



# ***EFCTC-EPEE: F-gases Workshop***

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## ***HFC ed efficienza energetica negli elettrodomestici***

### **Comments by Whirlpool:**

**The world's largest appliance manufacturer producer of both HFC and HC refrigerators.**



# *Factors for Refrigerant Selection*

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## ◆ Environmental

- Ozone Depletion Potential (ODP)
- Total Equivalent Warming Impact (TEWI)
- Life Cycle Climate Performance (LCCP)

## ◆ Financial

- Cost of materials for producing appliance
  - Much larger in scope than simply direct HFC/HC cost

## ◆ Others

- Cost preference of consumer & affordability
- Ability to comply with codes and regulations



# *The LCCP (Life Cycle Climate Performance) Concept*

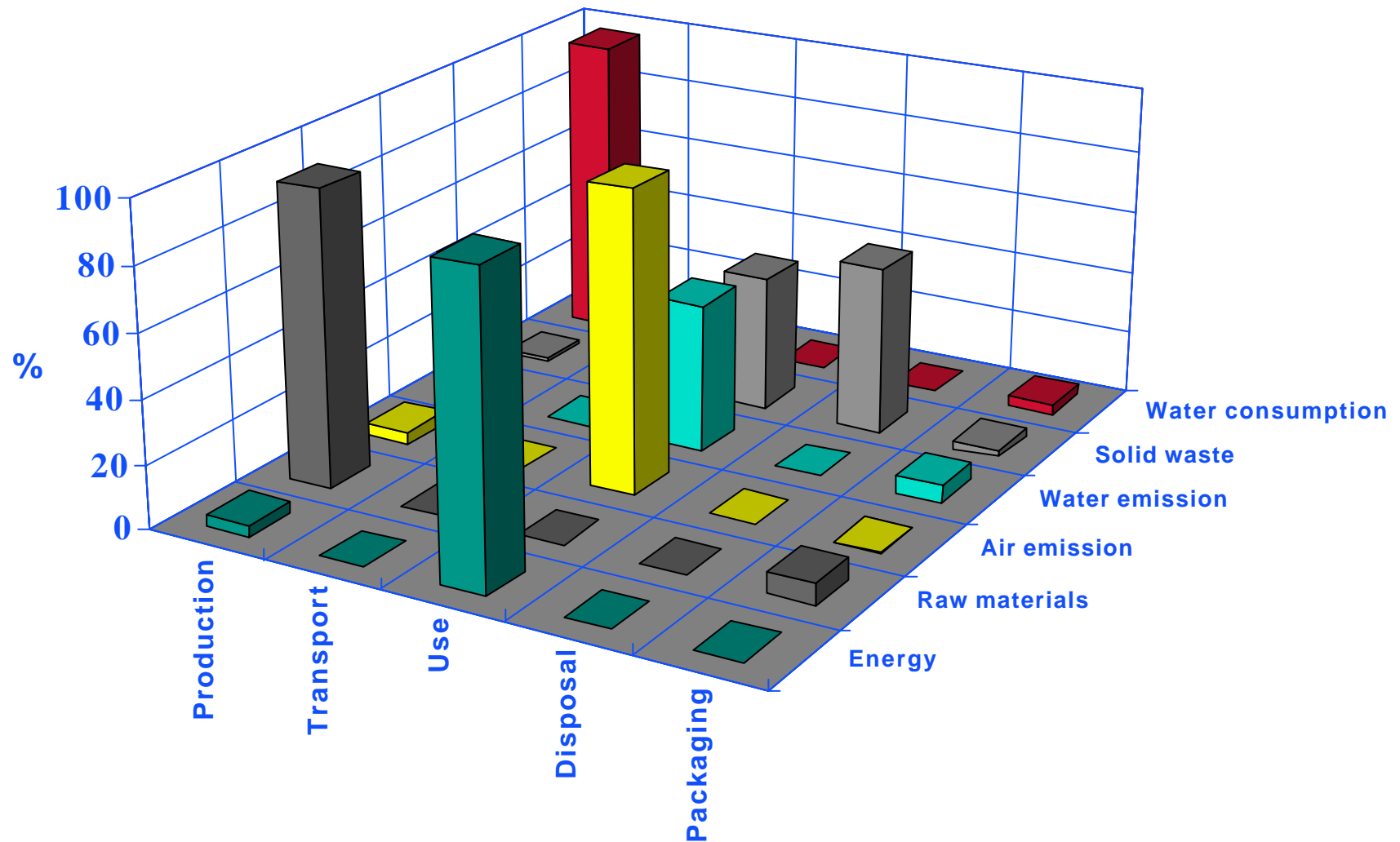
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- ◆ **CO<sub>2</sub> Equivalent Global Warming Impact over the Total Lifetime of the Appliance**
  - **Direct impact from refrigerant release to atmosphere**
    - significantly minimised by refrigerant recovery
  - **Indirect impact due to energy consumption in operation over life time and recycling process**
    - dependent on method used for energy generation
  
- ◆ **15+ Years of Lifetime Overrides Other Influences**
  - **not for hydro, nuclear, solar,... energy production unless peak energy is produced with fossil fuel**



# Life cycle

Percentage contribution of Life Cycle Stages to total environmental impact  
350lt four stars refrigerator (from ENEA/ANIE)





# HFCs vs HCs - Current Situation (cont'd)

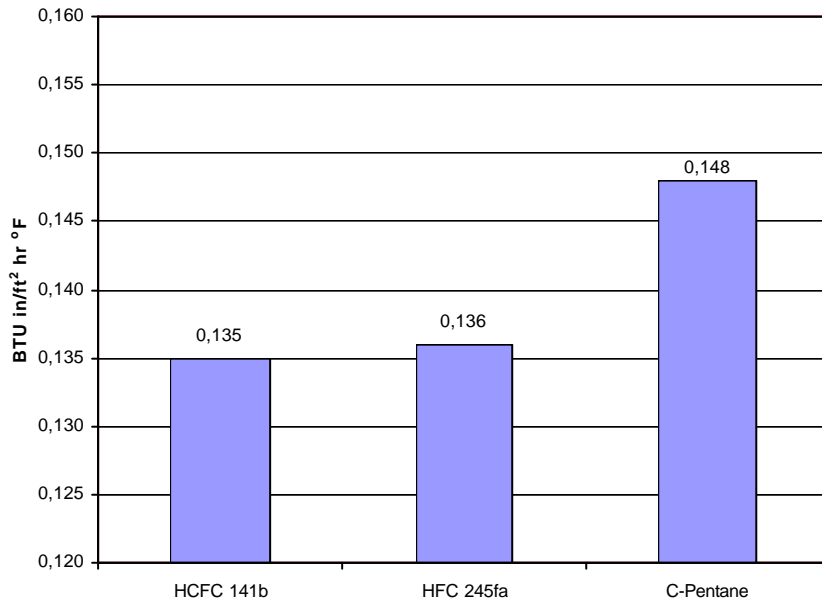


Figure 1

Cabinet Foam k-factor for Alternative Blowing Agents

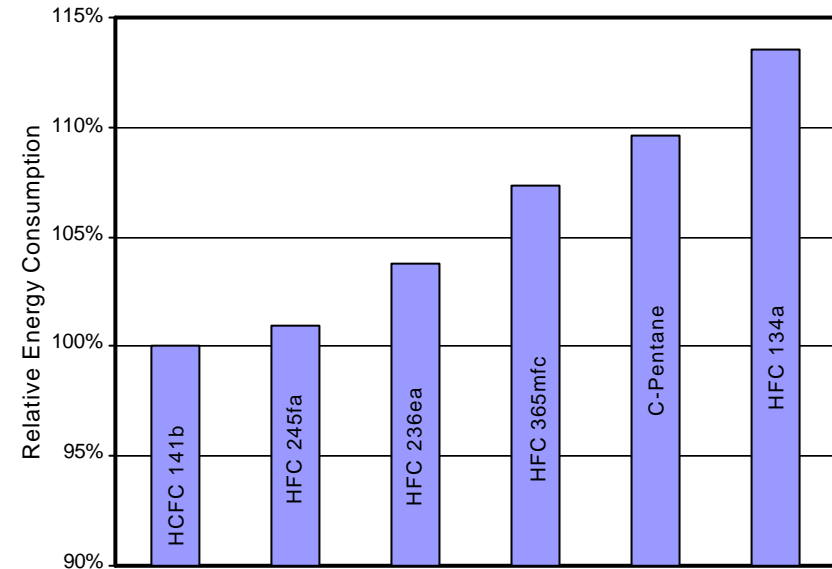


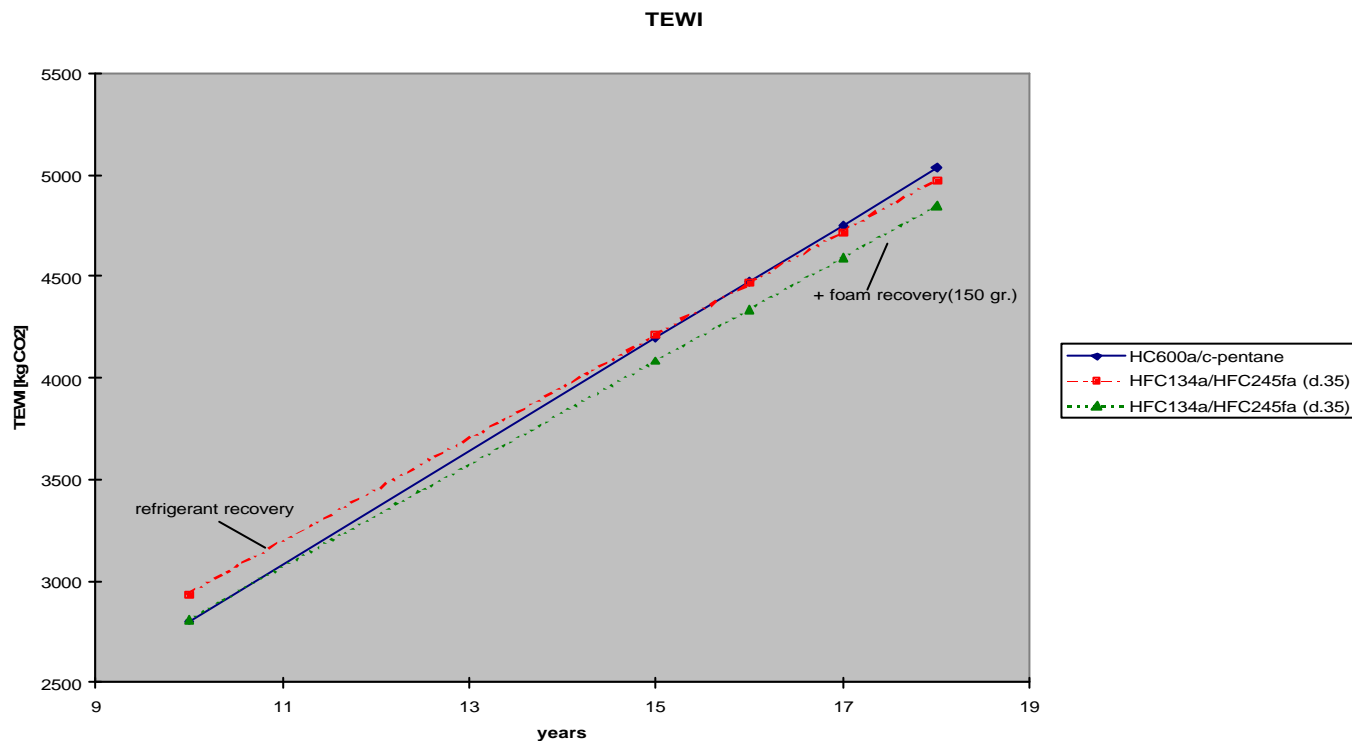
Figure 2

Relative Energy Usage with Alternative Blowing Agents

From a presentation at the "Earth and Technologies Forum, Sept '99 by  
AHAM, G.E., Maytag, Whirlpool



# HFCs vs HCs - TEWI (cont'd)





## ***HFCs vs HCs - TEWI (cont'd)***

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***Conclusion of the TEWI analysis:***

***assuming refrigerating circuit HC/HFC equal efficiency:***

- \* HFC as blowing agent has a 9 to 12% better insulation performance***
- \* Refrigerant HFC recovery alone show a better TEWI after 15 years operation (with a leak rate of 2 g/year)***
- \* Recovery of foam blowing agent show better TEWI (after 9 to 10 years operation, recovering 150 g. of the foamed 460 g., after 5 years operation with recovering quantity 350 g.)***
- \* Refrigerating appliance life time in Europe: over 13,5 years***



# ***EU Refrigerant Recovery***

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## ***Legislation Framework***

- \* EU Regulation 2037/2000, art 16:**

  - compulsory recovery of CFC/HCFC (in domestic refrigerators: refrigerant and foam blowing agent) from 1.1.2002**

- \* WEEE (Waste from Electrical and Electronic Equipment)  
Directive 96/02 EC - annex II**

  - compulsory recovery of gases that are ozone depleting or have a Global Warming Potential (GWP) above 15, contained in foam and refrigeration circuits (enforcement in 2005)**

# *Approach to zero HFC emission target*

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## ◆ Manufacturing

- Equipment to recover refrigerant installed on production lines in all European factories

## ◆ Appliance Use

- Leakage prevention assured by checking all cooling circuits by Helium leak detectors (set at  $\ll 2$  g/year sensitivity) before charging the refrigerant

## ◆ Service

- Refrigerant recovery device available to all Service engineers

## ◆ Disposal

- Partnership with certified recycling companies (e.g. Rethmann in Germany: Refrigerant amount reclaimed/appliance certified by TUV )



## European Manufacturers position

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**ceced**

**HFC's & Natural refrigerants:  
CECED is against banning or limiting the  
use of HFC's & Natural Refrigerants  
(HC, NH<sub>3</sub>, CO<sub>2</sub> in closed systems or  
rigid encapsulated insulation foams**