What is the IIR?

1st IIR International Congress of Refrigeration – 1908, Paris Sorbonne (France)

Founded in 1908

The IIR is an independent intergovernmental science and technology-based organisation

Objective: Worldwide dissemination of knowledge on all refrigeration technologies and uses

"Refrigeration for Sustainable Development"

Key domains include…

- Food quality and safety from farm to consumer
- Comfort in homes and commercial buildings
- Healthcare products and services
- Low temperature and liquefied gas technologies
- Energy efficiency
- Safe use of non-ozone depleting and low global warming refrigerants

Science and Technology Council

Five IIR Sections covering all fields of refrigeration

Section A	Section B	Section C	Section D	Section E
Cryogenics and liquefied gases	Thermodynamics, equipment and systems	Biology and food technology	Storage and transport	Air-conditioning, heat pumps and energy recovery

International network

59
Member Countries

+950
Corporate and Private Members

+300
Experts

Food and Agriculture Organization of the United Nations

OzonAction

UN environment programme

OECD
BETTER POLICIES FOR BETTER LIVES

UNIDO

AFD
AGENCE FRANÇAISE DE DÉVELOPPEMENT

CIHEAM

World Health Organization

What do we do?

A network of information on refrigeration adapted to your needs

- Fridoc database: 110,000 references
- International Journal of Refrigeration: the best peer-reviewed scientific journal in the field
- Guides, courses: online/on site
- Informatory Notes for decision-makers
- Professional directories: Expertise Directory, Laboratories, International Dictionary of Refrigeration
- Newsletter distributed monthly
- Conferences: 5 IIR conferences, 8 IIR co-sponsored conferences per year
- Working groups
- Research and development projects with the United Nations, countries and European Union funds, with the IIR network of members in Europe, Asia, Africa…

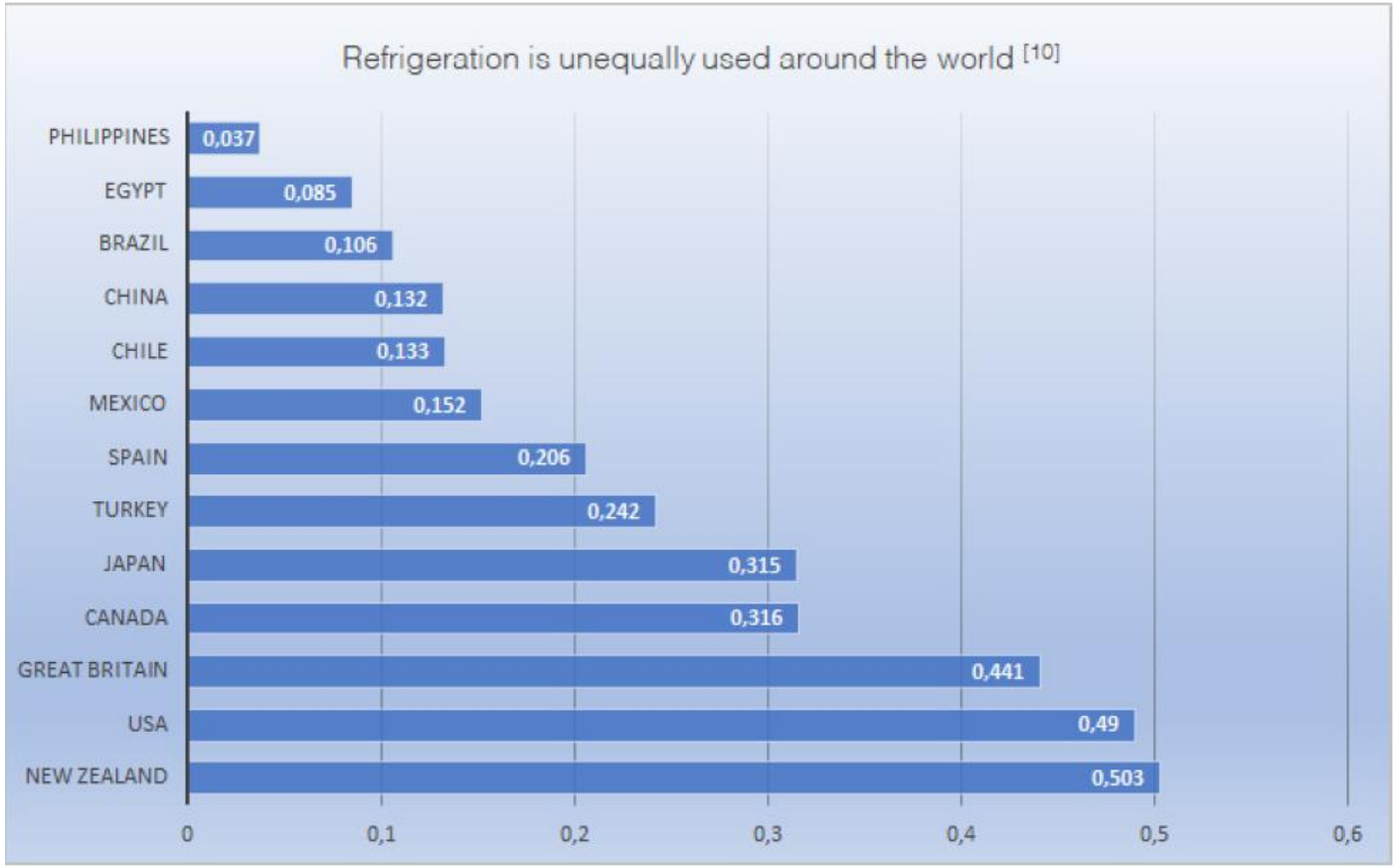
Visit the IIR website: www.iifiir.org

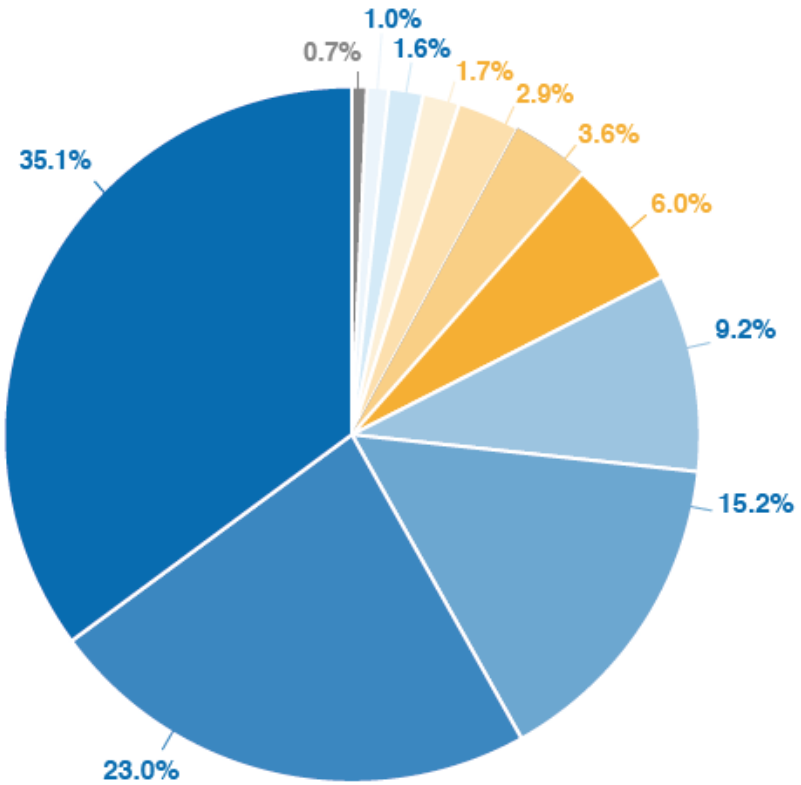
I. An increasing environmental impact

a. Increasing needs

- Needs are increasing
  - Nutrition issue
  - Health issue (vaccines, hospitals…)
  - Health issue (air conditioning)
  - Energy issue (LNG, other gases, heat pumps)
  - Technological issue (space industry, information technologies, biotechnologies…)
- Developing countries are most concerned
- Increasing needs for heat pumps and cold chain for food in particular, have a positive impact on the environment

Refrigerated warehouse capacity in m^3 per urban resident (2018)





Stock of air conditioners by country/region, end 2016

b. Energy and refrigerants

- Refrigeration (cold chain, air conditioning, heat pumps, cryogenics) represents 7,8% of global greenhouse gases emissions in CO_2 equivalent.
  - 37% are due to CFCs, HCFCs, HFCs
  - 63% are due to the energy production and transport
- Refrigeration accounts for about 20% of worldwide electricity consumption and the demand for refrigeration could double by 2050.
- In the European Union, refrigeration needs will be greater than heating needs in 2050.
- Air conditioning will have a major impact.

Vapour compression systems will remain predominant in the near future at least → refrigerants are a major issue.

However, the energy issue must be taken into account because of environmental and infrastructure impacts:

- Energy efficiency of the equipment, depending on the applications and refrigerants
- Energy needs to be reduced through passive cooling technologies, eco design, whole systems, consumer behaviour…
- Renewable energies

Chlorinated gases destroy the stratospheric ozone layer (CFCs, HCFCs).

- They are already banned in developed countries
- They will be banned in developing countries by 2030 (Montreal protocol).

The problem of banks remains.

But these gases, as well as other fluorinated gases (HFCs) generally are potent greenhouse gases (see table on next slide)

- ➢ Reducing losses is possible (controls, training, certifications, refrigerant charge reduction) but needs some regulations and is not enough.
- ➢ A public policy to reduce high GWP refrigerants use is necessary.

Substance		GWP100 [6]	Lifetime (in years) [6]
Direct emissions			
CFC	CFC-11	4,660	45.0
	CFC12	10,200	100.0
	CFC-115	7,670	1,020.0
HCFC	HCFC-22	1,760	11.9
	HCFC-123	79	1.3
	HCFC-124	527	5.4
HFC	HFC-32	677	5.2
	HFC-125	3,170	28.2
	HFC-134a	1,300	13.4
	HFC-143a	4,800	47.1
	HFC-152a	138	1.5
Indirect emissions			
	CO_2	1	*there is no distinctive lifetime*
	CH_4	28	12.4
	N_2O	265	121

List of GHGs emitted by the refrigeration sector.

II. Refrigerant policies

a. <u>Worldwide commitments</u>

- Kigali amendment already signed by 148 countries. Others regularly ratify
→ a commitment for all (the Montreal protocol was progressively ratified by all countries)

- But each country can develop its own policy to meet the targets, under the supervision of the Montreal Protocol Secretariat, the ozone officers and the Meetings of the Parties.

- National cooling action plans are progressively implemented, they are included in National Determined Contributions of the Paris agreement.

- Promotion at COP and MOP: e.g. the pavilion prepared by UNEP and IIR at the upcoming COP on climate change in Dubai.

	A2 countries	A5 countries (Group 1)**	A5 countries (Group 2)***
Baseline	2011-2013	2020-2022	2024-2026
Formula	Average HFC consumption	Average HFC consumption	Average HFC consumption
HCFC	15% or 25% baseline*	65% baseline	65% baseline
Freeze	-	2024	2028
1st step	2019 – 10%	2029 – 10%	2032 – 10%
2nd step	2024 – 40%	2035 – 30%	2037 – 20%
3rd step	2029 – 70%	2040 – 50%	2042 – 30%
4th step	2034 – 80%		
Plateau	2036 – 85%	2045 – 80%	2047 – 85%

* Belarus, Russia, Kazakhstan, Tajikistan, Uzbekistan

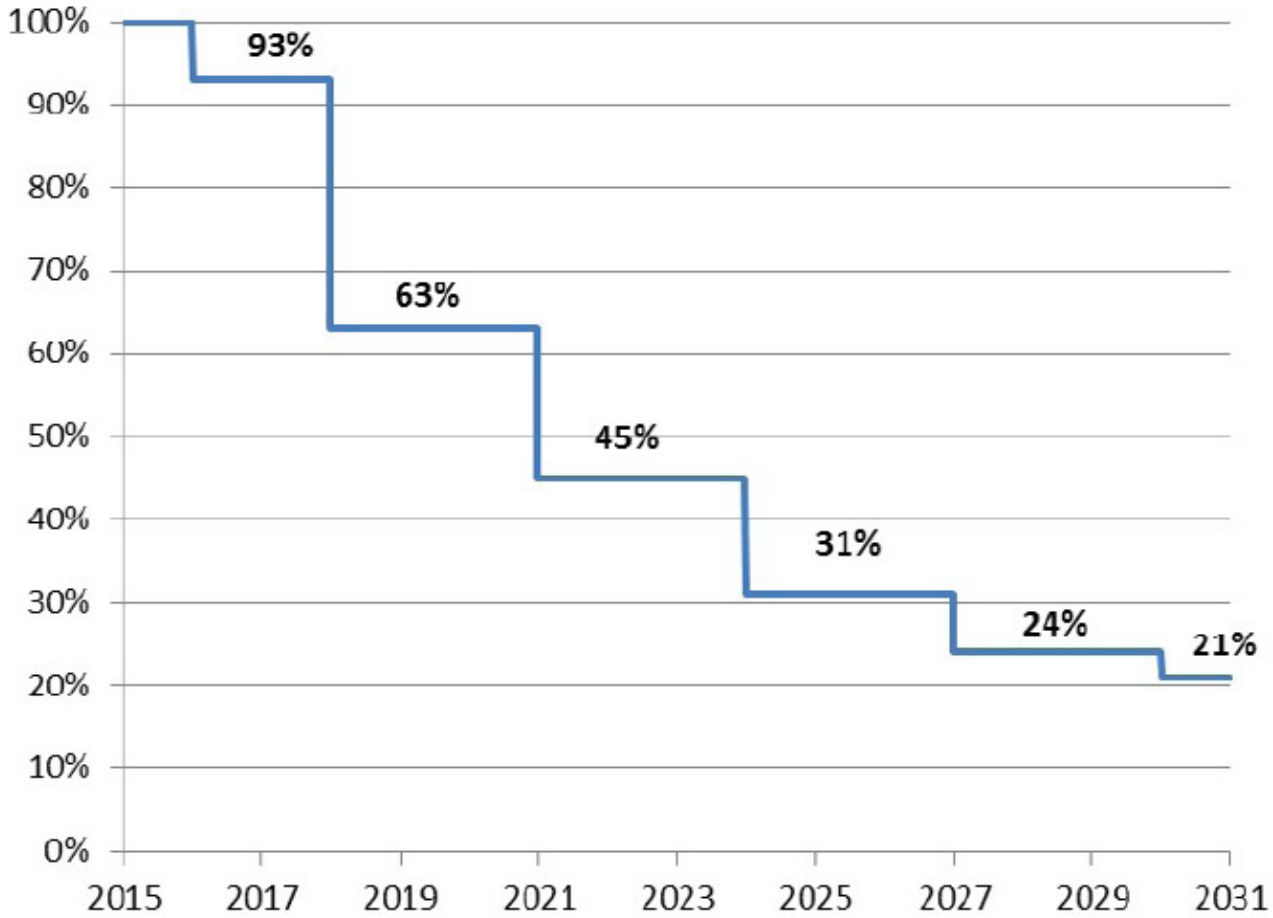
** Group 1: Article 5 parties not part of Group 2

*** Group 2: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates, India, Iraq, Iran, Pakistan

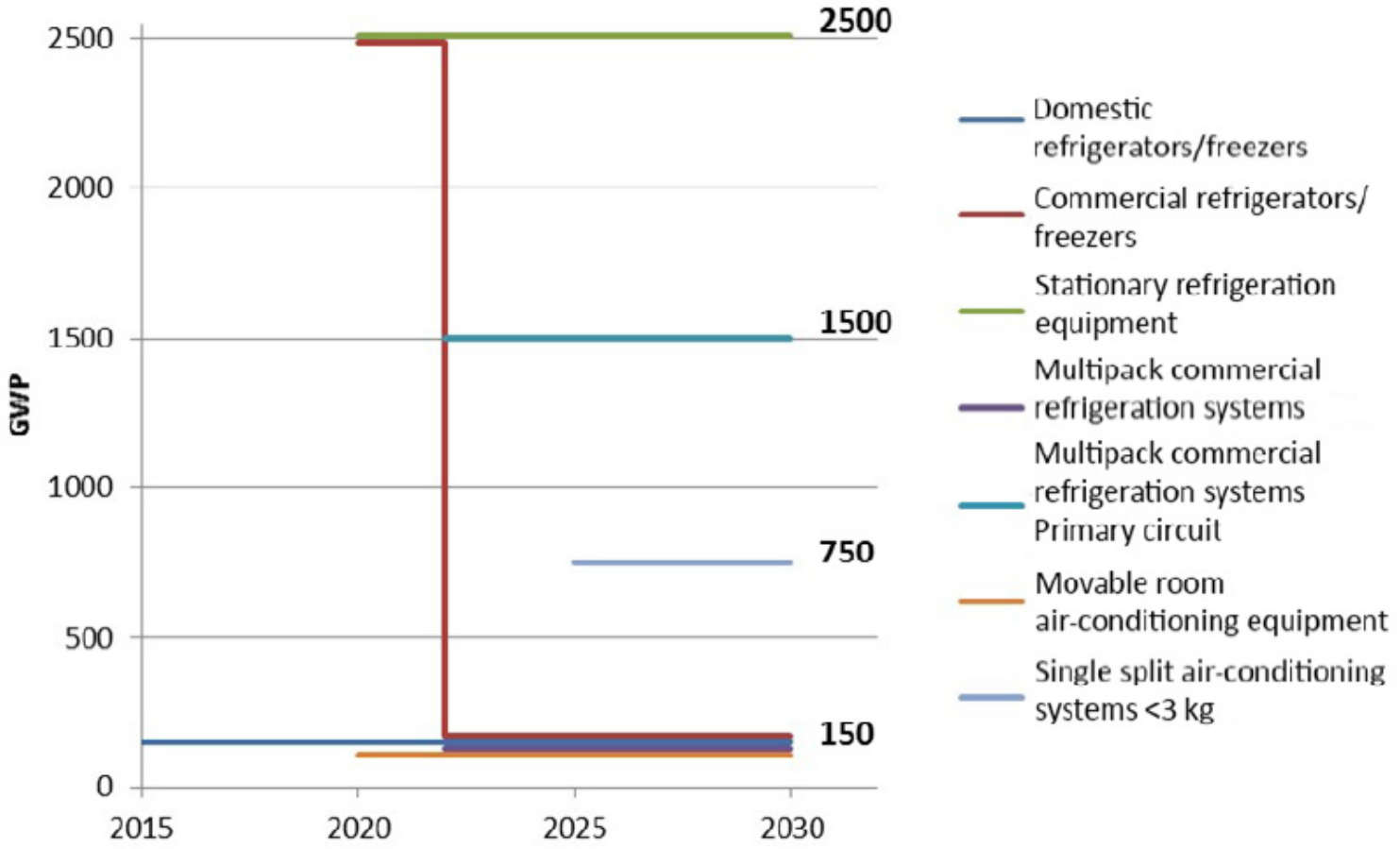
b. The case of the European Union

This is just one example of the various measures already taken or soon to be taken in other countries, as this is the first region in the world to have implemented an HFC phase-down strategy.

- As of 2006, a regulation on F-gases concerning training, certification and controls + limitation to a GWP of 150 for refrigerants in mobile air conditioning systems. Consequence: replacement mainly by HFOs in new cars and marginally by CO_2
- In 2014, new regulations were introduced with a phase-down schedule + bans in certain applications. In parallel, several European countries have introduced taxes based on CO_2 equivalent potential.



Phase-down schedule of the EU F-Gas Regulation based on the annual average of the total quantity (aggregated quantities of all types of hydrofluorocarbons, expressed in tonne(s) of CO_2 equivalent) placed on the EU market during the 2009-2012 period.



Marketing bans (Annex III of EU F-Gas Regulation).

Comments on the current F-gas regulation

- It is generally respected
- Prices for high GWP refrigerants have risen dramatically and then stagnated (traffic via Eastern Europe and the Middle East)
- Pre-charged equipment also have quotas
- HFOs are not concerned
- The phase down schedule is stricter than the Kigali amendment requirements. It ends in 2030 with a 79% reduction in CO_2 eq. It should only be continued until it reaches 85% in 2036.
- However, the EU has strong commitments regarding global warming in general: it should be carbon neutral by 2050 and reduce its impact by 50% (55%) already by 2030. The lifetime of HFCs is (relatively) short: accelerating the phase down is a (small) solution to the challenge

The new F-gas regulation draft

Commitment to review the F-gas regulation: The review process started in 2022 and should end in 2023. The European Commission made a proposal last year. The European Parliament made another proposal in April 2023. The Commission, the Parliament and the Council of Ministers should now agree on a final proposal.

Subjects to discuss :

- Bans: all stationary self-contained refrigeration equipment with F-gases with a GWP ≥ 150 would be soon banned; for self-contained air conditioning and heat pumps with small capacities and GWP ≥ 150 would also be banned, with exceptions if safety issues (GWP ≤ 750, allowing R32)

  More generally, for most equipment, the reference limit would be 150 with exceptions to 750 due to safety issues. The precise dates of bans are subject to discussions.
- HFOs: There is a desire to promote only natural refrigerants and some countries will ban them. However, a general ban is unlikely. It should be discussed within the Reach regulation on chemicals: problem of degradation products (PFAS-TFA)
- Reinforced phase down schedule

European Commission

Years	Maximum Quantity in tonnes CO_2 equivalent
2024 – 2026	41 701 077
2027 – 2029	***17 688 360***
2030 – 2032	9 132 097
2033 – 2035	8 445 713
2036 – 2038	6 782 265
2039 – 2041	***6 136 732***
2042 – 2044	***5 491 199***
2045 – 2047	***4 845 666***
2048 *onwards*	***4 200 133***

European Parliament

Years	Maximum Quantity in tonnes CO_2 equivalent
2024 – 2026	41 701 077
2027 – 2029	***20 888 360***
2030 – 2032	9 132 097
2033 – 2035	8 445 713
2036 – 2038	6 782 265
2039 – 2041	***4 138 941***
2042 – 2044	***3 247 259***
2045 – 2047	***1 623 629***
2048 - *2049*	***811 814***
2050 onwards	***0***

Council of Ministers

Years	Maximum Quantity in tonnes CO_2 equivalent
2024 – 2026	**42 874 410**
2027 – 2029	**21 665 691**
2030 – 2032	9 132 097
2033 – 2035	8 445 713
2036 – 2038	6 782 265
2039 – 2041	6 136 732
2042 – 2044	5 491 199
2045 – 2047	4 845 666
2048 onwards	4 200 133

The "trialogue" groups now line up with differences in the phase down scenarios

Conclusion: be prepared for rapid change

- Refrigeration needs will continue to grow and so will environmental problems
- Developed countries must already reduce the use of high GWP refrigerants. Alternative refrigerants with GWP ≥ 750 can only be transitory. The trend is to promote natural refrigerants as much as possible in most applications for new equipment.
- Developing countries start elaborating strategies to phase down HFCs. Even if low GWP HFCs and HFOs are being promoted in certain applications, hydrocarbons, CO_2, ammonia are likely to be primarily proposed.
- Safety issues and training are becoming increasingly important

Research needs :

- Among current technical improvements of systems, the most important shall be energy efficiency, safety and costs.
- Efforts must be concentrated on natural refrigerants: they are the future. On the contrary, synthetic refrigerants offer few possibilities (cf NIST study).
- The integration of the systems is key: integration in district heating, in district cooling, in the grid. Smart systems shall be developed to switch from an energy source to another, with energy costs in mind.
- General systems to reduce energy needs at the scale of a building, a factory, a district, are necessary.
- Reducing the carbon content of components will be a future challenge.

Finally

- Recruiting more young technicians, engineers and researchers, including women is a challenge: working on a more sustainable development must be a promotion argument.
- The IIR can help through its publications, conferences, working groups, databases, courses, projects in both developed and developing countries (Enough…)
- IIR Congress in Paris, 21-25 August 2023: Work in progress-innovation papers: deadline May 30; early bird registration, deadline June 1.
- Become an IIR member.

www.icr2023.org

26E CONGRÈS INTERNATIONAL DU FROID

26TH INTERNATIONAL CONGRESS OF REFRIGERATION

Pour un froid efficace, sobre et intelligent
Towards efficient, controlled and smart refrigeration

DU 21 AU 25 AOÛT 2023
21ST - 25TH AUGUST 2023

PALAIS DES CONGRÈS DE PARIS
PARIS CONGRESS CENTER
FRANCE

un événement de l'IIF / an IIR event

co-organisé par l'Association Française du Froid /co-organized by the French Association of Refrigeration

Key Dates
Dates clés

CALENDRIER SCIENTIFIQUE

- "WORK IN PROGRESS" & "INNOVATIONS" SUBMISSION : **26th October 2022 to 30th May 2023**
- NOTIFICATIONS OF "WORK IN PROGRESS" & "INNOVATIONS" ACCEPTANCE: **15th June 2023**
- SOUMISSION DES "TRAVAUX EN COURS" & "INNOVATIONS" : **26 octobre 2022 au 30 mai 2023**
- NOTIFICATIONS AUX AUTEURS DES "TRAVAUX EN COURS" & "INNOVATIONS" : **15 juin 2023**

REGISTRATION CALENDAR

- EARLY BIRD DEADLINE: **1st June 2023**
- STANDARD FEE : **from 2nd June to 20th August 2023**
- ONSITE FEE : **from 21st August 2023**
- TARIF PREFERENTIEL : **jusqu'au 1er juin 2023**
- TARIF STANDARD : **du 2 juin au 20 août 2023**
- TARIF SUR PLACE : **à partir du 21 août 2023**

Thank you!