清華大學
Tsinghua University

Brief on acquirement of fundamental data of LCCP calculation in China

Baolong Wang
Tsinghua University
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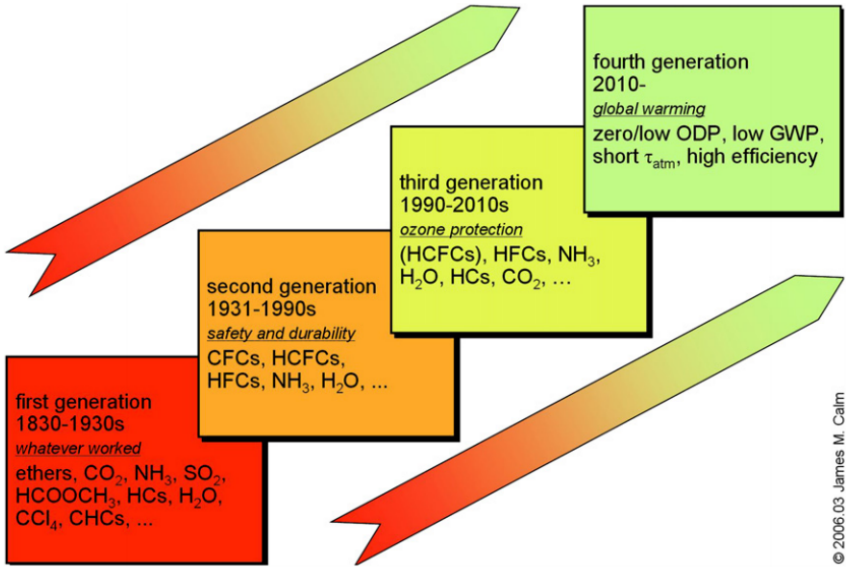
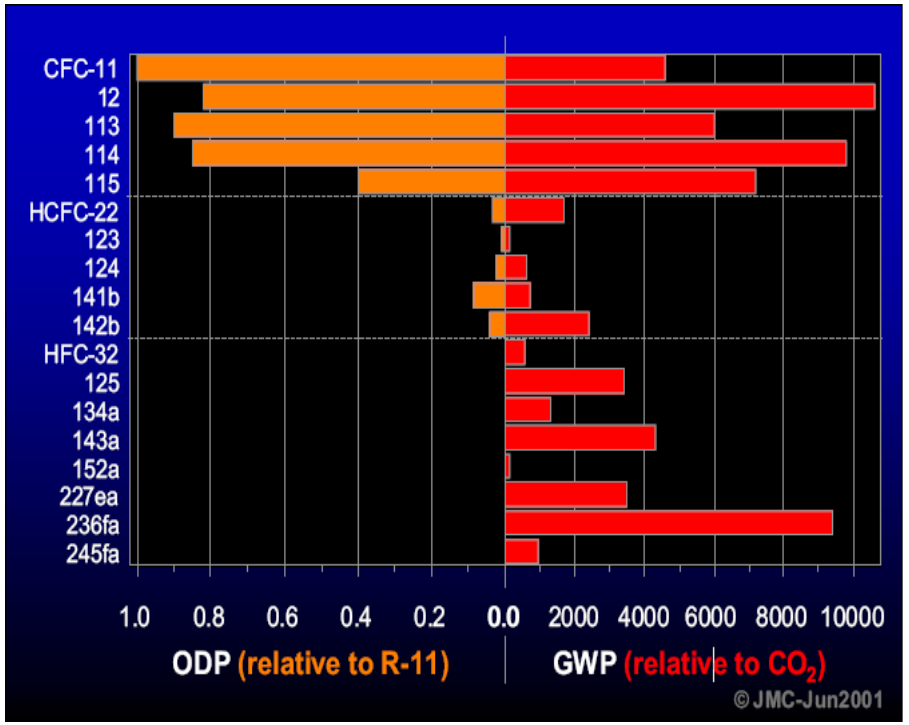
Background: from ODP to GWP





Besides SAFETY and EFFICIENCY, the global warming impact becomes the biggest challenge after the phase-out of the HCFCs.

Background: from GWP to LCCP

- **GWP（global warming potential）**
  - Relative to CO_2
  - Easy to evaluate
  - Just direct emission
- **TEWI（total equivalent warming impact）**
  - Direct emission + Indirect emission
  - Just indirect emission during use
  - Complicated to calculate
- **LCCP（life cycle climate performance）**
  - Direct emission + Indirect emission
  - From cradle to grave
  - More complicated to calculate

LCCP Definition

$$LCCP = N \times E_{ann} \times \beta + E + \left[GWP \times \left(L \times N + m(1 - \alpha_{rec})\right)\right] + F$$

m---refrigerant inventory, [kg]

α_{rec}---percentage of final recovery

L---annual leakage, [kg/a]

N---operating years, [years]

E_{ann}---annual energy consumption, [kWh/a]

β---utility emission rate, [kgCO2/kW.h]

E---indirection emission during making and transport

F---direction emission during making and transport

What information needed for LCCP

Main Category	Sub Category
1. System information	1.1 Application
	1.2 System Type
	1.3 System Lifetime
	1.4 Refrigerant and Charge
	1.5 GWP (100 Yrs horizon)
2. Geographic information	2.1 Location (City, Country)
	2.2 Weather Data
	2.3 Utility Emission Rate
	2.4 Load Profile
3. Direct Emission	3.1 Regular Emissions
	3.2 Irregular Emissions
	3.3 Service Emission
	3.4 End-of-Life Emission
	3.5 Leakage during Production & Transport (Fugitive)
	3.6 Decomposition
4. Indirect Emission	4.1 Energy Consumption of the System
	4.2 Energy to Make Components/System (Aluminum/Copper/Steel/Brass/Plastics)
	4.3 Energy to Produce & Transport Refrigerant (Embodied)
	4.4 Energy to Produce & Transport Components/System
	4.5 Energy for End-of-Life, Recycling/Recovery of System (metals/plastics) and Refrigerant

How to get the information

➢ Articles

- Journals, Theses
- Books, Reports

➢ Standards

- Refrigeration, air conditioner, VRF, etc

➢ Year books

- China Electric Power Yearbook
- China Energy Statistics Yearbook
- China Statistical Yearbook

➢ Organizations

- Chinese Association of Refrigeration (CAR)
- Chinese Refrigeration and Air conditioning industry Association (CRAA)
- China Household Electrical Appliance Research Institute (CHEARI)
- China National Institute of Standardization (CNIS)

Findings: System Information

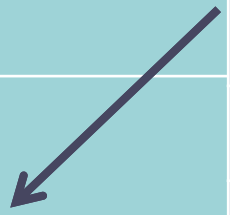
Section No.	Details
1.1 Applications	
1.2 System Types	
1.3 System Lifetime	
1.4 Refrigerants	
1.5 GWP (100 Yrs.H)	
1.6 Charge	

Life Time (year)	
type	China
Residential air conditioners	10
Central air conditioner	15
Heat pumps	15

Carbon Emission of Residential Building[D]. Tianjing University, 2012.

Findings: Geographic Information

Section No.	Details	Reference
2.1 Location (City, Country)	Cities listed in weather database	
2.2 Climate Data	Weather Data: weather database	
2.3 Utility Emission Rate		
2.4 Load Profile		•Designer's Simulation Toolkit (DeST)



Utility Emission Rate (kg CO2/ kWh)	
Region	Value
North China	0.9914
Northeast China	1.1109
East China	0.8592
Central China	1.0871
Northeast China	0.9947
South China	0.9762

Findings: Direct Emission

Section No.	Details	Reference
3.1 Regular Emissions	Annual operating	
3.2 Irregular Emissions		
3.3 Service Emission	Installation Repair service	
3.4 End-of-Life Emission	Remaining Recovery	
3.5 Leakage during Production & Transport		
3.6 Decomposition		

Findings: Indirect Emission

Section No.	Details	Reference
4.1 Energy Consumption of the System		
4.2 Energy to Make Components/System		•Zhaojian Li. Study on the Life Cycle Consumption of Energy and Resouce of Air Conditoning in Urban Residential Building in China[D]. Tsinghua University, 2007
4.3 Energy to Produce & Transport Refrigerant		•China Statistical Yearbook 2008
4.4 Energy to Produce & Transport Components/System		•Zhaojian Li. Study on the Life Cycle Consumption of Energy and Resouce of Air Conditoning in Urban Residential Building in China[D]. Tsinghua University, 2007
4.5 Energy for End-of-Life, Recycling/Recovery of System and Refrigerant		•Zhaojian Li. Study on the Life Cycle Consumption of Energy and Resouce of Air Conditoning in Urban Residential Building in China[D]. Tsinghua University, 2007

Difficulties in data collecting

- Various products and manufactures
- Unwillingness of manufactures to publish the fundamental data
- No data sharing platform for manufactures and institutes
- Few data provided by the official organizations

Further work

- Encourage the manufactures to participate in this project
- Data collecting organized by industry association
  - ✓ CRAA just starts a survey on the HCFC refrigerant use during maintenance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关于进行制冷空调维修企业使用 HCFC 情况调查的函

- Development of data sharing platform

Thanks! Questions?