Enviroment and Climate Regional Accession Network ECRAN

ECRAN Regional Training Seminar on the Assessment of
GHG Inventories in the Energy and Industrial Processes Sectors
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Good practice in selecting emission factors and other parameters – Part 2 - Fluorinated Gases

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Content

- Important sub-categories
- Data sources used by neighbouring countries
- Approaches according to the IPCC Guidelines
- Three approaches to estimate emissions
- Time series – gap filling
- Suggestions for group work

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Important sub-categories

Share of main sub-categories in overall F-gas emissions

	Italy	Greece	Austria	Croatia
2F1 Commercial and industrial refrigeration	58%	53%	49%	26%
2F1 Stationary air conditioning	12%	30%	8%	4%
2F1 mobile air conditioning	13%	13%	16%	28%

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Data sources used for commercial refrigeration

- **Austria: Based on imports of gases (survey of main importers)**
- **Croatia: Based on data reported by companies to a registry**
- **Italy: Based on information from F-gas producer**
- **Greece: Based on statistical data**

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Data sources used for Stationary Air Conditioning

- **Austria: Based on number of units sold per year (market survey)**
- **Croatia: Based on data reported by companies to a registry**
- **Italy: Based on information from F-gas producer**
- **Greece: Based on number of units sold per year (market survey)**

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Data sources used for Mobile Air Conditioning

- **Austria: Based on number of registered new cars**
- **Croatia: Based on car import data**
- **Italy: Based on number of registered new cars**
- **Greece: Based on number of registered new cars**

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Other sub-categories for F-Gases

The following categories have relatively low emissions in most countries:

- **Domestic refrigeration (part of 2F1):** Refrigerators for households switched to gases like isobutane 15-20 years ago.
- **Foam blowing, fire extinguishers, aerosols (2F2-2F4):** low emissions compared to other sub-categories.
- **Solvents (2F5):** F-gases have not been used in most countries in recent years
- **Electronics industry (2F7/2E):** relevant in countries with semiconductor manufacture
- **Electrical equipment (2F8):** Small amounts. Note: SF6 (high GWP)

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Methods according to the 2006 IPCC Guidelines

TABLE 7.2
OVERVIEW OF DATA REQUIREMENTS FOR DIFFERENT TIERS AND APPROACHES

	Approach A (emission-factor approach)	Approach B (mass-balance approach)
Tier 2 (emission estimation at a disaggregated level)	• Data on chemical sales and usage pattern by sub-application [country-specific or globally/regionally derived] • Emission factors by sub-application [country-specific or default]	• Data on chemical sales by sub-application [country-specific or globally/regionally derived] • Data on historic and current equipment sales adjusted for import/export by sub-application [country-specific or globally/regionally derived]
Tier 1 (emission estimation at an aggregated level)	• Data on chemical sales by application [country-specific or globally/regionally derived] • Emission factors by application [country-specific or (composite) default]	• Data on chemical sales by application [country-specific or globally/regionally derived] • Data on historic and current equipment sales adjusted for import/export by application [country-specific or globally/regionally derived]

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Simple and more advanced approaches

- **(1) Use emissions from other countries and drivers**
  - **GDP, population, number of cars**
- **(2) Use emissions from stock only**
  - **Example: Croatia – various sub-categories under 2F**
- **(3) Use emissions from from manufacturing, stock and disposal**
  - **Example: Austria – mobile air conditioning**

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Approach 1: Using emissions and drivers

- **Assumption:** A country has the same types of air conditioning equipment and the same number of air conditioners per inhabitant as another country

  → **F-gas emissions are proportional to the population** driver

- **Assumption:** The extent of commercial refrigeration is proportional to GDP (gross domestic product) or TVA (total value added)

  → **F-gas emissions are proportional to GDP/TVA**

- **Assumption:** A country has the same car fleet and the same share of air conditioned cars as another country.

  → **F-gas emissions are proportional to the number of cars**

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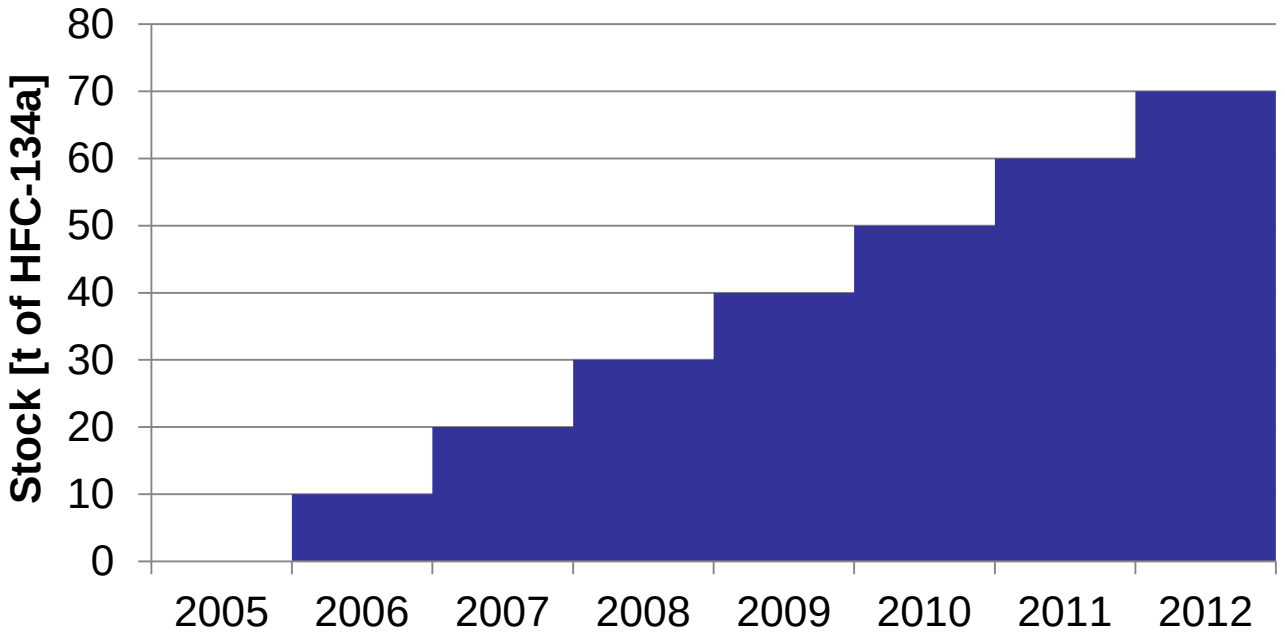
Approach 2: Using emissions from stocks

- **Example:**

Every year, 10 tonnes of HFC-134a are imported for use in room air conditioning.



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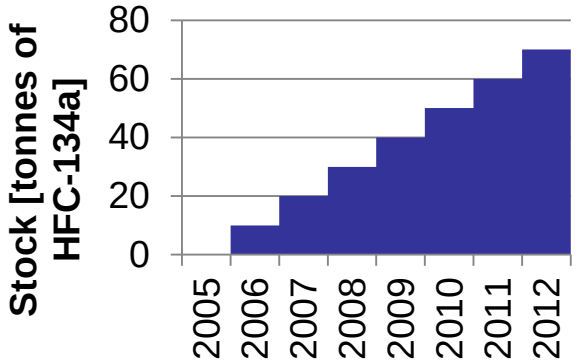
Using emissions from stocks

Applying the emission factor to the stock:

Example: Emission factor of 10 %

(for default emission factors, see next slide)



Emissions in 2006: 10 % of 10 t = 1 t

Remaining in the stock at the end of the year: 9 t

Emissions in 2007: 10 % of 19 t = 1.9 t

Remaining in the stock at the end of the year: 17.1 t

Etc.

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Default emission factors

TABLE 7.9
ESTIMATES[1] FOR CHARGE, LIFETIME AND EMISSION FACTORS FOR REFRIGERATION AND AIR-CONDITIONING SYSTEMS

Sub-application	Charge (kg)	Lifetimes (years)[2]	Emission Factors (% of initial charge/year)[3]		End-of-Life Emission (%)	
Factor in Equation	(M)	(d)	(k)	(x)	($\eta_{rec,d}$)	(p)
			Initial Emission	Operation Emission	Recovery Efficiency[4]	Initial Charge Remaining
Medium & Large Commercial Refrigeration	$50 \leq M \leq 2000$	$7 \leq d \leq 15$	$0.5 \leq k \leq 3$	$10 \leq x \leq 35$	$0 < \eta_{rec,d} < 70$	$50 < p < 100$
Residential and Commercial A/C, including Heat Pumps	$0.5 \leq M \leq 100$	$10 \leq d \leq 20$	$0.2 \leq k \leq 1$	$1 \leq x \leq 10$	$0 < \eta_{rec,d} < 80$	$0 < p < 80$
Mobile A/C	$0.5 \leq M \leq 1.5$	$9 \leq d \leq 16$	$0.2 \leq k \leq 0.5$	$10 \leq x \leq 20$[5]	$0 < \eta_{rec,d} < 50$	$0 < p < 50$

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Using emissions from stocks

Assumptions:

- There are no emissions from manufacture/filling.
  This is acceptable for filled-in products imported into the countries (e.g. domestic air conditioners, cars, …)
- There are no emissions from disposal. This is acceptable for the first few years after introduction of the gas in a certain category (depending on the lifetime).

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Using emissions from stocks – data in the CRF

Table 2(II).F for a certain year, a certain category and a certain gas:

Activity			Emission factor			Emissions		
Amount of fluid								
Filled into new manufactured products	In operating systems (average annual stocks)	Remaining in products at decommissioning	Product manu-facturing factor	Product life factor	Disposal loss factor	From manu-facturing	From stocks	From disposal
(t)			(% per annum)			(t)		
	10			10%			1	

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Approach 3: Using emissions from manufacturing, stock and disposal

Example for mobile air condition:

ACTIVITY DATA *Amount of fluid*			IMPLIED EMISSION FACTORS			EMISSIONS		
Filled into new manufactured products	In operating systems (average annual stocks)	Remaining in products at decommissioning	Product manu-facturing factor	Product life factor	Disposal loss factor	From manu-facturing	From stocks	From disposal
(t)			(% per annum)			(t)		
NO	10	1	NA	10%	30%	NO	1	0,3

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Approach 3: Using emissions from manufacturing, stock and disposal

Which data is needed?

Number of cars imported each year (or total number of cars)

Share of cars with air condition (e.g. the same as neighbouring country)

Average amount of fluid per car (approx. 0.6 kg)

Average lifetime of cars (e.g. 10 years)

Emission factors (e.g. default)

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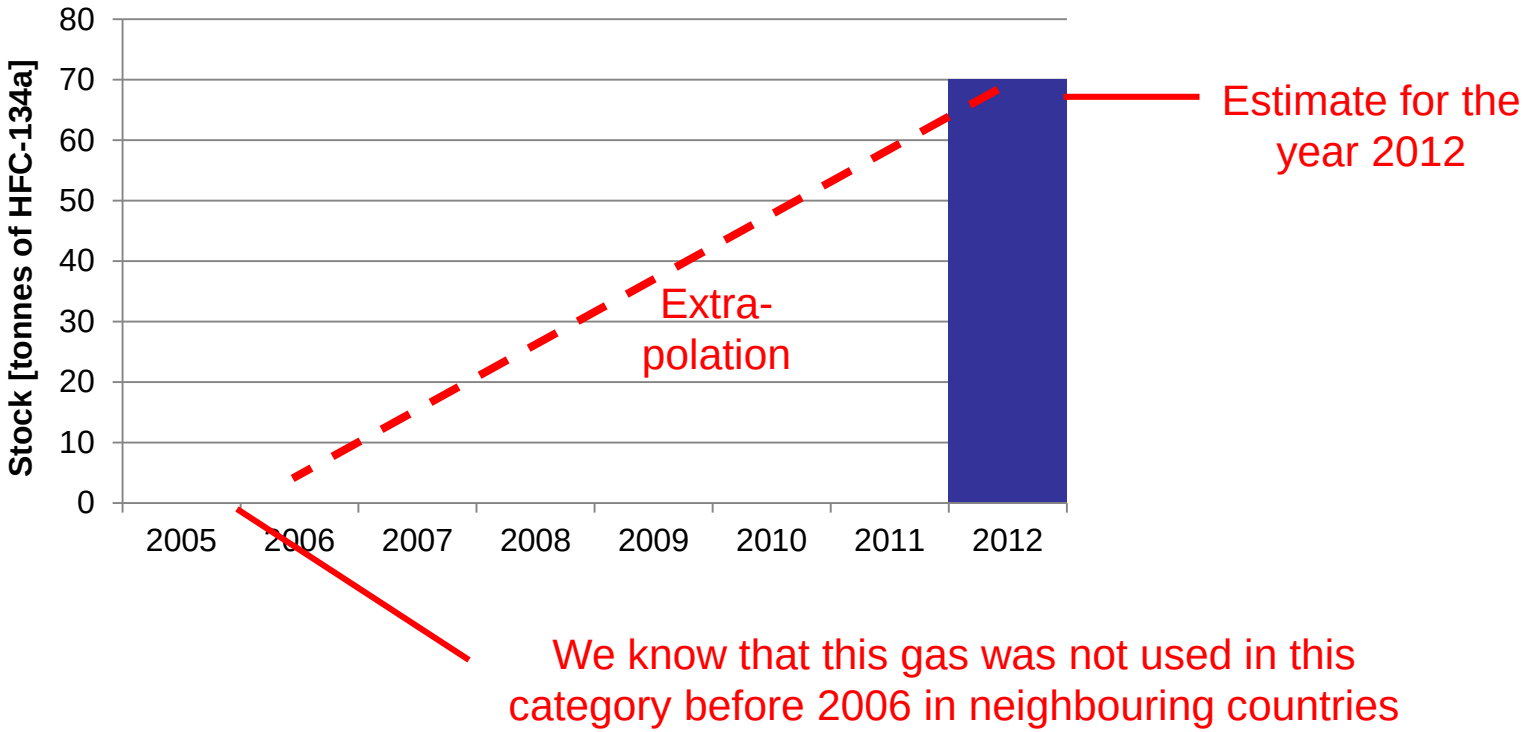
Time series – gap filling

Many F-gases were introduced at the same/similar time in several countries.



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Suggestions for group work

Approach 1: Using data from neighbouring countries

for refrigeration/air conditioning etc

Approach 2: Using information on stocks

for refrigeration/air conditioning etc

Approach 3: Using information on stocks and disposal

for mobile air conditioning

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