Eurovent Partners Meeting

HVACR and Sustainability; Drivers and Opportunities

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OzonAction, Law Division
UN Environment Programme (UNEP)

Dealing with HVACR Holistically

Why Refrigeration and Air-Conditioning Sector is of high importance

Economics

- Fast Growing sectors globally

- Capital Expenditures (CAPEX) & Operating Expenditures (OPEX)

- Workforce and Employment

Environment

- Ozone Layer Protection

- Climate Action

- Energy Efficiency

- Refrigerant Management

Sustainability

- Food Security and Food Safety

- Urban Planning & Cities

- Renewables

- Innovation and Smart Operations

Cool Coalition

The Challenge & The Opportunity

3.6 billion
cooling appliances
today

9.5
billion **appliances**
by 2050

If left unchecked, emissions from cooling are expected to double by 2030 and triple by 2100 driven by heat waves, population growth, urbanization, a growing middle class.

By combining energy efficiency improvements with the transition away from super-polluting refrigerants, the world could avoid cumulative GHG emissions equal to 4-8 years of total annual GHG emissions at 2018 levels.

Double efficiency of air conditioning would reduce the need for power generation by

1,300* GW by 2050

Moving to best available cooling technologies would reduce cumulative emissions by:

38 $GtCO_2e$
by 2030

130 $GtCO_2e$
by 2050

Why buildings?

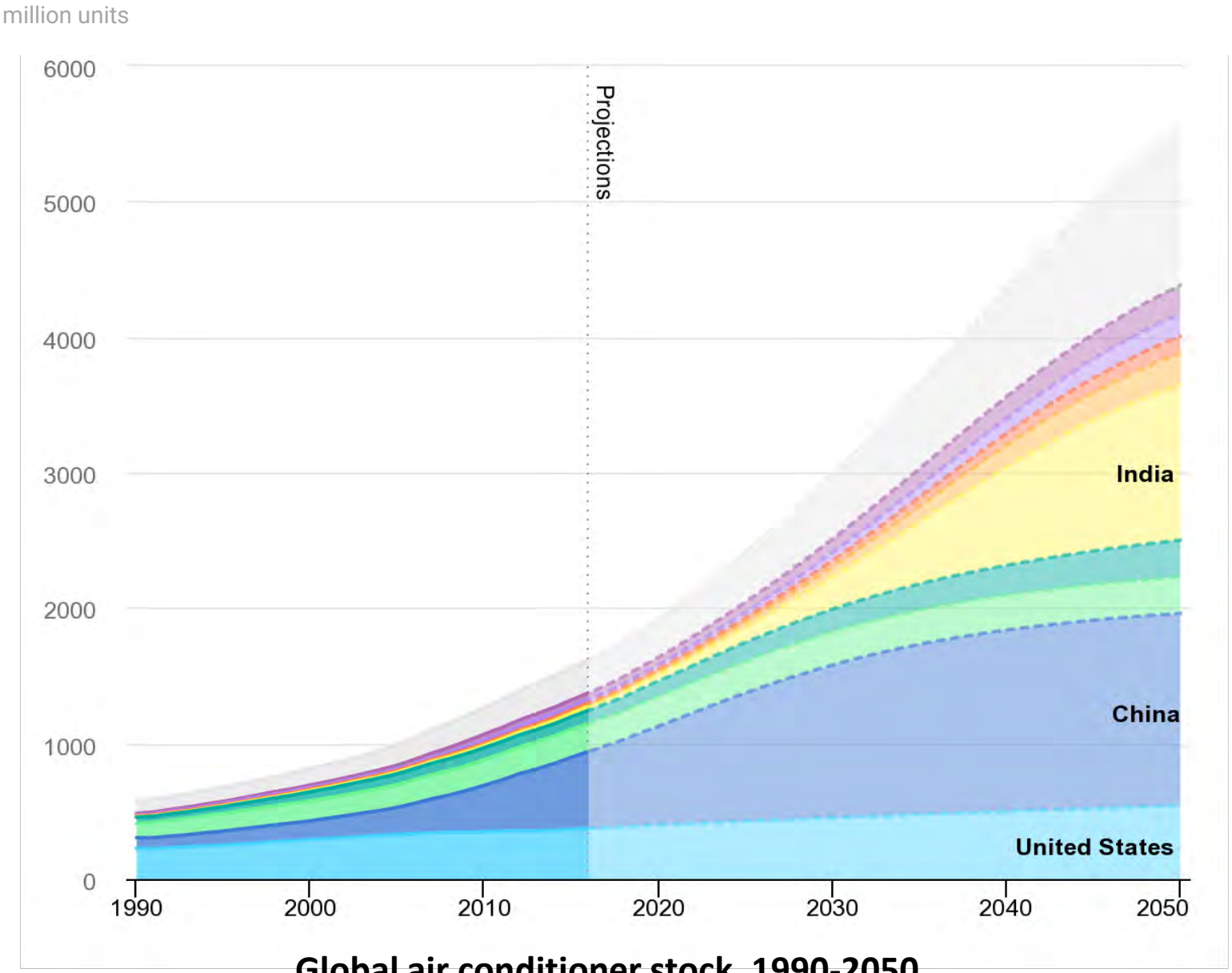
The equivalent of Paris is added in floor space every 5 days!

Half of the buildings standing in 2060 have not yet been built!

*The buildings sector offers the **most cost-effective mitigation** potential of any industrial sector and co-benefits **including job creation**, improved indoor and outdoor air quality, improved climate resilience and adaptive capacity*

Population Growth & Energy Bill

- Cooling is the fastest growing use of energy in buildings
- Cooling will drive peak electricity demand, especially in hot countries
- Most homes in hot countries have not yet purchased their first AC
- Investing in more efficient ACs could cut future energy demand in half

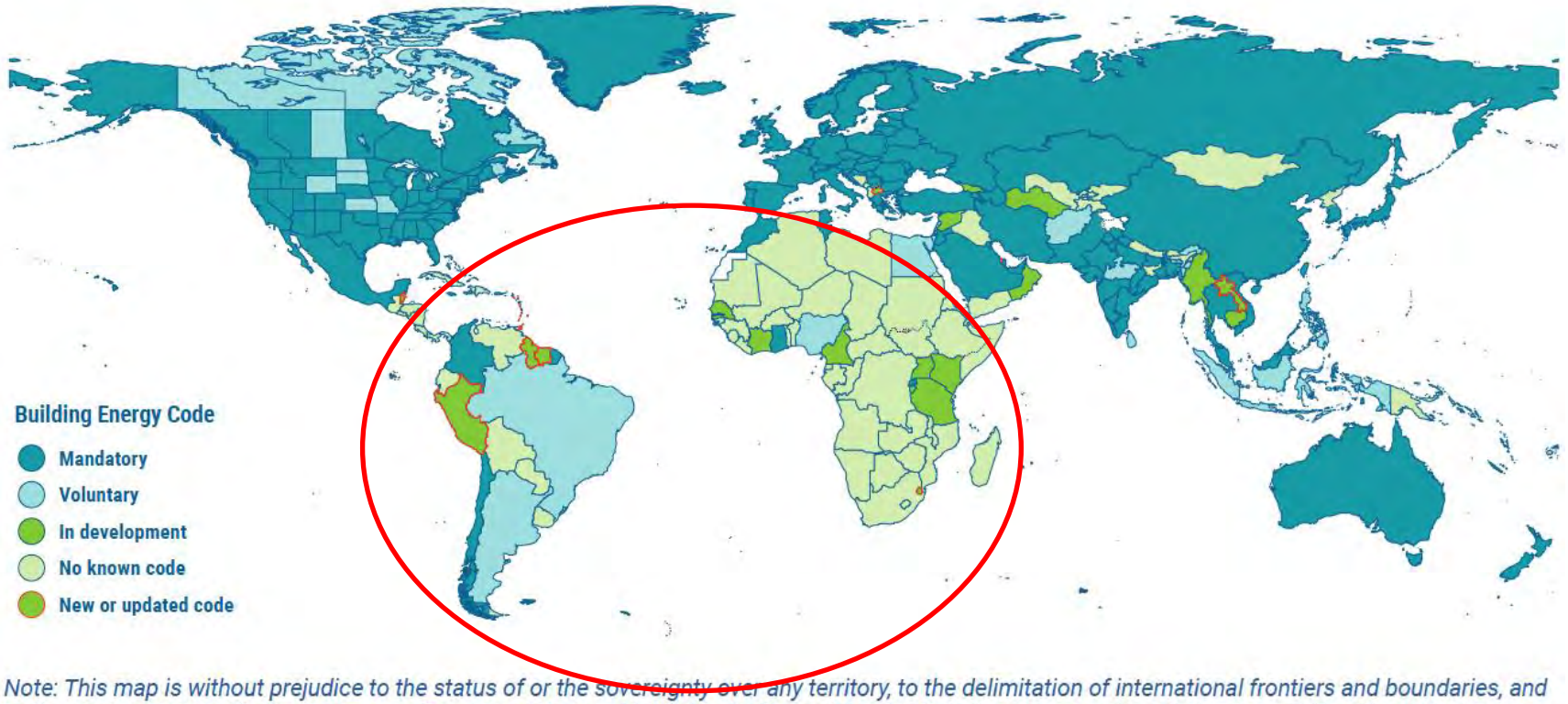


Global air conditioner stock, 1990-2050

IEA Future of Cooling Report (2018) updated 19-Nov-2019

Key Message: Countries increasingly recognize that building energy codes are essential, yet remain low across Africa and in South and Central America

Buildings sector Code coverage in 2020



Note: This map is without prejudice to the status of or the sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city, or area. Recent updates are highlighted with a red border. Building energy codes relating to specific cities only are not shown.

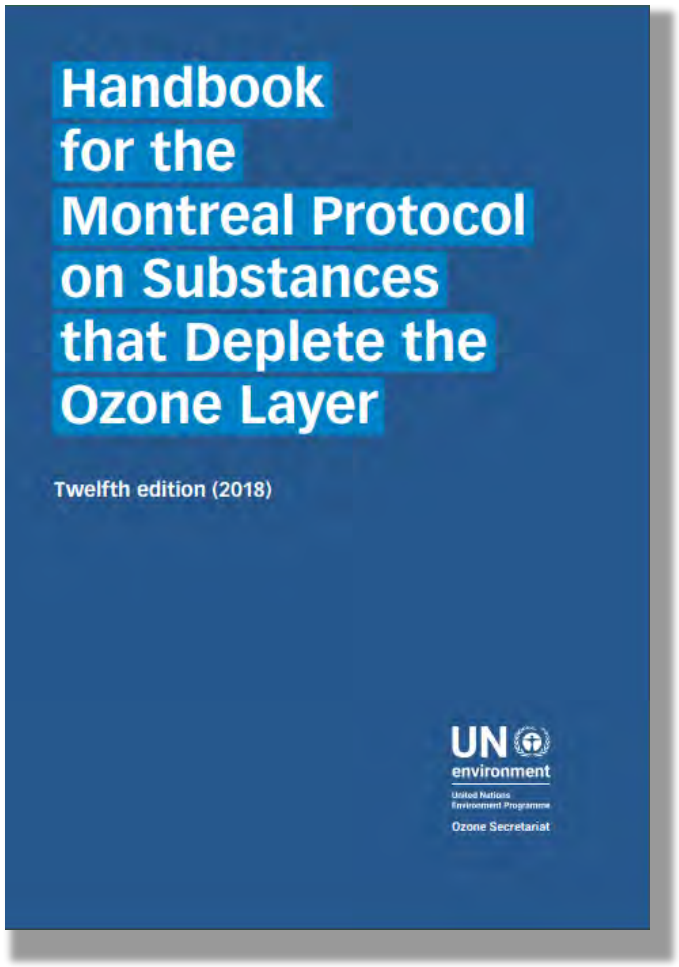
Source: IEA 2021e. All rights reserved.

As of September 2021, only 43 countries had nationwide mandatory codes for all buildings.

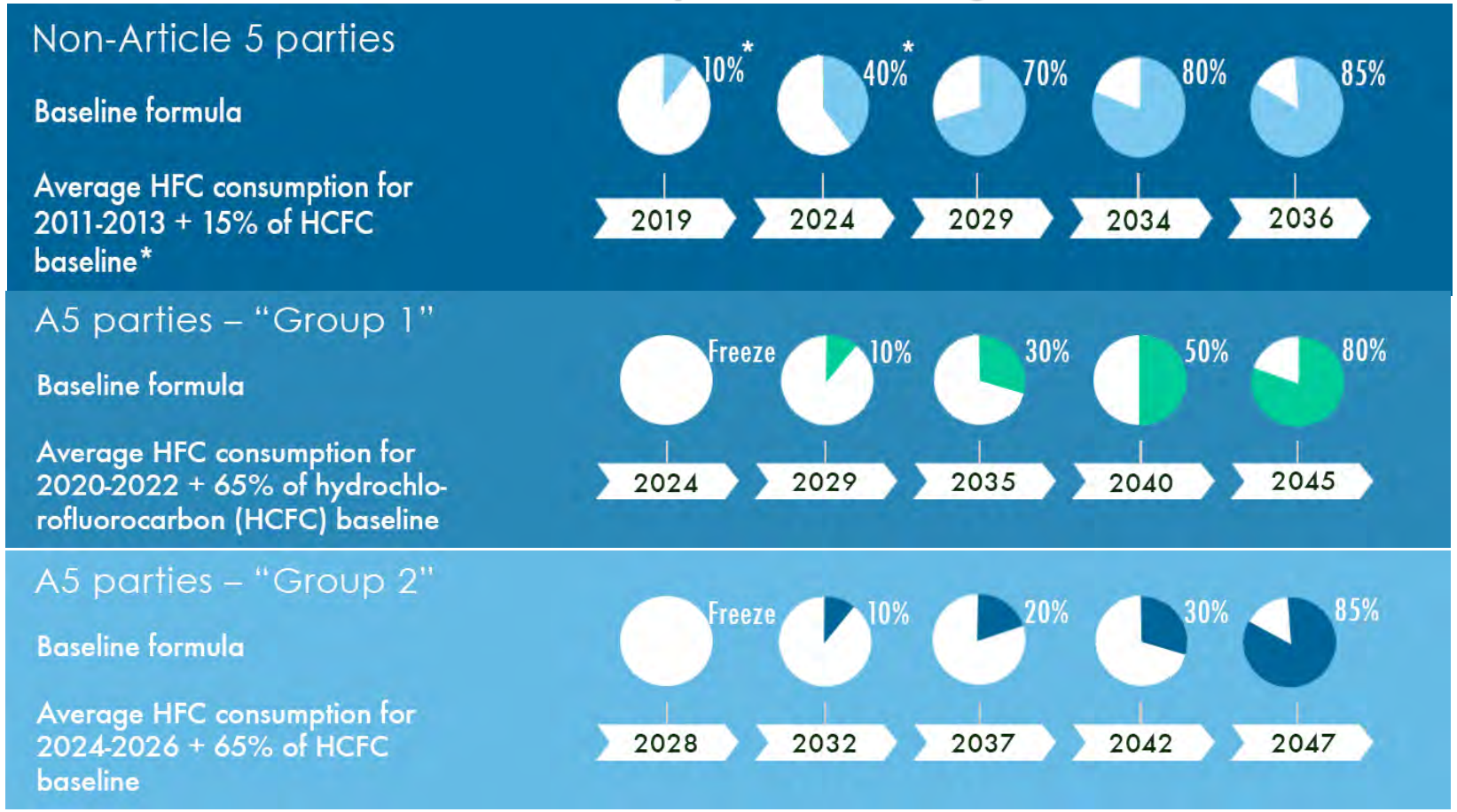
Where they are implemented, the codes are typically not aligned with meeting a net zero goal by 2050.

82% of the population that is to be added by 2030 living in countries without any building energy codes or only voluntary codes.

Montreal Protocol – A tool to protect ozone & climate



HFC control measures as per the 2016 Kigali Amendment



Refrigerant Transition –Progression

1830s-1930s

whatever worked

Ammonia, (NH3, R-717), carbon dioxide (CO2, R-744), sulphur dioxide (SO2, R-764), and others

1931-1990s

safety and durability

CFCs & HCFCs (R-11, R-12, R-22, R-502)

1990s – 2010s

avoidance of ODSs

HFCs and Blends (R-134a, R-407C, R-410A, R-407C)

2010s onwards

as low a GWP as practicable

Low-GWP HFCs, HFCOs, Natural Refrigerants (HCs, CO2, Ammonia)

Refrigerant Selection Criteria

1- Climate impact	6- Commercial availability
2- Ozone Depletion	7- High ambient temperature fitness
3- Energy efficiency	8- Safety risk
4- Thermal energy storage	9- Supporting Standards/Codes due to Flammability
5- Cost of Refrigerant/Components	10- Technological level

Montreal Protocol context

KIGALI AMENDMENT =

Refrigerants

Montreal Protocol obligation

Mandatory

Compliance-relevant

Financial support under Multilateral Fund

+

Energy efficiency

Aspirational under Montreal Protocol

Voluntary

Not compliance-relevant

Financial support under Multilateral Fund not yet decided

Reduction of direct emissions

Reduction of indirect emissions

- World still heading for a temperature rise in excess of 3°C this century – far beyond Paris Agreement goals of “well below 2°C”
- Government pledges (Nationally Determined Contributions) still woefully inadequate
- Levels of ambition in Paris Agreement must be X3 for 2°C pathway & increased at least X5 for 1.5°C pathway
- Growing number of countries committing to Net-Zero Emissions goals by midcentury is the most significant climate policy development of 2020
- These commitments must be urgently translated into strong near-term policies & action
- Cooling started to be included in Climate COP themes starting with COP-26

UNEP Emissions Gap Report 2020

AGENDA 2030


3 GOOD HEALTH
4 QUALITY EDUCATION
7 RENEWABLE ENERGY
8 GOOD JOBS AND ECONOMIC GROWTH
9 INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE AND JUSTICE
17 PARTNERSHIPS FOR THE GOALS

RACHP & Sustainable Development Goals

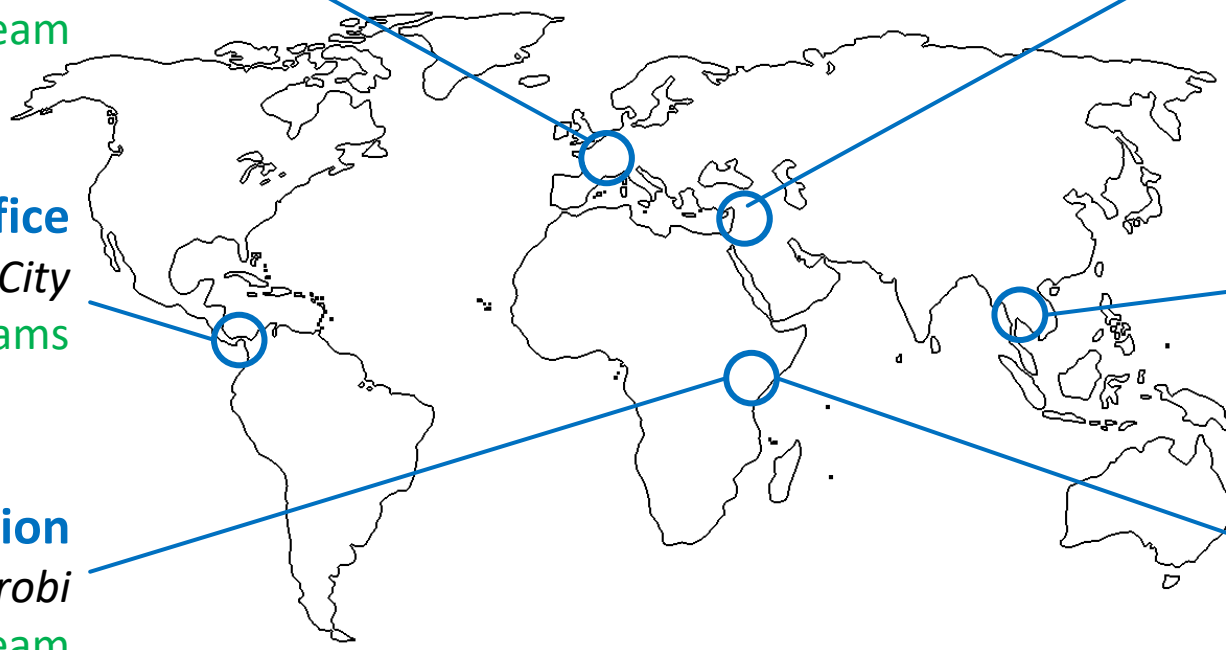
Welfare & Quality of Life	(2) Food Security (3) Health (4) Education (8) Economic Growth (11) Sustainable Cities (12) Sustainable Production & Consumption
Technology Selection	(2) Food Security, (3) Health (7) Renewable (9) Innovation (11) Sustainable Cities (12) Sustainable Production & Consumption (13) Climate Action
Education & Employment	(4) Quality Education (8) Good Jobs & Economic Growth, and Innovation

Connected **Not recognized**

OzonAction team locations

UNEP Paris Office
Paris
Branch Headquarters
Global CAP team
Europe & Central Asia CAP team

West Asia Office
Beirut
West Asia CAP team



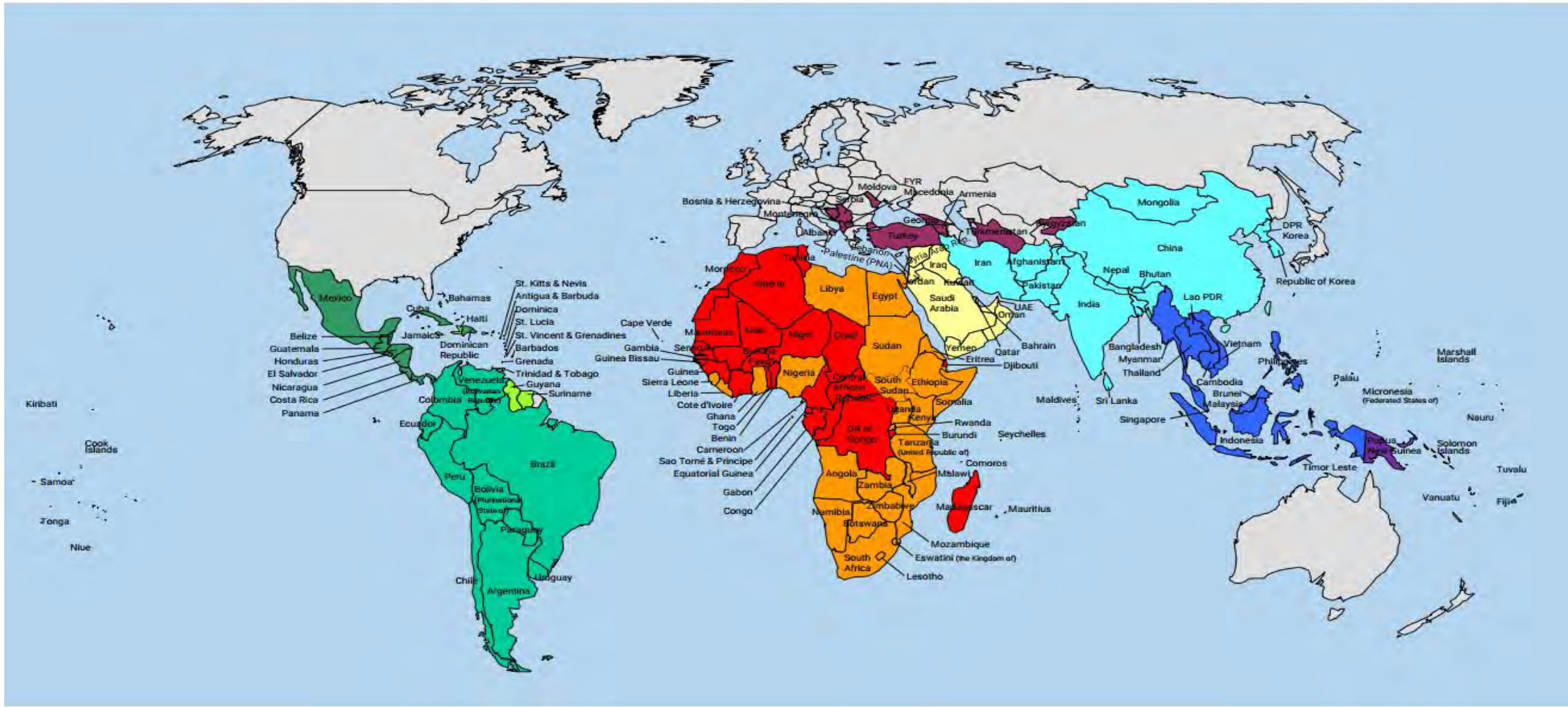
Latin America & Caribbean Office
Panama City
Latin America & Caribbean CAP teams

Asia-Pacific Office
Bangkok
Asia-Pacific CAP team

Law Division
Nairobi
Global Finance & Admin CAP team

Africa Office
Nairobi
Africa CAP teams

Members of the Regional Networks of Ozone Officers



South America
Central America
Caribbean
Europe & Central Asia
Anglophone Africa
Francophone Africa
West Asia
South Asia
South East Asia
Pacific Island Countries

Note: This map is for illustrative purposes only and is not an official United Nations cartographic document. The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Partnerships for achieving Montreal Protocol objectives (examples)

Refrigeration & air conditioning

abrava

ACAIRE

AHRI

AREA

AREMA

ASHRAE

ATF

BFS

CHEAA

EPEE

FAIAR

GFCCC

IIR

IOR

ISHRAE

JRAIA

MAC Partners Europe

Refrigerants Australia

REHVA

U3-ARC

WRD Secretariat

EUROVENT
EUROPEAN INDUSTRY ASSOCIATION

Example Initiatives

REFRIGERANT DRIVING LICENSE

e Learning
REFRIGERANTS LITERACY

HFC Outlook

UNEP COOLING RELATED PROGRAMS

UN environment programme

OzonAction
COMPLIANCE ASSISTANCE PROGRAMME

Cool Coalition

U4E United for Efficiency
UN environment programme

CLIMATE & CLEAN AIR COALITION
TO REDUCE SHORT-LIVED CLIMATE POLLUTANTS

DISTRICT ENERGY IN CITIES INITIATIVE

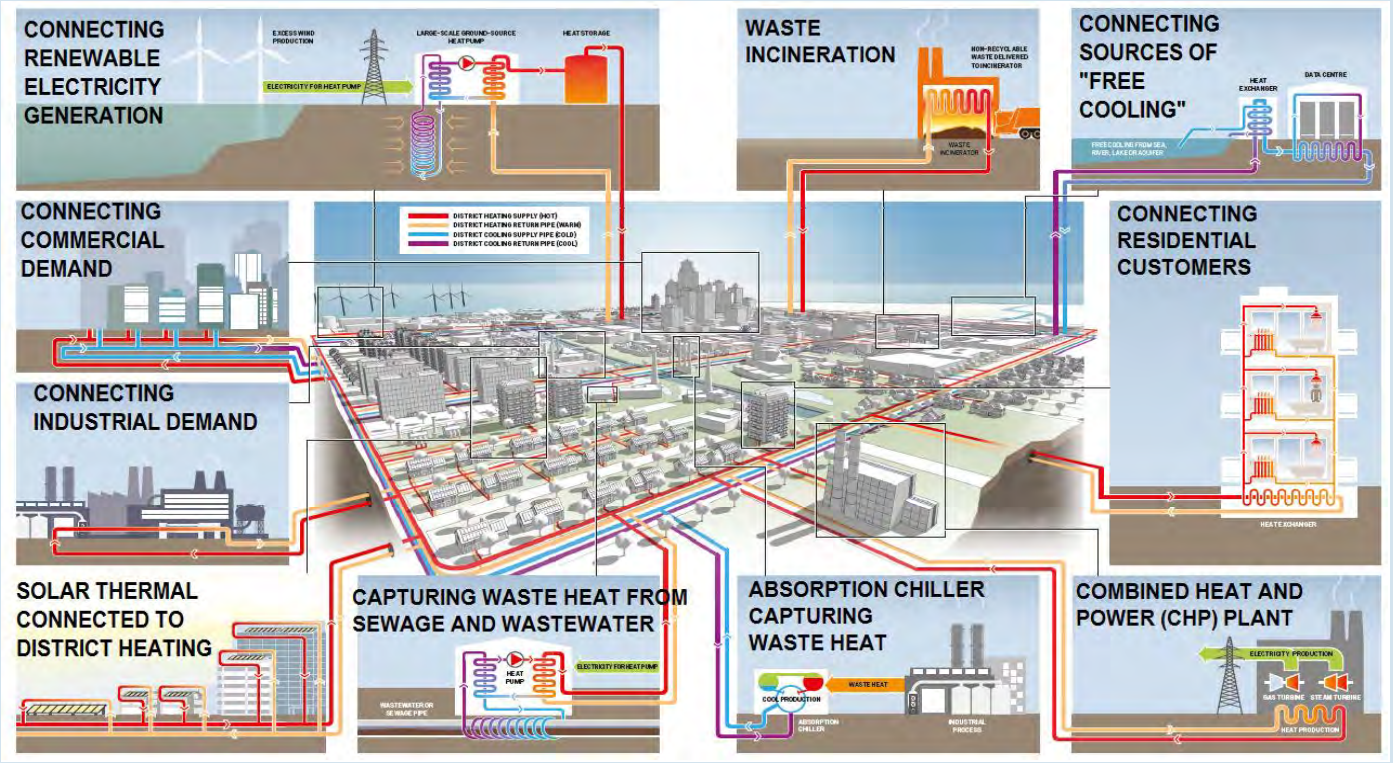
Global Alliance for Buildings and Construction

DISTRICT ENERGY IN CITIES INITIATIVE

WHERE ARE WE?

UN environment programme

14 Countries
30 Cities



THE INITIATIVE IN ACTION

DISTRICT ENERGY IN CITIES INITIATIVE

EGYPT

UN environment programme

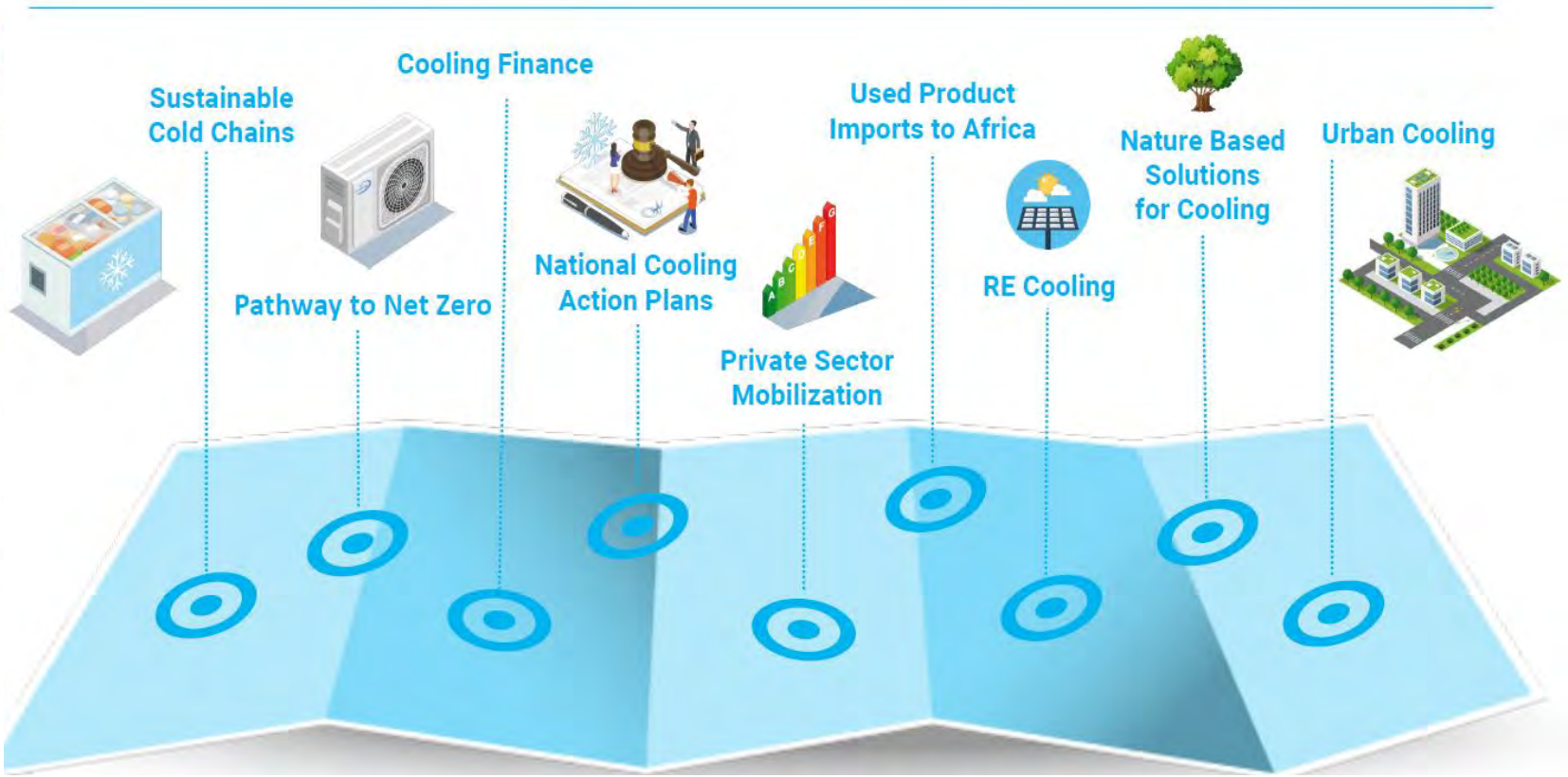
- Following a preliminary study undertaken by OzonAction the DES Initiative performed a feasibility analyses of a deep-sea district cooling project in the new city of El-Alamein (Egypt)
- Technical solution: hybrid Sea Water Air Conditioning System (SWAC) ; 32,000 TR; $172 M
- Next steps: on-going discussions with financial institutions and district cooling providers

About the GlobalABC

Founded at COP21, hosted by UNEP and with **215 members, including 34 countries,** the GlobalABC is the leading global platform for governments, private sector, civil society, research, and intergovernmental organizations committed to a common vision: **A zero-emission, efficient and resilient buildings and construction sector.**

The Cool Coalition

The Cool Coalition is a **global multi-stakeholder network** that connects a wide range of key actors from government, cities, international organizations, businesses, finance, academia, and civil society groups to facilitate knowledge exchange, advocacy and **joint action towards a rapid global transition to efficient and climate-friendly cooling.**



United 4 Efficiency

U4E is a global effort supporting developing countries and emerging economies to move their markets to energy-efficient appliances and equipment. U4E brings together all key stakeholders active in the area of product efficiency:

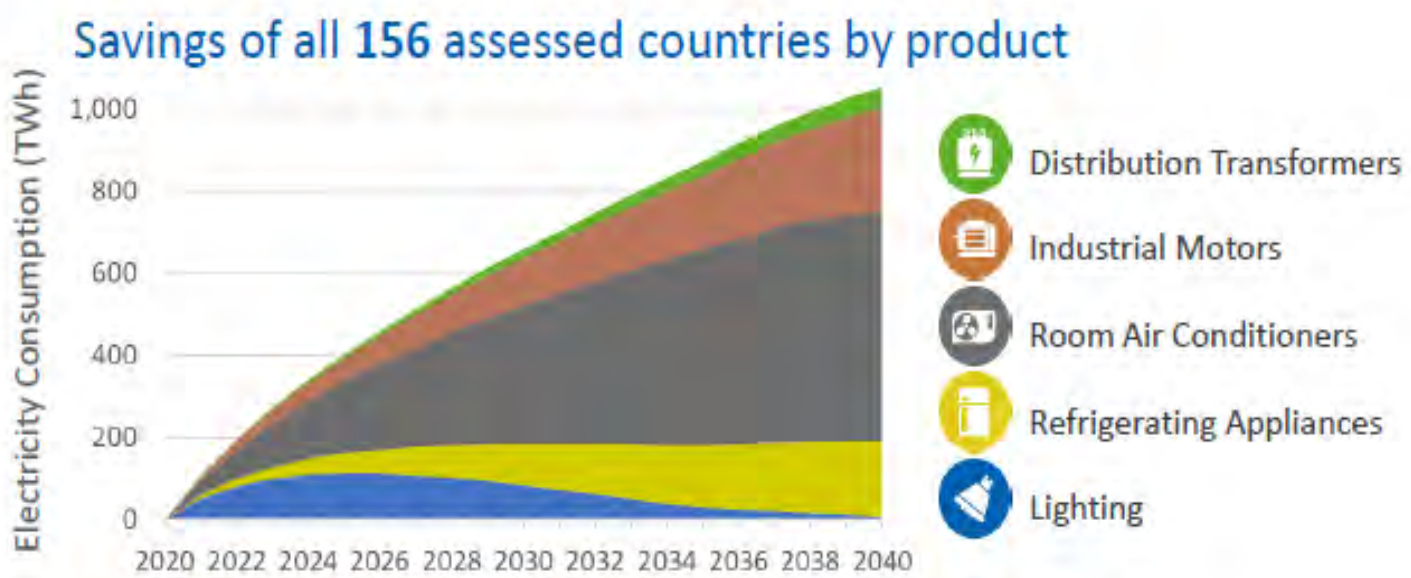
- Informs policy makers of the potential environmental, financial and economic savings of a transition to high-efficiency products;
- Identifies and promotes global best practices in transforming markets;
- Offers tailored assistance to governments to develop and implement national and regional strategies and projects to achieve a fast and sustainable market transformation.

Country Savings Assessments

Objective

Analysis on potential impact of Model Regulations for products that use >50% of electricity.

Gain commitment of important stakeholders to pursue energy-efficiency opportunities.

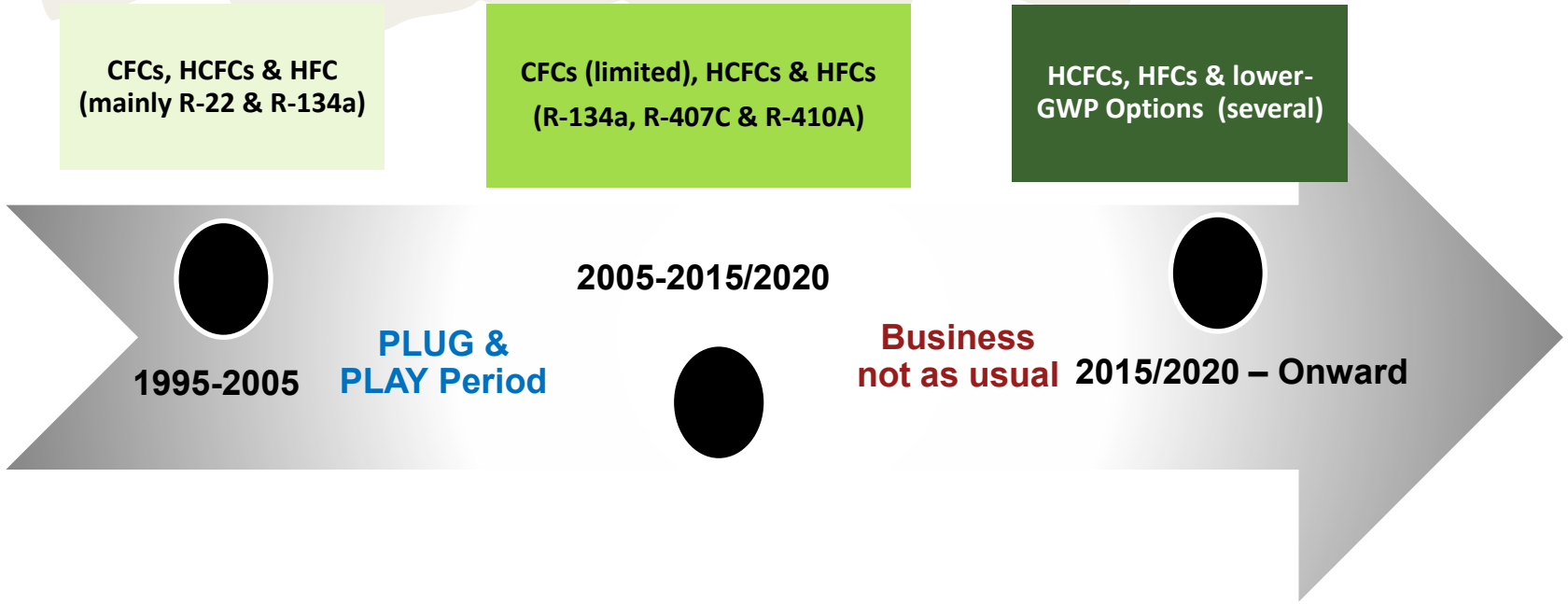


Resource: https://united4efficiency.org/countries/country-assessments/

IMPACT ON THE SERVICING SECTOR

Refrigerants - Market

Country	Sub-sector	Lifetime (year)
Developed (non-Article 5 countries)	Domestic refrigeration	15
	Industrial refrigeration	15-30
	Transport refrigeration	9-30
	Commercial refrigeration	15
	Stationary AC	10-25
	Mobile AC	15-16
Developing (Article 5 countries)	Domestic refrigeration	20
	Industrial refrigeration	15-30
	Transport refrigeration	9-30
	Commercial refrigeration	20
	Stationary AC	10-25
	Mobile AC	15-20



What do we mean by Business not as usual ?

Between 2020 – 2040 many markets in developing countries will have units that operate with HCFC-22, HFC-410A, HFC-32, HC-290 and other HFOs

(2018 Quadrennial Report of the TEAP/RTOC of the Montreal Protocol)

Evaluating the servicing sector by MLF (1)

MLF Desk Study on Servicing Sector in Developing Countries – Dec 2018
&
MLF Desk Study for the Evaluation of the Energy Efficiency in the Servicing Sector - March 2021

Certification Programs

The training of refrigeration and air-conditioning (RAC) technicians has had the highest impact across all countries (if only because of the important) high percentage of agents of change (trained and certified RAC technicians) reaching up to 90 per cent in some countries

Safety Considerations

Training on the safe handling of flammable and toxic refrigerants relies on strict codes and regulations which must be reflected in training curricula. The absence of trained and qualified technicians in handling flammable and toxic refrigerants and the lack of the respective codes and regulations are considered a barrier by suppliers of new low-GWP and energy efficient technologies

Drop-in refrigerants, retrofitting and conversion

Retrofitting HCFC-based equipment with flammable alternatives might be common practice in some countries. HCs are not recommended in systems that are not designed to use the flammable refrigerant. An awareness to technicians and end-users about the risks associated with such practices is highly needed.

Access to Technology

The main barriers identified for the adoption of lower-GWP alternative technologies to HCFCs are: (a) the higher costs involved; (b) lack of confidence in the new technology; (c) lack of local expertise; and (d) unavailability of equipment and servicing tools in the local market

Informal Servicing Sector

The training of the informal RAC servicing sector presents challenges of its own, which are made more difficult by the fact that the informal RAC servicing sector is usually bigger than the formal one in many countries.

Evaluating the servicing sector by MLF (2)

MLF Desk Study on Servicing Sector in Developing Countries – Dec 2018
&
MLF Desk Study for the Evaluation of the Energy Efficiency in the Servicing Sector 0 March 2021

Refrigerant Containment

There are many challenges facing the efficient and cost-effective reclamation schemes such as (a) quality and conformity of reclaimed refrigerants; (b) Logistic costs; (c) labour costs (recovery is time consuming); (d) Price of reclaimed refrigerants vis-à-vis virgin; (e) the lack of local availability of ancillary equipment and parts; and (f) absence of destruction facilities to handle un-wanted quantities.

Energy Efficiency

While most countries developed, or developing, MEPS programs for placing equipment in local markets; the attention to EE while servicing is not receiving the adequate attention. There is a need to ensure inclusion of such skills and competencies in the training and certification programs.

Regulatory Frameworks

The capacity and/or tools to develop and enforce specialized regulatory frameworks for managing the servicing sector and controlling practices are limited in many countries and need attention

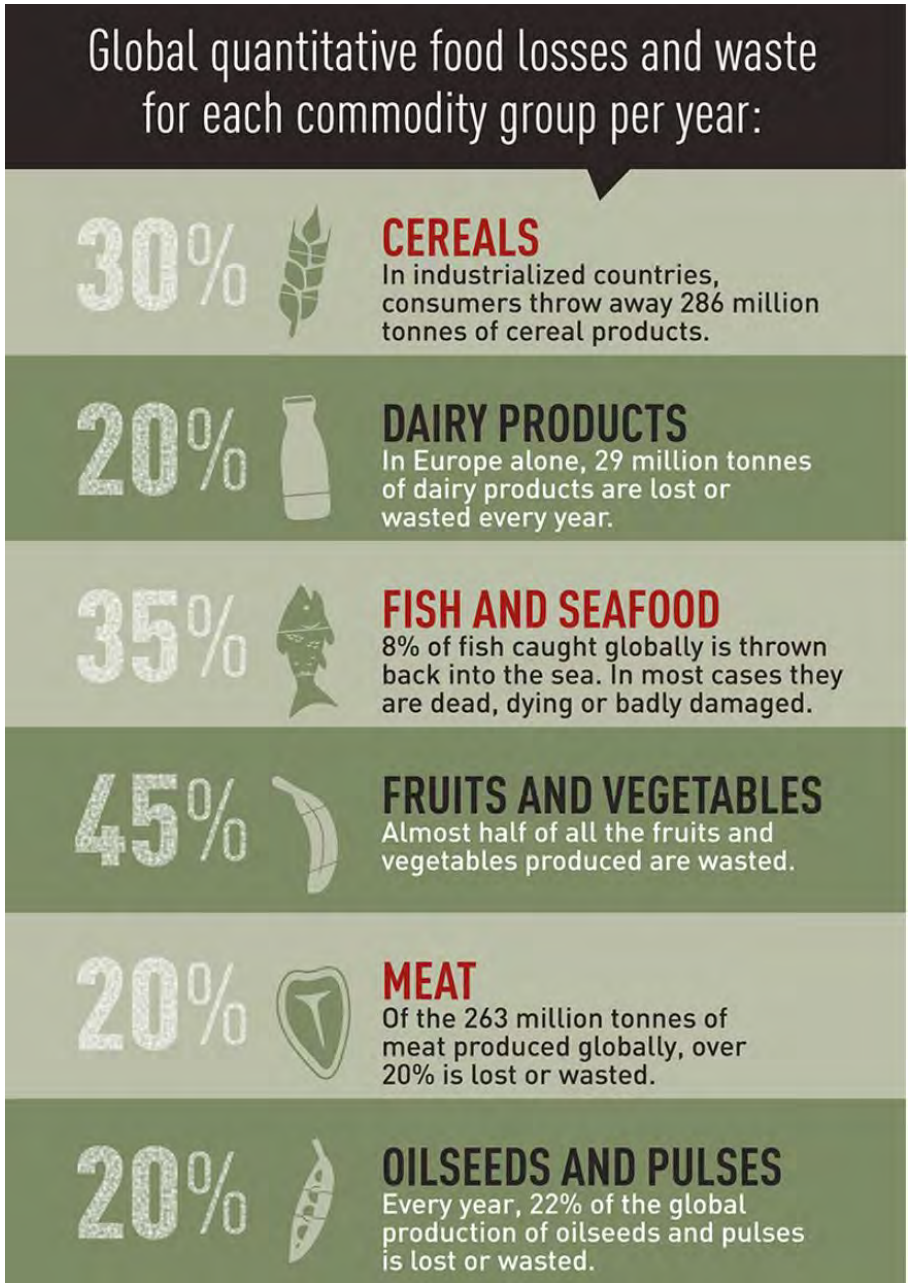
Sustainability of Training

Continuation of training beyond the funding of projects is another challenge. Training programs, especially those offered by TVET authorities, needs to be connected either to market needs or local enforceable certification scheme. This is in addition to the need to maintain regular updates to catch-up with the technological development

Role of Local Associations

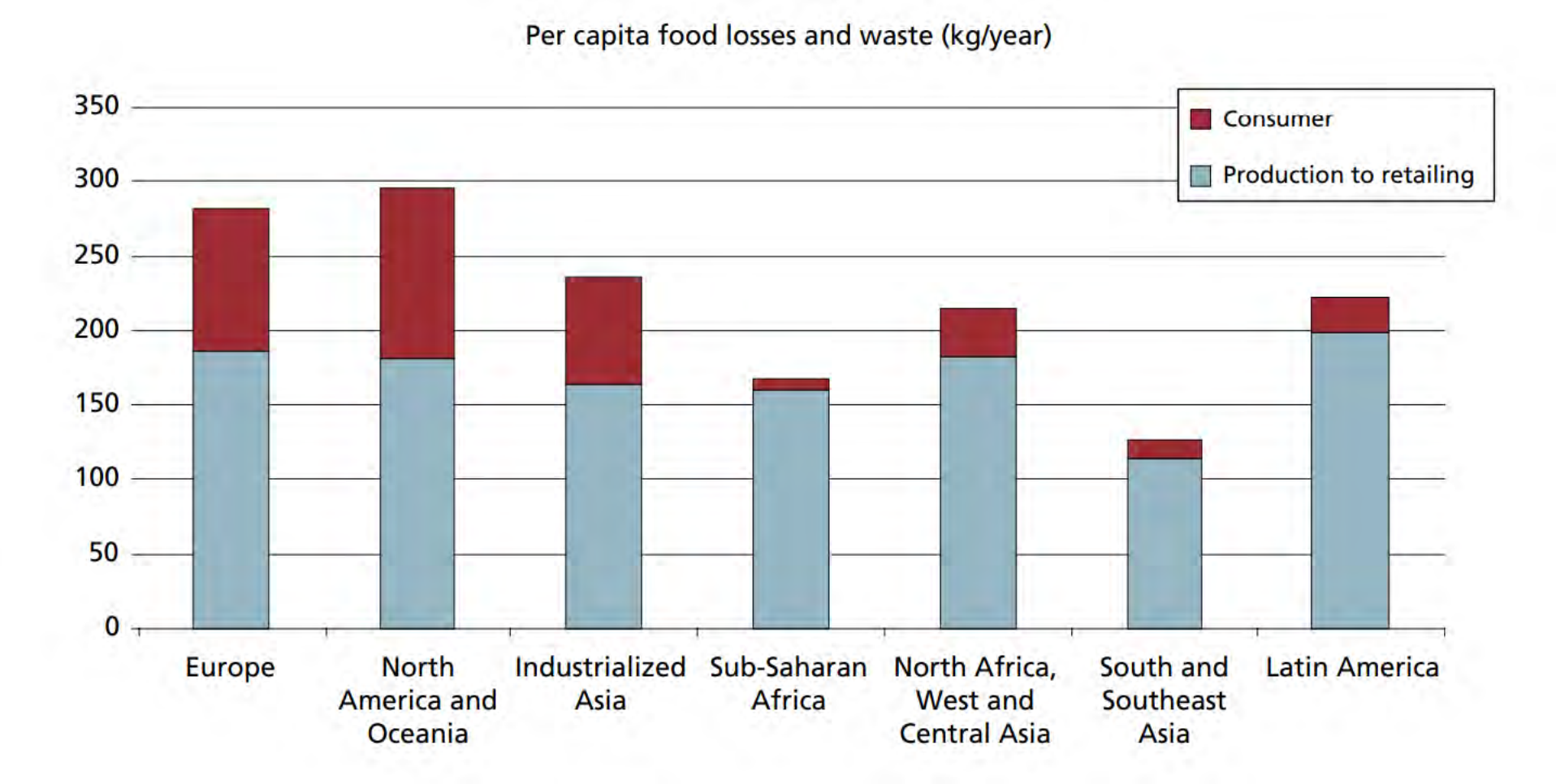
The most important local strategic partners have proven to be the RAC technician's associations and technical RAC training schools which have played relevant roles in the identification, contacting, training, certification and awareness-raising of RAC technicians and other sector players

Cold Chain;
the Overlooked Sector



Global Loss and Food Waste, FAO

Food Loss/Waste Challenge

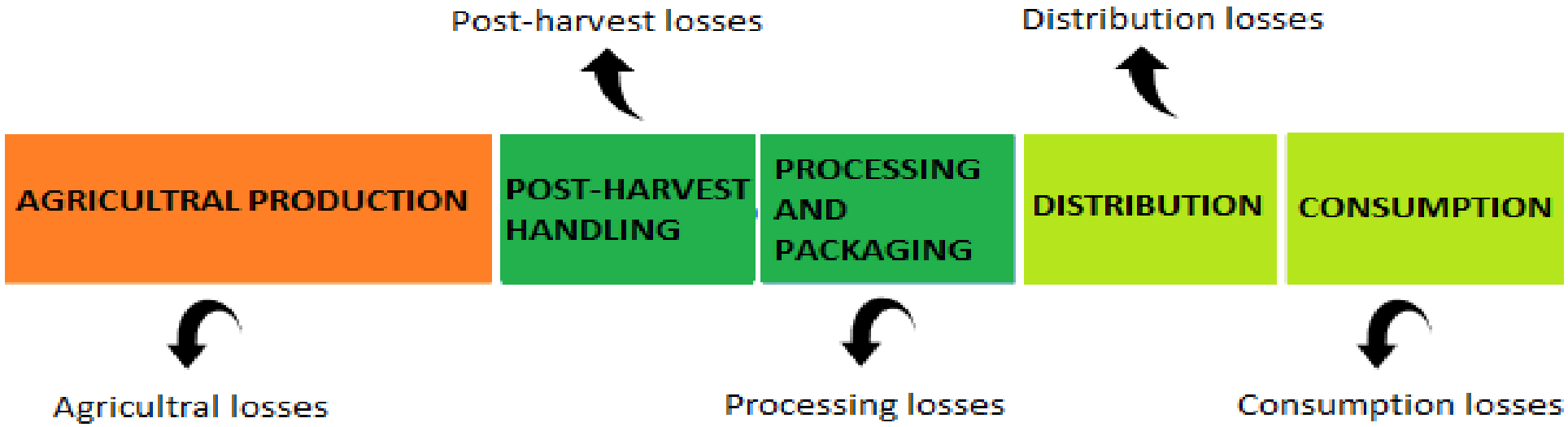


Global Loss and Food Waste, FAO

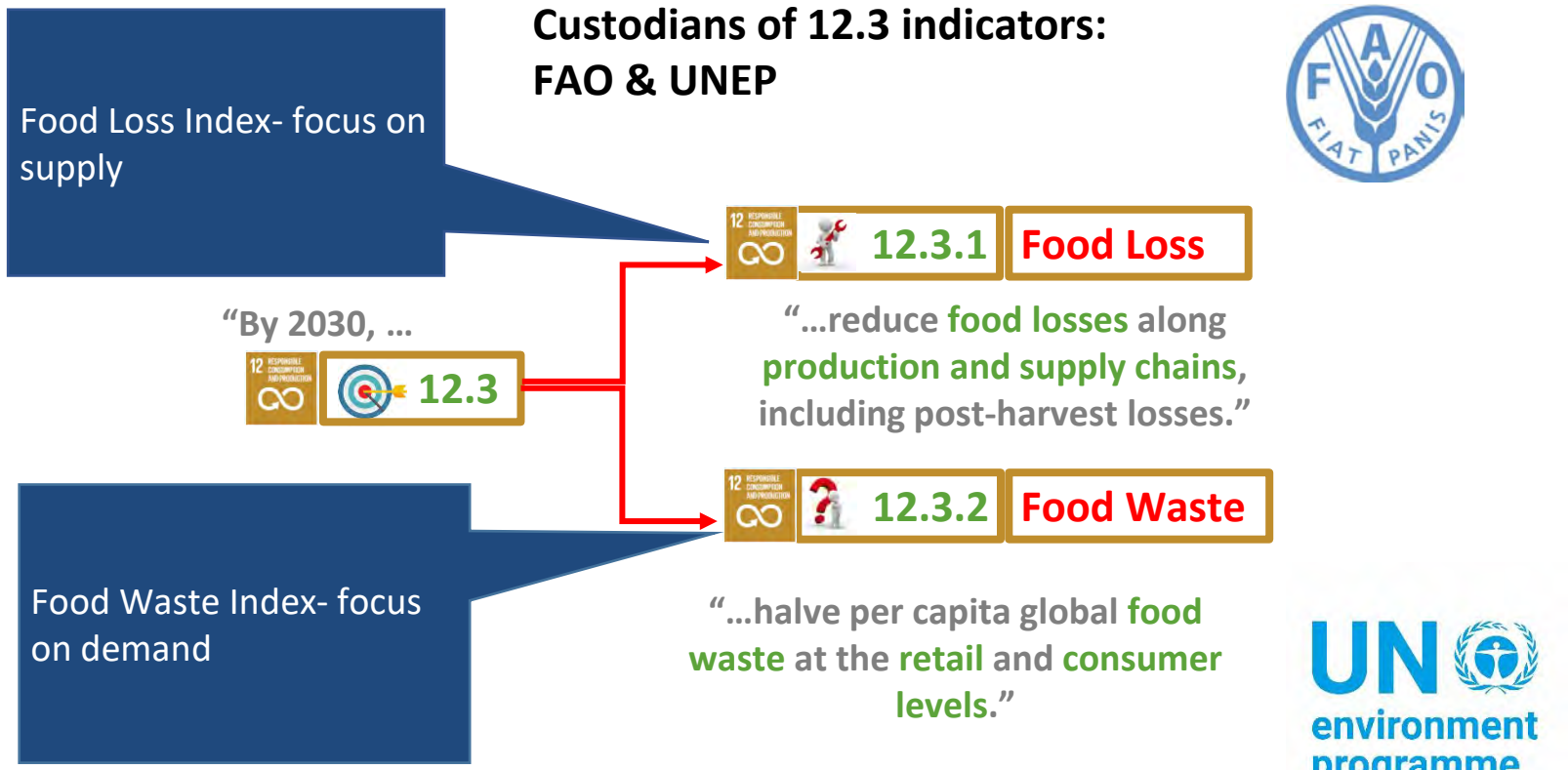
from Farm *to* Fork

Food losses and wastes from agricultural production up to final consumption

Losses due to a lack or insufficiency in refrigeration can occur at the stages of processing, packaging, distribution (transport and storage) and consumption

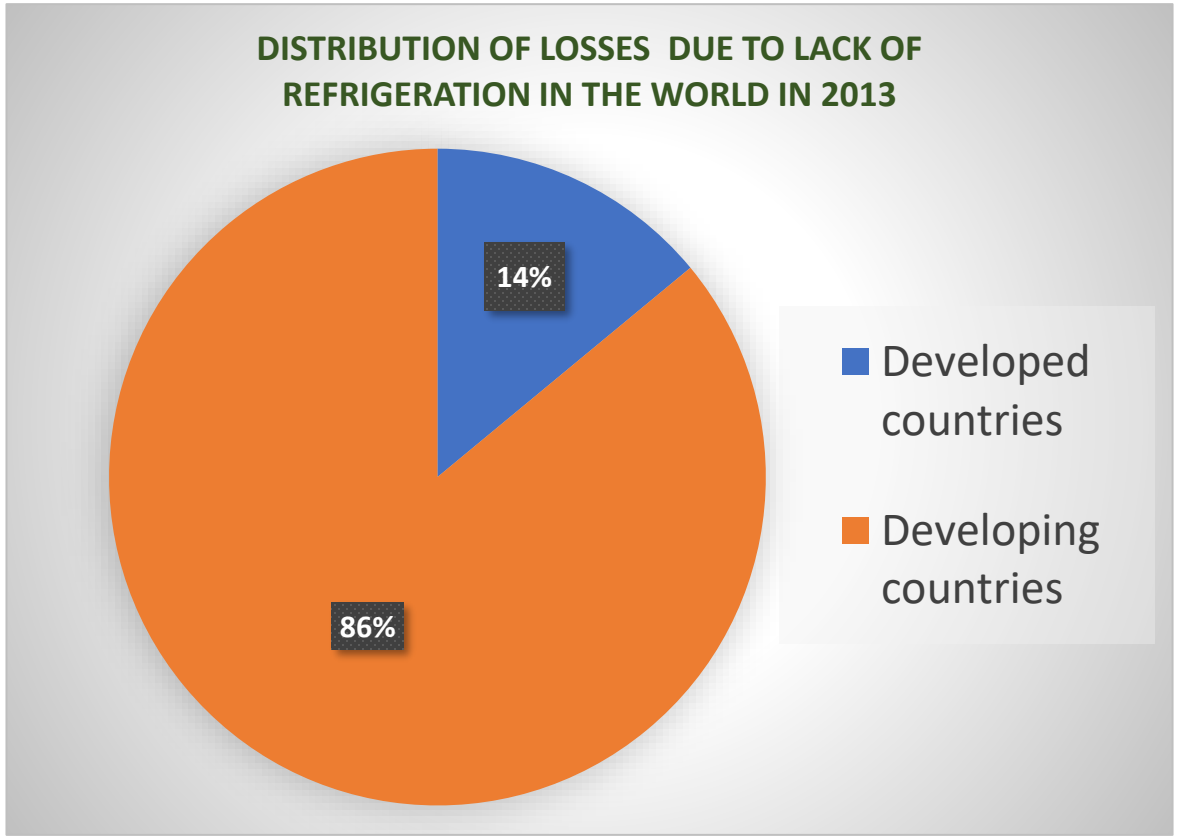


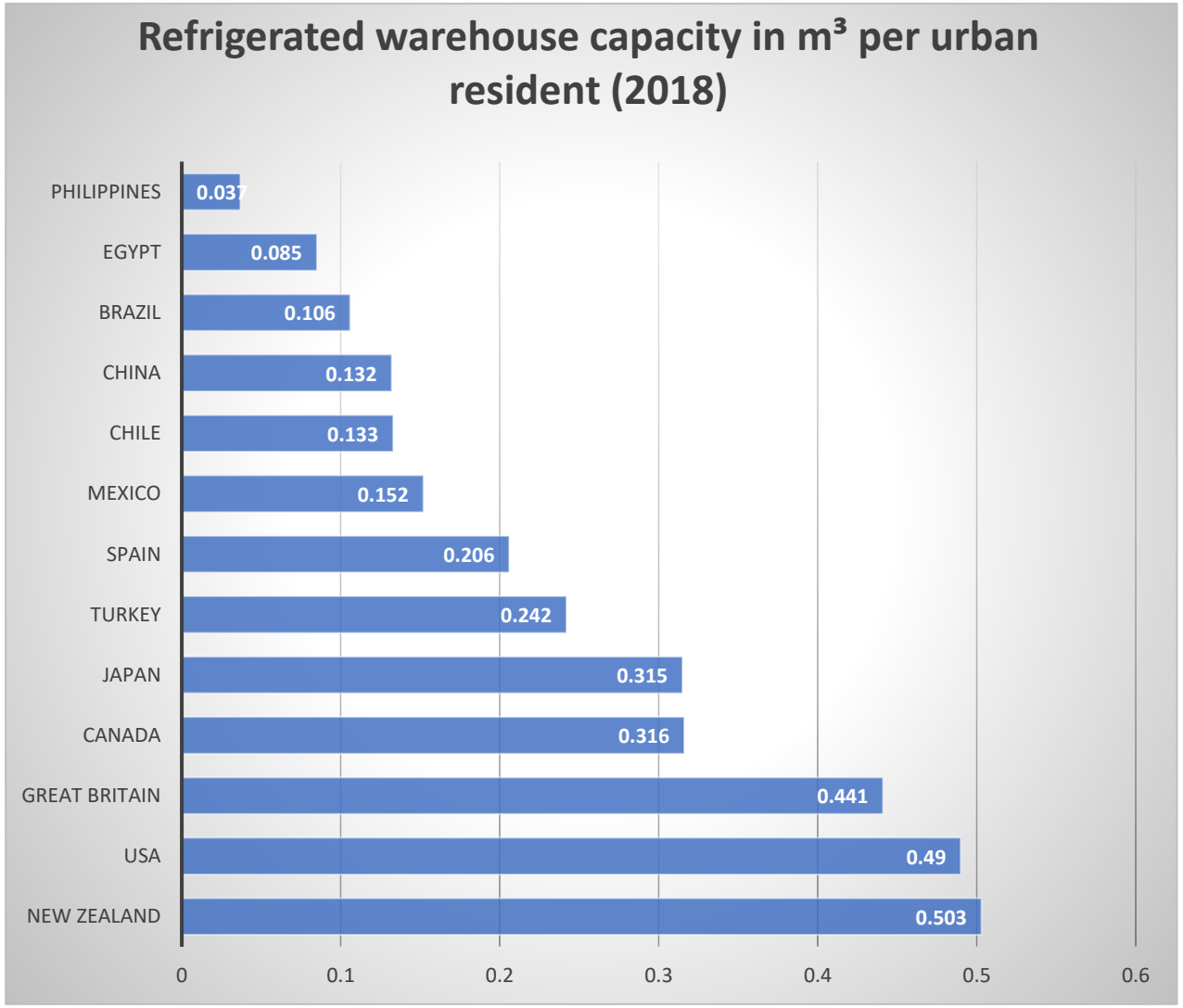
Tracking Progress on SDG 12.3



Cold Chain Contribution to Food Loss

GCCA estimations





IIR and UNEP OzonAction jointly developed 6 Technology Briefs about Cold Chain sectors:

1. Food Production Processing
2. Cold Storage and Warehouses
3. Refrigerated Transportation
4. Fishing Vessels
5. Commercial Professional and Domestic Refrigeration

6. Vaccines Cold Chain

The Cold Chain Database Model

- The initiative is a voluntary one with the purpose to design a comprehensive **Database Model** with analytical tool to plot the significance of each sub-sector in terms of technology and refrigerant types/consumption along with other aspects.

- While surveying and analyzing the Cold Chain sector from the Refrigerants/Technology perspectives, the **Database Model** will also build the connection with other strategic elements i.e., Food Loss, Energy and Economics of the different sub-sectors

- It is going to be **Living Tool** where countries update data and create thorough analysis when preparing future phase-out and phased-down projects

Understanding the Cold Chain Sector is the Key for Intervention

Main Sectors	Sub-sectors	Sub-sub-sectors
Primary production	Farming	On-farm milk cooling
		On-farm product cooling
		On-farm cold storage
	Fishing	Land-based Ice production
		On-boat fish cooling
Bulk Storage	Stand-alone warehouses	Chilled storage
		Frozen storage
		Pharmaceutical storage
Transport	Refrigerated transport systems	Intermodal containers
		Trucks and trailers
		Vans
		Rail waggons
		Cargo ships
		Air freight

Retail	Supermarkets	Small (200 - 500 m2)
		Medium (500 - 2000 m2)
		Large (2000 to 5,000 m2)
		Hypermarkets (>5,000 m2)
	Shops	Grocery
		Butchers
		Bakery
	Vending machines	Drinks
		Snack food
Food Service	Restaurants	Fast food
		Coffee shops
		Other restaurants
	Hotels	Small
		Medium
		Large
	Pubs	Drinks only
		With restaurant
	Catering	Office canteens
		Hospital catering
		School catering

1. Primary Cooling on farm / boat

2. Processing in factories

3. Bulk Storage

4. Refrigerated Transport

5. Food Retail

6. Food Service

UN environment programme | ozone secretariat

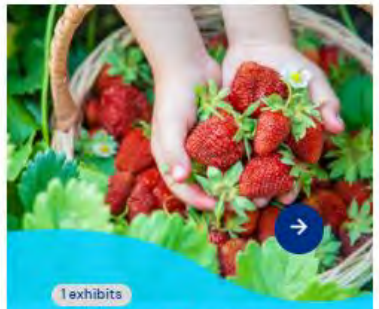
OzonAction
SUPPORTING MONTREAL PROTOCOL COMPLIANCE SINCE 1991

SUSTAINABLE COLD CHAIN
VIRTUAL EXPO

The exhibition aims to promote and highlight sustainable cold chain solutions for food loss and waste reduction, ozone layer protection and climate change mitigation. It is targeted at public and private sector decision-makers, including those who implement the Montreal Protocol. It informs on the importance of sustainable cold chains in achieving sustainable development objectives and provides examples of available state-of-the-art technologies.

- Roberto Aguilo, Argentina
- Judith Evans, UK
- Torben Funder-Kristensen, Denmark
- Lambert Kuijpers, the Netherlands
- Cesar Luis Lim, Philippines
- Silvia Minetto, Italy
- Rajan Rajendran, USA

https://ozone.unep.org/coldchainexhibition/index.html



Thank you

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UN environment programme