



Dr. Carvalho is a Physicist with a PhD from Purdue University, USA with over 35 -year experience in climate and ozone layer protection, assisting developing countries to protect the environment, fostering capacity building and implementation of effective and accountable programmes.

Former director of Technology Transfer at the São Paulo State Environment Protection Agency, Brazil and director of the Montreal Protocol and Chemicals Unit at UNDP in New York.

Currently, Dr. Carvalho is a senior expert member of the UNEP Technology and Economic Assessment Panel for the Montreal Protocol - TEAP, and senior technical adviser on ozone and climate policies and programmes at the Institute of Climate and Society in Brazil.

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Mr. Vital Ribeiro is an Architect with a master's degree in Management of Health, Environment and Sustainability, from Getúlio Vargas Business School ( FGV) in São Paulo. With 35 years of experience in environmental health, developing programs on sustainable health care, Mr. Ribeiro works at Center for Health Surveillance - Department of Public Health of São Paulo State Government since 1987.

He is member of the organization Healthcare Without Harm (HCWH), the Coordinator of the Global Green and Healthy Hospitals network in Brazil, and the President of the board of the Brazilian NGO called "Healthy Hospitals Project" (PHS).

## **MSC. Vital Ribeiro**

### **Projeto Hospitais Saudáveis (PHS)**

# WEBINAR SERIES

## CLOSING THE LOOP: ENVIRONMENTALLY SOUND MANAGEMENT OF END-OF- LIFE ODS AND HFC

### Towards economically sustainable EOL schemes: A case study from Brazil

Dr. Suely Carvalho- Senior Adviser  
Kigali Project, ICS, and  
MSc. Vital Ribeiro- Projeto Hospitais  
Saudáveis (PHS)



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UNIDAD TÉCNICA OZONO  
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This webinar is being organized within the  
framework of a project funded by US EPA



## About us...

### **Institute for Climate and Society (ICS)**

Philanthropic organization that promotes prosperity, justice and low carbon development in Brazil; prioritizing GHG emissions reduction while improving quality of life. ICS coordinates the Kigali Project, funded by K-CEP, in the Air Conditioning Sector in Brazil

### **Healthy Hospitals Project (Projeto Hospitais Saudáveis - PHS)**

PHS is an NGO dedicated to transforming the health sector in an example for the whole society on environmental, occupational and patient's health issues. PHS works to develop and support a cooperation network among health care institutions in national and international levels to promote awareness and action towards a more environmentally friendly health care operations.

- **This presentation intends to show the opportunity of using bulk procurement practices, through Buyers' Club, to make ODS and HFCs collection and End of Life actions, feasible.**
- **It goes through the process of selecting key partners and sectors in order to reach large scale cooling inefficient equipment replacement.**
- **Approach uses energy efficiency and corporate sustainability commitment as “entry points”.**

## Brazilian Context

### Initial Scenario in 2018

Inefficient AC equipment; outdated metrics, laboratory capacity, MEPs and Labelling. Knowledge of Kigali limited, no access to lower GWP technologies in AC sector, consumer awareness lacking. No ratification of Kigali by Brazilian Congress and Senate.

### 2021 scenario

MEPs revision and new mandatory labelling by INMETRO. Top runner label (PROCEL Gold Label) will consider EE and the GWP of refrigerant.

**Brazilian production** of R-32 split air conditioners started in Manaus.

**Lower GWP** AC products in the market by end of June 2021.

**Education campaigns** to speed up ratification. Partner with IDEC (Consumer Defense Institute) and several awareness raising organizations. Newspapers, TV, Black-Friday, and targeted campaigns to bring the Congress to ratify Kigali .

## Economics of Buyers' Club

- An organization or group working towards increasing benefits of bulk purchase via price reduction and better quality of standardized products.

**Purchase power of large buyers of specific product**



**Pool the demand for specific product**



**Negotiate price with manufactures**

## Supply and Demand

### Supply- AC Manufacturers/Distributors-

- Energy Efficiency as entry point, increase supply of low carbon products

### Demand- From Large Buyers in Major Consumer Segments

- Focus on large AC buyers, large scale/volume of units needed to lower the price. Increase demand for low carbon products.

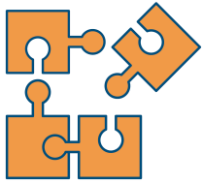


### EOL- Viability

- Significantly larger quantity of ODS and HFCs collected in large scale/controlled replacement programmes. Continuity based on having sustainable purchases programmes introduced into corporate policies



## 1<sup>st</sup> STEP - Market Assessments



### 3 types of assessments made

- **Room AC's market** – sales, sales' projections, major players, AC's types and capacities, energy efficiency levels...
- **Refrigerants' market** - types, sales' volume, major players, major consumers

## 2<sup>nd</sup> STEP – Technical and Economic Viability



- Meetings with specific manufacturers to identify products/access to/conditions to offer low GWP and high efficiency products
- Broad assessment of Brazilian public programs that provide financial support to energy efficiency projects (utility obligation law etc.)
  - *Energy Efficiency Program (PEE) => ANEEL*
  - *PROCEL => Eletrobras*

# 3rd Step- Mapping Opportunities from Sector Assessments

CLOSING THE LOOP:  
ENVIRONMENTALLY SOUND MANAGEMENT OF END-OF-LIFE ODS AND HFC



- > 2900 public and > 4300 private **health institutions**
  - > 445000 patient rooms, with split and refrigerators installed + central cooling systems
  - Major refrigerants: R22, R410A, R134a
- \*more detailed assessment later in this presentation*



- > 21000 bank agencies across Brazil
- Most part adopts central cooling systems
- COVID-19 accelerated the shift to smaller agencies, prompting the demand for splits
- Major refrigerants: R22, R410A, R134a



- > 31000 hotel buildings, > 960000 **hotel rooms**
- High demand for splits and central cooling systems
- High demand for small refrigerators
- Major refrigerants: R22, R134a, R404a



- >6300 **convenience stores**
- Sector is expanding in Brazil
- Each one demands at least 2 splits and 6 beverage and food expositor in average
- Major refrigerants: R22, R134a, R404a



- > 9000 **fast-food restaurants**
- Market dominated by few major companies
- Buildings usually demands splits, post-mix, ice-cream machines, freezers, etc.
- Major refrigerants: R22, R134a, R404a, R410A



- > 63000 **bakery stores** around the country
- Local players
- Buildings usually demands splits, post-mix, freezers, beverage expositors, etc.
- Major refrigerants: R22, R410A, R134a

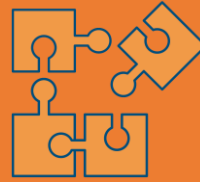
# Initial Sectors for Pilot Projects



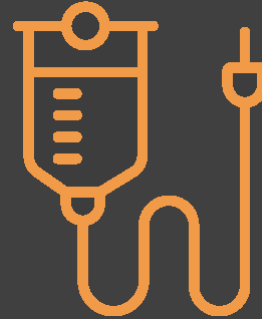
## BANKS

- Many meetings not only with the Brazilian Bank Association, but also the “Big 5” Banks in Brazil
- Partnership with Santander, who brought Magalu (big retailer store with over 3,000 stores)
- COVID-19 affected these companies’ expansion and AC replacement plans- to re-start 2<sup>nd</sup> semester 2021.

## PUBLIC SECTOR



- Partnership with Government of São Paulo State
- Sustainable Public Purchase Program for the State
  - Inclusion of energy efficiency and refrigerants’ requirements for public purchases . Approved May 2021.
  - Zero (no R-22) as of May 2021 . As of Nov 2023, only GWP lower or equal to 750, and zero ODP; PROCEL label for EE.



## HEALTH SECTOR

- Partnership with Healthy Hospitals Project, Mitsidi Projects and SITAWI (“finance for the good”)
- 1<sup>st</sup> phase: detailed assessment of 33 health institutions that are PHS’s members
- 2<sup>nd</sup> phase: business case development
- 3<sup>rd</sup> phase: partnership to scale up the pilots

## Health Sector

### Health Sector Pilot with partner PHS

- Hospitals' detailed assessment about cooling appliances usage [mid-2020 / April 2021]
- Pilot development [July 2021- Dec 2021]
  - Technical project
  - Financial model
  - Collection and destruction solutions
- Implementation [2022 - ...]

## PHS Energy Challenge

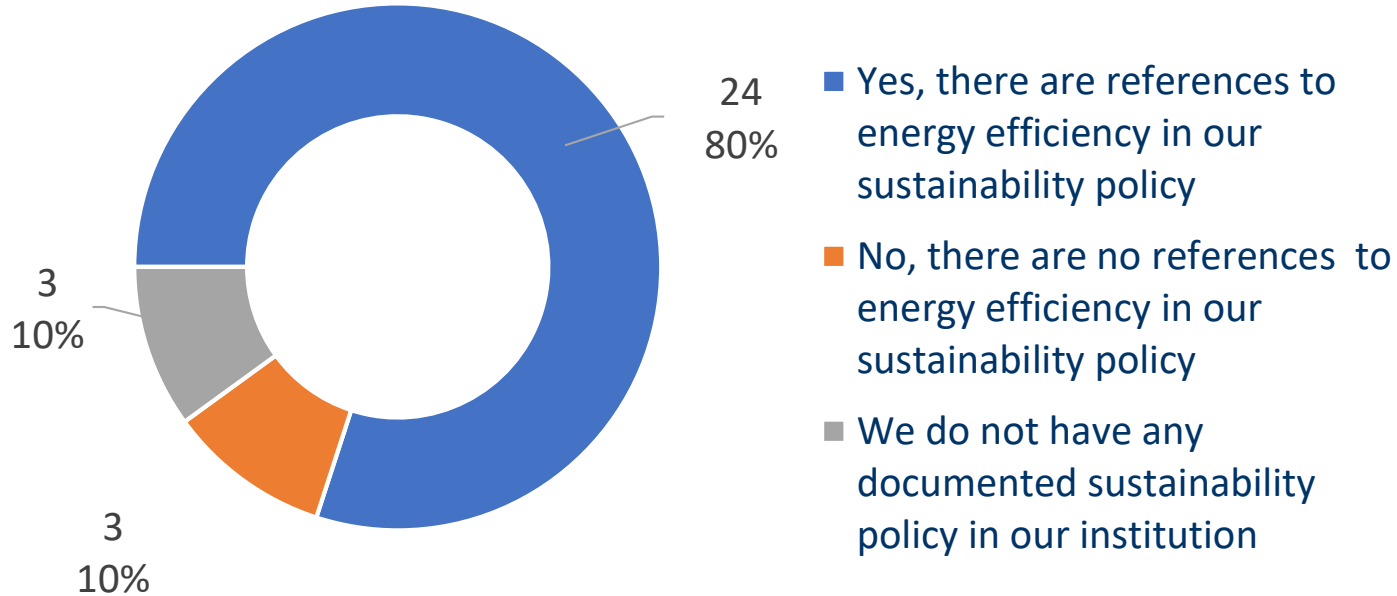
PHS Energy Challenge is a campaign promoted among health sector facilities which are PHS members, to raise awareness in the health sector.

It focus on environmental and economical aspects of energy use and its correlated aspects. It is comprised of a detailed qualitative and quantitative energy report (diagnosis) that is the first step to assess initiatives towards rational energy use and energy efficiency initiatives.

47 health sector facilities joined the PHS' Energy Challenge. 33 presented full reports encompassing:

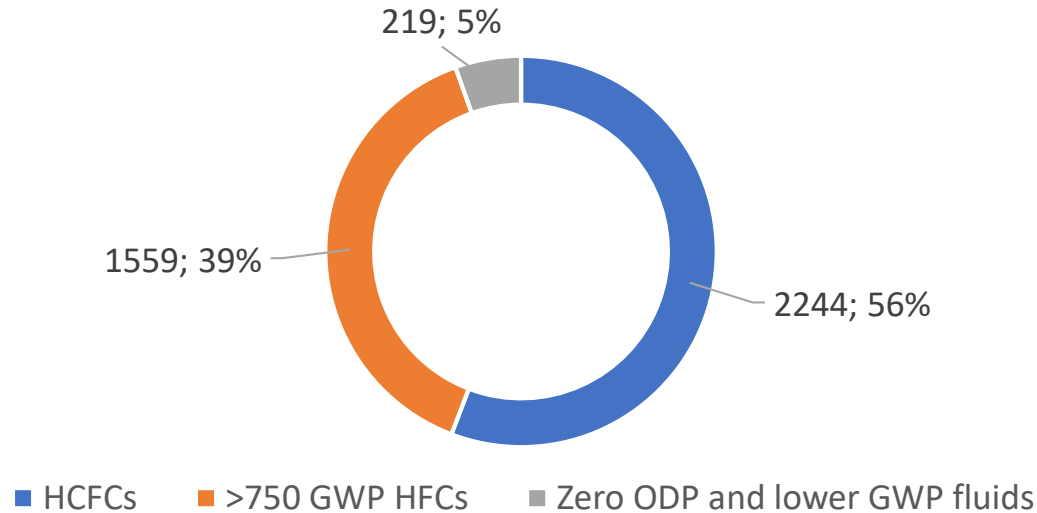
- Energy management internal policies
- Energy bills (kWh consumed and power use)
- Fossil fuel consumptions (diesel, gasoline, natural gas, among others)
- Distributed generation
- Lighting data
- HVAC equipment- technical specifications

Are there any specific references to energy efficiency in the institution's sustainability policy?



# Energy Challenge - Highlights

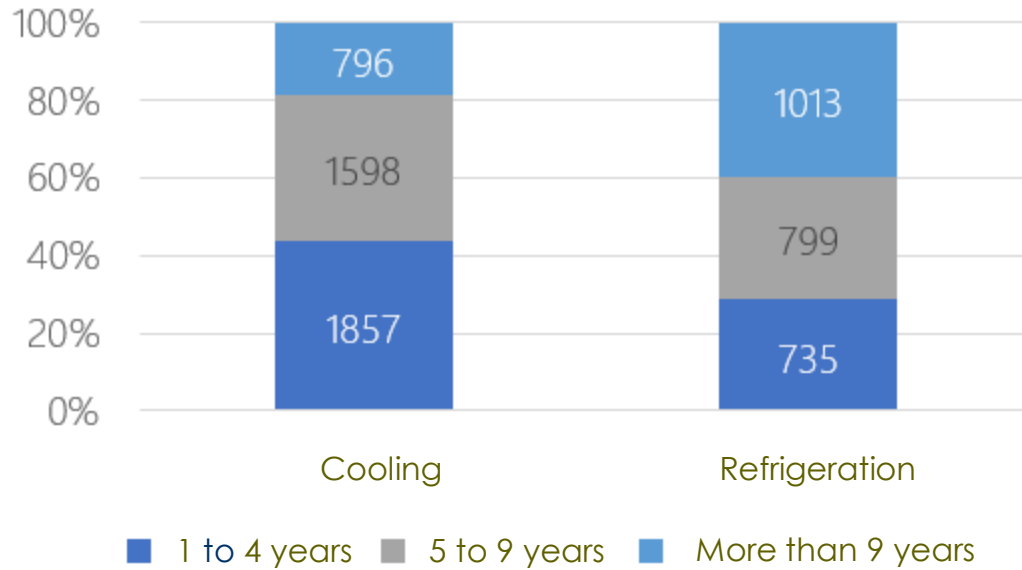
## AC equipment\* distribution per refrigerant type (# units; % of total)



\* Split and Window types



# Energy Challenge - Highlights



**Cooling and refrigeration units per age**

# Energy Challenge - Highlights

Energy Efficiency Action	Energy savings	Cost savings	Investment	Payback	Emissions reduction	Equipment Lifetime	Cost of saved energy over life cycle	Saved energy per US\$ over life cycle
	GWh/yr	Million US\$/yr	Million US\$	#years	tCO <sub>2</sub> /yr	#years	US\$/kWh	kWh/US\$
Replace centralized AC with models of superior efficiency	12.74	1.81	4.12	2.28	2120	25	<b>0.01</b>	77.36
Replace AC units with models of superior efficiency	3.35	0.42	2.20	5.20	184	15	<b>0.04</b>	22.88

# Potential for Refrigerant Collection and EoL Actions

<b>33 Health Facilities Assessed</b>					
<b>Refrigerant- AC size</b>	<b>Refrigerant mass per unit [g]</b>	<b>Number of units in sample</b>	<b>Refrigerant mass in operation [kg]</b>	<b>Total R410A [kg]</b>	<b>Total R22 [kg]</b>
R410A - 12000 BTU/h	900	890	801	1469	2116
R410A - 18000 BTU/h	1300	514	668,2		
R22 - 12000 BTU/h	900	1282	1153,8		
R22 - 18000 BTU/h	1300	740	962		

<b>Total Health Facilities-Brazil- EOL requirements in hospitals</b>		
<b>Approx. number of hospitals</b>	<b>Total R410A [ton]</b>	<b>Total R22 [ton]</b>
<b>6368</b>	<b>9356</b>	<b>13473</b>

## Sample AC Replacement and Refrigerant Collection Schedule Potential for Disposal ( ton)

Year *	R22 Collected for Disposal (ton)
2022	2523
2024	5065
2028	5886

\*10 year lifetime for R-22

Year **	R410A Collected for Disposal (ton)
2024	876
2027	876
2029	3517
2033	4087

\*\*15 year lifetime for R410A

## Important to Keep in Mind ...

- Energy Efficiency Standards & Labelling in place
- Ratification of Kigali Amendment
- Education Campaigns for consumer awareness
- Good interaction with industry
- Knowledge of sector, and technical and financial experts to support the Club. Business language for dialogues
- Corporate responsibility goals and commitment to purchasing sustainable products. Sustainability departments entry point.
- Proper collection and EoL disposal of refrigerants and replaced units
- Finance Needs, especially for public institutions

**Focus on energy savings and corporate environmental responsibility of Buyers' Club members can be entry points for successful AC replacement programmes, bringing the scale needed for an economically feasible EoL programme!**



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# Thanks for your attention

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