NATIONAL COOLING PLAN PROPOSAL - CHILE

Project No. 110507 "Energy Efficiency Interventions (Kigali Cooling Performance Program)"

FINAL REPORT

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LIST OF ACRONYMS

- AC : Air Conditioning
- AES : Agency for Energy Sustainability
- ASCC : Agency for Sustainability and Climate Change
- CC : Climate Change
- CChC : Chilean Chamber of Construction
- CChRyC : Chilean Chamber for Cooling and Temperature Control
- CDT : Technology Development Corporation of the Chilean Chamber of Construction
- CI : Construction Institute
- CPA : Clean Production Agreement(s)
- CR : Commercial Refrigeration
- CSB : Certification of Sustainable Buildings
- CTCN : Climate Technology Center and Network
- EAS : Environmental Assessment Service
- EMS : Energy Management System
- EE : Energy Efficiency
- EPF : Environmental Protection Fund of the Ministry of the Environment
- EPI : Energy Performance Index
- EPPBIP : Energy Performance in Public Buildings and Infrastructure Program
- ESCO : Energy Service Companies
- FAC : Fixed air conditioning
- GP : Good practices
- GRP : Good Refrigeration Practices
- GHG : Greenhouse Gases
- GWP : Global Warming Potential
- HCFC : Hydrochlorofluorocarbons
- HFC : Hydrofluorocarbons
- IR : Industrial Refrigeration
- IRS : Internal Revenue Service
- ISO : International Organization for Standardization
- K-CEP : Kigali Cooling Performance Program
- KPMP : Kigali Phase-down Management Plan
- LTCS : Long-Term Climate Strategy
- MAC : Mobile Air Conditioning
- MEPS : Minimum Energy Efficiency Standard
- MINVU : Ministry of Housing and Urbanism
- MiPyMEs: Micro, small and medium companies
- MLF : Multilateral Fund for the implementation of the Montreal Protocol
- MMA : Ministry of the Environment
- MOP : Ministry of Public Works
- MRV : Monitoring, Reporting and Verification
- MTT : Ministry of Transportation and Telecommunications
- NAAC : National Automotive Association of Chile

- NAMA : Nationally Appropriate Mitigation Actions
- NCP : National Cooling Plan
- NCPP : National Cooling Plan Proposal
- NDC : Nationally Determined Contributions
- OCC : Office of Climate Change, Ministry of the Environment
- ODP : Ozone Depletion Potential
- ODS : Ozone Depleting Substances
- OECD : Organization for Economic Cooperation and Development
- PRTR : Pollutant Release and Transfer Registry
- RAC : Refrigeration and Air Conditioning
- RPC : Residential, public, commercial sector
- RR : Residential Refrigeration
- RT : Refrigerated transportation
- SC : Sustainable Construction
- SE : Superintendency of the Environment
- SEC : Superintendency of Electricity and Fuels
- SEGPRES: Ministry General Secretariat of the Presidency
- STTDCC: Strategy for Technology Transfer and Development for Climate Change
- SUBDERE: Undersecretariat of Regional and Administrative Development
- GA : Guild Association
- TNA : Technology Needs Assessment
- UNEP : United Nations Environment Programme

EXECUTIVE SUMMARY

This document submits a National Cooling Plan Proposal (NCPP), focused in defining the main measures to advance towards energy efficient cooling alternatives based on low or zero GWP refrigerants. Likewise, these objectives include the development of potential synergies between Climate Change (CC) mitigation and Energy Efficiency (EE) measures implemented at the national level.

In this context, the report includes all the information gathered in the different stages of this Proposal, which started with a first stage to collect secondary information about HFCs' consumption in Chile, and various national measures on EE and CC mitigation that can be linked to the objectives of the Plan Proposal.

Regarding HFC consumption¹ in Chile, the Refrigeration and Air Conditioning (RAC) sector is the main user nationwide, covering 70% of the substances bench as of 2018. In terms of bulk HFC imports, figures point out HFC-134a, R-507A, R-410A and R-404A in decreasing order of importance, all of them with high levels of GWP. This consumption has increased in recent years, mainly due to the different applications in the RAC sector, that is: Residential refrigeration (RR), commercial refrigeration (CR), industrial refrigeration (IR), refrigerated transportation (RT), fixed air conditioning (FAC) and mobile air conditioning (MAC).

As per the use of HFC, industrial refrigeration (IR), followed by commercial refrigeration (CR), fixed air conditioning (FAC) and mobile air conditioning (MAC) hold a significant use of HFC and therefore show higher GHG emission levels. From a forecast based on those figures by 2050 in a BAU (business-as-usual) scenario, it can be seen that FAC and IR continue leading the list, while CR and MAC decrease their relevance (GreenLab- Dictuc, 2019).

Part of the EE measures connected to the objectives established in the National Cooling Plan Proposal are an EE certification, EE labeling and the setting of minimum EE standards (MEPS). The various programs implemented by the Energy Sustainability Agency (ESA); the initiatives for sustainable construction (SC) and house labeling; and clean production agreements (CPA) coordinated by the Agency for Sustainability and Climate Change (ASCC) are included as well.

On the other hand, part of the CC mitigation measures implemented at the national level which may impact on the RAC sector are the Long Term Climate Strategy (under development); the Strategy for Capacity Development and Climate Empowerment (under development); the Climate Change Technology Transfer and Development Strategy (CCTTDS) (under development), and the "HuellaChile" Program. All these initiatives are led and/or coordinated by the Office of Climate Change (OCC) of the Ministry of the Environment (MMA). In fact, the leading entity begun conversations with the different counterparts to advance in the generation of synergies between the objectives of the Plan Proposal and the objectives of the strategies and programs mentioned.

During the second stage of the NCPP, the incumbents raised first-hand information through interviews held with different actors throughout the entire supply chain of the sector, including importers of substances, importers of RAC equipment, technical services installation and maintenance, RAC systems final users, refrigerant gases'

¹ Under the Montreal Protocol, the total "consumption" of controlled substances, such as HFCs, equals production of substances, plus imports minus exports (Consumption = Production + Imports - Exports). In the case of Chile, there is no production of substances and exports are minimal, so when talking about "consumption" of substances, it refers to imports. On the other hand, the "use" of substances refers to their use in different sub-applications and/or for different purposes.

regenerators, trade associations, as well as public and private actors. The 27 interviews held allowed the identification of a number of challenges to introduce new technology with EE criteria and alternative refrigerants in the RAC sector. The poor knowledge about the Kigali Amendment and its implications; the limited information available on technological alternatives in different sub-applications of the sector; the useful life still existing in the installed technology; the need for new technical capacities to support technological change; and the funding required to introduce new technology are part of the main challenges identified.

This NCPP' structure was designed based on the objectives described therein, the challenges identified and the opportunities to link with different CC mitigation and EE measures implemented at the national level. The structure of the Plan is based on six lines of work (see Figure 1):

- 1. Support for the management of refrigerants and EE in the RAC sector;
- 2. Capacity Building in the RAC Sector;
- 3. Financing and Investment;
- 4. Regulation and Inspection;
- 5. Women's Participation in the RAC Sector at the National Level, and
- 6. Dissemination and awareness (crosscuts all the above).

Each line of work holds various strategic guidelines and measures to overcome the challenges set and support the different users in managing their cooling premises, improving their energy and environmental performance. It should be noted that the different lines, guidelines and measures crosswise cover all the sub-applications of the RAC sector.

Finally, this Proposal was validated through five participatory workshops holding a wide variety of persons from the RAC sector (public/private). Measures were evaluated and different comments raised, which helped to develop a more comprehensive Proposal for a National Cooling Plan, consistent with the current national scope. Another outcome of the validation workshops was the definition of an implementation roadmap for each line of work.



Figure 1. Lines of work of the National Cooling Plan Proposal Source: compiled by author.

1. INTRODUCTION

The Refrigeration and Air Conditioning sector (RAC) plays a crucial role in the well-being and comfort of both, the world's population and in economy as well. It impacts a wide range of areas, including food preservation and safety; health and human comfort; medical aspects such as the transportation and storage of blood and vaccines; energy performance; costs associated with economic and environmental terms (climate change and ozone destruction); standards and certification of equipment and technical staff; and legal matters, among others (UNEP, 2019).

The requirement and operation of RAC equipment are growing rapidly at a global level. This market expansion reflects the economic growth, a population sustained increase, changes in lifestyles, global trends in urbanization, the extension of cooling chains and, in particular, the middleclass growth in developing countries and emerging economies (UNEP, 2019). This growing trend is also accelerated by the observed increase in temperatures at a global level in a context of climate change.

This accelerated growth becomes more relevant when considering that the RAC sector and its sub-applications (i.e., residential refrigeration (RR), commercial refrigeration (CR), industrial refrigeration (IR), refrigerated transportation (RT), fixed air conditioning (FAC) and Mobile (MAC)) are the highest consumers of HCFC and HFC worldwide. Those substances may have serious consequences in our atmosphere either due to their high ozone depletion potential (ODP) or to their high global warming potential (GWP), respectively. Specifically, most HCFCs and HFCs used in RAC equipment have GWPs over 1,000 to 4,000 times more powerful than carbon dioxide.

Thus, the Montreal Protocol plays a crucial role in controlling these substances since all of them, the HCFCs and their HFC replacements, are within its scope. Since 2016, the Montreal Protocol defined the latter as controlled substances through the Kigali Amendment, aiming at reducing the production and consumption of high-GWP refrigerants.

According to the Montreal Protocol, the Kigali Amendment, and this report, the consumption of controlled substances (HCFC, HFC) is understood as this mathematical operation:

Consumption = Production + Imports - Exports

The Kigali Amendment entered into force on January 1, 2019. Since then, developing countries or countries operating under Article 5 of the Montreal Protocol are challenged to gradually reduce the production and consumption of HFCs by 80% during the next 25 years. This challenge holds greater relevance as HCFCs and HFCs are widely used in developing countries in RAC applications, which became essential in a context of climate change and steady increase in temperatures (UNEP, 2019).

Chile follows that trend, as the country shows a significant consumption of refrigerant gases such as HCFCs and HFCs in different applications and sub-applications of the RAC industry, which leads to an important contribution in GHG emissions nationwide. According to the figures provided by the updated national GHG inventory (1990 - 2016), included in Chile's Third Biennial Update Report on Climate Change (2018), the use of HFCs in refrigeration is one of the main causes of the increase in emissions from Industrial Processes and Product Use (IPPU). This sector

has increased emissions by 12.9% since 2013, reaching 6.2% of total emissions in 2016, where 41.4% of them correspond to the category "use of substitute products for ozone depleting substances" (see Figure 2).



Figure 2. Contribution of the use of HFC in emissions from the IPPU sector in the National GHG Inventory Source: Third Biennial Report of Chile on Climate Change, 2018.

However, this trend shall change in the next few years as Chile ratified the Kigali Amendment before the Montreal Protocol on 19 September 2017 and included it in the national legal system through the Decree No. 32/2018 of the Ministry of Foreign Affairs. Thus, Chile commits to comply with a HFC reduction schedule, established in Group I, which is calculated on a baseline that considers the average annual consumption of these substances in 2020-2022, plus 65% of the HCFC baseline. The HFC reduction schedule applicable in Chile shall freeze consumption as of 1 January 2024 and reduce 10% by 2029, 30% by 2035, 50% by 2040 and 80% by 2045.

Additionally, the Kigali Amendment highlights the importance of energy efficiency (EE) in the use of RAC equipment, since the consumption of electricity related to this sector reaches between 17% - 20% of world consumption according to the estimates (IIR, 2019). Considering the expected growth of this type of equipment, a worrying increase in electrical energy consumption can be foreseen worldwide, with the significant consequences in terms of energetic security and Greenhouse gas emissions (GHG) (UNEP, 2018a).

Regarding the above, GHG emissions related with the RAC field are given by the use of refrigerant with high GWP (direct emissions) and in greater proportion, emissions associated with the sources of electrical energy used by the sector (indirect emissions), especially in countries with a high presence of fossil fuels in their energy matrix. For example, 71% of emissions from refrigeration systems correspond to the use of electrical energy and 29% to the use of refrigerants (UNEP, 2018a).

Thus, under the auspices of the Kigali Amendment, together with the commitments to reduce production and consumption of HFCs, in Decision XVIII/2 of the Parties to the Montreal Protocol, reference is made to the maintenance and/or improvement of EE in the transition to low or no GWP technologies. In this context, the countries agreed to explore opportunities to improve the EE of equipment, as a way to further contribute to the

mitigation of global warming². It is in fact expected that compliance of the Kigali Amendment avoids a 0.4° C increase in global temperature by 2100, protecting the ozone as well (MMA , 2017).

To meet the EE objectives in the framework of the Kigali Amendment, an initiative called Kigali Cooling Efficiency Program or K-CEP supports developing countries in their transition to more efficient and environmentally friendly cooling technologies³. National Cooling Plans (NCPs) are part of the instruments financed under this mechanism, which seek to define the necessary measures to achieve this transition and incorporate EE criteria in the RAC sector. Different countries, at different progress levels, are elaborating these NCPs.

In this context, at the national level the Ozone Unit of the Ministry of the Environment (MMA) and the Sustainable Energy Division of the Ministry of Energy committed to elaborate a National Cooling Plan Proposal⁴, which defines the measures required for the improvement of energy and environment performance in the Refrigeration and Air Conditioning sector (RAC). The Plan also seeks to connect the EE policies established by the Ministry of Energy and the CC mitigation measures carried out by the MMA, in order to bring forces together and define a joint roadmap.

Thus, this document represents the National Cooling Plan Proposal developed for Chile and its detailed roadmap, whose implementation involves a significant GHG reduction of the RAC industry, given by the reduction in energy consumption, lower consumption of refrigerant substances⁵ with high GWP and the decrease in refrigerant leakage levels in that sector.

² <u>https://www.informea.org/en/decision/decision-xxviii2-decision-related-amendment-phasing-down-hydrofluorocarbons</u>

³ <u>https://www.k-cep.org/</u>

⁴ As the Ozone Unit is part of the MMA, it has no legal competencies to elaborate plans in EE, which could only be elaborated by the Ministry of Energy. That is the reason for naming this document as a "Proposal".

⁵ Substances used in RAC facilities will be named as "refrigerants".

2. NATIONAL BACKGROUND

2.1. Data collection

The methodology used to collect all the background information and data required to develop this National Cooling Plan Proposal is divided in two stages:

- 1st Stage Secondary information gathering: different documents were reviewed and analyzed, including:
 - National and international regulatory framework related to refrigerant gases;
 - National HFC consumption inventories;
 - National policies, programs and regulations on mitigation and EE;
 - Sectoral energy consumption at the national level;
 - Revision of other countries' National Cooling Plans.
- 2nd Stage Primary Information gathering: interviews with various stakeholders covering the entire supply chain in the RAC sector, and meetings with public and private counterparts to assess linkage opportunities. This stage totaled 21 interviews and six meetings.

The main background information considered to prepare the proposal is summarized as follows.

2.2. HFC consumption in Chile

The refrigeration and air conditioning sector is the major responsible for HFC consumption nationwide, covering 70% of the substances in 2018. In fact, the most bulk-imported substances in this respect (i.e., HFC-134a, R-507A, R-410A and R-404A in order of importance) are mainly associated with the different sub-applications of the RAC sector (GreenLab-Dictuc, 2019).

The bulk import of HFC substances increased significantly in recent years. The main substances explaining this growth are R-507A and HFC-134a. In the case of HFC-134a, the sustained increase is due to the wide use in all sub-applications of the RAC sector, i.e. in RR, CR, IR, RT, FAC and MAC industries.

On the other hand, the R-507A has been strongly introduced in the market since 2005 (35% of bulk imports in 2018), mainly to replace substances such as R-404A in CR and IR, as R-404A is a zeotropic mixture that may split in case of leakage (GreenLab-Dictuc, 2019). The high level of GWP contained in the R-507 involves a great concern regarding the accelerated growth in consumption, as it is the highest level of the main substances consumed (see Table 1).

Substances (pure and mixtures)	GWP (10 years)
HHFC-13a (pure)	1,430
R-410A	2,088
R-404A	3,922
R-507A	3,985

Source: compiled by Author.

HCFC-22 continues being a significant substance in CR, IR and FAC. However, consumption is being controlled since 2013 through defined maximum import volumes and gradual reduction schedules, established in the Supreme Decree 75/2012 of the MINSEGPRES. Later, the Supreme Decree 3/2019 of MINSEGPRES⁶, limited those volumes, increasing the ambition for their reduction, which shall reach 65% by the year 2021.

Regarding the use of HFC by sub-application, IR, FAC and MAC require the highest levels and show the highest GHG emissions (see figure 3). The research made by GreenLab-Dictuc (2019), details a forecast of the HFC consumption behavior as of 2050 in a BAU scenario (business-as-usual), where the FAC and IC shall continue leading the use of HFC, while CR and MAC shall decrease their relevance (see Figure 4).



Figure 3. Emission level (Gg CO2e) by sub-application, 1990-2018 Source: GreenLab-Dictuc, 2019.

⁶ Available at: <u>https://www.leychile.cl/Navegar?idNorma=1140643.</u>



Figure 4. HFC consumption projection (ton) by 2050 by sub-application Source: GreenLab-DICTUC, 2019

2.2.1. Import of equipment containing HFC

The HFC consumption is related as well to the manufacturing and importing equipment containing this type of refrigerant (bench). Thus, information related to the import of residential refrigeration equipment, commercial refrigeration equipment and fixed air conditioning equipment may be obtained through the tariff items issued by the National Customs Service.

Sub-application	Total equipment imported 1990- 2018	Average equipment imported 1990-1999 (annual)	Average equipment imported 2000-2009 (annual)	Average equipment imported 2009- 2018 (annual)			
Residential refrigeration	6.407.619	75.892	155.948	421.024			
Commercial refrigeration	2.802.939	21.069	53.663	228.402			
Fixed Air Conditioning	2.401.381	25.173	54.138	179.697			

Table 2. Amount and average of imported RAC equipment

Source: Author compilation from the data obtained in the GreenLab-Dictuc inventory (2019)

In line with international trends, the import and use of this type of equipment nationwide has increased significantly in the last years, even though the number of residential and commercial refrigeration equipment manufactured in the country is impossible to obtain.

Regarding the industrial refrigeration systems, AC systems and refrigerated transportation, the available inventories did not reach de minimum required information to estimate the total number of equipment and facilities. Finally, regarding commercial refrigeration systems and the mobile air conditioning, the available inventories do not have detailed information on the number of equipment and facilities.

2.3. Electricity consumption in Chile

The national energy balance available⁷ and its related databases⁸ show the main sectors consuming electricity as of 2018. Out of 65,471 Tcal total consumption (76,143 GWh), 61% corresponds to the industrial and mining sectors, 33% to the commercial, public and residential sectors (CPR), 4% to the own consumption of the energy sector and 2% to transportation (Figure 5). The available data do not expose the information related to the consumption specifically associated to the RAC sector, as it is included across all the sectors mentioned.



Figure 5. Electricity consumption by sector in 2018 Source: Author compilation with data obtained from <u>www.energiaabierta.cl</u>.

From the information related to electricity consumption in the residential sector can be obtained the consumption of RAC equipment for household use. According to the research "Uses of household energy, Chile 2018" prepared by the Technology Development Corporation (CDT) during 2019, the devices showing the highest consumption levels are the refrigerator (19.4%), lighting (16.9%), television (16.3%) and stand-by consumption (9.2%). Air conditioning consumes 0.9% (see figure 6).

Although the electrical consumption of house AC is not relevant at present, this situation shall change in the coming years considering the growing projections in the use of these appliances due to the increase in temperatures. Thus, the incidence of RAC equipment in residential electricity consumption could be increasingly significant.

⁷ www.energiaabierta.cl

⁸ Available at: <u>http://energiaabierta.cl/visualizaciones/balance-de-energia/.</u>



Figure 6. Distribution of residential electricity consumption by appliance as of 2018 Source: CDT, 2019.

The information related to residential electricity consumption has served as the basis for the definition of Minimum Energy Performance Standards (MEPS) established to date for refrigerators, freezers, lighting fixtures and air conditioners for household use. Given the importance of having up-to-date data on electricity consumption in the development of coherent policies, gathering this information is particularly crucial in the RAC sector.

Regarding the above, during the interviews some users provided information about the electrical consumption of cooling systems in their companies, and appraised their relevance as per total consumption (Table 3).

Sub-application	RAC electrical consumption as per total consumption	
Commercial Refrigeration system (in company without other efficient	30-40%	
technologies, e.g. LED lighting).		
Commercial Refrigeration system (in company with other efficient	Hasta 60%	
technologies, e.g. LED lighting).		
Industrial refrigeration system	25-30%	
AC system in retail	30-40%	
AC system in office building (not new)	40-50%	

Table 2. Estimation of cooling systems	anargy concumption for como	sub applications of the DAC costor
Table 5. Estimation of cooling systems	energy consumption for some	Sub-applications of the RAC sector

Source: Author compilation based on estimates of the interviewees.

Although this information does not represent the sector, this small sample reveals the high electricity consumption associated with RAC equipment, which confirms the relevance of having representative data on electricity consumption of that sector and the importance of EE measures.

2.4. Energy efficiency policies and programs related to the RAC sector

Chile holds EE policies devoted specifically to some refrigeration and air conditioning equipment, mainly for domestic use, such as the EE certification, EE labeling and the minimum EE standards (MEPS). Other EE initiatives, even if not specifically targeted to the RAC sector, represent interesting connections that may lead to a better use of energy by the sector. All these policies, programs and initiatives, and the connection opportunities are exposed below.

- EE Certification and Labeling for electrical equipment:

In Chile, some electrical products must go through an energy-performance certification process prior to their commercialization. Once certified, products shall provide information on their energy performance through a label. The Ministry of Energy defines which products are subject to energy performance certification and which ones shall hold an information label.

The Table 4 summarizes the electrical appliances belonging to the RAC sector requiring an EE certification and those that shall inform their EE through labelling. This information was obtained from the SEC⁹ databases.

Appliance Use Labelling		Labelling	Technical Comments		
Freezer	House	Yes	In terms of performance, the following products are exempted from		
Refrigerator	House	Yes	this requirement: Refrigerators, freezers and refrigerators-freezers		
Refrigerator- Freezer	House	Yes	used as means for cooling with other devices than moto- compressors. Those manufactured exclusively for industrial purposes. Special designs for commercial use. Those using batteries as a power source. Those supplied with three-phase alternating voltage. Any type of absorption refrigerators (Monovalent, Bivalent or Trivalent). Refrigerators using semiconductor cells as cooling system (Peltier Effect). Wine cellars, because although it is true that they may have a Cooling circuit with a compressor, they do not operate within the temperatures of the testing standard.		
Air Conditioners	House	Yes	Applies to single-phase equipment, direct expansion of refrigerant gas, divided type or unit type, without air distribution through ducts, up to 12 kW (42000 Btu/h), and condensed by air. Electric heat pumps for water heating of swimming pools or any other use besides air conditioning and dehumidifiers are not considered. Portable or mobile air conditioning equipment is also waived.		
Commercial cold-storage appliances	Used in food exhibits and sales	No	Applies to refrigerated displays, single-phase and/or three-phase, having built-in compressor, in direct contact with customers, and under or equal to 3 meters length.		

Table 4. Appliances related to the RAC sector requiring EE certificate and labeling

⁹ Available at: <u>https://wlhttp.sec.cl/PublicacionProductos/publicacion.do.</u>

Source: Author compilation.

- Minimum EE Standards (MEPS)

Setting MEPS is recognized as the most important measure to improve EE of small RAC devices, which can be replicated in different countries and with the opportunity to increase minimum standards through time (UNEP, 2018b).

Chile nowadays holds minimum standards in four products' categories: non-directional lamps for general lighting (2013, under update process); refrigerators, refrigerator-freezers and freezers for household use (2015, under update process); three-phase induction electric motors (2017); and air conditioning (2018). The selection of these products is based on their energy consumption, technology available, national and international experience, and the effectiveness cost of the measure, among other factors.

Table 5 summarizes the technical information related with the RAC sector products, i.e., characteristics of the product subject to the standard, the minimum standards required, the effective date and the legal instrument defining it.

Product	MEPS	Legal instrument
Refrigerators, refrigerators-freezers and freezers.	As of 2017, only refrigerators, refrigerators-freezers and freezers A, A+ and A++ can be traded. A (42≤ EPI ¹⁰ < 55) A+ (30 ≤ EPI < 42) A++ (EPI< 30)	Exempt Resolution 74/2015 of the Ministry of Energy ¹¹ .
Air conditioners that are single-phase, direct expansion of refrigerant gas, split type or unit type, without air distribution through ducts, up to a thermal power of 12 kW (42000 Btu/h) and that are condensed by air.	As of November 2019 (21 months after the resolution was issued), air conditioning equipment holding a classification below A. ((42≤ EPI < 55)	Exempt Resolution 4/2018 of the Ministry of Energy ¹² .

Table 5. Technical information of products from the RAC sector having MEPS

Source: Author compilation.

While Chile has shown significant advance when compared to other countries in terms of certification, the labeling and the definition of MEPS for equipment in the RAC industry, these standards are only recommended for small self-contained devices (UNEP, 2018c) which reflects the need to develop additional measures to improve EE in more complex systems.

The implementation of EE certification and labeling processes are the sole responsibility of importers and manufacturers of equipment, who must take all the necessary actions before trading them. However, as the

¹⁰ EPI: Energy Performance Index. Annual consumption of energy of a facility (as per calculations of NCh3000 Of. 2006). The lowest the value, the highest the EP (information obtained by Fundación Chile regarding a GEF project (under development) "Leapfrogging Chilean's markets to more efficient refrigerators and freezers").

¹¹ Available at: <u>https://www.leychile.cl/Navegar?idNorma=1073371&idVersion=2015-01-10</u>

¹² Available at: <u>https://www.leychile.cl/Navegar?idNorma=1115032</u>

knowledge related to these processes and monitoring for compliance show some failures, the NCPP includes some measures at this respect.

- Programs and initiatives of the Agency for Sustainable Energy (ASE)

The ASE implements different EE measures and programs defined by the Ministry of Energy that represent an opportunity to improve energy performance of RAC sector companies in its different sub-applications. These programs include:

- i. Energy Efficiency in Public Buildings and Infrastructure Program (EEPBIP): seeks to implement measures improving EE in public buildings through changing technology or optimizing processes¹³, which may have impacts on the energy performance of refrigeration and AC systems in public buildings.
- ii. Clean Driving Program: focused in certifying and acknowledging efforts made by transportation companies in sustainability and EE¹⁴.
- iii. MiPyMEs Energy Management: focused in training and providing information on various technical tools to improve energy performance in small and medium-sized companies, also informing on funding alternatives for their implementation¹⁵.
- iv. Energize in your SME Program: program holding seven different initiatives related to energy management in companies. Interested companies can apply for one of these initiatives¹⁶.
- v. Energy Excellence Seal: recognition granted by the Ministry of Energy to the leading companies in energy management¹⁷.

Additionally, opportunities to include requirements in alternative refrigerants of said programs which may represent an additional impact in terms of EE can be analyzed.

- Sustainable construction certifications and EE labels for houses and buildings

Various initiatives in the construction sector seek to reduce the need of cooling and heating devices in houses and buildings, and in improving their EE. Moreover, other related initiatives involve the elaboration of house and building labels qualifying EE to support customers' purchase decision. In Chile, these initiatives currently being implemented are:

- Sustainable Building Certification (SBC)¹⁸
- Sustainable Housing Certification (CVS)¹⁹ (currently holds voluntary requirements related to low or zero GWP refrigerants).

¹³ https://www.agenciase.org/programa-de-eficiencia-energetica-en-edificios-publicos/

¹⁴ https://www.girolimpio.cl/

¹⁵ <u>http://www.gestionaenergia.cl/mipymes/</u>

¹⁶ <u>https://www.agenciase.org/energia-a-tu-pyme/</u>

¹⁷ <u>https://www.selloEP.cl/</u>

¹⁸ <u>https://certificacionsustentable.cl/</u>

¹⁹ <u>https://cvschile.cl/#/home</u>

- Green Building Council (GBC) Certification²⁰
- Housing Energy Rating (HEC)²¹ and public buildings.

All these initiatives represent valuable opportunities to incorporate requirements related to low or zero GWP refrigerants in order to improve energy efficiency of cooling equipment in the construction sector as well as its environmental performance.

- Clean Production Agreements (CPA)

CPAs are coordinated by the Agency for Sustainability and Climate Change (ASCC) to promote cleaner production through goals and specific actions to be implemented by a specific productive sector. Thus, CPAs can be very effective tools to generate changes at guilds and industrial level.

One of the requirements incorporated in some CPAs is energy management of the member companies -as in the CPA-IV of the processed food industry- which includes goals related to the measurement of energy consumption of cooling systems and the relationship with the use of refrigerants.

That is an example of how these agreements can generate important synergies with the objectives established in the National Cooling Plan Proposal. Consequently, it is important to explore the possibilities to incorporate requirements related to EE and refrigerant gases in a crosswise manner in future CPAs.

- EE labelling for light and medium vehicles

The EE labelling for light and medium vehicles aims to provide official and reliable information about fuel economy, allowing users to compare different vehicles under the same consumption parameters. The label shall also provide information on CO₂ emissions associated with vehicle performance, for consumers to select vehicles with lower emissions and thus reduce their impact on the environment²².

In terms of refrigerant used in mobile AC equipment and their contribution in CO_2 emissions (see Figure 3), it is advisable to complement the information provided in current labels with data about the type of refrigerant incorporated and its GWP, besides highlighting the importance of a proper maintenance to avoid refrigerant leaks.

2.5. Climate change policies and mitigation measures related to the RAC sector

There are several climate change mitigation policies and measures under development in Chile with real connection opportunities with the RAC sector. These are the following:

²⁰ <u>https://www.chilegbc.cl/</u>

²¹ <u>https://www.calificacionenergetica.cl/</u>

²² http://www.consumovehicular.cl/etiqueta/su-importancia

- Long-Term Climate Strategy (LTCS)

The LTCS is an intersectoral work coordinated by the Climate Change Office of the Ministry of the Environment that seeks to determine the different sectoral mitigation objectives and measures required (Sectoral Mitigation Plans) to reach carbon neutrality goals by 2050 and the mid-term goals established in the NDCs. This strategy is the main instrument included in the draft Climate Change Framework Law (MMA, 2020a).

In this context, all sectors shall consider the impact of refrigerants used in different industries and the benefits in terms of CC mitigation that may result from a good management of these substances. This becomes more relevant when considering the impact of complying with the Kigali Amendment in the mitigation objectives of the Paris Agreement.

The LTCS is under development. Thus, the Ozone Unit has actively participated in the panel discussions in order to highlight the impact of refrigerant in terms of global warming and the importance of proper management in the different sectors.

- Capacity Building and Climate Empowerment Strategy

This strategy is one of the various means for the implementation of the Nationally Determined Contribution (NDC) focused in strengthening sectoral, national and subnational capacities of individuals and organizations (public and private), academia and civil society, to reach the mitigation and adaptation goals of the country (MMA, 2020b). The strategy is under development, the implementation is foreseen for 2021 and the update process will be on a five-years-term.

This strategy is essential to fulfill the need of capacity building in the RAC sector established in the framework of a National Cooling Plan that aims to advance in efficient technology with low or zero GWP refrigerants. Coordination activities between counterparts have begun in order to implement training, awareness and education activities in the RAC sector.

- Climate Change Technology Transfer and Development Strategy (CCTTDS)

This strategy represents other means of implementation of the NDC aiming at promoting and strengthening technology transfer and development by supporting and promoting the cultural, social, environmental and economic transformations required to achieve a sustainable, resilient and carbon neutral development by 2050 (MMA, 2020b) . The Ministry of Sciences and the Agency for Sustainability and Climate Change (ASCC) of the Ministry of Economy, together with the MMA, led the CCTTDS.

Likewise, the ASCC in coordination with the Climate Technology Center and Network (CTCN) are applying for funding from the Green Climate Fund to prepare a Technology Needs Assessment (TNA). This research establishes priorities in sectors and technologies for mitigation, evaluates these technologies based on different criteria such as their GHG reduction potential, cost-benefits, etc., identifies different barriers for their development and defines frameworks to address them (based on national policies and measures) (CTCN, 2020).

As in previous case, this strategy is very relevant considering the magnitude of the technological change required to comply with the Kigali Amendment and, in particular, the National Cooling Plan Proposal. Thus, counterparts started the conversations to incorporate the RAC sector in the strategy and in the TNA, which would foster allow to gather information on the state of the art of efficient technology based on alternative refrigerants, benefits and development barriers, among others.

- HuellaChile Program

This program is carried out by the MMA Climate Change Office and seeks to promote the quantification, reporting and management of carbon in public and private institutions. It has a tool to calculate GHG emissions inserted in the PRTR One-Stop Window System²³. Members must report "fugitive emissions", which include emissions related to refrigerants' leakage. However, it has been noted that members do not manage and record the information properly²⁴.

After evaluating different options for joint work with different timeframes, the most relevant and immediate is the development of refrigerants reporting methods. These reports could include information such as: type of gas used, annual purchases, and uses within the company (quantity used, quantity recovered, quantity regenerated), among others. This is essential within the scope of a future HFC reduction plan (*Kigali Phase-down Management Plan*, KPMP).

In the medium term, the HuellaChile Program hopes to become an integrated platform for climate action, holding opportunities to promote and disseminate the management of cooling facilities to improve their energy and environmental performance.

2.6. Challenges for the RAC sector in terms of refrigerants and EE

Twenty-seven interviews held with different public and private actors involved in the entire supply chain of the RAC sector identified a number of challenges related to the objectives of the National Cooling Plan Proposal, particularly regarding the transition to efficient cooling technology with low or zero GWP.

²³ <u>https://huellachile.mma.gob.cl/</u>

²⁴ Information obtained in an interview with HuellaChile's counterpart.

Main challenges identified are the following:

• Challenge 1: Develop and disseminate information on new energy efficient technologies with low or no GWP refrigerants:

One of the barriers to advance in the incorporation of energy efficient technology with low or zero GWP refrigerants is the poor knowledge about the alternatives available for the different applications of the RAC sector and the lack of information about costs and benefits. In this context, the Ozone Unit of the MMA has implemented various pilot projects for technology renewal with low or zero GWP refrigerants. Hence, this type of initiatives shall be replicated incorporating EE criteria, strengthening the development of information on the different technologies applicable in the sector and communicating their benefits.

• Challenge 2: Promote the improvement in energy and environmental performance of installed technology:

Another problem informed by users is the amount of installed systems and equipment which several years of useful life under an appropriate maintenance. In this case, it is necessary to develop the necessary tools and information to help users to improve the energy and environmental performance of their facilities, based on reconversions or complementary measures.

• Challenge 3: Generate funding for a technological change:

The main barrier affecting the transition to efficient technology with alternative refrigerants is the significant investment required for this replacement. In this regard, it is necessary to generate relevant financing opportunities to change technology. In this context, the Ozone Unit has implemented various projects to reduce ozone depleting substances' consumption, co-funded by the Multilateral Fund (MLF) of the Montreal Protocol and the incumbents, as appropriate.

• Challenge 4: Improve professionals' skills and practices in the RAC sector:

A crosscutting barrier identified by all the users interviewed was the limited capacity in the sector to guarantee the necessary technical support to introduce new technology. In this regard, the technical knowledge of persons working in that sector, as well as the practices carried out in the installation and maintenance processes of cooling equipment/systems showed significant deficiencies. In fact, a significant percentage of the high energy and refrigerants consumption is due to bad practices of technical staff. In this context, it is essential to strengthen and expand the scope of training programs about good cooling practices developed by the Ozone Unit since 2003 in order to raise awareness and train professionals in EE and alternative refrigerants.

The recent closure of careers such as refrigeration engineering and HVAC engineering of the INACAP Technical University of Chile, and cooling technician and HVAC Technician granted by the Technical Training Center of INACAP supposes an additional challenge in this matter. This training center is the only one teaching those careers at a technical level, allowing the specialization of students from technical high schools. Consequently, said closure will have a significant impact on the availability of specialized professionals in the RAC sector. The closure was informed after the validation workshops occurred; therefore, the situation could not be discussed with the various stakeholders involved.

• Challenge 5: Disseminate the Kigali Amendment to the Montreal Protocol, timelines and implications:

The main reason for the inaction and poor proactivity of the RAC sector in the introduction of efficient technology with low or no GWP is the scarce knowledge and/or understanding about the Kigali Amendment, its deadlines and implications. Thus, it is necessary to increase the dissemination of this information among all users of the sector, strengthening promotion activities currently implemented by the Ozone Unit.

3. NATIONAL COOLING PLAN PROPOSAL VALIDATION WORKSHOPS

The first draft NCPP was submitted through several validation workshops in order to assess the relevance of the measures included therein and the coherence with the national reality of the RAC sector. Likewise, the workshops focused in jointly establishing an implementation schedule for each of the proposed measures (roadmap).

The activity consisted in five validation workshops totaling near 40 participants from different areas related to the RAC sector, both public and private. Participants included importers of refrigerants, importers of equipment, technology providers, support service centers, academic entities, end users, refrigerant regeneration centers, trade associations and various public institutions related.

Given the current health situation, the workshops were held virtually (Microsoft Teams platform), with a friendly participatory methodology (each workshop used the FunRetro²⁵ virtual tool (see photographic records of workshops in Annex 3)) and with a limited number of attendants to facilitate an appropriate participation of all actors.

Thus, each workshop was divided in two parts: a first webinar-style with the introductory presentation on the Kigali Amendment and the detailed presentation of the National Cooling Plan Proposal; and a second part based on the joint work. Each stage lasted approximately 60 min and 90 min respectively (2.5 hours in total each workshop).

To ensure an organized discussion, the initial guest list (approximately 60) was distributed in smaller sectoral groups in order to discuss common issues related to their daily activities. Annex 2 includes tables with information about subjects' distribution in these sectoral groups, dates of workshops, attending sectors and details about participants to each workshop.

Comments made by each validation group and the photographic records are shown in Annex 3.

²⁵ <u>https://funretro.io/</u>

4. NATIONAL COOLING PLAN PROPOSAL

The NCPP's structure is based on six lines of work that, as a whole, seek to face the variety of challenges from the RAC sector to move towards efficient technology, with alternative low-GWP refrigerants, and maximize the benefits of linking with different EE and climate change mitigation policies and programs implemented at the national level. Figure 7 describes the specific objective of each line of work, which will be addressed through different strategic guidelines (see Figure 8), which will, in turn, be developed based in different measures. Measures proposed include comments obtained from validation workshops, which are directly related with the NCPP's objectives.

LINE 1: SUPPORT TO THE MANAGEMENT OF REFRIGERANTS AND EE IN THE RAC SECTOR Promote the introduction of measures to manage environment and energy performance in new and installed RAC facilities. LINE 2: CAPACITY BUILDING IN THE RAC SECTOR Disseminate good practices and update students, teachers and technical staff in new cooling and EE trends. LINE 3: FINANCING AND INVESTMENT Study financing opportunities and design funding strategies to be implemented in	LINE 6. DISSEMINATION AND AWARENESS Provide users the information generated in the different lines to
LINE 4: REGULATION AND MONITORING Regulate and strengthen measures for good practices, technical services and EE	promote management of RAC facilities.
LINE 5: WOMEN'S PARTICIPATION IN THE RAC SECTOR Identify and promote opportunities to increase women participation and leadership in the RAC sector.	

Figure 7. Objectives in each line of work of the National Cooling Plan Proposal Source: Author compilation.

Annex 1 shows the National Cooling Plan Proposal with the measures included in each guideline and the implementation roadmap for each line.



Figure 8. Lines of work and strategic guidelines for the National Cooling Plan Proposal Source: Author compilation.

4.1. Considerations for designing a monitoring, reporting and verification (MRV) system

Climate change mitigation measures must be associated with a system allowing to measure the expected mitigation impacts (GHG reductions), report them in a specific format ensuring the integrity of the report, comparison over time and verification of the results by a third part; that is, a monitoring, reporting and verification system (MRV) (Factor CO₂, 2017). In this context, some considerations are included to identify relevant actors for an eventual MRV system in the case of the present National Cooling Plan Proposal is implemented.

Given their importance, many MRV systems applied to different emission reduction projects have been developed, particularly in contexts of commitments for reduction or where emission transaction systems operate. That is the case of Chile, where there is a MRV system for CPAs (MMA, 2015), another for energy projects (Ministry of Energy, 2019) and for different mitigation projects. Hence, some measures to assess the possibility to incorporate those systems and elaborate one sole MRV centralized at national level are being considered (Centro de Energía, 2016).

One of the shortcoming appeared in the design of MRV systems is the double accounting of impacts; i.e., the reductions generated by a particular mitigation project are also being accounted for as reductions generated by another project (MMA, 2015).

MRV systems are a dynamic matter within ministries, which hold many studies and consultancies at this respect. Thus, the design of an MRV system connected with the National Cooling Plan Proposal to measure the expected impacts (i.e. reduction in energy consumption, use of HFCs and the leakage level) requires a first stage to analyze the current situation of MRV integration initiatives, systems currently operating, reporting and verification platforms behind, etc. This stage would allow assessing the possibility of being part - from the beginning - of a compatible and coherent system, and minimize the risk of double counting impacts. The risk of double counting is possible considering that the Plan proposal includes the connection with other mitigation initiatives that have their own MRV systems, such as the CPAs.

Given the vast experience in reporting and recording CO₂ reductions, the HuellaChile Program is a relevant actor that may support the design and structuring of an MRV system for the Plan Proposal. The ASCC is other significant actor, taking into consideration their experience in the MRV system of CPA's NAMA. Working together with both entities from the beginning is a critical strategy to evaluate issues such as the potential of incorporation of existing MRV systems, avoid double counting of impacts and define the most coherent way to implement an MRV system, in case of an eventual implementation of the National Cooling Plan Proposal.

Regarding the existing platforms that could host an MRV system of the National Cooling Plan, the RETC of the MMA is a tool currently addressing issues related to refrigerants in the framework of registry for products controlled by the Montreal Protocol (Art. 8° S.D. 3/2019 MINSEGPRES).

5. CONCLUSIONS

The implementation of a National Cooling Plan Proposal implies moving towards an energy efficient technology with low or zero GWP refrigerants, which is justified by the high consumption of high-GWP refrigerants and the significant electricity consumption associated with cooling systems. Regarding refrigerants consumption in Chile (i.e. HFC), the refrigeration and Air Conditioning sector is the main user nationwide, covering 70% of 2018 substances' benchmark. Regarding the electricity consumption of the RAC sector, there is no specific information related; however, based on interviews, it was possible to confirm the relevance of the cooling systems' electricity consumption and the need to have specific data from the sector to design appropriate public policies.

A comprehensive gathering of primary and secondary information identified various challenges that hinder the incorporation of new technology by the RAC industry. Part of the challenges are related to the poor knowledge about the Kigali Amendment and its implications, the lack of information on technological alternatives applicable in the different sub-applications of the sector, the remaining useful life in installed technology, the lack of technical capacities supporting technological change and the lack of funding in certain sectors to introduce new technology.

However, there is a great diversity of measures and programs implemented at the national level in matters of EE and CC mitigation that may support the fulfillment of the National Cooling Plan Proposal objectives and face the challenges involved in their implementation.

Based on this background, and once identified challenges and opportunities for connection, the National Cooling Plan Proposal developed is structured based on six lines of work:

- 1. Support for the management of refrigerants and EE in the RAC sector;
- 2. Capacity Building in the RAC Sector;
- 3. Financing and Investment;
- 4. Regulation and Inspection;
- 5. Women's Participation in the RAC Sector at the National Level, and
- 6. Dissemination and awareness (crosscuts all the above).

Each line of work holds various strategic guidelines and measures to overcome the challenges set and support the different users in managing their RAC premises, thus improving their energy and environmental performance.

The validation process undertaken by this Proposal was crucial to incorporate the vision of different actors in the RAC sector, which resulted in a more comprehensive and coherent proposal, in line with the national reality.

Finally, the implementation of this National Cooling Plan Proposal expects to achieve a significant reduction of GHG related with the RAC sector, which is given by the reduction in electricity consumption, high GWP refrigerants use and leakages.

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7. ANNEXES

Annex 1. National Cooling Plan Proposal and Implementation timeframe (Roadmap)

The National Cooling Plan Proposal (NCPP) is structured under six lines of work that, together, aim to face the various challenges of the RAC sector towards an efficient technology with alternative low-GWP refrigerants, and maximize the benefits related to connecting with different EE and CC mitigation policies and programs implemented at the national level. Each line is built by different strategic guidelines (see Figure 7), where each guideline holds different measures focused in complying with the objective of each guideline, as described below.



Figure 9. Lines of work of the National Cooling Plan Proposal Source: Author compilation.

1. Working lines, strategic guidelines and measures included in the NCPP

LINE 1: Support to the management of refrigerants and EE in the RAC sector

The Kigali Amendment promotes a technological change that includes introducing low or zero GWP refrigerants and simultaneously improve the EE of equipment and systems using such refrigerants. This supposes a strong support to the introduction of new technology and/or measures aimed at managing energy and environmental performance of the installed equipment.

The strategic guidelines defined under this line point to generate the information required to promote the introduction of new technology and the refrigerant and EE management in new and installed equipment in the various sub-applications of the RAC sector. Likewise, they focus on the generation of synergies with policies and programs related to the environmental and energy performance of the sector; and to the development of tools for end users in managing cooling facilities.

Strategic Guideline 1.A.: Research and generation of information on EE and refrigerants

The provision of information supporting decision makers is one of the main components proposed by UNEP both to promote investment in efficient technology and to improve the energy performance of facilities (UNEP, 2018 b). This coincides with two of the main challenges identified in the development of the Proposal, regarding the need of information on new technology and the need to improve energy performance of existing facilities and those under operation.

Regarding the latter, EE measures for facilities under operation become relevant when considering the recently installed equipments and systems and/or those installed several years ago but with remaining usefull life given its good maintenance, which occurs mainly in industrial refrigeration and commercial AC equipment (retail).

In this context, this guideline aims to generate all the information required to encourage the introduction of new technology and allow project developers and end users to manage cooling facilities, improving performance in coolants and EE.

Measures proposed are the following:

1.A.1. State of the art efficient technologies with low or zero GWP refrigerants.

Description :

Research and elaboration of document(s) summarizing the different technological alternatives with better energy performance and based on zero or low GWP refrigerants existing nationally and internationally, for the different sub-applications of the RAC sector, mainly commercial and industrial cooling, fixed AC and cooling transportation. In this regard, it could include, for example, information on technology replacement pilots implemented at national and international level.

The objective is to generate relevant information serving as background for different actors, sectors and public/private institutions, e.g.: decision makers in user companies, investors, public bids and purchases managers, state suppliers, and public/private construction projects developers, among others.

Thus, it seeks to summarize and systematize the information for each type of technology, providing data about costs, energy consumption, type of refrigerant used, related benefits (e.g. savings) and current and potential uses (sectors). It is recommended to include technologies using different types of alternative refrigerants and to incorporate experiences and examples applied at different scales (small, medium and large installations).

This measure is included in the Climate Change Development and Technology Transfer (EDTTCC). However, it is recommended to evaluate partnerships with academic institutions and research centers that could include this subject in their investigation projects research and/or thesis.

Finally, this proposal suggests a data collection on a permanent basis, considering periodic updates (e.g. every two years). **Scope:** RR, CR, IR, RT, MAC, FAC.

Responsible entities: Ozone Unit in coordination with the Sustainable Energy Division of the Ministry of Energy. **Implementation timeframe:** permanent in the short, medium and long term (2021 onwards).

1.A.2. Development of information reports based on new installations (pilots) Description: Based on pilot projects implemented to date, this measure proposes to develop information reports showing the main features of projects implemented and the results recorded in energy consumption and savings.

This type of document is highly recommended for each of the pilot projects to be implemented in the short, medium and long term.

Scope: CR, IR, RT, FAC.

Responsible entities: Ozone Unit in coordination with the Sustainable Energy Division of the Ministry of Energy supported by experienced professionals in the implementation of pilots and success stories.

Implementation timeframe: permanent in the short, medium and long term (2021 onwards).

1.A.3. Reconversion guidelines for installed RAC equipment

Description:

One of the alternatives to improve the environmental performance of installed equipment is through the reconversion of equipment. In this context, the recommendation is to develop retrofitting guidelines to low or zero GWP refrigerants, based on technical and financially viable examples, including information regarding reconversion potential and effectiveness assessment, components to adjust, parts used, results, benefits (savings) etc.

It is recommended to include retrofitting cases for different types of alternative refrigerants and for different scales facilities, whenever feasible.

Scope: CR, IR, RT, FAC.

Responsible entities: Ozone Unit in coordination with the Sustainable Energy Division of the Ministry of Energy, supported by experienced professionals and/or technical services in retrofitting.

Implementation timeframe: short and medium term (2021-2029).

1.A.4. Documents on EE measures for new and installed RAC equipment

Description:

The energy performance potential of a refrigeration or air conditioning equipment will depend on many factors beyond the equipment itself (UNEP, 2018b). Different measures developed internationally enhance energy performance in RAC systems, from their design or in already operating facilities. This measure is focused in collecting the existing and updated information in this regard (i.e., national and international research, information from experts, etc.), validate them with the corresponding counterparts and develop a report with the main measures and trends in EE implementable at a local level. It is recommended to include measures devoted to different scales installations and applicable in different sub-applications of the RAC sector, with periodic updates (e.g., every two years).

Scope: CR, IR, RT, FAC, MAC.

Responsible entities: Ozone Unit and Sustainable Energy Division of the Ministry of Energy, supported by experienced professionals and/or technical services in the design and installation of efficient systems.

Implementation timeframe: permanent in the short, medium and long term (2021 onwards).

1.A.5. Commercial refrigeration equipment information collection to define MEPS

Description:

The establishment of Minimum EE standards (MEPS) is recognized as the most important measure to improve the EE of small RAC appliances, which can be replicated in different countries, with the opportunity to increase the standard requirement (UNEP, 2018c). The MEPS definition process for a specific device requires the collection of technical and commercial information (i.e., energy consumption, available technology, and trade, among others) for years in order to evaluate the relevance and minimum standard level²⁶.

In this regard, the proposal is to begin with the information gathering process for commercial refrigerant equipments (showcases) in order to establish minimum EE standards in the medium or long term.

Scope: CR.

Responsible entities: SEC and Sustainable Energy Division of the Ministry of Energy, supported by the Ozone Unit of the MMA.

Implementation timeframe: short and medium term (2021-2029).

²⁶ Information provided by the technical counterpart of the Sustainable Energy Division of the Ministry of Energy.

1.A.6. Background on the connection between the use of mobile AC with the vehicle's EE and leakage level

Description:

Nowadays, various national initiatives provide information on vehicle's EE (i.e., fuel performance) and its environmental impact in terms of CO₂. These include the EE labelling for light and medium vehicles, and information platforms of the Ministry of Energy to compare those criteria amongst different types of vehicles²⁷.

These initiatives do not include the use of AC in vehicles and their leakage level, as there is no clear connection among using AC, vehicle's EE and leakage level. Therefore, the impact of AC in GHG emissions and in the vehicle's EE is not being considered in the related public policies, and final users do not have information at this respect.

This measure aims to investigate and gather information at national and international level to connect the operation and maintenance of ACs, with the leakage level and vehicles' potential EE.

The information collected will be useful to develop awareness campaigns in the automotive sector and include these criteria in related public policies.

The dissemination of the above detailed information to technical services and end users through different means and platforms –with the collaboration of ANAC-, is highly recommended, highlighting the importance of ACs' operation and maintenance in the vehicle's EE and its environmental impact.

Finally, this measure proposes to include refrigerated transportation in order to establish potential relationships among the operation of the cooling equipment, the EE of the vehicle and the leakage levels.

Scope: MAC, RT.

Responsible entities: Ozone Unit and Sustainable Energy Division of the Ministry of Energy.

Implementation timeframe: short term (2021 - 2024)

Strategic Guideline 1.B.: Connection with programs in implementation at the national level

There is a broad programs portfolio nationwide representing valuable opportunities to improve the energy and environmental performance of RAC facilities. Some of them have the ultimate goal of improving the EE of small and medium-sized companies, buildings, industrial sectors and transportation, among others. All of them may create virtuous synergies to support the objectives of the National Cooling Plan Proposal, either through the introduction of requirements related to refrigerants and EE, or through their promotion in the RAC sector.

1.B.1. Implementation of new facilities' pilot projects with EE criteria, in coordination with the MMA Ozone Unit Description:

The MMA Ozone Unit has implemented different technology exchange pilot-projects in the RAC sector, co-financed with international funds. In this context, this measure proposes to continue with this initiative by implementing pilot projects for new facilities (or retrofits), incorporating low or zero GWP refrigerants and EE criteria.

Depending on national and/or international funds available, priority should be in sub-applications with high consumption of HFCs, and a lower technological advance, to apply them in scales with poor access to information (e.g., small supermarket chains).

Additionally, the implementation of these pilots will improve gathering different parameters (e.g. refrigerant charge, recharge, consumption and energy savings, etc.) to compare and disseminate the results through informative documents (measure 1.A.2).

It is recommended to set some pilots in regions, whenever technically and economically possible, and to incorporate the knowledge and experience gained by professionals and national technical services in the design and installation of projects with efficient technology based on new refrigerants.

Additionally, the evaluation of funding for the implementation of pilots for educational purposes to execute in different technical education centers is highly recommended.

²⁷ <u>http://www.consumovehicular.cl/inicio#/</u>

Scope: CR, IR, RT, FAC

Responsible entities: Ozone Unit in coordination with the Sustainable Energy Division of the Ministry of Energy, supported by funding resources and users interested in co-financing the projects.

Implementation timeframe: permanent in the short, medium and long term (2021 onwards).

1.B.2. Participation of companies related to the RAC sector in programs of the Energy Sustainability Agency

Description:

This measure seeks to improve the energy performance of companies related to the RAC sector and, in particular, of their cooling systems through the promotion of programs coordinated by the ESA. These programs may impact directly on energy consumption in the different RAC sub-applications, namely:

- Clean Driving Program -> refrigerated transportation
- EPPBIP: Energy Performance in Public Buildings and Infrastructure Program -> Refrigeration and AC systems
- MiPyMEs Manages Energy-> commercial refrigeration, industrial refrigeration and fixed AC
- Energize your SME -> commercial refrigeration, industrial refrigeration and fixed AC

A second stage aims to assess the relevance of introducing measures in ESA programs related to the use of alternative refrigerants and GRP, which could affect the equipment's EE. The information, guidelines and documents developed in guidelines 1.A and 2.A shall be used for these purposes.

Scope: CR, IR, RT, FAC.

Responsible entities: Ozone Unit and Sustainable Energy Division of the Ministry of Energy, in coordination with the ESA and the corresponding counterparts.

Implementation timeframe: permanent in the short, medium and long term (2021 onwards).

1.B.3. Incorporate requirements on refrigerants in Sustainable Construction certifications and EE labelling of buildings and houses

Description:

There are various initiatives in the construction sector supporting the energy and environmental improvement of RAC equipment and systems used in buildings and houses, namely:

- Sustainable Building Certification (SBC)²⁸
- Sustainable Housing Certification (SHC) (already holds voluntary requirements in low or zero GWP refrigerants).
- Green Building Council (GBC) certification
- House and Public Building Energy Rating (HER)

Sustainable construction certifications have incorporated requirements on EE for building air conditioning systems. Consequently, this measure aims to analyze, together with the relevant counterparts, the introduction of requirements on alternative refrigerants. For this purpose, voluntary requirements on alternative refrigerants included in the SHC can be taken as a reference.

The HER considers energy performance of heating and cooling equipment in use for housing purposes²⁹. Consequently, potential effects in labelling and the advantages related to the inclusion of more efficient RAC equipment shall be evaluated. Thus, it is recommended to start conversations with the Ministry of Housing and Urbanism, together with the Ministry of Energy, for a better understanding of the objective of labelling, the criteria considered and the results to date.

Scope : CR, IR, FAC

Responsible parties: Ozone Unit, supported by the corresponding public and private counterparts (i.e., MINVU, IC, Ministry of Energy, ChileGBC).

Implementation timeframe: short and medium term (2021-2029).

1.B.4. Incorporation of goals related to refrigerants and EE in new CPAs

Description :

²⁸ It should be noted that conversations have already begun with the Construction Institute (IC) to incorporate this type of requirement in the SBC, in their certification model for existing buildings.

²⁹ https://www.calificacionenergetica.cl/elementos-que-influyen-en-la-calificacion-energetica/

This measure seeks to incorporate goals related to refrigerant used, good practices in managing refrigerants and the implementation of EE measures (e.g., ISO 50.001 on energy management systems) in the CPAs' development process, emphasizing those sectors with higher refrigerant consumption. To this end, the information provided under guideline 1.A. will be available.

This measure proposes a staggered-requirements structure, in coordination with the relevant counterparts, to foster an increasing ambition in subsequent CPAs within one same sector.

Scope: CR, IR, RT, FAC, MAC.

Responsible entities: Ozone Unit and Sustainable Energy Division of the Ministry of Energy, in coordination with the ASCC and the corresponding public and private counterparts.

Implementation timeframe: permanent in the short, medium and long term (2021 onwards).

1.B.5. Include requirements in public bidding bases for buildings and for state suppliers

Description:

One of the options to promote the introduction of alternative refrigerants and EE measures in public buildings' RAC equipment is to incorporate these criteria in the public bidding rules and in state suppliers' platform (ChileCompra).

In the case of bids for projects, these criteria should be part in the design of the building, so it is recommended to identify the ideal institution to channel this incorporation into the bidding regulations of State organizations. At the same time, it is recommended to disseminate the matter among State bodies issuing various scale project bids which include refrigeration or air conditioning systems, such as MINSAL (Ministry of Health), MOP (Ministry of Public Works), Ministry of Education, ASE, MINVU, Subdere (Regional and Administrative Development Secretariat), among others.

In the case of public procurements, the proposal sets a joint assessment with ChileCompra to include minimum requirements related to the type of refrigerant and EE in tenders and suppliers' framework agreements for the maintenance and acquisition of RAC equipment. It is recommended to start such conversations as soon as possible since a New Procurement Law is currently under development³⁰.

Finally, the definition of requirements for efficient technology and alternative refrigerants may use the documents elaborated in the previous measures.

Scope: RR, CR, IR, FAC.

Responsible entities: Ozone Unit, Ministry of the Environment, Sustainable Energy Division of the Ministry of Energy and ChileCompra, in coordination with corresponding counterparts.

Implementation timeframe: medium and long term (2024 - 2035)

Strategic Guideline 1.C.: Tools for the management of RAC facilities (EE and refrigerants)

This guideline focuses in developing different tools to facilitate the management of RAC facilities, either from the central level or by end users, in order to improve their environmental and energy performance.

1.C.1. RAC Facilities Record

Description:

³⁰ https://www.chilecompra.cl/2020/08/ministerio-de-hacienda-anuncia-modernizacion-d el-sistema-de-Compras-Públicas/

Developing a record of RAC facilities currently operating in the country, to track the type of installed technology, useful life, type of refrigerant used, loads, reloads, energy consumption and management of said components; incorporating information related to the facilities development, expansion or closure.

This information is very useful to elaborate specific sector-related data and make diagnosis on energy and refrigerant consumption, types of technology used and advances at the national level, in order to design national plans and measures accordingly (i.e. KPMP) and prioritize facilities, sectors and areas requiring proactivity to improve their environmental and energy performance. Special attention should be paid to the facilities holding HCFCR-22, or prohibited refrigerants such as CFC-12 or similar, to evaluate the possibilities of a direct replacement to refrigerants with low or zero GWP, without going through HFCs.

In addition, this registry will support companies in monitoring their refrigerants' consumption (loading and reloading) and facilities' energy consumption, as well as to evaluate the results of the different management measures implemented.

Activities proposed for the implementation of the record:

- Definition of the scope of the registry (type of facilities to be included according to refrigerant, type of facility or other criteria).
- Definition of an access and reporting methodology, for example: through the PRTR, the HuellaChile Program or other; the format and periodicity of the report, and records accepted (purchase invoices, etc.); among others.
- Definition of data verification systems.

This measure recommends to work together with the HuellaChile Program in the aforementioned activities and evaluate if there may be any technical link between both tools or if it is advisable to implement them separately. Doing so as part of the HuellaChile Program would allow setting up an acknowledgement system for companies on refrigerants and energy consumption management related to their cooling facilities, besides expressing the information in GHG reductions, which could eventually be traded in a carbon market.

The registry may be volunteer during the first years (trial phase), encouraging an early registration of the largest number of facilities and disseminating its operation, protocols and benefits; to evolve towards a mandatory registration in the long term, when reductions in HFC consumption begin (2029).

Once registration becomes mandatory, it is recommended to work together with the Environmental Assessment Service (EAS), the ASCC and the related guilds to access and triangulate information on existing RAC facilities.

Finally, it should be noted that the Ozone Unit holds the base studies for the development and implementation of a RAC facilities record, so this proposal focuses on their assessment, updating if necessary, and formal implementation.

Scope: CR, IR, RT, FAC.

Responsible entities: Ozone Unit together with the HuellaChile Program and relevant counterparts. **Implementation timeframe:** medium and long term (2024 -2035)

1.C.2. Report of practices of installation and maintenance services in RAC sector

Description:

This item proposes the development of a system to facilitate reporting the practices carried out in the installation and maintenance services, i.e. implemented maintenance measures, type of refrigerant used, quantity used, and staff in charge, among others.

This type of report has multiple benefits. On the one hand, it allows monitoring the different types of refrigerant used and the amount consumed in installation and maintenance services. On the other hand, the record would maintain the traceability of interventions carried out in a particular RAC system, ensuring a continuous implementation of good

practices, extending the useful life of the equipment and maximizing the EE. In addition, a mandatory reporting process and a permanent monitoring encourage technical staff to improve their performance on a regular basis. Additionally, this report would provide the information required for the RAC Facilities Record Registry (1.C.1.).

Companies holding facilities -regardless whether maintenance services are outsourced- shall be responsible for the permanent update of reports.

Working in friendly reporting formats, consistent with practice and aligned with the GPs of the RAC sector, taking as a reference the information produced in the framework of the National Cooling Plan Proposal, is highly recommended. Finally, it is proposed to work on a joint design with the stakeholders involved (technical services, maintenance and operation staff, personnel responsible for managing refrigerants, machinery owners, etc.).

Scope: RR, CR, IR, RT, FAC, MAC

Responsible entities: Ozone Unit in coordination with the relevant counterparts. **Implementation timeframe:** permanent in the short, medium and long term (2021 onwards)

Line 2: Capacity Building in the RAC sector

One of the most significant challenges in implementing the National Cooling Plan Proposal refers to the improvement of practices and technical capacities of the staff responsible for the equipment. This improvement promotes a technological change towards low or zero GWP refrigerants, and helps to maximize RAC systems' EE through the implementation of good installation, maintenance and operation practices.

In this context, this line has two strategic guidelines. The first one seeks to spread the implementation of good practices in technical services and personnel in charge of RAC facilities, as a strategy to improve the EE of the systems. The second guideline seeks to train students and update technical personnel working in the RAC sector, in matters related to EE and low or zero GWP refrigerants.

Strategic Guideline 2.A: Dissemination of good practices in technical staff and RAC equipment operators

Good practices in the installation and maintenance of RAC equipment and systems have a direct impact on energy and environmental performance. For example, airtight equipment (or a system minimizing leaks) is more energy efficient than a "permeable" one and does not release refrigerants into the atmosphere³¹. Moreover, refrigerants' recovery during maintenance services instead of releasing it into the atmosphere is another practice holding a direct environment impact of the facility. Thus, it is essential to promote the implementation of good practices amongst everyone working with RAC equipment, and in charge of operating the said equipment. To this end, the following measures are proposed:

2.A.1. Promotion of good practices in the installation, maintenance and operation of RAC systems

Description:

This measure seeks to develop and increase access to official information on good installation, maintenance and operation practices for RAC systems in order to promote their implementation amongst technical staff and end users. In this regard, it is proposed to develop two manuals with different target audiences:

Installation and maintenance manual for RAC facilities: based on standards and regulations available to date on good practices in installation and maintenance services, in order to gather, simplify and disseminate the information in this

³¹ Information obtained interviewing different technical support services.

regard. It should be noted that the MMA Ozone Unit has currently implemented his type of initiatives. Consequently, this measure aims to give them continuity and expand their impact.

Operation manual for RAC facilities: develop and disseminate a manual for personnel in charge of the RAC facilities' daily operation, identifying good practices during the operation, defining the responsibilities of the operating personnel, detailing the basic equipment required for the implementation of good practices, and the demands on service providers, among others.

Finally, both manuals shall be permanently available to facilitate access of the target audience.

Scope: CR, IR, FAC.

Responsible entity: Ozone Unit

Implementation timeframe: short and medium term (2021 - 2029)

2.A.2. Good practices training for the installation, maintenance and operation of RAC systems

Description :

One of the initiatives of the Ozone Unit is the development of training courses on good refrigeration practices (GRP) at the national level. In this context, this measure aims to extend these courses by expanding their contents (e.g. EE) and the target audience.

On the one hand, to continue with the GRP courses, based on the information collected in the installation and maintenance manual (2.A.1.), intended for technical staff and training centers.

On the other hand, to carry out courses on good operating practices for RAC systems, based on the operation manual (2.A.1.), intended for personnel in charge of RAC systems' daily operation.

Including content on current international commitments about refrigerants, new cooling trends and the importance of good practices for their implementation is highly recommended as well.

Scope: CR, IR, FAC.

Responsible entity: Ozone Unit.

Implementation timeframe: permanent in the short, medium and long term (2021 onwards).

Strategic Guideline 2.B.: Technical staff training in new cooling trends and EE

One of the main barriers in introducing new RAC technology is the uncertainty about the technical capacity available for its installation and maintenance. That is why it is essential to update and train technical staff, teachers and students in new cooling trends based on alternative refrigerants and with EE criteria.

Accelerating the updating of content and training of students currently pursuing careers related to the RAC sector, becomes crucial as per the closure of technical and university degrees in cooling and HVAC taught by the INACAP Institute/University, which will lead to a technical staff reduction in the coming years.

Most of the measures proposed in this guideline were included in the Strategy for Capacity Building and Climate Empowerment, which is in the design stage.

2.B.1. Review and update of training centers' RAC-related curricula

Description :

To support the improvement of technological changes required under the Kigali Amendment, it is necessary to strengthen the academic training of cooling and HVAC students. Thus, the curricula of entities teaching cooling and HVAC careers must be reviewed and updated, incorporating theoretical and practical knowledge on good practices in managing refrigerants during maintenance and at the end of their useful life, on current cooling trends with low or zero GWP refrigerants and EE criteria. These training centers include technical schools, technical-professional institutes, technical training centers and universities nationwide.

The prompt implementation of this measure becomes extremely relevant given the closure context of technical and university degrees in cooling and HVAC taught by the INACAP Institute/University, which will represent a reduction of technical staff available in the medium term. This is why it is essential to include the new content as soon as possible in such a way as to train as many students as possible.

It is also recommended to include topics on national regulations and international environmental commitments related to the RAC sector, mainly the Montreal Protocol and the Kigali Amendment, emphasizing the importance of the service sector for their compliance.

Finally, it is recommended to study mechanisms to provide educational centers with machinery or models for the practical teaching of the updated contents of refrigeration and air conditioning.

Scope: RR, CR, IR, RT, FAC, MAC.

Responsible entities: Ozone Unit in coordination with the Sustainable Energy Division of the Ministry of Energy, the Education Unit of the Ministry of Energy and the Ministry of Education.

Implementation timeframe: short term (2021-2024)

2.B.2. Promotion of coordination among training centers and companies

Description :

One of the shortcomings of RAC professionals identified as per the interviews relates to lack of connection between the content taught in training bodies and business requirements. Thus, this line proposes to promote partnerships between training centers and different companies, aiming to connect formal education with current working requirements in terms of good refrigeration practices, use of alternative refrigerants with low or no GWP, new technology used and improvement in energy performance, among others.

Specific training in technological updates, guided visits to companies, and training internships, among others, can do this connection.

It is also proposed to foster partnerships between training centers and regeneration centers for visits and practical classes about handling refrigerants during maintenance and at the end of equipment's useful life.

Scope: RR, CR, IR, RT, FAC, MAC.

Responsible entities: Ozone Unit in coordination with the Education Unit of the Ministry of Energy, regeneration centers, CChRyC, DITAR and other relevant counterparts.

Implementation timeframe: permanent in the short and medium term (2021-2024)

2.B.3. Updating teachers, technical staff and designers on new cooling trends

Description:

Besides strengthening students' training (2.B.1. and 2.B.2.), it is necessary to level and train technical staff, teachers, and designers actively working in the RAC sector. Thus, it is proposed to review and update the training programs related to the use of HFCs in RAC, and on this basis to coordinate and give training and updating courses (theoretical and practical) on new cooling trends with alternative refrigerants and EE criteria.

Those subjects should include topics on national regulations and international environmental commitments associated with the RAC sector, mainly the Montreal Protocol and the Kigali Amendment, emphasizing the importance of the service sector for its compliance.

Teachers should be trained and updated based on the modifications to the curricular networks proposed in measure 2.B.1.

It is advisable to evaluate partnerships with different guilds or other relevant actors to support the execution of the updating courses (e.g. GA and ASE for commercial and industrial sectors).

Finally, developing a public record of technical staff and trained designers in the RAC sector is highly recommended.

It should be noted that this measure aims to give continuity to the training initiatives implemented by the Ozone Unit. In this case, the material and information generated along the different lines of work of the National Cooling Plan Proposal may be used.

Scope: RR, CR, IR, RT, FAC, MAC.

Responsible entities: Ozone Unit in coordination with the Sustainable Energy Division of the Ministry of Energy, the Education Unit of the Ministry of Energy, institutions and related associations.

Implementation timeframe: permanent in the short, medium and long term (2021 onwards).

2.B.4. Update of labor competencies profiles (ChileValora), based on new trends in RAC

Description:

To guarantee that technical staff related to the RAC sector incorporate content related to new RAC trends, it is necessary to update labor competencies in ChileValora, including the application of good practices in the use of HFCs alternative refrigerants, the improvement of EE and the use of energy efficient technologies. This update shall be implemented together with the Ministry of the Environment and the Ministry of Energy.

It should be noted that current profiles' validity will be as of 2022 (update every five years) and that the application period for projects update will begin on 30 October 2020³².

Scope: RR, CR, IR, RT, FAC, MAC.

Responsible entities: ChileValora in coordination with the Unit Ozone CChRyC, the Sustainable Energy Division and the Education Unit of the Ministry of Energy.

Implementation timeframe: short term (2021-2024).

2.B.5. Implementation and update of labor competencies assessing and certifying centers in the RAC sector

Description:

Along with updating labor skills profiles, it is necessary to expand the assessment centers network related to these skills (only one currently). Thus, it is proposed to implement labor competencies assessing and certifying centers related to the use of HFC alternative refrigerants and EE improvement in RAC, both in the Metropolitan Region and in region-wide. Likewise, in order to update the only operating center available today, a joint work with the current assessing center on alternatives to update the models based on the updating of training profiles is highly recommended.

To elaborate a forecast on the number of centers required and their location, it is necessary to estimate the demand for certification distributed by region³³.

Finally, it is recommended to evaluate any national/international financial support available for co-financing the equipment in these centers.

Scope: RR, CR, IR, RT, FAC, MAC.

Responsible entities: ChileValora, CChRyC, Ozone Unit in coordination with the Sustainable Energy Division of the Ministry of Energy, the Education Unit of the Ministry of Energy, and other related actors. **Implementation timeframe:** medium and long term (2024-2035).

2.B.6. Promoting a labor competencies certification (ChileValora) in the RAC sector

Description:

Spreading the incorporation of new RAC trends in technical staff requires the promotion of updated labor competencies certification (2.B.4.) by advertising the certification in different media, disseminating the co-financing granted by SENCE and through end customers who may require their service providers to work exclusively with certified staff.

³² Information obtained in the validation workshops.

³³ Information provided by ChileValora's counterpart during the validation workshops carried out.

In the short term, this requirement will need a supervisory work by the end customer, which can be supported by the Certified Staff Public Record managed by ChileValora. In the medium and long term, work with certified technical staff is expected to be mandatory and will hold formal control measures (see Line 4, guideline 4.A.).

It is recommended to evaluate possibilities of national and/or international financial support for co-financing the certification processes.

Scope: RR, CR, IR, RT, FAC, MAC.

Responsible entities: ChileValora, CChRyC in coordination with the Ozone Unit.

Implementation timeframe: medium and long term (2024-2035)

Line 3: Financing and Investment

The main barrier identified by RAC users in terms of installing new equipment or retrofitting the existing technology is the cost related. This situation is even more critical in small and medium size companies. In this context, studying funding opportunities and strategies at the national and international level, and designing strategies to promote technological change in the entire RAC sector is crucial. In turn, the evaluation, design and implementation of financing strategies are essential to implement the measures proposed concerning training courses, and elaboration of guidelines, amongst others.

Strategic guideline 3.A. Raising current financing opportunities

There is a large number of financing alternatives to support the transition towards more efficient and environmentally friendly technology. In this sense, these opportunities and their application in the RAC sector shall be revised and in detail.

3.A.1. National and international funding registry to cover technological projects

Description:

There is a great diversity of international funding to support technology replacement projects benefiting climate change mitigation, so it is essential to identify them and revise their scope.

At the national level, the Environmental Protection Fund (FPA) finances projects submitted by civil society benefiting the environment, including projects submitted by guild associations (GA). Thus, it would be interesting to know their scope and operation.

It is also recommended to evaluate financial support from the Multilateral Fund of the Montreal Protocol, K-CEP or other international entities supporting the implementation of some of the proposed measures, mainly in training and in the generation of relevant information.

Scope: RR, CR, IR, RT, FAC, MAC.

Responsible entity: Ozone Unit.

Implementation timeframe: short term (2021-2024).

3.A.2. Research on national funding for technology improvement projects

Description:

Nowadays, there is a series of economic programs and instruments developed that represent a great opportunity to finance the required technological changes.

For example, some banking entities hold instruments such as green credits, the ESCO models and programs providing funding for renewal activities such as "Energyze your Pyme" from the ASE. In this context, the proposal recommends to study these instruments and programs in depth and analyze their applicability in the RAC sector.

This work should involve the ASE as per their vast experience in financing programs, in the development of ESCO projects and in mass campaigns for funding development of projects.

In parallel, this measure proposes to analyze national alternatives to finance the implementation of measures about training in the RAC sector and the elaboration of relevant information.

Scope: RR, CR, IR, RT, FAC, MAC.

Responsible entities: Ozone Unit, supported by the ASE. **Implementation timeframe:** short term (2021-2024)

Strategic guideline 3.B. Analysis and design of financing strategies for the RAC sector

Along with assessing current funding opportunities and scope, it is necessary to design different funding strategies to promote technological change and support the RAC sector.

3.B.1. Analysis with guilds about opportunities to promote mass reconversions and generate economies of scale

Description:

One of the opportunities raised by guilds to encourage investment in new technology is the coordination and massive purchase of equipment to generate economies of scale. It is therefore recommended to evaluate this possibility with the guilds and their associates. The information generated under guideline 1.A. can be used for this purpose.

Scope: CR, IR, RT, FAC.

Responsible entities: Trade associations, ASCC in coordination with the Ozone Unit.

Implementation timeframe: permanent in the short, medium and long term (2021 onwards)

3.B.2 Funding strategies design in the RAC sector based on international experiences

Description:

It is essential to know the experiences and funding strategies at the international level to achieve important technological changes and build capacities, either in the framework of the Kigali Amendment or other contexts fostering this type of initiatives.

The information collected should be the basis for designing funding strategies applicable to the different technologies used in the RAC sector and in capacity building.

Scope: RR, CR, IR, RT, FAC, MAC.

Responsible entities: Ozone Unit in coordination with stakeholders.

Implementation timeframe: permanent in the short, medium and long term (2021 onwards)

3.B.3. Design of a national economic incentives system to encourage technology exchange in the RAC sector

Description:

Based on the international experience, and considering the influence of economic incentives in the promotion of technology renewals, it is proposed to design a national incentives system to promote the introduction of efficient and environmentally friendly technology for the RAC sector. This system can include a set of economic measures such as tax benefits, and taxes, among others, which should be studied and designed with the relevant counterparts for their implementation in the medium or long term.

Scope: RR, CR, IR, RT, FAC, MAC.

Responsible entities: Ozone Unit, Ministry of Energy, Ministry of Economy and Ministry of Finance.

Implementation timeframe: medium and long term (2024-2035)

Line 4: Regulation and Monitoring

Regulation is considered one of the basic components to move towards improving environmental and energy efficiency of equipment (UNEP, 2018b). On the other hand, according to the interviews, the definition of laws and decrees is one of the most effective measures to set the technological and behavioral changes required to fulfill the Kigali Amendment and the eventual implementation of the National Cooling Plan Proposal.

This Line proposes a series of regulations designed to govern and strengthen some areas covered above, mainly regarding the implementation of best practices, certification of competencies and EE measures. Likewise, the proposal includes measures to strengthen controls of said regulations.

Strategic guideline 4.A. Regulations on good practices (GP), technical services and EE

4.A.1. Mandatory application of RAC installation and maintenance GPs

Description:

To ensure and standardize the implementation of good practices in the installation and maintenance of RAC equipment and systems, it is recommended to establish a mandatory application of good practices (based on the standards or regulations available to date) through Supreme Decree or any relevant legal instrument. One alternative is to incorporate the enforcement into the regulations elaborated by the Ministry of Health for the application of Article 14 of Ozone Law No. 20.096/2006.

The said legal instrument should include aspects such as a report of practices of installation and maintenance services (1.C.2); and good practices in the operation of cooling facilities (2.A.1).

Scope: RR, CR, IR, RT, FAC, MAC.

Responsible entities: Ministry of Health in coordination with the Ozone Unit.

Implementation timeframe: long term (2029 onwards)

4.A.2. Enforcement to work with certified staff and trained designers; and mandatory technical staff certification Description:

In line with the regulation detailed above, this proposal recommends to enforce working exclusively with technical staff and designers duly trained and certified, regardless of whether it is through a technical service or a professional.

This measure aims to ensure, on the one hand, the incorporation of EE components and alternative refrigerants in the new RAC projects from their design; and, on the other, that qualified staff execute the installation and maintenance of said projects.

In addition, the measure recommends the establishment of a mandatory certification on labor competencies (2.B.4.) and training (2.B.3.) for all professionals working in the RAC sector, both technical staff and designers, in order to ensure that the people related to the sector have the appropriate and updated knowledge based on new cooling trends. This certification and training should be the sole responsibility of technical staff and designers, who will have various supporting tools for this purpose (2.B.6.).

This certification shall be renewed on a regular basis for a permanent incorporation of new trends.

Finally, it is recommended to take as a reference the SEC certification process for installers and inspectors of gas facilities, considering its evolution over time and their components; and incorporate it into the regulations to be elaborated by the Ministry of Health for the application of Article 14 of Ozone Law No. 20.096/2006, mentioned above.

Scope: RR, CR, IR, RT, FAC, MAC.

Responsible entities: Ozone Unit in coordination with the corresponding counterparts.

Implementation timeframe: long term (2029 onwards)

4.A.3. Mandatory registration of RAC facilities

Description:

This measure aims to establish a mandatory registration of facilities (1.C.1.), with their loads, refrigerant reloads and electricity consumption, among other factors; applied to the facilities within a defined scope.

This enforcement is sought for a detailed knowledge and a permanent monitoring process of refrigerants and electricity consumption of most RAC equipment, to support policies and measures reducing HFCs consumption (i.e. KPMP).

As the regulations proposed above, this enforcement can be incorporated in the regulations elaborated by the Ministry of Health for the application of Article 14 of Ozone Law No. 20.096/2006.

Scope: defined in the registry.

Responsible entities: Ozone Unit in coordination with the corresponding counterparts. **Implementation timeframe:** long term (2029 onwards)

4.A.4. Increase certification alternatives in equipment's EE

Description:

This measure focuses on increasing EE certification alternatives for RAC equipment through the validation of international EE standards complying with the national certification criteria, in order to streamline and ensure compliance with EE objectives and goals raised at the national level.

This measure would accelerate processes and ensure the inclusion of all the equipment subject to certification.

To this end, a joint work between the SEC and the Ministry of Energy to analyze the different international standards and the potential validation at the national level is highly recommended.

Scope: RR, CR, FAC.

Responsible entities: SEC in coordination with the Sustainable Energy Division of the Ministry of Energy.

Implementation timeframe: short and medium term (2021-2029).

4.A.5. Expansion of EE labeling for commercial refrigeration equipment (display fridge) and incorporation of refrigerant information

Description:

This measure seeks to extend the scope of EE labeling to commercial showcases, which are currently enforced to certify the EE levels.

This measure also proposes to include on the label some details related to the type of refrigerant used in order to provide more information to buyers and end users.

Scope: CR.

Responsible entities: SEC and Sustainable Energy Division of the Ministry of Energy, supported by the Ozone Unit of the MMA and the Superintendency of the Environment (SMA).

Implementation timeframe: medium term (2024-2029).

4.A.6. Resolution setting MEPS for commercial refrigeration equipment (display fridge)

Description:

This measure proposes to establish the corresponding exempt resolution holding the minimum accepted EE standard for commercial refrigeration equipment, the implementation deadlines and the update frequency, among other details, after collecting all the technical and commercial information related to that equipment (1.A.5.). However, prior the above, the background collected must confirm that this measure is technically and commercially feasible.

Scope: CR.

Responsible entities: SEC and Sustainable Energy Division of the Ministry of Energy in coordination with the Ozone Unit. **Implementation timeframe:** long term (20292035) according to technical feasibility.

Strategic guideline 4.B. Strengthening monitoring in RAC sector

4.B.1. Proposals for GP monitoring mechanisms and professionals' certification in the RAC sector

Description :

According to Article 14 of the Ozone Law No. 20.096/2006, the Ministry of Health is responsible for defining the regulations for an appropriate monitoring "applicable to the generation, storage, transportation, treatment or recycling of substances and products monitored" by the Montreal Protocol (Minsegpres, 2006).

In this context, the Ozone Unit proposes on a permanent basis to the Ministry of Health, various monitoring mechanisms to comply with the regulations regarding refrigerants. Consequently, this measure aims to continue the work of the Ozone Unit, proposing oversight mechanisms encompassing the regulations proposed in the previous guideline.

These oversight mechanisms shall be incorporated in the regulations developed by the Ministry of Health for the application of Article 14 of Ozone Law No. 20.096/2006.

Scope: RR, CR, RT, FAC, MAC.

Responsible entities: Ministry of Health in coordination with the Ozone Unit and the relevant counterparts.

Implementation timeframe: medium term (2024-2029).

4.B.2. Dissemination strategies on EE certification processes, EE labeling and MEES

Description :

Manufacturers and importers of residential RAC equipment are responsible for the implementation of EE certification and labeling processes in the equipment they manufacture/import. However, the interviews held with various importers confirmed an evident lack of information as many of them stated they had no information about the certification process; they were never revised or never received any information at this respect.

Consequently, this measure proposes to intensify the dissemination strategies on the EE certification processes, EE labeling and MEPS for residential RAC equipment, responsibilities and deadlines, ensuring an efficient delivery of the information to the entities in charge of processes.

Scope: RR, CR, FAC.

Responsible entities: SEC in coordination with the Ministry of Energy and the Ozone Unit.

Implementation timeframe: short and medium term (2021-2029).

4.B.3. Analysis of measures to improve monitoring in EE of RAC equipment (certification, labeling and MEPS) Description:

Regarding the shortcomings in the inspection mentioned above, this measure proposes a joint analysis with the SEC, about different measures to improve its audit capacity of certification, labeling and MEPS processes for residential RAC equipment.

This proposal includes a joint work with Customs to verify that equipment with mandatory certification, labeling and a minimum EE standard is being properly registered.

Additionally, it is recommended to expand the triangulation of information by incorporating other records, such as databases from the Internal Revenue Service (SII) to identify, if feasible, companies holding import and/or manufacturing related activities.

Scope: RR, CR, FAC.

Responsible entities: SEC in coordination with Customs, the Ministry of Energy and the Ozone Unit.

Implementation timeframe: short and medium term (2021-2029).

Line 5: Women Participation in the RAC Sector at the National Level

Releasing the role of women and promoting greater female participation in different productive sectors is a global trend that has a number of social and economic benefits. From female workers' vision, greater participation in formal work is closely related to a higher income levels and a better quality of life for their families. From a business perspective, increasing female staffing brings benefits such as lower rotation rates, better working environments and higher performance³⁴.

³⁴ <u>https://pactoglobal.cl/2019/los-beneficios-economicos-de-la-igualdad-de-genero/</u>

At the national level, the RAC and construction sectors still show a higher male prevalence (UNEP, 2019). Construction has suffered significant changes to increase their female staff, as the benefits related are well known. To this end, several studies have helped to identify works better performed by women and the working conditions that keep them away from the industry. Likewise, working environment has suffered substantial changes to create suitable environments for the coexistence of both genders³⁵.

In this context, the National Cooling Plan Proposal represents a great opportunity to analyze different components related to female participation in the RAC sector, allowing thus the identification and promotion of opportunities to increase their participation and leadership.

Strategic guideline 5.A. Women participation in the RAC sector analysis

5.A.1. Record on women participation in the RAC Sector and identification of barriers for their incorporation

Description:

This measure aims to raise the background required at the national level to promote female participation in the RAC sector. To this end, this measure proposes to implement a record of women working in the RAC sector, the different subapplications in which they work and the role/position they hold. Once identified, the measure aims at gathering the information related to the main barriers that they have to overcome within the sector and opportunities identified to overcome these barriers and increase their participation.

Scope: RR, CR, RT, FAC, MAV.

Responsible entities: Ozone Unit in coordination with the corresponding counterparts.

Implementation timeframe: short term (2021-2024).

5.A.2. Analysis of benefits related to women participation in the RAC sector

Description:

This measure proposes the collection of background at the national and international level regarding the participation of women in the field, in particular about the roles/positions they hold, the benefits identified and the initiatives carried out to promote their participation (if applicable).

This information, together with the above-described measure, allow the design of appropriate and consistent measures to increase women participation and leadership in the sector.

Scope: RR, CR, RT, FAC, MAC

Responsible entities: Ozone Unit in coordination with the corresponding counterparts.

Implementation timeframe: short term (2021-2024).

Strategic guideline 5.B. Promoting women participation and leadership in the RAC sector

5.B.1. Design and implementation of measures promoting women integration and leadership in the RAC sector

Description:

Based on the information gathered above, the proposal here is to design and implement measures to promote women participation, empowerment and leadership in the RAC sector. This includes making the necessary cultural and behavioral changes to favor female integration and the respectful coexistence of both genders in the field.

In fact, today there are similar initiatives implemented by ChileValora to encourage the certification of women's technical capabilities through funding certification processes.

Scope: RR, IR, CR, RT, FAC, MAC.

³⁵ <u>https://www.cchc.cl/comunicaciones/opiniones/la-mujer-en-la-construccion</u>

Responsible entities: Ozone Unit in coordination with the corresponding counterparts. **Implementation timeframe:** permanent in the medium and long term (2024 onwards).

Line 6: Dissemination and awareness

The objective of this line is to provide users all the information obtained in the implementation of the different lines contained in the proposal, in order to raise awareness and encourage the management of cooling facilities in the RAC sector.

This line aims to address crosswise the different challenges identified during the development of the National Cooling Plan Proposal.

Strategic Guideline 6.A.: Dissemination of information to manage RAC facilities

The objective of this guideline is to provide RAC users all the relevant information, in a permanent manner, to promote the management of RAC facilities. To this end, the following measures are proposed:

6.A.1. Dissemination of the Kigali Amendment, implications for the RAC sector and deadlines

Description:

The interviews confirmed the poor knowledge and understanding about the Kigali Amendment, its importance, scope, requirements, deadlines and implications, which leads to inaction of RAC users.

In this context, since 2018 the Ozone Unit performs talks on the Amendment of Kigali, reinforcing the need to continue with mass dissemination campaigns to promote the Amendment and create awareness about the importance of all the RAC sub-applications' due compliance. Additionally, this measure recommends including information about zero ODP and low or zero GWP alternative refrigerants available in the market and their benefits.

For this purpose, this measure proposes to continue making common talks with different guilds and other initiatives directly connected with the private sector, as Acción Empresas³⁶, HuellaChile Program, Global Pact Network³⁷, and others. **Scope:** RR, IR, CR, RT, FAC, MAC.

Responsible entities: Ozone Unit in coordination with the relevant counterparts.

Implementation timeframe: short and medium term (2021-2029).

6.A.2. Centralize information of RAC facilities management through the "Cooling Management Platform" Description:

The "Cooling Management Platform" aims to create a space to centralize, update and record all the information obtained under the National Cooling Plan Proposal; and provides users all the necessary background to manage their RAC facilities, from an energy and refrigerant point of view.

- The information included is mainly related to:
- New technology available and its benefits (1.A.1.);
- Guidelines for new cooling projects and for retrofits (1.A.2 and 1.A.3.);
- EE management and measures in RAC facilities (1.A.4.);
- National EE programs (1.B.2.);
- Good practice manuals for installation, maintenance and operation (2.A.1);

³⁶ <u>https://accionempresas.cl/</u>

³⁷ <u>https://pactoglobal.cl/</u>

- Training initiatives and calls for GP courses and/or update of technical staff, planners, and companies (2.A.2. and 2.B.3. respectively);
- Certified technical services and qualified designers (2.B.3.); and
- Financing opportunities and strategies (Line 3); among others.

Likewise, this platform could have direct access to the RAC Facilities Record (1.C.1), no matter which the hosting platform is, so users can track their consumption of refrigerants and energy, and their facilities' management results. Finally, HuellaChile Program and the Ministry of Energy should jointly manage the administration of the said platform. **Scope:** RR, IR, CR, RT, FAC, MAC.

Responsible entities: Ozone Unit, HuellaChile Program and Sustainable Energy Division of the Ministry of Energy. **Implementation timeframe:** permanent from the medium term (2024 onwards).

Strategic Guideline 6.B.: Awareness in key RAC subsectors

Along with disseminating relevant information to promote the management of RAC facilities, it is necessary to raise awareness in some key RAC subsectors, such as mobile AC and refrigerated transport. These are crucial, since the RAC equipment used is factory-built, so modifications to improve energy and environmental performance are not feasible.

However, reaching this improvement requires an effective communication of the environmental impacts of each sub-sector, and the maintenance and operation measures that can influence these performances. In this regard, the following measure is proposed:

6.B.1. Awareness program in mobile AC and refrigerated transport

Description:

MAC and RT sub-sectors are key considering their responsibility in terms of HFCs use and their impact in GHG, in the case of MAC; and the use of inefficient and second-hand machinery, in the case of the RT. In both cases, it is impossible to modify the equipment to improve energy and environmental performance since it is factory-built.

In this context, this measure aims to implement awareness programs to inform users about the impacts resulting from their activity, and provide background information on the operation of their AC equipment and their relationship with the EE of AC equipment, vehicles and leakage level. The information collected in measure 1.A.6 may be used for this purpose. **Scope:** RT, MAC.

Responsible entities: Ozone Unit in coordination with the corresponding MA.

Implementation timeframe: permanent from the medium term (2024 onwards).

2. Implementation Schedule (Roadmap)

During the validation workshops, participants defined a timetable to implement the measures included in the National Cooling Plan Proposal. For this purpose, three timeframes were established:

- Short term (2021-2024): covers the last years of HFC free consumption. This period considers the implementation of enabling measures to improve EE in facilities, to connect with national programs in implementation and measures whose availability of information allows a prompt execution.
- Medium term (2024-2029): encompasses the HFC imports freezing period so measures to change refrigerants and improve EE would increase. The measures carried out in this period depend mainly on the implementation of other related measures in the short term (enabling).

• Long term (2029-2035): reductions in HFC consumption begin in this period, so changing refrigerants and EE measures shall be more dramatic. As in the previous case, the implementation of measures in the long term will depend on the progress of related measures in the short and medium term.

The organization of measures proposed for each working line is based on these timeframes and through a participatory work with different users of the RAC sector. Thus, the resulting roadmap for the implementation of the National Cooling Plan Proposal appears in the following figures:



Figure 10. Roadmap Line 1. Support to RAC refrigerants and EE management Source: Author compilation.







Figure 12. Roadmap Line 3. Financing and Investment

Source: Author compilation.



Figure 14. Roadmap Line 5. Women's participation in the RAC industry Source: Author compilation.



Source: Author compilation.

These figures confirm the large number of measures to be implemented in the short term. In this regard, it is advisable to prioritize, together with the technical counterpart, based on interests at the central level, the relevance of each measure, the availability of human resources and the availability of financing for its implementation.

Annex 2: Details about the organization and attendance in validation workshops

Actors per group (number of members)	Subjects for discussion
Group 1. End customers of industrial and	LINE 1: Technology and EE
commercial refrigeration, refrigerated	- L1.A: Research and development of efficient technology with low or no
transportation, mobile and fixed AC, trade	GWP.
associations, importers of equipment and	- L1.B: Improvement of environment and energy efficiency of RAC
substances, and technical support services	equipment (new and installed)
(25).	LINE 3: Financing and Investment.
Group 2. Technicians, academic	LINE 2: Capacity building in RAC field
institutions, TU, ChileValora, Regener (17)	LINE 4: Regulation and Inspection
	LINE 5: Women participation in the RAC sector
Group 3. Public sector, related programs	LINE 1: Technology and EE
and trade unions (21)	- L1.B: Improvement of environmental and energy efficiency of RAC
	equipment (new and installed)
	- L1.C: Introduction of requirements related to refrigerants and EE in
	existing programs nationwide
	LINE 3: Financing and Investment
	LINE 4: Regulation and Supervision
	LINE 5: Women participation in the RAC sector

Table 6. Definition of sectoral groups and subjects addressed³⁸

Source: Author compilation.

Groups 1 and 3 were divided in two not to exceed 10 participants each. Thus, a total of five validation groups worked on the assigned topics in separate workshops (i.e. five sessions).

Validation Group	Date/time of session	Total attendants	Sectors (n° of representatives)
Group 1a	Tuesday, 18 August 10:00 to 12:30	9	 Substances importer (1) Installation service (1) Final user in refrigeration and Commercial HVAC (2) Final user in Industrial Refrigeration (2)
Group 1b	Tuesday, 18 August 15:00 to 17:30	7	 Fechnical counterpart (3) Equipment import and installation (2) Final user in Industrial Refrigeration (2) Technical counterpart (3)
Group 2	Wednesday, 19 August 10:00 to 12:30	11	 Equipment importer and installer (1) Regeneration center (1) Capacity evaluation center (1) Academic institutions' professors (4) ChileValora (1) Technical counterpart (3)
Group 3a	Thursday, 20 August 10:00 to 12:30	13	 Agroindustrial trade union (2) Automotive industry trade union (2)

Table 7. Validation groups, date, time, number of attendants and sectors included

³⁸ The final structure of the National Cooling Plan Proposal was modified as per the validation workshops and conversations with the technical counterpart. Consequently, the names of the subjects included in the table may not coincide with the lines and guidelines presented in this final report.

			- Ministry of the Environment (HuellaChile) (1)
			 Ministry of Housing and Urbanism
			- Energy Sustainability Agency (1)
			- Superintendency of Electricity and Fuels (1)
			- HVAC Consultancy (1)
			- Technical counterpart (3)
Group 3b	Thursday, 20 August	11	- Ministry of the Environment (GHG Inventory) (1)
	15:00 to 17:30		- Ministry of the Environment (Circular Economy) (1)
			- Customs National Service (2)
			- Energy Sustainability Agency (2)
			 Industrial Refrigeration Service (2)
			- Technical Counterpart (3)

Source: Author compilation

Table 8: validation workshops' attendants

No.	Company / institution	Sector	Name	Group
1	Union Química Rodolfo Palma EIRL	Import (substances)	Roberto Barrera	1a
2	Nuova Service	Cooling (Retail Installer)	Pier zecchetto	1a
3	Tottus	Supermarkets (end user commercial ref)	Guillermo Sanguinetti	1a
4	Walmart	Retail (Cooling and HVAC)	Edgardo Aguilera	1a
5	INRA Refrigeración Industrial SpA.	Cooling (industrial ref end user)	Klaus Peter Schmid	1a
6	Chilean Grape Group	Cooling (industrial ref end user)	Cesar Antonio Silva	1a
7	Epta Chile	Cooling (Retail Installer)	Roberto Carreño	1b
8	Epta Chile	Cooling (Retail Installer)	Carlos Carreño	1b
9	IANSA companies	Cooling (industrial ref end user)	Leonardo Márquez	1b
10	BAYAS DEL SUR SA	Cooling (industrial ref end user)	Mario Reed Vergés	1b
11	Trane Chile SA	AC (Importer , installation, maintenance)	Ismael Quiroga	2a
12	Regener Chile	Refrigerant regeneration	Jose Luis Rojas	2a
13	Chilean Chamber of Cooling and HVAC	Assessment and Certification Center (TU)	Klaus Schmid	2a
14	ChileValora	Public sector	Alvaro Aguilar	2a
15	Ernesto Pinto Lagarrigue Rancagua High School	Education	Julio Meza	2a
16	Consultant	Education	Byron Gómez	2a
17	Liceo Víctor Bezanilla Salinas	Education	Luis Hevia Lizana	2a
18	Liceo Víctor Bezanilla Salinas	Education	Jose Luis Fuentes	2a
19	Chilefood	Agroindustry (Trade Union)	Carlos Descourvières	3a
20	Chilefood	Agroindustry (Trade Union)	Sandra bock	3a
21	National Automotive Association of Chile - ANAC	Mobile AC (Trade Union)	Diego Mendoza	3a
22	National Automotive Association of Chile - ANAC	Mobile AC (Trade Union)	Daniel Nunez Palma	3a
23	MMA-HuellaChile	GHG Registry	Sebastian Garin	3a
24	Ministry of Housing and Urbanism	Public sector	Allan ubilla	3a
25	Ministry of Housing and Urbanism-DITEC	Public sector	Hermes Seeúlveda	3a
26	Energy Sustainability Agency	Public - private sector	Juan Pablo Payero	3a
27	Superintendency of Electricity and Fuels	Public sector	Nicolas Mena Reyes	3a
28	Secos Team	Consulting for Air Conditioning Projects	Claudia silva	3a
29	MMA-GHG Inventory System	Public sector	Camila Labarca	3b
30	MMA-Circular Economy	Public sector	Claudia Guerrero	3b

31	National Customs Service	Public sector	Juan Alonso Pérez	3b
32	National Customs Service	Public sector	Rafaela Jimenez	3b
33	Energy Sustainability Agency	Public - private sector	Carolina Castillo	3b
34	Energy Sustainability Agency	Public - private sector	Clément Demonds	3b
35	Johnson Controls - Chile GBC	Industrial Cooling	Pablo Fernandez	3b
36	Johnson Controls - Chile GBC	Industrial Cooling	Sebastian Chancalay	3b
37	MMA-Ozone Unit	Technical counterpart	Claudia Paratori	Everyone
38	MMA-Ozone Unit	Technical counterpart	Dolores González	Everyone
39	Min of Energy- Sustainable Energies	Technical counternart	Marcelo Padilla	Everyone
	Division			

Source: Author compilation.

Annex 3: Comments and photographic records of each validation group

Systematization of the comments obtained in each validation workshop of the National Cooling Plan Proposal.

- Comments Workshop Group 1a (Tuesday, August 18, 10 am): Axes 1 (guidelines 1A and 1B) and 3.

Line/measure	Participants' Comments
1 / 1.A.1. Technology	Promote new technology information.
information and	• Be proactive to avoid the introduction of cheap and obsolete technology given the
development	current economic situation.
1 / 1.A.2. Renewal pilots	Include academic entities across sectors implementing pilots.
1 / 1.A.3. Dissemination document	• Disseminate the document through organizations positioned in Chile such as CCHRyC, ASHRAE Chile.
1 / 1.B.1 Record of facilities to report loads,	 Define the methodology for reporting/quantifying refrigerant loads and reloads, establishing periodicity for reporting and evaluating retroactivity.
refrigerant reloads and electricity consumption	 Focus on audit, and ensure that numbers are correct, since there may be differences between nurchases and actual charges
cleaning consumption	 Incorporate methodologies to include older facilities
	 Define the scope of the registry based on sub-applications using the most HFCs and the reduction targets.
	• Define clear regulations and protocols to obtain standardized data. The information to be used for the HFC Reduction Plan shall be mandatory for all operators.
	• Collection of information for registration: use existing information. Survey driven from Arica to Punta Arenas with ChileAlimentos.
Line 3. Financing	Measures to promote reconversion, equaling prices.
	• Define policies to disseminate new technologies and clear incentives promoting renewal.
General comments:	
- Clear signals, regulations and incentives are crucial to increase coverage and speed up implementation.	
- The interaction of regulation and financial support is virtuous.	

- The proposed Plan can show a clear work plan to be incorporated at a high level in organizations.

- Inventory control from importer to the end user, justify what is done with refrigerants are necessary to promote a better use.



Photo 1. Validation workshop, Group 1a

- Group 1b Workshop (Tuesday, August 18, 3:00 p.m.): Lines 1 (guidelines 1A and 1B) and 3.

Line / guideline / measure	Participants' comments
1 / 1.A.1 State of the art technology	• Disseminate less polluting, and most energy efficient equipment; equipment advantages (economic savings). It serves as a background for decision makers and investors.
1 / 1.B.1 Facilities record	 Include a record of years of operation (time) since energy performance decreases in time. A regulation accelerates reporting (incentive to report). Consider that maintenance services are outsourced and providers manage the records. Sometimes there are no maintenance managers within organizations. The report on PRTR is mandatory; do something similar.
1 / 1.B.4. Recommendations for Mobile AC	 Include cooling transportation as there are no information about them, they do not have environmental practices, and they work with machinery discharged from the US. Focus in end customers, let them set the demands
1 / 1.D. Dissemination	• Provide more information on EE and refrigerants to the end user of AC equipment through technical data sheets or guidelines with short explanation.
Line 3. Financing	• It is important to define the funding method for the replacement; it can serve as an incentive.
General comments: - The renewal of technology is acc HACCP certification.	celerated by international regulations, for example: exporting food to the US requires a



Photo 2. Validation Workshop, Group 1b

- Workshop Group 2a (Wednesday, August 19, 10 am): Lines 2, 4 and 5.

Line / measure	Participants' Comments
2 / 2.A.1. Develop a	Online dissemination, the information shall be available region-wide.
good practices'	Transfer to business owners or clients.
Manual	 Write a standards' interpretive manual for a better understanding.
2 / 2.A.2. GCP	• Broaden the target audience of the GCP courses: include business decision makers, business
training courses	owners, and vendors; short talks about GCP to high school and university students.
2 / 2.A.3. Technical	• Relieve the crucial role of companies, as usually technicians do not have the equipment for
services practice	GCP.
report	 Regener offers support, as they have experience with reports, and have developed technical data sheets for refrigerant traceability.
	Supermarkets have internal reporting systems.
	• Companies and technicians are both responsible for the implementation of GP.
	• Unify reporting criteria, based on NCh3241-2017.
	Processes traceability and work recording generate details that allow setting the quantities
	of gases involved.
2 / 2.A.4. Inform end	 Include workshops for owners and managers.
customers about	 Companies choose the cheapest; prioritize cost over technical quality.
good practices	 Develop GP in the operation of facilities for users (end customer). Encourage owners and operators commitment with their facilities.
	Create user standards different from technician standards.
	• Customers need to know what to do and what not to do. Today nothing is illegal (e.g.
	release refrigerant, reload without fixing leaks).
	• Ensure that companies have the equipment required to implement GP (recovery plant, etc.).
2./2.B.1. Update	Include national regulations on refrigerant gases; communicate in simple language for a
curricula	better understanding.

	 Training centers must be equipped. Students do not have the tools to learn and teachers do not have the practical means to teach. Many schools cannot buy or renew practical learning equipment. Promote regeneration through mass talks. In Chile, training include synthetic refrigerants. It is necessary to expand teaching with natural refrigerants, at a technical level.
2 / 2.B.2. Center and	School visits to regeneration centers.
company agreements	Develop agreements with Regener.
2 / 2.B.4. Update profiles	 Call opened in 30 October to apply for projects to update and create profiles of labor competencies (90% financed by ChileValora, 10% by the sector). Update together with MMA and Energy. Profiles will last until 2022, and shall be updated every 5 years. CECCL is working on new profiles.
2 / 2.B.5. Implement updated evaluation centers	 To open new evaluation centers, the certification demand must be estimated over a two-year timeframe. It is recommended make a gender differentiation on demand in order to apply measures promoting women certification. Today's profiling centers work with templates. New refrigerants could not be included with current templates.
2 / 2.B.6. Promote	Certification does not guarantee GP in technicians.
certification	• A law punishing bad practices and monitoring technical service's work is essential.
Line 4	 It is necessary to open-up road before setting obligation in the sector.
5 / 5.A.1. Labor barriers and record	• Women participation has increased but companies are sexist. For example, some companies only have men's bathroom.
	 High percentage of women in the USACH (University of Santiago).
	 Tendency of women-targeted works: salesperson, administrative, executive, managerial. They do not perform fieldwork.
5 / 5.A.2. Benefits of	One of the benefits is that women are more careful with details.
including women	Disseminate advantages and disadvantages of women according to their position.
5 / 5.B.1.	ChileValora has funds to finance women's certification.
Development	
General comments:	
 Incorporate training a the curricula. 	nd updating for teachers, as well as technicians and students, depending on the modifications in



Photo 3. Validation workshop, Group 2a

- Group Workshop 3a (Thursday, August 20, 10 am): Lines 1 (guidelines 1B and 1C), 3, 4 and 5.

Line / measure	Participants' comments
1 / 1.B.1 Cooling facilities registry	• Analyze the motivation of facilities' owners to be part of the registry. How to motivate or compel this registration.
	 Strengthen reporting frameworks in terms of GHG, to account for reductions and generate financing opportunities through the eventual carbon market (incentive).
	 Develop a regulation for the registration of facilities.
	• Consider a link in reporting emissions and GHG reductions through the HuellaChile Program.
	Analyze the SEC model for electrical facilities.
1 / 1.B.4.	Vehicle importers insert maintenance conditions user manuals.
Recommendations to avoid leaks and increase EE in mobile AC	 Highlight the importance of complying with the recommendations of the AC user manual.
1 / 1.B.6. EE certification	Approve standards for high power equipment.
alternatives	Spreading certification under the Chilean regulations and model.
1 / 1.C.2. Requirements in sustainable construction certifications	 The Sustainable Housing Certification (SHC) for new houses includes voluntary requirements related to refrigerant (i.e. non-polluting refrigerant and non-polluting thermal insulation).
	 Evaluate including requirements on refrigerants in the Sustainable Building Certification (SBC).
	• The House Energy Rating (HER) includes air conditioning features.
	• The energy rating of a public building may provide interesting information. It can
	include the cooling installations and the type of refrigerant used by the designers.
	 Requirements about refrigerants should be voluntary in the medium term and mandatory in the long term.
	 The information and requirements related should be disseminated amongst the certifying institutions and the users certified, so that these requirements become a minimum standard in each installation.
Line 3. Financing and	ASE has several new programs.
investment	

	Financing experience in private buildings.
	• Support ASE with expertise in financing programs regarding the development of ESCO
	projects or funding campaigns.
4 / 4.B. Control	• Projects and equipment installation must be supervised.
	 Improve strategies for disseminating air conditioning equipment EE certification
5 / 5.B.1. Promotion of	• There is an increasing number of female air conditioning engineers (USACH).
women participation	• Scholarships or financial support for women applying to this career during the
	admission period every year.

General comments:

- Create a space to centralize all the information (marketplace), for example installers, efficient equipment, etc., and connect it with the registration of ChileValora.
- Build capacities in the sector. For example, energy consultants for cooling facilities. Target installation and maintenance service companies, not just technicians.
- Train HVAC planners in the design of cooling systems to install appropriate equipment. The current oversize affects the EE.
- ASE support in capacity building, advance in initiatives related to the industrial and commercial sector.
- There are no instruments forcing clients to work with certified technicians updated in the latest cooling trends. As there is no way to demand construction or real estate companies due compliance, it must be mandatory, defining in which stages certified personnel is required.
- In order to guide economic incentives promoting the implementation of best practices in refrigerants, it is essential to know the state of the art and the map of actors in the cooling sector in the short term.



Photo 4. Validation Workshop, Group 3a

- Group 3b Workshop (Thursday, August 20, 3:00 p.m.): Lines 1 (guidelines 1B and 1C), 3, 4 and 5.

Line / guideline /	Participants' comments
measure	
1 / 1.B.1 Cooling facilities record	 The information obtained in the registration could be used to encourage GP in EE and refrigerants through a state platform where companies can compare their performance and good governance is acknowledged. Define criteria on the scope of the registry (very ambitious to include them all). There is an energy management platform for public buildings (gestionaenergia.cl) where managers upload information on consumption. Evaluate opportunities to connect with that platform, managers could collect information on refrigerants or create something similar. The ASE made a survey about information and diagnoses on consumption in public
	buildings. Take advantage of that information.
1 / 1.B.2. EE measures for cooling systems	 New trends to improve the EE of cooling facilities, easier to implement in the industrial sector.
1 / 1.B.6. EE certification alternatives	 The SEC certification terms are long. Companies show unawareness, admitting teams without certification. Create a validation protocol for EE certification under international standards.
1 / 1.C.1. Requirements in public biddings	 Most public buildings have split equipment, purchased as other devices fail. There are no central systems in existing public buildings and there is no formal designated buyer of AC equipment. Equipment purchases are made through ChileCompra, without including EE or refrigerants criteria. Focus in including EE and refrigerant requirements/criteria in public procurement (framework agreements) to promote the supply of EE equipment. In new high-consumption public buildings, there is no policy for cooling systems. The cheapest, low cost and investment define the priority, not considering useful life and refrigerants. This type of requirements in the databases of institutions bidding large projects (for example, MINSAL). Evaluate the inclusion of criteria on refrigerants in projects of the Undersecretariat of Regional and Administrative Development (Subdere).
Line 5. Women	Relieve and highlight this Line. Change the approach from "promoting integration" to "onbancing women approaching"
	ennancing women empowerment and leadership.
- Promote research at the	national level, in universities.

- Promote the use of alternative refrigerants in construction companies.



Photo 5. Validation Workshop, Group 3b