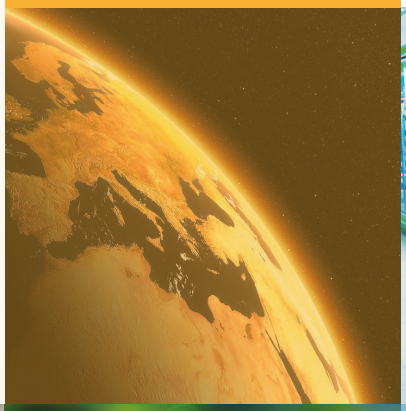
2024

ACTIVITY REPORT

THE IIR AT THE HEART OF SUSTAINABLE DEVELOPMENT



IIF
IIR

INSTITUT INTERNATIONAL DU FROID
INTERNATIONAL INSTITUTE OF REFRIGERATION

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Report prepared by the IIR Head Office in March 2025.

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Letter from the Director General

IIR Director General Yosr Allouche

Esteemed IIR Member Countries and Dear IIR Network,

The year 2024 has marked a period of profound transformation for the International Institute of Refrigeration (IIR). Through the collective efforts of the IIR Head Office, the Management Committee, the Science and Technology Council, and the Executive Committee, we have developed a bold and visionary strategy for 2024-2028, designed to not only advance our mission but also to meet the evolving challenges of our time and ensure benefits for all.

This Annual Report highlights the impactful work the IIR is doing in collaboration with partners worldwide. The organisation serves as a vital bridge between scientists, policymakers, and industry stakeholders, tackling pressing issues and seizing opportunities in the fields of refrigeration and heat pumps. Our efforts are grounded in evidence-based scientific knowledge, with over 400 top global scientists and experts driving innovation. The younger generation's contributions are integral to advancing the latest scientific breakthroughs, which we share through IIR's international conferences, the International Congress of Refrigeration (ICR), and the International Journal of Refrigeration (IJR). The IIR serves as a global platform that also showcases the solidarity within our scientific community, which helps drive technological development, inform policy decisions, and promote a more inclusive and sustainable future for all.

In addition to advancing scientific knowledge, our team has been actively engaged in key international events, including COP29 on Climate Change and the 36th Meeting of the Parties to the Montreal Protocol (MOP36). Our participation ensures that science remains central to global discussions, enabling us to contribute to solutions that are equitable and sustainable.

We are also supporting countries in various regions by addressing their specific needs and advancing their objectives through tailored pilot research and development projects. IIR-supported initiatives have made meaningful progress in regions such as Sub-Saharan Africa and the European Union. Projects such as **SophiA,** **ENOUGH**, and **BETTED** continue to strengthen the use of sustainable and reliable refrigeration across key sectors, such as dairy, food, and healthcare while ensuring that these technologies are tailored to meet the specific needs of each region.

Our efforts also include providing technical and policy briefs that inform innovation and policymaking, and developing an open access plan for the IIR's global database, ensuring that critical refrigeration and heat pump scientific information is accessible to all our members.

As the world's only intergovernmental, science-based organisation entirely focused on refrigeration and heat pump technologies, the IIR is committed to fostering collaboration and enhancing knowledge in all aspects of these vital technologies and their applications. In our pursuit of a sustainable future, we are guided by a commitment to inclusivity, ensuring that no one is left behind. Our goal is to ensure a healthy present while building a secure and sustainable future for generations to come.

The momentum we have built in 2024 sets the stage for an even more impactful 2025 and beyond. We remain focused on adapting to the challenges ahead and continuing our mission to drive positive change across the globe.

Sincerely,

Yosr Allouche, IIR Director General

IIR at a glance

The International Institute of Refrigeration (IIR) is an intergovernmental organisation dedicated to enhancing knowledge and fostering collaboration on all aspects of refrigeration, such as food and health cold chains, air conditioning, cryogenics, heat recovery and heat pumps technologies and their applications, in order to contribute to a sustainable future for all.

Its purpose is to disseminate information, foster scientific and technical exchange, and encourage research and development towards sustainability in the refrigeration sector. The aim is to deploy these technologies around the world for the benefit of all, as well as to improve existing technologies to address the threats of environmental damage and resource depletion.

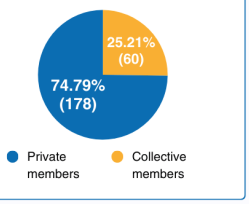
For over 100 years, the IIR has been the reference organisation working with governments, academia, and industries to address the need for trusted and valuable science-based information about the refrigeration sector.

The IIR plays a crucial role in promoting scientific research and technological innovation within the refrigeration sector worldwide. By actively engaging in discussions at international platforms such as the Montreal Protocol and the United Nations Framework Convention on Climate Change (UNFCCC), the IIR provides scientific evidence and supports the development and implementation of refrigeration technologies that address pressing global challenges while meeting essential needs and the growing demand for refrigeration in a world increasingly impacted by climate change.

IIR GLOBAL COLLABORATION AND EXPERTISE

59 MEMBER COUNTRIES

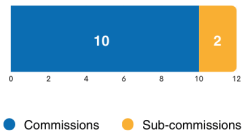
238 COLLECTIVE AND PRIVATE MEMBERS



380 EXPERTS IN THE NETWORK

9 IIR CONFERENCES WORLDWIDE

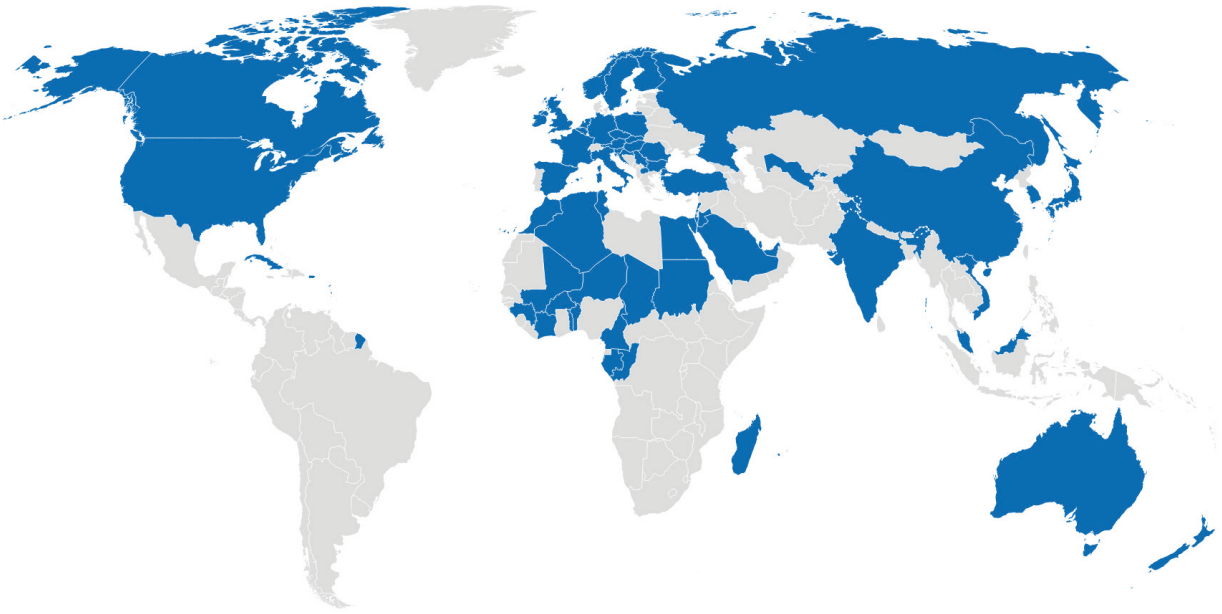
12 COMMISSIONS AND SUB-COMMISSIONS



12 WORKING GROUPS

2024 data

Governance



The IIR's structure ensures the **quality** and **neutrality** of its actions. It is composed of the following statutory bodies:

- The **General Conference (GC)**, IIR's highest authority, is composed of representatives appointed by member countries and is responsible for issuing the general directives on the organisation's operations.
- The **Executive Committee (EC),** which comprising delegates from its 59 developed and developing member states, from all continents. The EC, expanded every four years in the form of a general conference, decides on the strategic directions, approves allocated budgets, activity reports, and elects the director general. The Head Office, led by the Director General under the aegis of the EC, carries out technical and administrative activities to ensure the implementation of the IIR's duties and actions.
- The **Science and Technology Council (STC)**, composed of the presidents of five sections and ten commissions, covering the various uses and technologies of refrigeration. Each of these commissions comprises between 20 and 50 members, each with their own area of expertise, who are made available to the IIR to write or review publications, organise conferences, undertake studies, collect data and take part in projects. *See the structure in the next page.*
- The **Management Committee (MC)** is responsible for overseeing the operations of the Institute between meetings of the Executive Committee. It is composed of three representatives from the EC and three from the STC.

Science and Technology Council

SECTION A
Cryogenics and liquefied gases

Commission A1: Cryophysics, cryoengineering

Commission A2: Liquefaction and separation of gases

SECTION B
Thermodynamics, equipment, and systems

Commission B1: Thermodynamics and transfer processes

Commission B2: Refrigerating equipment

SECTION C
Biology and food technology

Commission C1: Cryobiology, cryomedicine and health products

Commission C2: Food Science and engineering

SECTION D
Storage and transport

Commission D1: Refrigerated storage

Commission D2: Refrigerated transport

SECTION E
Air conditioning, heat pumps, energy recovery

Commission E1: Air conditioning

Commission E2: Heat pump, energy recovery

Main IIR actions

The main actions of the IIR include:

- **Scientific publications** such as the International Journal of Refrigeration, the unique scientific journal fully dedicated to the refrigeration sector.
- **Technical, techno-economic and policy publications** targeting industry, academia and decision-makers.
- Databases, including **FRIDOC, the world's largest database of scientific refrigeration information**, featuring approximately 110,000 referenced documents across all areas of refrigeration.
- **IIR Conference series**, bringing together industry and research to exchange on all fields of refrigeration.
- **Promotion of innovations, and dissemination of knowledge and legislation** in the refrigeration sector.
- **Awareness-raising and training workshops**, highlighting the essential role of refrigeration for well-being and the economy. Strengthening the technical and policy capacities of the network.
- **Cooperation projects funded at national, European and international levels**, aligned with IIR's core mission of disseminating knowledge about refrigeration to improve the quality of life in a cost-effective and sustainable manner.

These actions, carried out within the framework of working groups, partnerships and international projects in collaboration with the head office, enable IIR to have a positive global impact.

They are executed by the IIR network, consisting of the experts from its commissions, countries delegates, corporate and individual members, either independently or in partnership with United Nations agencies and programmes, other intergovernmental bodies, business or engineering associations, at the international, regional or national level.

2024 Highlights

The IIR's work is intrinsically linked to the Sustainable Development Goals (SDGs), as refrigeration responds to the various vital needs of human activity and is essential to well-being and to achieve a resilient economy. Refrigeration currently accounts for almost 20% of the world's electricity consumption, and demand is expected to continue rising. The IIR's note entitled "**The Role of Refrigeration in the Global Economy**", explores the importance of refrigeration across the economy, human wellbeing, the energy transition.[1]

The IIR recognises its key role in responding to **UN Secretary-General António Guterres' call to action on "Extreme Heat"**, issued on 25 July 2024 stating "urgent and concerted effort to enhance international cooperation to address extreme heat in four critical areas: Caring for the vulnerable - Protecting workers - Boosting resilience of economies and societies using data and science - Limiting temperature rise to 1.5°C by phasing out fossil fuels and scaling up investment in renewable energy".

A new IIR strategy 2024-2028 was established to define the vision for the next four years. The IIR is expanding and evolving by leveraging cooperation and driving innovation to globally provide support on how to simultaneously meet the growing refrigeration demands while mitigating associated emissions. The new vision will focus on enhancing collaboration and partnerships with the major players in the sector, and in particular with national refrigeration associations in IIR member countries.

The IIR delivered an official statement at the Conference of the Parties to the Vienna Convention (COP13), the Meeting of the Conference of the Parties to the Montreal Protocol (MOP36), and the UN Climate Change Conference (COP29).

Dr-Ing. Yosr Allouche addressing the Plenary at COP13/MOP36

Dr-Ing. Yosr Allouche addressing the Plenary at COP29

IIR statements at COP13/MOP36 & COP29

At MOP36, the IIR renewed the engagement with the Ozone Secretariat and all parties to support national ozone units through reinforced dialogue based on scientific information.

⇨ **Statement from IIR Director General at COP13/MOP36**

At COP29, IIR was the only entity to highlight at the high-level segment the refrigeration and heat pump sectors as a priority to be addressed at this level and emphasised the pressing need for the sector to be placed at the top of the agenda.

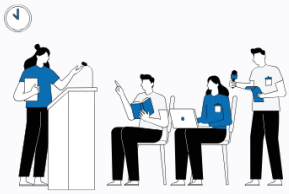
In her statement, Director General Dr. Yosr Allouche confirmed that IIR firmly believes that evidence-based policymaking is essential to achieving our environmental and climate targets. She also emphasised the crucial role of refrigeration, heat pumps, and cold chains in achieving climate goals.

Dr. Allouche highlighted how these technologies are indispensable not only for ensuring food security and protecting health, but also for advancing economic stability.

⇨ **Statement from IIR Director General at COP29**

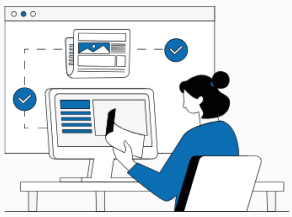
2024 in numbers

2024 IIR HIGHLIGHTS



8 **IIR AND IIR CO-SPONSORED CONFERENCES**
in 6 countries

2 **NEW TECHNICAL BRIEFS**
involving 7 authors and 4 reviewers, i.e. 11 scientists in all



17,000

PUBLICATION DOWNLOADS
(conference proceedings, papers, articles from IJR, books & guides, technical briefs, courses and training materials)

2 **NEW EU PROJECTS LAUNCHED**
benefiting 6 countries

11 **NEWSLETTERS**
to 5,162 subscribers
AND 12 NEWSFLASHES
to 6,827 subscribers

2024 data

Our progress in advancing the sustainable development goals

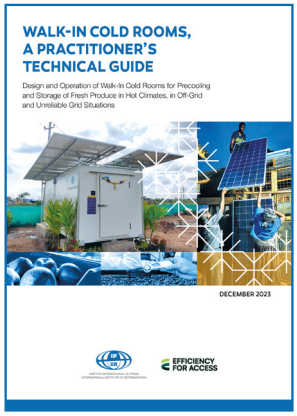
The IIR has defined its strategic actions in line with the Sustainable Development Goals (SGDs) of the 2030 Agenda for Sustainable Development, adopted by all UN members in 2015. This report presents IIR's progress and achievements in 2024, these are grouped according to the SDGs as follows:

Goals 1, 2, 3: Eradicating poverty and hunger, achieving good health and well-being

Access to a reliable cold chain would allow better use of the food produced and limit the need for increased agricultural production. In 2020, the IIR estimated that food losses due to the lack of cold chain accounted for 13% of global food production[2]. In 2021, SEforALL estimated that around 2.7 billion people could not have reliable access to vaccines due to inadequate supply chains and logistical challenges associated with cold chains[3].

Food security, well-being and economic competitivities can be greatly enhanced by the development cold chain infrastructure, improving the livelihoods of farmers, immunisation rates and access to nutritious food and medicines. The development of cold chain infrastructure creates jobs in transportation, logistics and warehousing, contributing to economic development.

IIR's main actions and achievements in 2024 related to Goals 1,2,3, are:



Following the release of the **Walk-in Cold Rooms Guide**, which provides insights into the latest technologies for designing and operating walk-in cold rooms suitable for hot climates, particularly in off-grid and weak-grid areas, the IIR, in collaboration with Efficiency for Access, co-organised a **series of webinars titled 'Cool Insights'**.

These webinars enabled 500 participants to improve their skills in using walk-in cold rooms for pre-cooling and storing fresh produce in the Global South.

⇨ **Cool Insights Webinar: Intro to Design and Operation of Walk-In Cold Rooms**

⇨ **Cool Insights Webinar: Estimating Cooling Demand and Electrical Power Demand of Walk-In Cold Rooms**

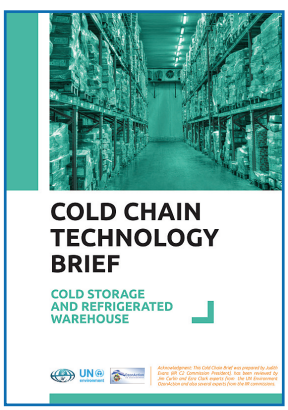
IIR and UNEP renewed their partnership to develop **four Cold Chain Technology Briefs** (three updates and one new publication to be issued in 2025). These aim to disseminate the latest advances and best practices in the following fields:

⇨ **Cold storage and refrigerated warehouse (update from 2018)**

⇨ **Commercial, professional and domestic refrigeration (update from 2018)**

⇨ **Marine refrigeration: fishing vessel application (update from 2018)**

⇨ **Refrigerated transport in hot climates (new publication in 2025)**



The IIR implements research and development projects funded by the European Commission in partnership with its consortium members, bringing together European and African experts, the vast majority of whom belong to the IIR network.

The SophiA project (Sustainable Off-grid solutions for Pharmacies and Hospitals in Africa) **supports the deployment of technologies to supply sustainable energy and water free of bacteria and viruses for rural and remote health facilities in Africa.** Through four demonstration pilots in rural hospitals in **Burkina Faso, Cameroon, Malawi and Uganda,** the project seeks to demonstrate the use of solar-powered containers to provide streamlined access to electricity, clean water, and ultra-cold storage for storing vaccines. SophiA is also strengthening partnerships between universities, the private sector, farmers and policymakers for the solar activity programme and providing training for the technology and further developing local value chains.

The SophiA project's achievements in 2024 are as follows:

- **In Burkina Faso**, the SophiA containers were inaugurated on June 27, 2024, at Leo Hospital. After 2.5 years of development, testing, and installation, the first SophiA system is now fully operational. The inauguration was organised by the local partner 2iE, the International Institute of Water and Environmental Engineering, in the presence of local officials who emphasised the positive impact on healthcare and sustainable development in the country. The solar-powered container unit is equipped with electricity, water treatment, and refrigeration systems using natural refrigerants (propane, CO_2 and ethane), capable of maintaining temperatures as low as -70°C for vaccines. **Training was provided to 28 local engineers and technicians to ensure the long-term maintenance and operation of the system.**

National officials and project partners inaugurating the SophiA containers in Burkina Faso

SophiA solar-powered container in Burkina Faso. The facility is equipped with a 1,000l capacity storage for drinking water and a CO_2/propane cascade system to provide with the refrigeration needs for vaccine storage at +5°C, -30°C and -70°C

- **In Cameroun**, the SophiA technologies consist of solar-powered medical cold chain units, a solar steam sterilisation unit, a solar kitchen, and a water treatment system, designed to improve medical infrastructure in hospitals and health centres. The systems are being installed in Douala and are expected to be operational in 2025. A capacity-building workshop and a train-the-trainer session for engineers, aiming to develop local capacities for a safe and energy-efficient operation of SophiA systems, were hosted early 2025.
- **In Malawi**, the project aims to improve healthcare services for Mua Mission Hospital (MMH) through sustainable, clean and energy-efficient solutions. For over 100 years, the Mua Mission Hospital has provided healthcare services to more than 130,000 people in the central region of Malawi. The project is currently in the planning phase, the consortium carried out an assessment of a SophiA refrigeration technology for the Mua Mission Hospital (MMH) and researchers from Karlsruhe and Makerere Universities visited the hospital to evaluate the site for the solar-powered refrigerated container that will be used to store vaccines and medicines.

Diocese of Dedza, health coordinator of the Mua Mission Hospital (Malawi) and Oliver Schmid from Karlsruhe University of Applied Sciences reviewing the project plan

The EU funded AGRI-COOL project was launched in June 2024. The initiative will offer a **cost-effective, sustainable solution to combat food waste, contribute to food security, and reduce the impact of climate change**.

Four demonstration sites in rural communities in **South Africa, Cape Verde, Somalia** and **Zimbabwe** have been selected for the installation of solar-powered containers in which food can be stored and cooled.

They will feature thermal energy storage using phase-change materials, chillers and smart controls for optimisation. The AGRI-COOL project will provide training programmes, develop a market and business strategy with local institutions to support local farmers, and conduct life-cycle assessment to measure the impact of the technology.

The AGRI-COOL project's achievements in 2024 are as follows:

- **In South Africa**, the team began energy monitoring studies at the Valota farm, under the supervision of the University of the Western Cape. Located at the farm, specialised equipment has been installed at the existing cold room located to track power usage for irrigation to analyse energy consumption patterns. The results will serve the project experts to configure the solution tailored to local needs. IIR is leading the "Stakeholders' engagement, dissemination, and outreach" working package and has implemented a strategy to raise global awareness and disseminate project's goals through various communication channels.
- The IIR has also launched the **AGRI-COOL project website** and various communication materials to promote the project's findings and achievements by showcasing the innovative technologies and real-world impacts to a wider audience.

Goal 7: Affordable and clean energy

Globally, the number of households equipped with air conditioning has risen from 25% in 2010 to around 35% in 2021 (IIR Technical Brief, 2024[4]).

However, among the 3.5 billion people living in hot climates, only around 15% owned an air conditioner in 2021, with even lower levels of ownership in sub-Saharan Africa and South Asia.

According to IIR estimates, air conditioning accounts for over 12% of electricity consumption and 5% of energy-related CO_2 emissions worldwide. It is also estimated that the number of air conditioning equipment will see a 2.5-fold increase by 2050.

Global efforts to decarbonise and electrify heating services are evolving. Heat pumps play a crucial role in achieving energy security through reduced reliance on fossil fuels. Additionally, thanks to their energy efficient operation, heat pumps represent a sustainable heating alternative to fossil fuel boilers at both climate and economic levels, as it allows for electricity bill and carbon savings.

According to the International Energy Agency, heat pumps are three to five times more energy-efficient than natural gas boilers[5]. Application of environmentally friendly and clean refrigerants such as propane largely contribute to the reduction of direct greenhouse gas emissions.

While challenges related to high capital costs and safety considerations are often mentioned, ongoing technological advancements are effectively addressing these issues for their wider and safer deployment at a larger scale. Addressing these challenges requires specific training and innovative solutions, which can be only fostered by science and research.

One of IIR's main missions is to bridge the gap existing between science, industry and policymaking by providing evidence-based information and strengthening collaboration to develop supportive regulations, incentives, and investment in technology advancements.

IIR's actions on Goal 7 during 2024 were as follows:

- **Publication of the 58th IIR technical Brief** on Refrigeration Technologies entitled "**Domestic heat pumps using hydrocarbons: current status and market overview in Europe**".

- At the **13th meeting of the Conference of the Parties to the Vienna Convention (COP13)** and the **36th meeting of the Conference of the Parties to the Montreal Protocol (MOP36)**, the IIR hosted a side event on the first day, 28 October, in partnership with the Cool Up Programme, focusing on "**Enhancing energy efficiency in the refrigeration and cooling sectors**". The event raised awareness among parties to place energy efficiency among the highest priority topics due to its economic and environmental potential, and to discuss challenges and innovations.

Panellists of the "Enhancing energy efficiency in the refrigeration and cooling sectors" session at MOP36

- At the **29th UN Climate Change Conference (COP29)**, on 15 November, the IIR organised an official side event in collaboration in collaboration with Alliance for an Energy Efficient Economy (AEEE), CLASP, and Sustainable Energy for All (SEforALL), on "**Tracking Efficiency Progress in the Global South**". The event focused on how enhancing data collection and analysis mechanisms is crucial for better decision-making, aligning national energy efficiency targets with global climate commitments, and driving energy efficiency uptake.[6]

Participants and panellists of the "Tracking Energy Efficiency Progress in the Global South" side event at COP 29

- IIR's Director General, Yosr Allouche, moderated a COP29 side event on "**Financing the Adoption of Passive Cooling Strategies for a Cooler Future**" at the Cool Coalition and Global ABC Pavilion. The session focused on the importance of passive cooling strategies to reduce reliance on mechanical cooling systems, therefore providing a sustainable solution to curb the growth in energy demand while mitigating climate impacts.
- On 27 November, IIR hosted a **hybrid workshop to raise awareness and present case studies on solar cooling in the context of the SophiA project**. Over 70 participants engaged with the speakers from national research institutions, universities and industry associations.

- The IIR participated in the **ECOWAS Sustainable Energy Forum (ESEF)** in Abidjan, Côte d'Ivoire, on 28-29 November, showcasing its work on solar cooling and sustainable refrigeration. With over 400 participants from 30 countries, ESEF 2024 focused on "Towards a Just Energy Transition in the ECOWAS Region."

IIR team with representatives of ECREEE, the Ghana delegation, the 2iE Institute and GIZ, attending ESEF 2024 in November

Related research and demonstration project in consortium with IIR partners:

The BETTED Project: Through this programme, the IIR is contributing to the assessment of the dairy sector's environmental and economic implications.

It aims to **help European companies (especially small and medium enterprises, SMEs) operating in the dairy supply chains to foster the market uptake of energy efficiency measures, including the use of renewables and the deployment of heat pumps**, which directly relates to SDG 13.

IIR has engaged key stakeholders in the refrigerated dairy supply chain, developing training content on refrigeration technologies and has conducted an industry-wide survey on sustainability, energy efficiency, and renewable energy in the dairy sector.

On 17 December 2024 the project hosted a **training webinar organised by the IIR on energy efficiency in the dairy sector. It was attended by 40 participants, including industry representatives**, who provided feedback for improvement.

To ensure a continuous monitoring of the project outcomes, and keep the stakeholders informed about the key achievements, the IIR communication Team actively disseminates updated content through the **newsletter**, social media platforms and the project's website.

Goal 13: Measures to combat climate change

According to IIR estimates, air conditioning accounts for over 12% of electricity consumption and 5% of energy-related CO_2 emissions worldwide[7].

Only a real break in the rate of increase in energy efficiency, combined with a transition to low GWP-refrigerants would make it possible to achieve an objective of reducing air conditioning-related emissions by 1/3, despite the 2.5-fold increase in the number of air-conditioning equipment by 2050 projected by the new model developed by the IIR.

These emissions consist of 77% indirect emissions associated with the electricity consumption of air-conditioning equipment, and 23% direct emissions associated with refrigerant leakage during the operation, maintenance and disposal of this equipment.

Reducing food losses through an enhanced cold chain would avoid the carbon dioxide (CO_2) emissions associated with the production of unconsumed food and the methane released into the atmosphere from the food waste decomposition.

It should be noted that the Global Warming Potential[8] of methane considering its impact over a 100-year timeframe (GWP_{100}) is between 27-30[9]. **Refrigeration is a critical infrastructure to reduce food loss and make food available to fight hunger and malnutrition**.

However, a larger deployment of cold chains would require the use of equipment that comes inevitably with associated GHG emissions. In 2021, the IIR carried out an analysis to answer this question. It was found that **an improved global cold chain, upgraded to the standards of higher income countries in terms of energy efficiency**, number of equipment per capita and adoption of low-GWP refrigerants, would prevent 55% of food losses while cutting GHG emissions from the current global cold chain by more than 47%[10] (IIR Informatory Note, 2021).

IIR actions this year on Goal 13 include:

- The development and publication of the "**57th technical brief on refrigeration technologies titled "CO_2 Emissions from Air Conditioning**".
- The IIR, in partnership with the UNEP-led Cooling Coalition, initiated the CREED "**Cooling and Refrigeration Emissions and Energy Data**" working group. This group brings refrigeration and data experts together to identify data sources, evaluate gaps and assumptions to support countries to track their cooling emissions and energy consumption, and track progress under the **Global Cooling Pledge**.

- At MOP36, the IIR hosted a second side event, "**Overcoming Barriers to Natural Refrigerant Adoption in Emerging and Developing Countries**" that took place on Day 3, 30 October. The session explored the example of Europe's regulatory progress and the EU's transition towards low-GWP refrigerants, as well as India's journey towards refrigerant lifecycle management and the advancement of natural refrigerant technologies. The panel discussion focused on national approaches, emphasising the critical role of policies, technological advancements, and financing mechanisms in overcoming the hurdles to natural refrigerant adoption.
- The IIR actively engaged in COP29 held in Baku, Azerbaijan, from 11 to 22 November, contributing to discussions on sustainable and energy-efficient refrigeration technologies, highlighting the role of low-GWP refrigerant adoption and the crucial role of the Kigali Implementation Plan for the reduction of hydrofluorocarbons (HFCs). **As the only intergovernmental organisation solely focused on refrigeration and heat pumps, the IIR's involvement underscored the importance of these sectors in achieving the climate goals**.
- On 14 November, the IIR took part in a key COP29 side event, "**Cooling the Heat: Enhancing Efficiency of the Refrigeration and Cooling Sector**", organised by the Ozone Secretariat. IIR delivered a keynote presentation on why sustainable refrigeration and cooling are key for the climate agenda, and on the importance of enhancing energy efficiency in cooling technologies and strengthening cold chains globally. This event was followed by a panel that brought together technical experts and policymakers to discuss solutions to improve energy efficiency in the refrigeration sector.

From left to right. Executive Secretary of the Ozone Secretariat, Megumi Seki, IIR Head of Policy and Partnerships, Marco Duran and Senior Advisor for the Cool Coalition, Shikha Bhasin. Opening session of the COP29 side event, Cooling the Heat: Enhancing Efficiency of the Refrigeration and Cooling Sector.

Related research and demonstration project in consortium with IIR partners:

The **ENOUGH project is providing tools and methods to support the EU Farm-to-Fork strategy, to achieve climate-neutral food businesses**. The project seeks to identify pathways to climate neutrality, enhancing integrated sustainability, and meeting European societal objectives.

The project also aims at raising awareness among policymakers, businesses, investors, entrepreneurs, institutions, stakeholders, and citizens about innovative systemic solutions and their potential for EU-wide adoption. Additionally, ENOUGH demonstrates promising technological solutions across the food chain -from harvest to consumption- for various product categories such as meat, fish, fruits/vegetables, and dairy.

The consortium comprises 30 partners from 12 European countries, bringing expertise across the entire food chain.

Since 2021, the IIR is leading the communication and scientific dissemination work package aiming to maximise the scientific impact and broader outreach of the project.

The IIR is also leading the work package on the emissions database of the European food supply chain, as well as the future predictions for 2030 and 2050.

- The IIR and its partners developed models and methodologies to establish a solid and detailed database about current and future emissions of several EU countries and the UK. The associated deliverable can be found **here**.
- The established databases and emissions figures are available via this **link**.
- The progress made on developing the European food supply emissions database and approaches on data collection and emissions calculation was presented at the **Global Cold Chain Symposium** on 26 October in Thailand. ENOUGH's work and mission is a reference for other regions on the importance of assessing the food supply chain.
- IIR led the production of the project's **e-newsletter** to ensure stakeholders are well informed about the progress of the ENOUGH Project.

Goal 4: Quality education

The IIR continues to expand its training policy through the publication of new online courses on its website.

The IIR website includes 43 course materials on a wide range of refrigeration technologies and uses, and 29 training programmes offered by the IIR and in partnership with other organisations, in various languages (Bulgarian, Danish, Dutch, English, Finnish, French, German, Greek, Hindi, Hungarian, Italian, Norwegian, Portuguese, Russian, Slovak, Spanish and Swedish).

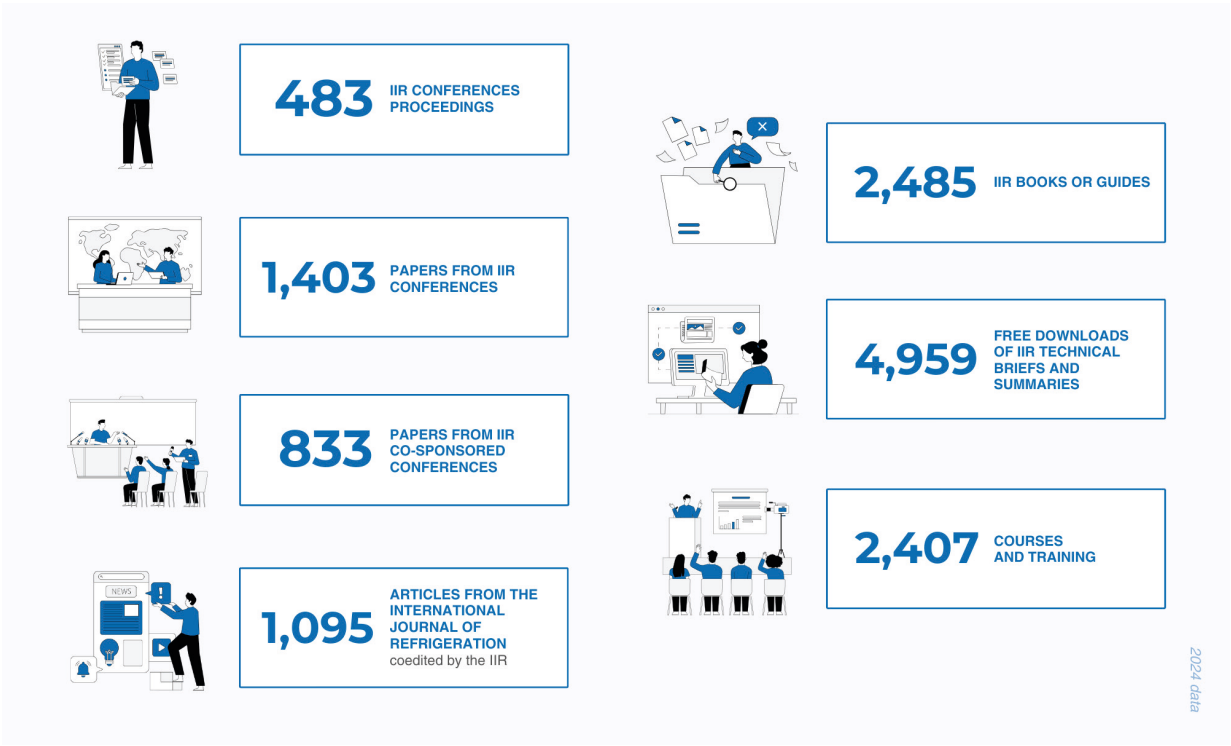
The IIR strives to promote the refrigeration sector to young people and women, as this is essential to ensure the availability of qualified human resources at all levels.

FRIDOC by IIR is the world's largest and most comprehensive database dedicated to refrigeration information.

FRIDOC covers every sector of refrigeration and compiles documents from scientific and technical works from across the globe.

These are made available to impwrove access to knowledge, promote innovation and synergies.

This year over **17,000 documents were consulted, including:**



On 10-11 October, officials from 21 French-speaking African countries were convened in Tunis, Tunisia for the third edition of the **Twinning Workshops for Montreal Protocol officers, energy policymakers and finance officials**, organised by UNEP's **OzonAction**. The IIR participated as an expert trainer, presenting on the energy efficiency's role in the refrigeration sector, and policies and regulations to drive energy-efficient and climate-friendly refrigeration.

The workshops aimed to build capacity, raise awareness of the Montreal Protocol, mobilise resources and strengthen collaboration to deliver more affordable and sustainable refrigeration.

Souhir Hammami, Director of Scientific and Technical Information at the Twinning Workshops for Montreal Protocol officers, energy policymakers and finance officials in Tunisia

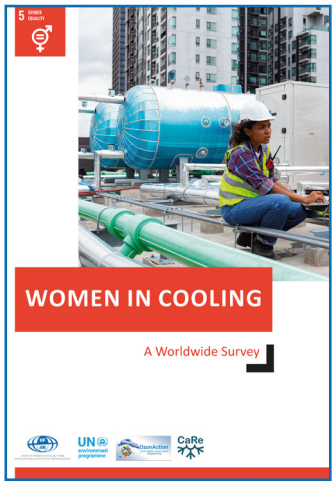
On 18 November, IIR joined the side event on "**Equitable South-North Partnerships in Sustainable Energy, Research, Innovation, and Higher Education**", hosted by the Norwegian University of Science and Technology (NTNU) and the Norwegian Research Centre SINTEF. During this session, Yosr Allouche discussed how universities and research collaborations can support the green energy transition, particularly in the refrigeration sector.

Panellists and speakers of the COP29 "Equitable South-North Partnerships in Sustainable Energy, Research, Innovation, and Higher Education" side event

Goal 5: Gender equality

The IIR working group "**Careers in Refrigeration**" CaRe is dedicated to addressing the current shortage of engineers in the refrigeration sector by inspiring and supporting the next generation of talent.

The working group is increasing the visibility of the refrigeration sector and actively promoting careers in refrigeration to the younger generation worldwide, with a strong emphasis on encouraging women to join the field.



According to the **Women in Cooling Worldwide Survey**[11], **developed by IIR and UNEP OzonAction under CaRe**, almost 5 out of 1000 people have a job linked to the manufacturing, installation, maintenance, and servicing of refrigeration equipment, i.e. 15 million people.

The survey also highlights that women are significantly underrepresented in the refrigeration sector, with only 6% of members in national refrigeration associations, organisations, and institutions being women.

This reflects the broader reality of gender imbalance in the refrigeration industry and workforce[12].

The **International Network of Women in Cooling (INWIC)** is an international network of organisations that elevates the role of women in the refrigeration, air conditioning, and heat pump (RACHP) industry by looking to provide better and more opportunities for women to establish professional careers within these fields.

The IIR is a founding partner and coordinated a range of activities in 2024, including:

- The IIR organised and participated in the **INWIC networking event at the AHR Expo**, which is held in conjunction with the 2024 ASHRAE winter conference in Chicago (USA). The event attracted over 60 participants. IIR presented the preliminary results of a North American survey of members of the "Women in HVACR" association as part of a presentation entitled "Women in RACHP". This survey aims to improve understanding of the background, motivation, challenges, and opportunities faced by women working in the industry.

Group picture with panellists after the INWIC event at the AHR Expo

- **In January 2024**, Ina Colombo, IIR Head of the European and International Programmes Department was confirmed as INWIC president elect for 2025, a position she will hold for one year. In April, the IIR's STC approved a new governance (president and vice-presidents) for CaRe. Souhir Hammami, Director of the Scientific and Technical Information Department of the IIR joined the INWIC Board as deputy delegate.
- **In November 2024**, the IIR delivered a presentation for the SophiA workshop on Women in Cooling, highlighting the CaRe and the UNEP led INWIC initiative. The IIR shared insights from global surveys on women's participation in the refrigeration, air-conditioning, and heat pump (RACHP) sectors, emphasising the need for continued advocacy to address challenges such as gender pay gaps and limited access to leadership roles for women in some regions.

Ina Colombo, IIR Head of the European and International Programmes Department presenting the CaRe working group at ESEF 2024

- **INWIC participated in multiple events in 2024 to raise awareness about the network among women globally**. These include: the IOR Women in RACHP event held on the 24 June 2024, at Carter Thermal Industries in Birmingham, England; REFCOLD India 2024, held from 3 to 5 October in Kolkata, India; and Chillventa 2024, held from 8 to 10 October in Nuremberg, Germany.

Goals 8 and 9: Decent work and economic growth / Industry, innovation and infrastructure

According to a recent report by IFC-UNEP[13], the refrigeration market in developing economies is expected to grow from around USD 300 billion to at least USD 600 billion per year by 2050.

The report also states that in developing economies, sustainable space cooling solutions can reduce electricity bills, equipment costs, and power sector investments by USD 8 trillion by 2050.

It also highlights the need for significant upfront investments estimating the investment gap required by households and small and medium enterprises in developing countries to USD 400-800 billion, in addition to future increases in demand. The projected sector's growth will be a driver for job creation and economic growth.

All the actions presented below aim to enhance knowledge and innovation to contribute to further progress and improvement in the refrigeration and space cooling infrastructure.

Bridging the gap between technology, decision makers and industry, while improving understanding of the sector to attract investment is an essential role of the IIR.

Particularly when it relates to supporting the development of new technologies and new uses of refrigeration, IIR's conferences and co-sponsored conferences provide a platform to exchange about better solutions for a more sustainable, accessible and efficient refrigeration infrastructure.

- **IIR's Scientific and Technical Information Department (STID) has developed a new strategy that aligns with the 2024-2028 IIR strategy.** The STID's strategy will be implemented starting in 2025 and it underscores the department's commitment to supporting the United Nations Sustainable Development Goals (SDGs).
- A new conference was integrated to IIR's conference series in partnership with the UK Institute of Refrigeration (IOR). The **1st IIR International Conference on Refrigeration Adapting to Rising Temperatures** will take place in Manchester, UK from 10 to 13 August 2025.
- IIR Conferences in 2024. *See page 33*
- IIR co-sponsored conferences in 2024. *See page 34*

IIR conferences in 2024

NO.	EVENT TITLE	EVENT DESCRIPTION	ABBR.	COUNTRY	CITY	PARTICIPANTS
14th	**IIR Conference on Phase-Change Materials and Slurries for Refrigeration and Air Conditioning (PCM)**	The event brought together scientists, researchers, and industry professionals working with phase- change materials (PCMs) and slurries to discuss the latest developments in the field.	PCM	**France**	Paris	~50
11th	**Int. Conference on Compressors and Refrigerants**	This international event provided a platform for knowledge exchange in the field, focusing on the future challenges of science and production in response to climate change.	Compr	**Slovak Rep.**	Bratislava	~60
8th	**IIR Conference on Sustainability and the Cold Chain**	Held biennially since 2010, the conference aimed to foster discussions on how to establish a truly sustainable cold chain by integrating renewable energies and life cycle assessments into food supply systems.	ICCC	**Japan**	Tokyo	150
10th	**Int. Conference on Magnetic Refrigeration at Room Temperature**	The conference provided an overview of new caloric materials and innovative cooling techniques, offering an ideal platform to showcase the latest advancements in these fields.	Thermag	**China**	Baotou	185
16th	**IIR Gustav Lorentzen Conference**	The conference highlighted innovations in natural working fluids for applications in refrigeration, air conditioning, heat pumps, and heat engines.	GL	**USA**	College Park	~250

IIR co-sponsored conferences in 2024

NO.	EVENT TITLE	EVENT DESCRIPTION	ABBR.	COUNTRY	CITY	PARTICIPANTS
12th	**Ibero-American Congress of Refrigeration Science and Technology**	The event covered topics such as refrigeration technologies, commercial and industrial refrigeration, air conditioning systems, food processing and preservation, and energy efficiency with renewable energy integration. It also celebrated World Refrigeration Day and explored the future of these essential industries.	CYTEF	**Spain**	Elche	~160
27th	**International Compressor Engineering Conference at Purdue**	Since 1972, Herrick Labs has hosted premier international conferences on Compressor Engineering, Refrigeration and Air Conditioning, and High-Performance Buildings. These renowned Purdue University Conferences brought together experts in the field to present groundbreaking research, exchange ideas, and explore Herrick Labs' state-of-the-art facilities.	Purdue	**USA**	Purdue University	> 800
20th	**International Refrigeration and Air Conditioning Conference at Purdue**	Covering both fundamental and applied topics, the conference explored heat transfer and fluid flow, alternative refrigerants, system modelling, heat exchanger enhancements, diagnostics, controls, and industrial applications.	Purdue	**USA**	Purdue University	> 800
8th	**International High-Performance & Green Buildings Conference at Purdue**	At this conference experts and researchers presented innovations in building materials, lighting, diagnostics, mixed-mode cooling, natural ventilation, and smart building controls, along with case studies on high-performance building design and operation.	Purdue	**USA**	Purdue University	> 800

Goal 17: Partnerships for global goals

The IIR is a trusted organisation to partner with, our unbiased role and independent source of verified information is an asset to many organisations.

Many of IIR's actions are coordinated with the various UN programmes and international cooperation agencies, such as the World Bank, IEA, FAO, UNEP, with which the IIR has built strong partnerships.

The IIR also participates in European commission and national funded projects implementing actions across various regions of the world to address their specific needs (*see Goals 1, 2 and 3*).

IIR actions this year on Goal 17 include:

- As a trusted partner, the IIR was **nominated a member of the UNEP-led Cool Coalition's steering committee**. The Cool Coalition is a global multi-stakeholder network that connects a wide range of key actors to facilitate knowledge exchange, advocacy and joint action towards a rapid global transition to efficient and climate-friendly cooling.
- The IIR participated and delivered **two keynotes in REFCOLD India 2024**, held in 3-5 October in Kolkata, India. An ISHRAE flagship conference and exhibition on refrigeration and cold chain aiming at advancing the refrigeration and cold chain industries in South Asia.
- During COP 29, **Dr. Allouche joined the COP 29 Ministerial Roundtable: Delivering on the Global Cooling Pledge**, which was launched at COP28. The pledge, aimed at reducing cooling-related emissions by 68% by 2050, brought together key stakeholders to discuss its implementation.

- IIR **partnered with UNEP to publish four Cold Chain Technology Briefs** (three updates and one new publication) to be published in 2025. IIR will collaborate with UNEP to provide technical expertise and ensure the briefs reflect the latest advancements and best practices in the refrigeration field.
- The team **took part in the «Journée Fluides 2024» (Fluids Day 2024), organised by the French Association of Refrigeration (AFF)** at the Lycée Raspail in Paris. The theme for 2024 was "Refrigerants: urgency and prospects for the industry" and the event brought together nearly 80 participants, including professionals, students and industry partners. This edition was marked by the entry into force of the new European F-GAS regulation, a decisive step towards the phase-out of fluorinated gases by 2050.
- The IIR **joined the HBRC International Conference held in Cairo** from 14 to 17 December 2024. IIR led discussions on emerging technologies to reduce the reliance on mechanical refrigeration, applicable technologies in arid climates as well as their financial feasibility in the MENA region.

IIR at the heart of sustainable development

As the world's only intergovernmental, scientifically based organisation entirely focused on the refrigeration and heat pump sector, we ensure an interactive process that enables effective exchanges of knowledge between scientific evidence providers and scientific evidence users.

We remain committed to our mission of fostering collaboration and enhancing knowledge on all aspects of refrigeration and heat pumps technologies and their applications to contribute to a sustainable future for all. We firmly believe that evidence-based policymaking is essential to strengthen economic competitivity, drive innovation and achieve our environmental and climate targets.

International cooperation is essential to tackle the global challenges we face. The IIR is at the heart of sustainable development and its role, whether at international, regional or national level, continues to grow.

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