

**INSTITUT INTERNATIONAL
DU FROID**

Organisation intergouvernementale
pour le développement du froid



**INTERNATIONAL INSTITUTE
OF REFRIGERATION**

Intergovernmental organization
for the development of refrigeration

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First Meeting of IIR Working Party *on Life Cycle Climate Performance Evaluation*

Yunho Hwang, Ph.D.

Chair of LCCP WP

Vice President of Commission B1

IIR Working Party: Life Cycle Climate Performance Evaluation

Agenda

Time	Topic	Organizer/Presenter
8:00 – 8:10 am	LCCP WP Overview	Yunho Hwang
8:10 – 8:30 am	Global Warming Impact of Low GWP Chiller Refrigerants	Konstantinos Kontomaris, DuPont
8:30 – 8:50 am	Discussion on Evaluating the Environmental Impact of Mechanical Refrigeration System for Cooling and Heating	Xiuping Zhang, Hefei General Machinery Research Institute
8:50 – 9:10 am	Overview of Recent LCCP Efforts	Vikrant Aute, Univ. of Maryland
9:10 – 9:30 am	Life Cycle Analysis Of Systems – Sampling Of Emerson Experience	Bachir Bella, Eric Winandy, Emerson
9:30 – 9:50 am	Life Cycle Assessment of Air-Conditioning and Heat Pumps, Manufacturer's Experience	Martin Dieryckx, Daikin Europe
9:50 – 10:10 am	LCA and Carbon Footprint of Refrigeration Systems	Dan Merry Bibalou, London South Bank University
10:10 – 10:30 am	Eco-Efficiency Concept in Commercial Refrigeration	Achaichia, Abdennacer, Honeywell.com
10:30 – 10:45 am	Break	
10:45 – Noon	Discussion 1 - Membership Discussion 2 - Scope Discussion 3 - Approach Discussion 4 - Deliverables Discussion 5 - Meeting Schedule	Yunho Hwang
Noon	Adjourn	Yunho Hwang

- Meeting location: Robert Hooke Room, Faculty of Mechanical, Maritime, and Materials Engineering, Mekelweg 2.



Background

- There are many metrics to evaluate environmental effects of working fluids

- TEWI (Total Equivalent Warming Impact):

$$\text{TEWI} = \text{GWP (direct)} + \text{GWP (indirect)}$$

- Due to refrigerant leaks
- Due to A/C operation

- LCCP (Life Cycle Climate Performance) :

$$\text{LCCP} = \text{TEWI}$$

- + *GWP (Indirect)* [energy consumption expressed as CO₂-eq emissions from chemical production & transport, manufacturing components & vehicle assembly and end-of-life]
- + *GWP (direct)* [chemical refrigerant emissions including atmospheric reaction products, manufacturing leakage, and end-of-life]

• Source: Green-MAC-LCCP, Stella Papasavva and Stephen O. Andersen, 2008



Background

- Tools available

- GREEN MAC LCCP (2004) – Excel based

GREEN-MAC-LCCP[©]

The Metric for MAC Environmental Superiority

- AHRTI Residential HP LCCP (2011) – Excel based

	Instructions	Energy_Cal	Refrigerants	Perf_Data_Input	HP_Manu_Simpl	HP_Manu_Detail
	EOL (simple)	EOL(detailed)	Leakage	Power_Gen_CO2	Climate Data	Run Model
Data Set / Runs	1	2	3	4	5	
Refrigerant	R-134a	R-410A	R-410A	R-410A	R-410A	R-410A
Location	St Louis	Washington, DC	Seattle			
Heating Region	Ill					
Power Generation Division	Pacific Noncontiguous					
System_Type	Single stage	Single stage	Two stage			
System_Matl	HP_Equip_Simple	HP_Equip_Deailed	HP_Equip_Simple			
EOL	EOL(simple)	EOL(detailed)				

- ORNL Supermarket Refrigeration LCCP (2012) – Web based

Life Cycle Climate Performance - Supermarket Systems V0.24



Scope

- **LCCP working party (WP) is**
 - **to assess the merits of different methods for evaluating the environmental impact of refrigerants**
 - **to produce implementation protocols for these methods, for use by decision makers and refrigeration stakeholders.**
 - **and to improve the LCCP**



Objectives

- **To collect information on direct and indirect emissions of working fluids** for various applications from individual countries and from the current IIR's WP on Mitigation of Direct Emissions of GHGs
- To initiate within IIR member states the **formation of similar Working Party-Groups** to cooperate with the IIR Working Party
- **To establish the LCCP evaluation methodology** applicable for refrigeration and air conditioning systems
- **To evaluate how different assumptions** selected by a user of these methodologies can affect the result of the assessment.



Objectives

- **To evaluate how improvement options can affect the result of the assessment.**
- **To assemble such information and to disseminate it amongst WP members and all IIR member states**
- **To write a booklet on the LCCP evaluation methodology developed available to members of the Working Party and all IIR members and to be available to non-members via Fridoc**
- **To support and promote international collaboration and initiatives to improve the LCCP of the refrigeration and air conditioning systems**
- **To represent the IIR at events dealing with environmental impact evaluation**



Membership

- **Membership of the Working Party should be multi-national and open to private members or representatives of corporate members of the IIR.**
- **The IIR is currently recruiting members from following areas for this WP:**
 - **Commission, private, and corporate members of the IIR**
 - **Experts whose knowledge of the subject will benefit the WP**



Deliverables

- **As an outcome of the effort, the WP will deliver the followings to the IIR:**
- **Consolidated listings and references for relevant information on direct and indirect refrigerant emissions**
- **One statement, position paper and/or Informatory Note**
- **Booklet on the LCCP evaluation methodology**
- **A workshop with the publication of the proceedings in CD-ROM form**
- **Periodically updated web page on the IIR site**



Timescale

- **Project started: January 2012**
- **Entire WP efforts: 4 years**
- **First WP meeting: Delft, June 2012, during the 10th IIR-Gustav Lorentzen Conference on Natural Working Fluids (GL2012)**
- **The Working Party shall hold at least one meeting per year.**
- **Minutes shall be taken at each meeting and posted on the IIR web page of the Working Party.**

Phase	Prep. phase	Working phase		
Year	2012	2013	2014	2015
Meeting	1	1	1	1



Progress in Last Nine Months

- **Formation of New Working Party (WP) on LCCP**
 - On September 21, 2011, the terms of reference for LCCP WP was prepared and submitted to IIR STC members.
 - On October 13, 2011, the LCCP WP was approved by the STC members.
 - On November 18, 2011, the revised version of the terms of reference for LCCP WP was finally by the IIR STC members.
- **Official WP Kick off: January 2012**
- **Announce of New WP and Member Invitation**
 - On January 11, 2012, new WP on the LCCP was announced and member invitation was sent out to IIR members.
 - Similar advertisement was made during the ASHRAE Winter Meeting held in Chicago, IL, US on January 22, 2012
 - IIR headquarter introduced this new WP in the IIR's Newsletter No. 49 in January 2012 version.



Progress in Last Nine Months



New IIR Working Party on LCCP evaluation

■ Since the global-warming contribution of refrigeration equipment (including air conditioning) is above all due to indirect emissions, the climate performance of a refrigeration system during its life cycle is an area of concern. Moreover, correct evaluation of this impact is a key factor in determining the true impacts of working fluids for specific applications and geographic locations, and will assist in determining next-generation working fluids for refrigeration and air-conditioning systems.

The IIR therefore decided to set up a working party (WP) to assess the merits of different methods of evaluating the Life Cycle Climate Performance (LCCP) of refrigeration systems and to produce implementation protocols for these methods, for use by decision-makers and refrigeration stakeholders.

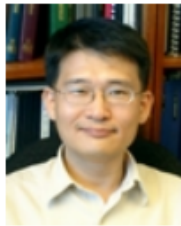


Progress in Last Nine Months

- **First meeting in Delft**
 - The first meeting is planned on June 28, 2012 in Delft.
- **A new web site of the working party**
 - A new web site of the working party is being prepared.
 - Basic information of the working party can be obtained from this web site.

http://www.iifiir.org/medias/medias.aspx?INSTANCE=EXPLOITATION&PORTAL_ID=portal_model_instance_WP_LCCP_Evaluation.xml

Working Party on LCCP Evaluation



Welcome to the Working party Web page

Since the main part of the global warming contribution from refrigeration equipment (including air conditioning) is due to indirect emissions, the climate performance of refrigerating system during its life cycle is an area of concern. Moreover, its proper evaluation is a key factor in determining the true impacts of working fluids for specific application and geographic location, and will assist in determining next generation working fluids for refrigeration and air-conditioning systems.

The IIR has therefore decided to set up a working party (WP) to assess the merits of different methods for evaluating the **Life Cycle Climate Performance (LCCP)** for refrigerating systems environmental impact of refrigerants and to produce implementation protocols for these methods, for use by decision makers and refrigeration stakeholders. **Yunho Hwang**, Vice-President of IIR Commission B1, is the chairman of this new WP, which started from January 2012, after approbation of the Science and Technology Council of the IIR.

