



IIR Working Party

Life Cycle Climate Performance Evaluation

Meeting Minute

Second Meeting at NIST, Gaithursgurg, U.S. on October 31, 2012

1. LCCP WP Overview by Yunho Hwang

- Yunho gave overview of LCCP WP Timescale, Plan, Deliverables, WP Website

2. Presentations:

2.1 Dr. Vikrant Aute – LCCP Model

- Replace System Model with "Power Consumption", and make system model, performance maps
- Standard data a part of it.

2.2 AHRI & PacCalc LCCP Models

- On behalf of Ming Zhang and Morten Juel Skovrup, Yunho introduced AHRI and PacCalc LCCP models.
- Dorin, Bock and Bitzer for compressor data
- ISO 9309 standard for compressor polynomials
- PacCalc model - freely available desktop version

3. Discussions on Emission Factors

3.1 Questions:

- Do we need LCCP?
 - > Omar - Presidential mandate to reduce GHG by 80% by 2050.
 - > Piao - In Japan, home appliance TEWI was carried out for last 2 yrs, if new model has lower TEWI than previous, government gives money/incentive to customer. Now people buy 2 TVs, thereby increasing the energy consumption. What if the customer does not switch on the AC? Then there is no indirect emission at all and then direct emission becomes more important.
 - > LCCP should be used for reducing environmental effects such as design for lowest LCCP - green advertisement.
- How to improve accuracy, quantify contribution of various factors
- How to harmonize the LCCP methodology
- Do we need different versions? - Academic vs. Industry (i.e., public version, easy to use)
 - > Domanski - Cannot ignore the low values. Need to keep this.
- How many LCCP models do exist?
 - > JCI, Daikin, AHRI, Honeywell - Have internal LCCP/TEWI calculation engines.



3.2 Review of Emission Factors

System Types:

- Omar - A/C HP needs to be split into residential and commercial
- Omar - System type, use Integrated Systems need to be added as a system type

System Lifetime:

- Building Energy Databook (2011) has Residential and Commercial equipment lifetime.
- EU- F Gas Regulation also has system life time.
- Japanese System - Residential 13 years, Commercial - 15 years life time.
- Leakage during reconfiguration of a supermarket systems is of concern (weekend moves) in Japan.
- How to choose system lifetime? Qualify the LCCP with number of years. Or levelized values (divide by number of years)
- System lifetime can be chosen/selected after a sensitivity analysis

Refrigerant:

- Any fluid is acceptable as long as it is REFPROP or ISO Property Standard Compliant in terms of fluid property accuracy

GWP Values:

- GWP values are from UNEP 2010 Report. This data could be used.
- GWP of mixtures could be calculated using mass weighted average approach until more accurate value becomes available.
- For new pure fluids - it could be trial and error and refined later.
- ** Include GWP values in the Sensitivity analysis
- Is Fugitive/Decomposition included in the above GWP values? ORNL-LCCP has place holder for this value.
- Need to make sure that fugitive and embodied emissions are not counted twice.
- Samuel will investigate the accuracy of GWP and if fugitive emissions are included.

Weather Data:

- Country specific data sets should be used.
- Need to find out for regional database.
- Piao will find out the one from Japan.
- YH will ask Martin or Carlos for EU.

Utility Emission Rates:

- Discussion on difference in using annual averages vs. hourly data
- Same emission data should be used for LCCP comparison
- What if energy storage is used?
- What are the best sources for emission data?
- Those who have hourly data can use it, others can use a recommended value



177, boulevard Maiesherbes, F-75017 PARIS, France

Tél. 33-(0)1 42 27 32 35 – Fax 33-(0)1 47 63 17 98 – E-mail: iifiir@iifiir.org – Web: www.iifiir.org

Load Profile:

- Which standard should be used?
- Again, standards are available for some systems but not all systems.
- Need to look at standards from US (AHRI), EU and China
- Sateesh will look for standards from the above.
- Look into energy standards (90.1 etc.)

Regular Direct Emissions:

- Source is 2006 IPCC guidelines for National GHG Inventories
- EPA Vintage Model provides refrigerant leaks
- Need more/better sources for emission data
- European reference is Clodic and Barrault, 1990 - 2010 Refrigerants Inventories in EU, 2011.
- Fugitive Emissions - Johnson C., Earth Tech. Forum US EPA 2004

Indirect Emissions:

- Piao - Japan has energy efficiency standard and several LCCP works were published in EarthTech Forum in 2004.
- Energy Required to Make components are from Earth Tech forum, US EPA 2004, Johnson.
- Use these as the default values in ORNL-LCCP.
- Same source for energy used in transport.
- Weckert Thesis (2008) provides data for energy consumed in manufacturing 1 kg of refrigerant
- Energy needed for end-of-life emission calculation is similar.

4. Next Meetings

Our next meeting is suggested in conjunction with *Thermophysical Properties and Transfer Processes of Refrigerants*, Delft, the Netherlands, June, 17th -19th, 2013.

Contacts for Membership in this WP

Yunho Hwang, Chairman of the WP, Vice President of Commission B1
4164E Glenn Martin Hall Bldg., Dept. of Mechanical Engineering
University of Maryland, College Park, Md 20742, USA
Tel.: +1-301-405-5247 – Fax: +1-301-405-2025, E-mail: yhhwang@umd.edu

Contact for Membership in IIR

Jean-Luc Dupont, Head of the Scientific and Technical Information Department
International Institute of Refrigeration
E-mail: jl.dupont@iifiir.org

Didier Coulomb, Director of the IIR
International Institute of Refrigeration (IIR)
177, boulevard Maiesherbes, 75017 Paris, France
Tel.: +33 1 4227 3235 - Fax: +33 1 4763 1798, E-mail: iif-iir@iifiir.org