in the market.

#### **Specific activities:**

- Creation of incentives for the import and production of clean and efficient technologies, as well as environmentally friendly refrigerants.
- Implementation of incentives for projects that use clean technology and substances zero ODP y low GWP.
- Elimination of indirect incentives for the use of inefficient equipment and substances with high ODP and/or GWP.

### 8.1.4 MONITORING, VERIFICATION AND COMPLIANCE [PRIORITY: HIGH]

The general objective of this thematic area is to guarantee the execution of the PCP's activities and the fulfillment of its objectives, by establishing a monitoring and evaluation system, which includes both work plans and periodic progress reports. As a specific goal, it will be important to continually review all indicators and evaluation criteria established in the PCP. In this way, not only will its real impact be measured, but also the necessary adjustments or

corrections can be made in a timely manner during its execution.

#### **Specific activities:**


- Systematized monitoring and verification of the indicators and other measurement criteria identified, which allow the impact of the PCP to be periodically evaluated.
- Establishment of a reporting and registration mechanism that allows the control of imported RAC equipment (including energy efficiency and refrigerant gas charging).
- Creation of platforms that facilitate the process of permits and verification of compliance with the SBR, while recording information and creating a building database.

### 8.2 SECOND PILLAR: ENERGY EFFICIENCY

The strategy within this pillar focuses on promoting efficient equipment and the replacement of inefficient equipment, improving building designs to reduce air conditioning requirements, promoting district cooling as an efficient alternative that reduces the requirements of RAC systems and, finally, influence people's preferences and consumption patterns, so that they demand efficient equipment and use them appropriately.

Energy efficiency is one of the key points within the RAC sector, because it reduces costs, increases productivity and avoids GHG emissions. The opportunities are many, considering that the barriers, such as the initial price of the investment and the lack of knowledge of the technology, can be solved relatively quickly; besides that there is a wide availability of equipment in the country. With some incentives and proper





promotion, there would be a broad impact due to the domino effect.

The thematic areas of the energy efficiency pillar are presented below.

### **8.2.1 EFFICIENT EQUIPMENT**

#### **[PRIORITY: MEDIUM]**

Transitioning existing RAC equipment can take some time, considering the useful life of this equipment and the initial costs of a new equipment. Therefore, promoting the replacement of inefficient equipment, increasing the demand for efficient equipment, and influencing the supply of equipment, is the main objective of this thematic area. This type of program, which encourages competition among suppliers, also aims to increase supply and reduce prices.

Public institutions must lead by example, favoring the acquisition of highly efficient equipment. This single action not only shows its confidence in the rapid recovery of the investment due to the savings in energy consumption, but also creates a real demand for this equipment, sending a clear signal to importers of equipment and technologies of what the country requires.

In the case of the residential sector, it will be key to design and implement replacement projects that facilitate financing to overcome the initial price barrier. It would be expected that these types of projects promote success stories that make known the benefits of the new technology, especially those related to reducing energy costs. Within this context, the implementation and updating of the energy efficiency labeling, as a friendly tool of relevant information for the consumer, should be considered.

#### **Specific activities:**

- Inclusion of specifications for high-efficiency equipment (with an efficiency well above the minimum) in public procurement policies.
- Creation of replacement programs for inefficient equipment installed in public institutions and / or modernization of systems to optimize efficiency.
- Implementation of programs that facilitate the replacement of inefficient equipment in the residential sector.
- Evaluation of the feasibility of an accredited energy efficiency testing laboratory.

### **8.2.2 BUILDING DESIGN [PRIORITY: MEDIUM]**

The Sustainable Building Regulations (SBR), the Eco-protocol and the Air Conditioning and Ventilation Regulations (ACVR) are important tools to reduce the requirement for air conditioning and, therefore, energy, in the design and construction of new buildings. Therefore, the objectives of this thematic area aimed at aligning these initiatives, covering the gaps that still exist to increase the supply and demand of buildings that reduce the need for energy for air conditioning and refrigerant charging through innovative designs. Strengthening the capacities of both enforcement authorities and design professionals is key to ensuring that the expected benefits are achieved. Similarly, the identification and promotion of adequate incentives that help accelerate the transformation of the real estate sector is an issue to consider, given the relevance of its high energy consumption and demand for RAC services.

#### **Specific activities:**

- Strengthening the capacities of the municipalities



and entities responsible for verifying compliance with the standards for insulation design in buildings and SBR.

- Inclusion in university curricula, the design of passive cooling and the use of insulating materials that improve the efficiency of the air conditioning system.

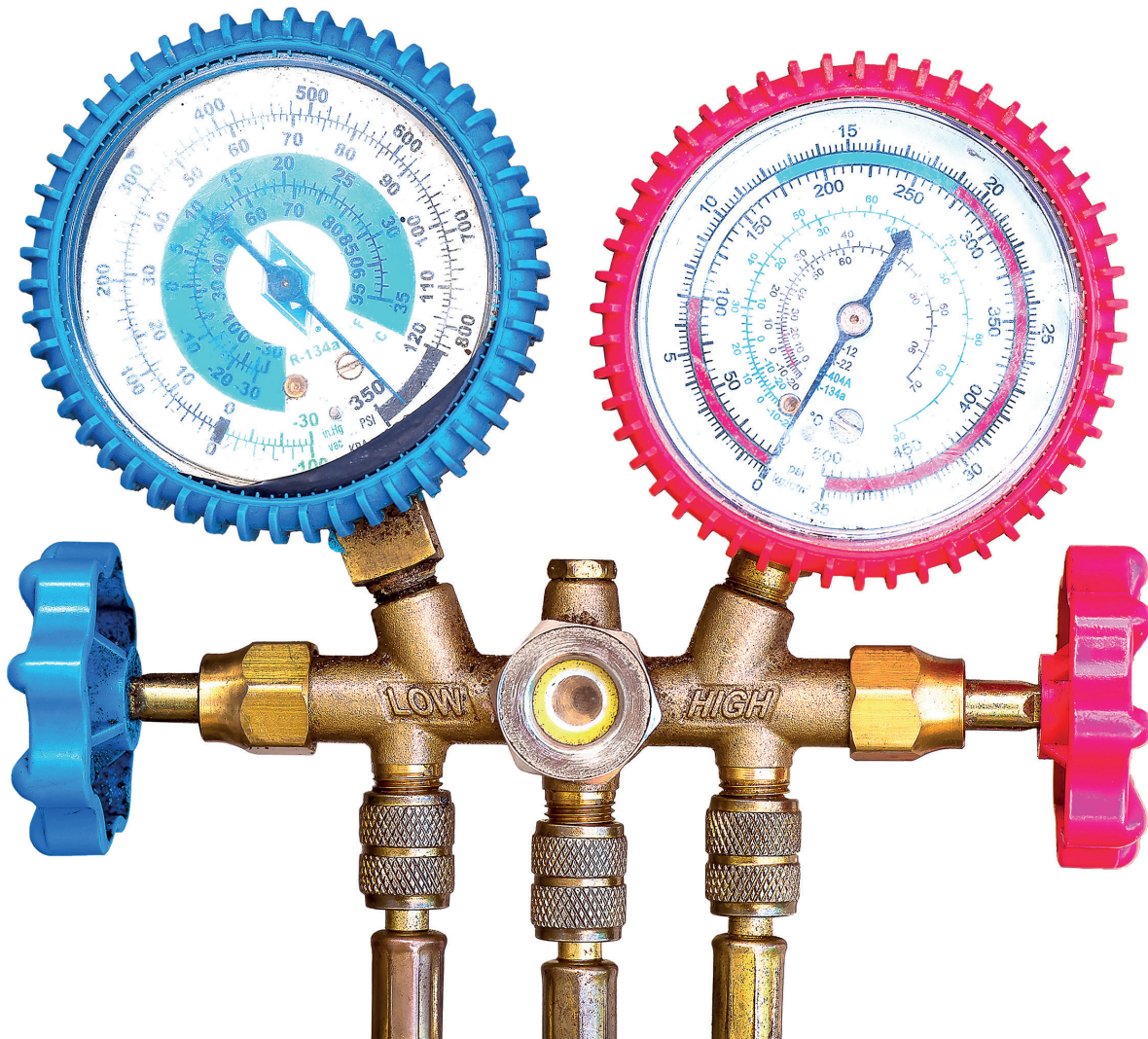
- Creation of incentives for homes that apply high efficiency measures, use of renewable energy, passive cooling and new thermal insulation technologies.

### 8.2.3 CONSUMPTION PREFERENCES AND PATTERNS [PRIORITY: HIGH]

Understanding preferences and consumption patterns is an essential issue if you want to modify / transform a market. In the case of the RAC sector, the supply of equipment and services responds to demand from

consumers. Whenever there is demand for inefficient equipment, cheap installations and buildings that do not consider adequate insulation, there will be an offer to supply that demand. Therefore, understanding the consumer, educating them about the pros and cons of their choices and giving them appropriate signals (through incentives, labeling, etc.) will cause changes that in turn will modify the offer.

The primary objective of this thematic area will then be to develop an awareness and dissemination program or campaign that allows changing the patterns of use of air conditioning systems and the demand for efficient RAC equipment. To achieve the desired impact, its design must consider the different educational levels of the target population, as well as know the motivations that define their current preferences.





### **Specific activities:**

- Identification of preferences and purchasing patterns in the various consumer sectors (residential, commercial, industrial, transportation).
- Development of equipment cost studies (purchase, operation and maintenance).
- Implementation of sectoral promotion and awareness plans to modify consumption patterns.

#### **8.2.4 DISTRICT COOLING [PRIORITY: LOW]**

The district cooling system is an energy efficient air conditioning system, which consumes between 35% and 20% less electricity compared to traditional air conditioning systems, which are based on the cooling of air or water by means of the evaporation of a refrigerant gas. Additionally, this district cooling method has a central point for the maintenance of the refrigerant circulation system, allowing the reduction of leakage sites or their inappropriate handling.

Although there are already some examples in Panama, the promotion of this type of system would help reduce ODS consumption, as well as GHG emissions. In this sense, this component seeks to establish the favorable conditions for the development of district cooling projects, as an alternative to reduce energy consumption and the demand for refrigerants.

### **Specific activities:**

- Implementation of district cooling projects and disseminate the results.
- Mapping of the areas with the greatest potential to develop district cooling projects.
- Development of district cooling demonstration projects in government facilities, through public-private partnerships.

- Creation of incentives for urban projects that implement district cooling.
- Sensitization to promoters and government authorities (central and municipal) about the benefits of district cooling.

### **8.3 THIRD PILLAR: ENVIRONMENTAL SUSTAINABILITY**

The development of activities in the RAC sector must incorporate the elements of environmental sustainability, identifying their impact, promoting clean and environmentally friendly technologies, and promoting recycling, both of equipment and refrigerants. It will also be important to consider the dissemination of relevant information to guide decision makers, private companies and the general public about the importance of the measures indicated in this plan, as well as the effect of their decisions / activities at the local and global level.

The thematic areas of the environmental sustainability pillar are presented below.

#### **8.3.1 NATIONAL INVENTORIES OF GREENHOUSE GASES [PRIORITY: MEDIUM]**

Law 8 of 2015, which creates the Ministry of the Environment, establishes that "the Ministry of the Environment, with the support of other institutions, will periodically prepare and publish a national inventory of emissions by sources and removals by sink of uncontrolled greenhouse gases by the Montreal Protocol". However, it is important to clarify that, due to poor service practices and the generation of leaks, the RAC sector influences both ODS and GHG emissions to the environment as well as excessive energy consumption.



The strategic objective of this area will be to understand, in a transversal way, the impact of the RAC sector on the environment, which will contribute to the design of complementary policies, norms and programs oriented to specific topics; in addition to collecting relevant data and information that strengthens the development of other thematic areas.

#### **Specific activities:**

- Development of surveys about:
  - RAC equipment market.
  - Characteristics of the RAC equipment installed.
- Preparation of time series and scenarios of:
  - CO<sub>2</sub>eq emissions from the use of alternative refrigerant gases to ODS.
  - Indirect CO<sub>2</sub>eq emissions from the use of RAC equipment.

### **8.3.2 ENVIRONMENTAL LABELING [PRIORITY: LOW]**

Environmental labeling is defined as one of the first voluntary measures that a country can implement to stimulate demand for products and services with lower environmental burdens, offering relevant information on their life cycle to satisfy consumer demand for environmental information.

In order to influence the preferences and purchasing patterns of end users/consumers, this component aims to implement environmental labeling, which serves as a hallmark of highly efficient equipment with low impact on the environment. In addition to the fact that this measure makes it easier for consumers to identify environmentally-friendly equipment, it also has benefits for suppliers, since it can give them recognition, facilitate the application of incentive

programs and, finally, give visibility and enhancement to the equipment for marketing in stores.

#### **Specific activity:**

- Creation of an environmental labeling for equipment that exceeds minimum standards and that contain refrigerants with zero ODP and low GWP.

### **8.3.3 RECOVERY AND RECYCLING OF REFRIGERANT GASES [PRIORITY: MEDIUM]**

In Panama, there are no facilities for the storage, recovery and recycling of refrigerants or their final disposal, therefore, under this thematic axis two important objectives are pointed out: (1) facilitate the development of initiatives for recovery and recycling, either by the public or private sector and (2) assess final disposal options, inside or outside the country, in accordance with international standards.

The issue of recovery, reuse, recycling and regeneration was included in previous stages of HPMP II, however, it was not possible to set up facilities that would provide the service, so the effort must be resumed, incorporating the lessons learned.

The recovery and recycling of refrigerants would help reduce the need for imports, and would allow maximum use of the substances that are already in the country.

#### **Specific activities**

- Creation of refrigerant collection and recycling centers.
- Identification of alternatives and opportunities for regeneration of refrigerants.
- Implementation of a mechanism for the final disposal, elimination or export of refrigerants to be destroyed.



### 8.3.4 DISPOSAL AND RECYCLING OF EQUIPMENT [PRIORITY: MEDIUM]

Discarded RAC equipment, either due to irreparable damage or technological obsolescence, must first be recycled, in order to make the most of its components and avoid ending up intact in landfills or inappropriate sites. The recycling industry around RAC equipment could make profitable and attractive the investments to upgrade existing facilities and create more jobs.

Mass equipment replacement programs to promote clean technologies generate large amounts of discarded equipment. Therefore, through this axis it is specifically intended to identify, promote and strengthen the actions of recycling, disposal and final disposal of equipment that can be developed or be developing in the country.

#### Specific activities:

- Linking the incentives to purchase efficient equipment with the responsible disposal of old and inefficient equipment.
- Identification of RAC equipment recycling centers nationwide and their capacities.
- Strengthening the capacities of RAC equipment recycling centers.

### 8.3.5 COMMUNICATION [PRIORITY: HIGH]

Communication, in the context of the PCP, seeks to make available to all people both the impacts of the use of substances with high ODP and GWP, as well as the potential benefits of alternative technologies / substances that exist in the market.

The key feature in this process will be the transmission of simple messages to a public that is not familiar with highly specialized concepts of energy efficiency, refrigeration and air conditioning, allowing them to

understand some issues of their reality, improve their health and even contribute the care of the environment.

The communication strategy, in addition to generating relevant information that is understandable to the target audience, must establish the most appropriate dissemination channels.

Communication efforts and the associated informative material must be designed, both for decision makers and personnel in charge of verification and compliance, as well as companies from the private sector and the general public.

#### Specific activities:

- Dissemination of information on the negative impacts of the use of technology inefficient and substances with high ODP and GWP, both globally and locally.
- Awareness aimed at decision makers on policies, regulations and projects to accelerate the transition to the use of substances and environmentally friendly RAC technologies.
- Information disclosure on alternative substances with zero ODP and low GWP, exiting in the market and their economic and environmental benefits.
- Promotion of demonstration projects for the use of new technology and alternative substances, publicizing the results (benefits, lessons learned, etc.).

## 8.4 FOURTH PILLAR: REFRIGERATION AND AIR CONDITIONING SERVICES

The design, installation, operation, maintenance and retirement of RAC equipment directly influences its performance. When these services are of quality, guarantee the efficiency of the equipment and extend its useful life.

RAC services must be developed by properly trained,



updated and certified personnel, which requires investment in training and training centers, creation of regulations that standardize procedures and certifications of competencies.

This sector should include the cold chain, which is essential in the food and medicine supply chain, as well as the use of mobile refrigeration equipment, since it is important to attend to all the edges of the sector.

Next, the thematic areas of the refrigeration and air conditioning services pillar are presented.

#### **8.4.1 INCLUSION [PRIORITY: HIGH]**

The RAC sector has traditionally been dominated by the male sex; however, in Panama we have seen an increase in the participation of women, particularly in leadership and decision-making roles. From this perspective, it will be important as the objective of this thematic area to assess the barriers that still persist and prevent greater participation of women, seeking strategies that promote a more conducive environment, which facilitates their labor insertion in the technical field.

Decision-making in the sector must incorporate the vision of all stakeholders, including end users, who must be heard and their opinions considered. Therefore, another of the objectives to be considered under this thematic area will be to promote spaces for effective participation that allow the exchange of ideas and experiences with consumers in the RAC sector.

Energy is a means to satisfy various basic needs of the population, some of which require refrigeration to preserve food medicines and / or vaccines, among others. The country's electrification programs must be designed with an inclusive vision, taking into consideration the vulnerable low-income population,

so that they can access this type of services, with quality, efficient refrigeration equipment that contains refrigerants of low environmental impact.

#### **Specific activities:**

- Identification of barriers to the participation of women in the RAC sector and how to overcome them.
- Promotion of spaces for participation for women in the sector (both at the management / administrative level and at the technical level).
- Promotion of women's participation in forums, spaces for consultation and decision-making, as well as workshops and training courses.
- Expansion of the consultation and citizen participation processes on issues related to RAC.
- Evaluation of the scope / coverage of basic RAC services and identify opportunities in rural communities / businesses.
- Analysis of the social impact and economic potential of expanding access to RAC services.


#### **8.4.2 TRAINING [PRIORITY: HIGH]**

Having a qualified workforce

is key for RAC facilities to yield the expected benefits, guaranteeing both the useful life of the equipment and the proper handling of the refrigerants they contain. The exhaustive training of RAC technicians ensures the fulfillment of this objective.

Training programs must be well structured, with defined topics, and supported with appropriate guides, practices, and teaching materials. To measure the scope and effectiveness of these programs, it is also necessary to maintain a database of trained RAC technicians, as well as the subsectors they serve: commercial, industrial, residential, mobile





air conditioning, among others). In order to support these aspects, the PCP aims to strengthen training institutions so that they not only provide quality technical education, but also contribute to compliance with regulations and decision-making in this sector.

**Specific activities:**

- Creation of a registry of professionals (by sex and age group) dedicated to RAC services.
- Implementation of standardized minimum contents for courses on good refrigeration practices and the use of substances or alternative technology, based on international best practices and national regulations.
- Strengthening the capacities of the institutions dedicated to the technical training of RAC professionals.
- Training aimed at government entities dedicated to the control and verification of national regulations on RAC.
- Training on policies, regulations, incentives and initiatives carried out in other countries and that are success stories or case studies, from which valuable lessons can be obtained to be adapted to Panama.

**8.4.3 CERTIFICATION [PRIORITY: MEDIUM]**

Certification is the process by which the application of the knowledge acquired during the education and training process is verified. Certification, which can be given at different levels and activities, makes it easier to identify professionals who meet certain parameters of proven experience and knowledge. In addition, a certification scheme generates greater confidence in employers or users who hire the services of these professionals.

The objective of this component is to promote

the implementation of a certification system for professionals in the RAC sector, which includes, among other aspects, the establishment of a regulatory framework, the accreditation of companies that provide certification services, certification of evaluators of the competencies, the identification of incentives and recognitions, the registration and certification of technicians.

The value of certification for a technician is in the possibility of obtaining a better remuneration and increasing the chances of obtaining a contract. For the contractor, guarantee that the installation, operation or maintenance services are carried out adequately, with quality and safety.

**Specific activities:**

- Development of a certification system/scheme for RAC service professionals.
- Creation of a database, of certified RAC professionals, accessible to the public.
- Implementation of a recognition/distinction to RAC service companies that certify 100% of their technical staff.
- Include, in public procurement policies, that only companies and RAC service personnel that have the competency certification will be hired.

**8.4.4 COLD CHAIN [PRIORITY: LOW]**

The cold chain is the controlled management of the temperature and humidity of perishable products, from their origin to the points of distribution and consumption, reducing costs related to waste and offering better quality products to consumers.

Currently, with the Panama Cold Chain project, four post-harvest handling centers and one of the eight markets that were planned to be built are in operation.



While still in the planning or construction phase, many projects could integrate the use of alternative refrigerants and not have to change technology once built.

From this thematic area, it will be key to promote the development of the cold chain infrastructure with the use of cooling systems with low energy consumption, based on refrigerants that do not affect the ozone layer and have low global warming potential (GWP).

#### **Specific activities:**

- Linking the cold chain development plans with the plans to promote energy efficiency, use of clean energy and reduce the use of substances with high ODP and GWP.
- Identification of the impact on the environment and the potential for savings in the cold chain, by using clean and efficient technology.
- Raising funds to promote the use of efficient equipment, use of renewable energy and substances with zero ODP and low GWP.

programs and develop pilot projects.

#### **Specific activities:**

- Creation of a registry of transport, with specific RAC equipment.
- Preparation of a base line of refrigerant consumption in RAC mobile equipment.
- Assessment of alternatives to the use of substances with high GWP in MAC sector.
- Promotion of demonstration projects for the use of environmentally friendly substances in MAC.

### **8.4.5 MOBILE AIR CONDITIONING [PRIORITY: MEDIUM]**

Identifying opportunities for improvement in the use of refrigerants in the MAC sector is extremely important, since it is estimated that 36% of the HFCs used for air conditioning are used by MAC .

In order to influence the change in technology and the consumption of refrigerants in the MAC sector, it will be necessary to make a field diagnosis, which identifies the characteristics of the equipment and refrigerants of the mobile fleet in Panama. Likewise, a better understanding of the current situation will later make it possible to evaluate existing and economically viable alternatives, in order to launch promotion







## 9. CONCLUSIONS

The development of economic activity, the increase in family income, which facilitates acquiring RAC equipment in greater quantity and capacity, makes necessary the establishment of regulatory and normative measures that allow an orderly development of the RAC sector activities. The requirements for equipment, designs and installation, operation, maintenance and disposal services must be accompanied by incentive programs and capacity building, in such a way that the transition in the sector is facilitated and the expected benefits are guaranteed.

This Cooling Plan indicates the route to follow, identifying the activities necessary for a sustainable development of the RAC sector. Responsibility is shared between the government sector, private companies, independent professionals and the general population. Each of these actors has a role, whether in the offer of training courses, the market for equipment and services, or the rational and efficient use of systems.

Inclusion is a fundamental issue, inequality in access to RAC services must be fought and the barriers faced by women in the sector must be overcome. This will be possible to the extent that the necessary spaces for dialogue are enabled, which allow the formalization of activities, the strengthening of representative associations of both users and technicians, and the establishment of alliances that promote cooperation and development of the activities of this plan.

The movement towards sustainable refrigeration will need to be reinforced through a robust public-private management ecosystem, which drives the implementation of new technologies, the consumption of alternative refrigerants and the development of a skilled workforce.

Finally, this Cooling Plan must be periodically reviewed and updated, incorporating new scientific findings and innovative technologies, as well as changes in the national context or emergency situations. These updates must follow the same process as their creation, a participatory, inclusive and open process.





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**ANNEXES**



## ANNEX 1 | LIST OF THE COOLING PLAN AND THE SDG ANNEXES

PILAR	THEMATIC AREAS	2	3	4	5	6	7	8	9	10	11	12	13	17
MANAGEMENT AND REGULATIONS	1.1 GOVERNANCE													✓
	1.2 REGULATIONS AND STANDARDS					✓	✓	✓			✓	✓	✓	
	1.3 TECHNOLOGIES AND ALTERNATIVES					✓		✓				✓	✓	
	1.4 MONITORING, VERIFICATION AND COMPLIANCE					✓	✓	✓			✓	✓	✓	
ENERGY EFFICIENCY	2.1 EFFICIENT EQUIPMENT					✓		✓				✓	✓	
	2.2 BUILDING DESIGN					✓		✓			✓	✓	✓	
	2.3 PREFERENCES Y CONSUMING PATTERNS					✓						✓	✓	
	2.4 DISTRICT COOLING					✓		✓			✓	✓	✓	
ENVIRONMENTAL SUSTAINABILITY	3.1 NATIONAL GREENHOUSE GAS INVENTORIES											✓	✓	
	3.2 ENVIRONMENTAL LABELING											✓	✓	
	3.3 REFRIGERANT RECOVERY AND RECYCLING											✓	✓	✓
	3.4 EQUIPMENT DISPOSAL AND RECYCLING					✓						✓	✓	✓
	3.5 DIVULGATION						✓	✓	✓		✓	✓	✓	
RAC SERVICES SECTOR	4.1 INCLUSION			✓	✓			✓		✓				
	4.2 TRAINING			✓			✓	✓				✓	✓	✓
	4.3 CERTIFICATION			✓			✓	✓				✓	✓	
	4.4 COLD CHAIN	✓	✓	✓			✓	✓					✓	✓
	4.5 MOBILE AIR CONDITIONING (MAC)	✓										✓	✓	





ANNEX 2 | **MATRIX OF THE PANAMA COOLING PLAN**

<b>PILAR</b>			
<b>MANAGEMENT AND REGULATION</b>			
<b>Thematic Area</b>	<b>Objectives</b>	<b>Activities</b>	<b>Indicators</b>
1.1 Governance	Formalizing the framework for the implementation of the PCP. Strengthening the institutional and intersectoral intersectoral coordination.	Creation of an interinstitutional commission responsible for executing the strategy.	Number of annual meetings.
		Development of a workplan and progress reporting and results evaluation mechanism.	Published work plan. Number of progress reports published.
		Update and improvement of the existing legal and regulatory framework of the RAC sector.	Number of legal framework documents adopted/updated.
		Creation of a public-private commission to coordinate the efforts and provide follow up to the PCP implementation.	Number of annual meetings.
1.2 Regulations and Standards	Improve equipment and RAC services with clear regulations and standards.	Regulations and standards creation and update for: <ul style="list-style-type: none"> <li>• RAC equipment energy efficiency.</li> <li>• Safety in the use of natural refrigerants.</li> <li>• RAC systems design.</li> <li>• Building insulation design.</li> <li>• Minimum design and construction criteria for district cooling systems.</li> <li>• Installation and maintenance of RAC equipment.</li> <li>• Disposal/discard of RAC equipment.</li> <li>• Certification of labor competencies.</li> </ul>	Number of years since the creation / last regulations update.
1.3 Technologies and alternatives	Accelerate the transition of the RAC sector towards the use of clean and efficient technologies.	Creation of incentives for the import and production of clean and efficient , as well as alternative refrigerants. Implementation of incentives for projects that use clean substances with zero ODP and low GWP.	Incentives created. Total amount of incentives granted.
		Elimination of indirect incentives for the use of inefficient equipment and substances with high ODP and / or GWP.	Number of measures implemented.
1.4 Monitoring, verification and compliance (MVC)	Ensure the execution of activities and the fulfillment of the objectives.	Create a unified system to monitor and verify the impact of the PCP (in kWh, ODP Ton and CO <sub>2</sub> eq Ton avoided).	System created. Number of reports generated.
		Certify a testing laboratory, which verifies the compliance of the equipment with national standards.	Number of certified laboratories. Amount of equipment verified.
		Establish a reporting and registration mechanism for imported RAC equipment (including energy efficiency and refrigerant gas charging).	System created.
		Create the platforms that facilitate the permitting process and verification of compliance with the SBR, while recording the information and creating a buildings database.	Platform and database created. Number of permits granted.



## ANNEX 2 | MATRIX OF THE PANAMA COOLING PLAN

<b>PILAR</b>			
<b>ENERGETIC EFFICIENCY</b>			
<b>Thematic Area</b>	<b>Objectives</b>	<b>Activities</b>	<b>Indicators</b>
2.1 Efficient equipment	Promote the replacement of inefficient equipment and increase the demand for efficient equipment. Influence the supply of RAC equipment.	Inclusion of specifications for high-efficiency equipment (with an efficiency well above the minimum) in public procurement policies.	Established policy. Percentage of efficiency over the defined minimum.
		Creation of replacement programs for inefficient equipment installed in public institutions and / or modernization of systems to optimize efficiency.	Amount of equipment replaced. Amount invested in the program.
		Implementation of programs that facilitate the replacement of inefficient equipment in the residential sector.	Amount of equipment replaced. Amount invested in the program.
		Evaluation of the feasibility of an accredited energy efficiency testing laboratory.	Quantity of taggable equipment. Time since the last update.
2.2 Building design	Increase in the supply and demand of buildings that reduce the need for energy de energía y la carga de and the refrigerant charge for air conditioning through innovative designs.	Strengthening the capacities of the municipalities and entities responsible for verifying compliance with the insulation design standards in buildings and SBR.	Number of people trained. Number of training workshops.
		Inclusion in university curricula, the design of passive cooling and the use of insulating materials that improve the efficiency of the air conditioning system.	Number of college courses on passive cooling. Number of students trained.
2.3 Consumption preferences and patterns	Influence the patterns of use of air conditioning systems and the demand for efficient RAC equipment.	Identification of preferences and purchasing patterns in the various consumer sectors.	Number of reports of preferences and consumption patterns.
		Development of equipment cost studies (purchase, operation and maintenance).	Study developed.
		Implementation of sectoral promotion and awareness plans to modify consumption patterns.	Number of plans developed.
2.4 District Cooling	Create favorable conditions for the development of district cooling projects, as an alternative to reduce energy consumption and demand for refrigerants.	Implementation of district cooling projects.	Number of projects developed.
		Mapping of the areas with the greatest potential to develop district cooling projects.	Map published.
		Development of district cooling demonstration projects in government facilities, through public-private partnerships.	Developed projects.
		Creation of incentives for urban projects that implement district cooling.	Number of projects benefited. Total amount of incentives granted.
		Sensitization to promoters and government authorities about the benefits of district cooling.	Amount of people aware.



## ANNEX 2 | MATRIX OF THE PANAMA COOLING PLAN

PILAR		ENVIRONMENTAL SUSTAINABILITY	
Thematic Area	Objective	Activities	Indicators
3.1 National Inventories of Greenhouse Gases	Understand, in a transversal way, the impact of the RAC sector on the environment.	Development of studies of: <ul style="list-style-type: none"> <li>• RAC equipment market.</li> <li>• Characteristics of the RAC equipment installed.</li> </ul>	Study developed.
		Preparation of time series and scenarios: <ul style="list-style-type: none"> <li>• CO<sub>2</sub>eq emissions from the use of alternative refrigerant gases to ODS.</li> </ul>	Inventory with a developed time series. Number of scenarios developed.
3.2 Environmental labeling	Influence the preferences and purchasing patterns of end users / consumers.	Creation of environmental labeling for equipment that exceeds minimum standards and with zero ODP and low GWP refrigerants.	Defined label layout. Label created.
3.3 Refrigerant recovery and recycling	Facilitate the conditions for the development of the storage, recovery and recycling initiative, either by the public or private sector. Evaluate final disposal options, within the country or abroad, in accordance with international standards.	Creation of refrigerant collection and recycling centers.	Number of collection and recycling centers. Amount invested in collection and recycling.
		Identification of alternatives and opportunities for regeneration of refrigerant gases.	Report published.
		Implementation of a mechanism for the final disposal, elimination or export of refrigerants to be destroyed.	Established mechanism. Amount of refrigerant removed.
3.4 Disposal and recycling of equipment	Identify, promote and strengthen the actions of recycling, disposal and final disposal of equipment in an environmentally responsible manner in the country.	Linking incentives for purchasing efficient equipment with the responsible disposal of old and inefficient equipment. Identification of RAC equipment recycling centers nationwide and their capacities.	Amount of equipment discarded. Amount invested in promotion. Number of equipment recycling centers.
		Strengthening the capacities of RAC equipment recycling centers.	Number of people, workshops and learning centers trained.
3.5 Divulcation	Make available to everyone both the impacts of the use of substances with high ODP and GWP and the potential benefits of alternative technologies / substances that exist in the market.	Dissemination of information on the negative impacts of the use of technology inefficient and substances with high ODP and GWP, both globally and locally.	Amount invested in diffusion.
		Awareness aimed at decision makers on policies, regulations and projects to accelerate the transition to the use of environmentally friendly substances and technologies.	Number of people aware.
		Information disclosure on alternative substances zero ODP and with low GWP existing in the market and their economic and environmental benefits.	
		Promotion of demonstration projects for the use of new technology and alternative substances.	Number of projects carried out. Amount invested.



## ANNEX 2 | MATRIX OF THE PANAMA COOLING PLAN

PILAR			
RAC SERVICES SECTOR			
Main Theme	Objective	Activities	Indicators
4.1 Inclusion	Identify strategies that promote a more conducive environment, which facilitates job placement in the technical field. Promote spaces for effective participation that allow the exchange of ideas and experiences with consumers in the RAC sector.	Identification of barriers to the participation of women in the RAC sector and how to overcome them.	Report published.
		Promotion of spaces for the participation of women in the sector.	Number of promotion activities developed. Number of women benefited.
		Promotion of women's participation in forums, spaces for consultation and decision-making, as well as in workshops and training courses.	Number of women invited. Number of women who attended. Percentage of participation of women in workshops and events.
		Expansion of consultation processes, and citizen participation in issues related to RAC.	Number and percentage of consumer and citizen representatives who participate in processes.
		Evaluation of the scope/coverage of RAC's basic services and identification of opportunities in rural communities/businesses.	Report published. Number of communities that participate.
		Analysis of the social impact and economic potential of expanding access to RAC services.	Report published.
4.2 Training	To have a workforce qualified and updated in good RAC practices. Strengthen training institutions so that they not only provide quality technical education, but also contribute to compliance with regulations and decision-making in this sector.	Creation of a database and registry of professionals (by sex and age group) dedicated to RAC services.	Database created.
		Implementation of minimum standardized contents for courses on good refrigeration practices and the use of alternative substances or technology.	Contents manual created. Number of institutions that have adopted the manual.
		Strengthening the capacities of the institutions dedicated to the technical training of RAC professionals.	Number of institutes strengthened.
		Training aimed at government entities dedicated to the control and verification of national regulations on RAC.	Number of people and entities trained.
		Training on policies, regulations, incentives and initiatives carried out in other countries and success stories/studies from which valuable lessons can be drawn.	Amount invested in training. Number of people trained. Number of entities trained. Amount invested in training.
4.3 Certification	Promote the implementation of a certification system for professionals in the RAC sector.	Development of a certification system/scheme for RAC service professionals.	Established system.
		Creation of a database of certified RAC professionals for public access..	Number of certified professionals. Database created.
		Implementation of a recognition/distinction to RAC service companies that certify 100% of their technical staff. Inclusion in public procurement policies that only companies and RAC service personnel that have the competency certification will be hired.	Recognition established. Number of companies benefited. Established policy.



## ANNEX 2 | MATRIX OF THE PANAMA COOLING PLAN

PILAR			
RAC SERVICES SECTOR			
Main Theme	Objective	Activities	Indicators
		Inclusion in public procurement policies that only companies and RAC service personnel that have the competency certification will be hired.	Established policy.
4.4 Cold chain	Encourage the development of cold chain infrastructure with the use of low energy consumption cooling systems, based on low GWP refrigerants that do not affect the ozone layer.	Linking cold chain development plans with plans to promote energy efficiency, use of clean energy and reduction of the use of substances with high ODP and GWP.	Report published.
		Identification of the impact on the environment and the potential for savings in the cold chain, by using clean and efficient technology.	Report published.
		Raising funds to promote the use of efficient equipment, use of renewable energy and substances with zero OPD and low GWP.	Amount mobilized.
4.5 Mobile air conditioner (MAC)	Identify opportunities for improvement in the use of refrigerants in mobile equipment. Promote technological change in MAC.	Creation of a transport database/registry with mobile RAC teams.	Database created.
		Preparation of a base line of refrigerant consumption in RAC mobile equipment.	Report published.
		Evaluation of alternatives to the use of alternative substances in MAC.	Report published.
		Promotion of demonstration projects for the use of environmentally friendly substances in MAC.	Developed projects. Amount invested in the projects.

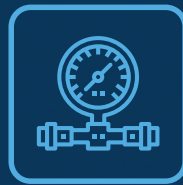












# PANAMA COOLING PLAN