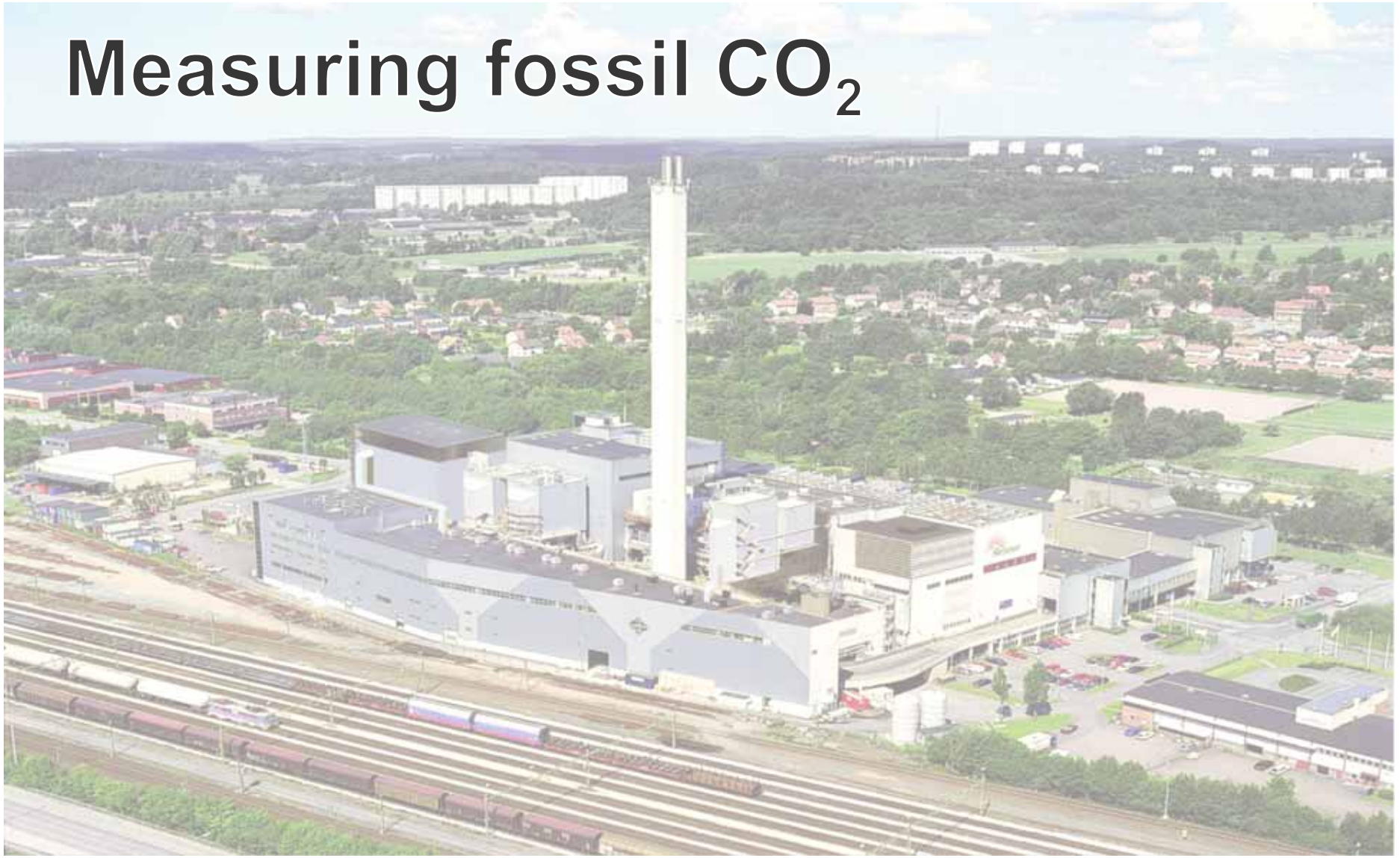
Measuring fossil CO_2

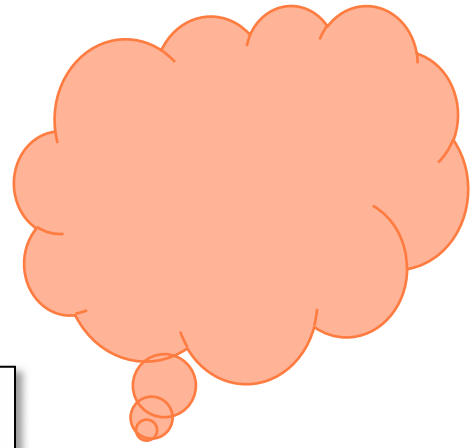


Swedish Experiences 2013

Lia Detterfelt, Process Engineer Renova

ETS

- Waste-to-Energy plants
  redefined as coincineration in Sweden



5.6.2009 EN Official Journal of the European Union L 140/63

DIRECTIVE 2009/29/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 23 April 2009

amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community

(Text with EEA relevance)

L 181/30 EN Official Journal of the European Union 12.7.2012

COMMISSION REGULATION (EU) No 601/2012

of 21 June 2012

on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council

(Text with EEA relevance)

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Monitoring regulations

Written for homogenous fuels, but in reality….

Standards
Not fully sufficient for waste

- **ASTM D6866**
  - Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis
  - American, New version in 2012

- **ISO 13833:2013**
  - Stationary source emissions -- Determination of the ratio of biomass (biogenic) and fossil-derived carbon dioxide -- Radiocarbon sampling and determination
  - Working document SO/DIS 13833

- **SS-EN 15440:2011**
  - Solid recovered fuels - Methods for the determination of biomass content
  - Working document SIS-CEN/TS 15747:2008

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Literature values

To be used by Category A installations:

< 50 000 tonnes CO_2 per year

Published by EPA (Naturvårdsverket) according to article 31.1 c i Commission regulation (EU) 601/2012 Date of publishing Nov 8, 2012		
	Household waste	Industrial waste
Biomass fraction	0,69	0,62
Fossil fraction	0,31	0,38
Heating value as delivered (TJ/Gg) = (GJ/ton)	9,64	11,7
Preliminary emission factor (ton total CO2/TJ fuel)	98,3	96,2
Emission factor (ton fossil CO2/TJ fuel)	30,2	36,8

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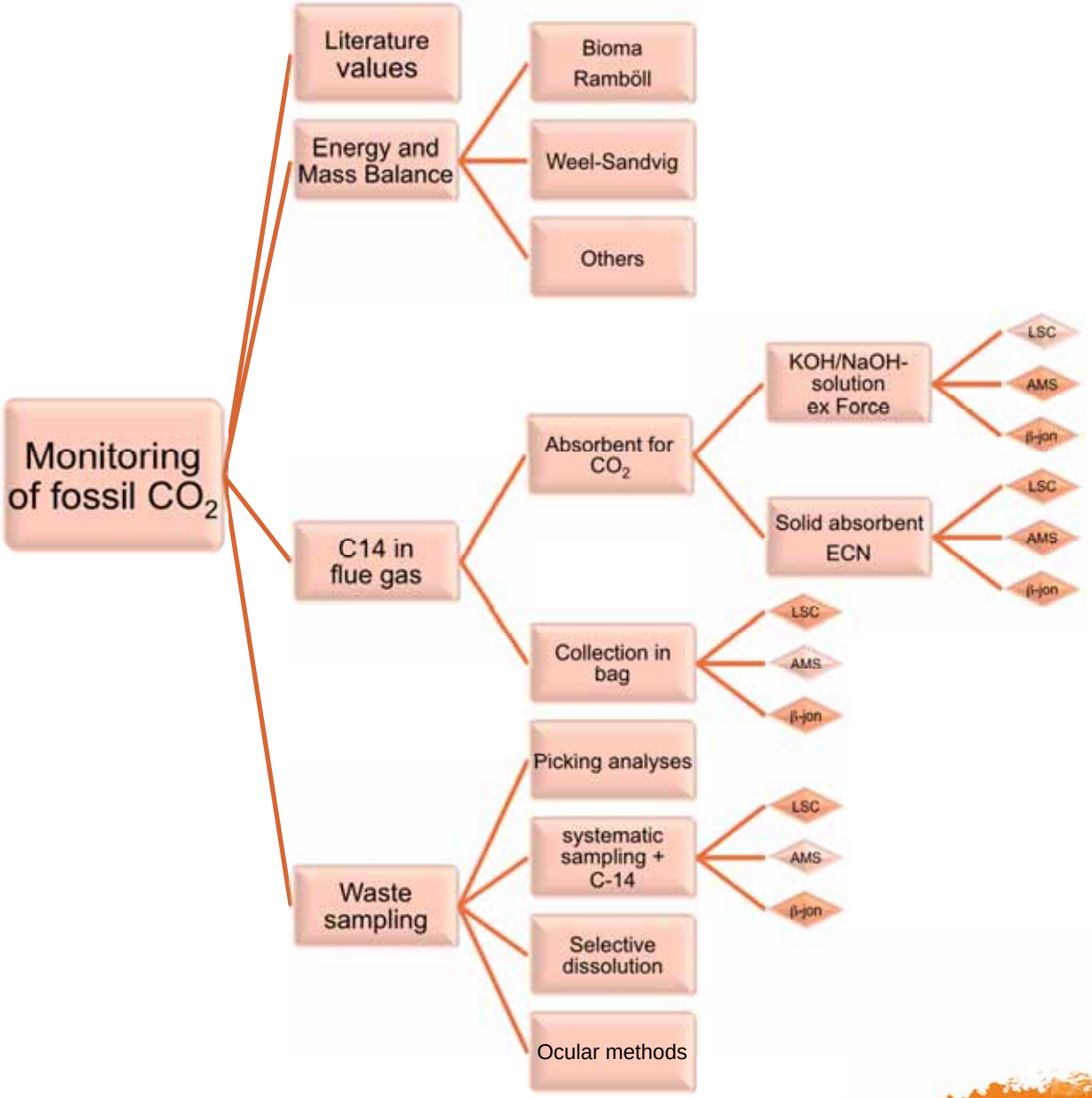
Monitoring of fossil CO_2



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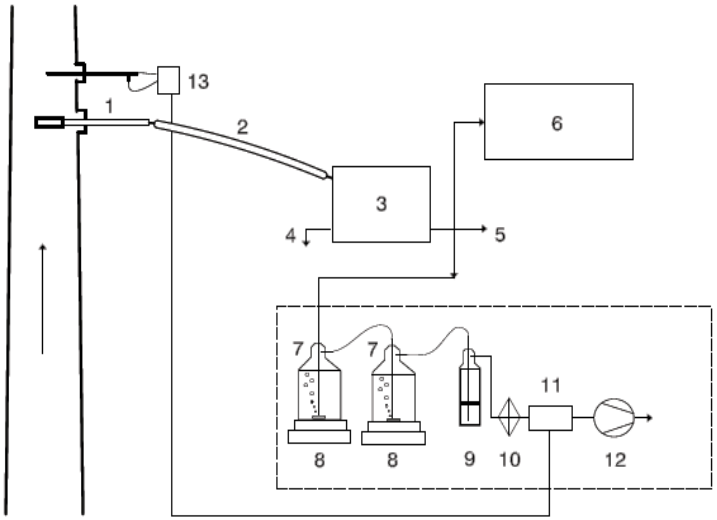
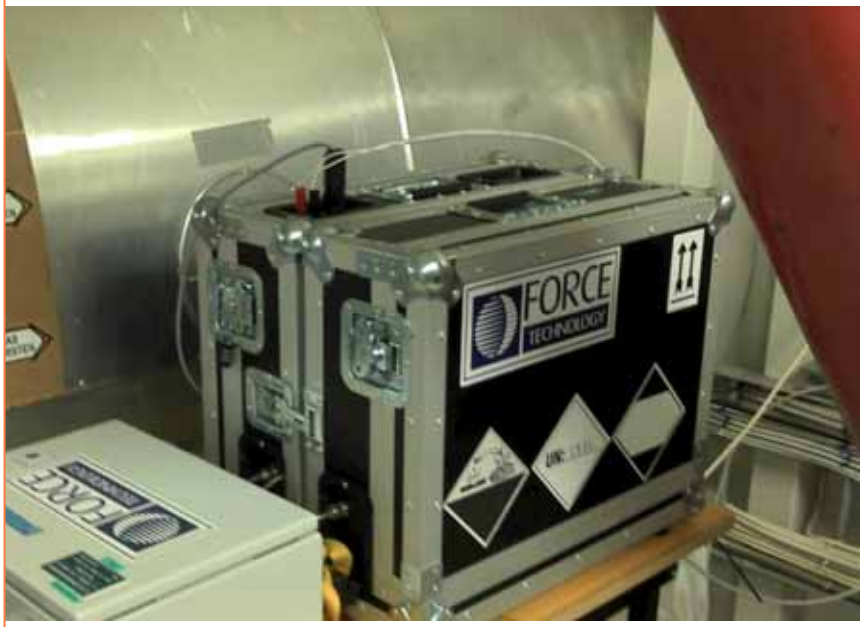
Force absorption in KOH-solution



1. Stack gas probe with filter for removal of particles.
2. Heated sample line.
3. Conditioning unit, reducing the water dew point to 4 °C. Contains a pump that ensures excess flow.
4. Condensed water outlet.
5. Excess sample air.
6. CO_2 analyzer with internal pump.
7. Absorption flask containing 4 M KOH.
8. Magnetic stirrer.
9. Drying unit containing silicagel.
10. Particle filter.
11. Mass flow controller, regulating the sample flow proportionally to velocity of stack gas as the measured by (13).
12. Pump unit.
13. S-pitot tube and differential pressure meter, measuring the stack gas velocity.



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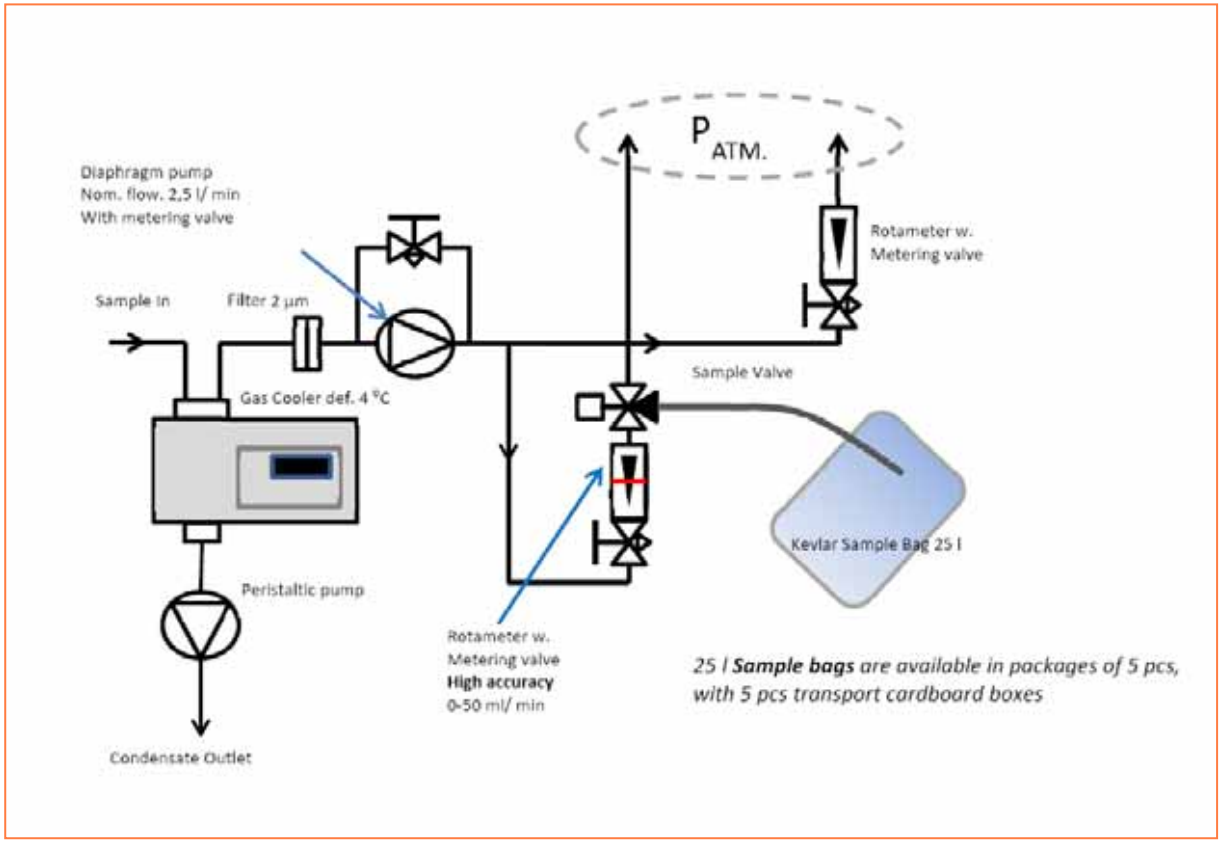
Metlab absorption in NaOH-solution

Alfacomp Collection in Bag



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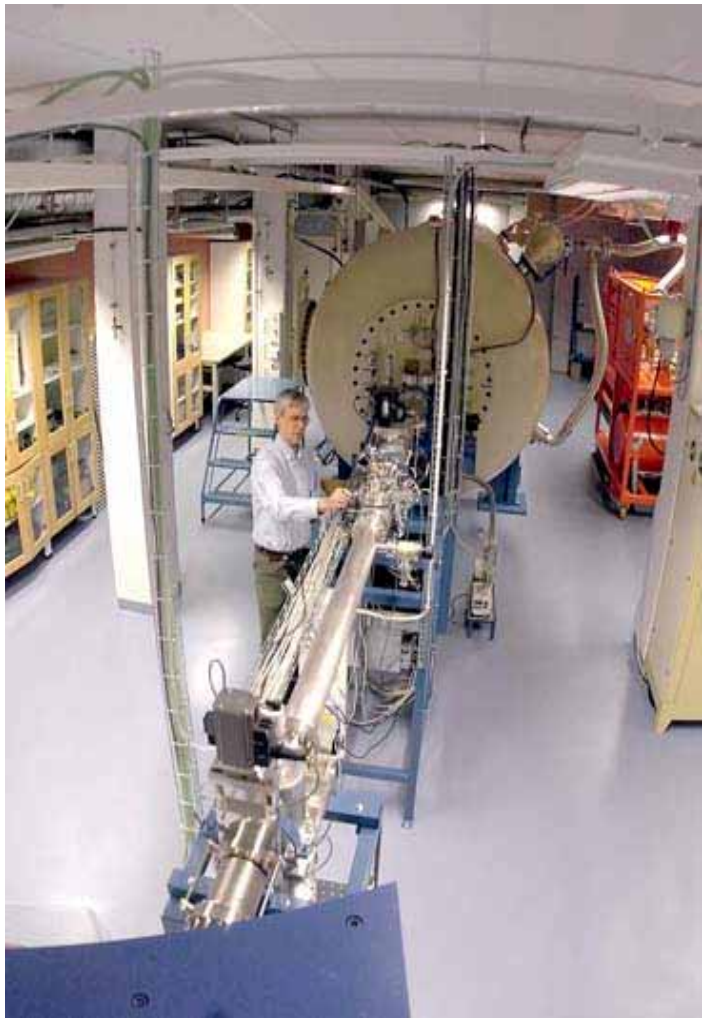
Waste sampling

AMS - Accelerator Mass Spectrometry_



(Source:Tandemlaboratoriet, Uppsala)

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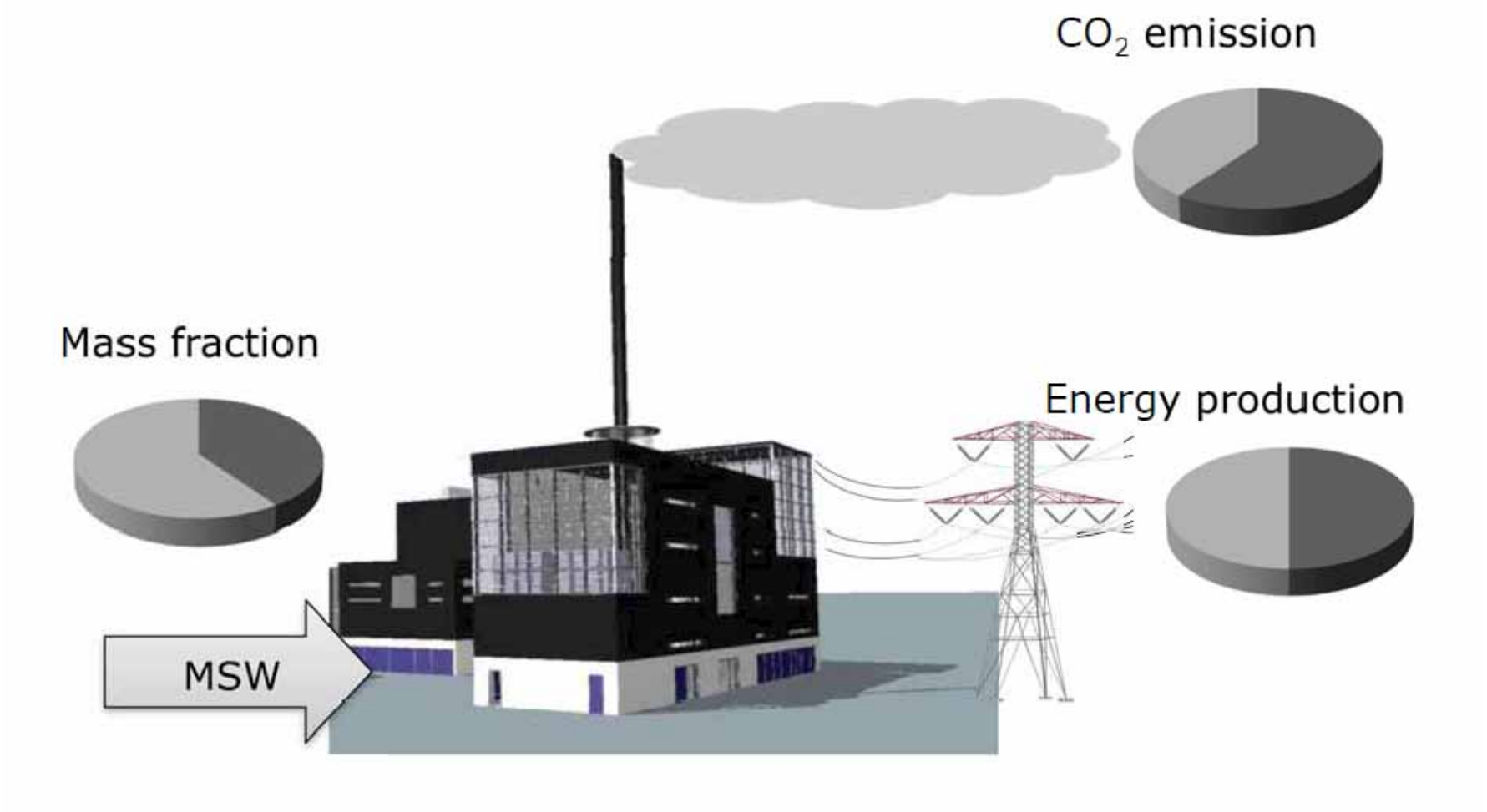
LSC - Liquid Scintillation Counting

Ramböll Mass- and Energy Balance



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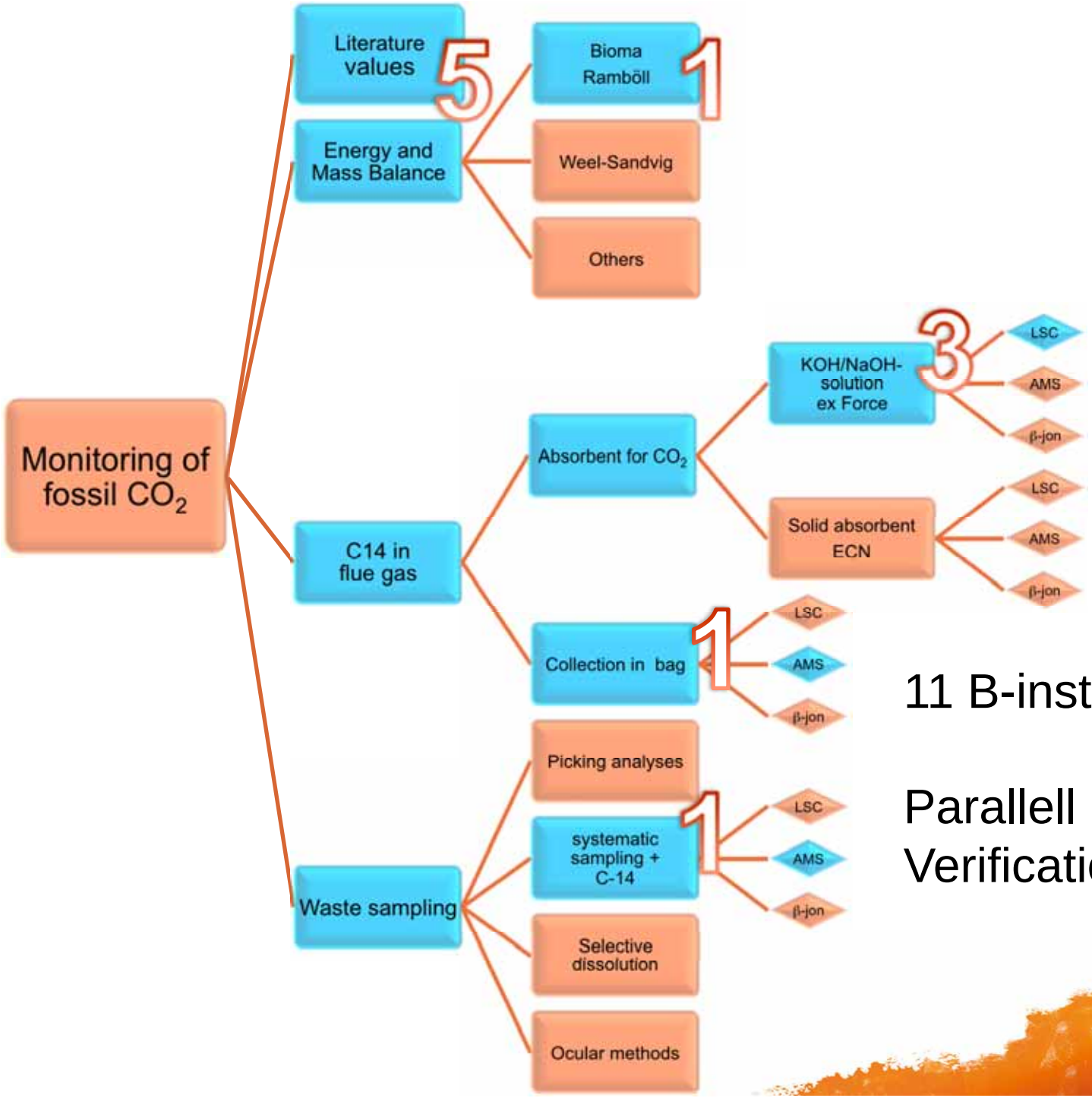

11 B-installations

Parallell
Verification also usec

Results

- 40 analyses in flue gas
  - 1 day up to 3 months
  - Representing 1000 days of flue gas from Waste to Energy in Sweden in 2013
  - Fossil share* of emitted CO_2: 17 - 44 %
  - Average 36 %

- Waste sampling
  - 6 samples
  - Fossil share* 20 - 53%

* If pmC(ref)=107

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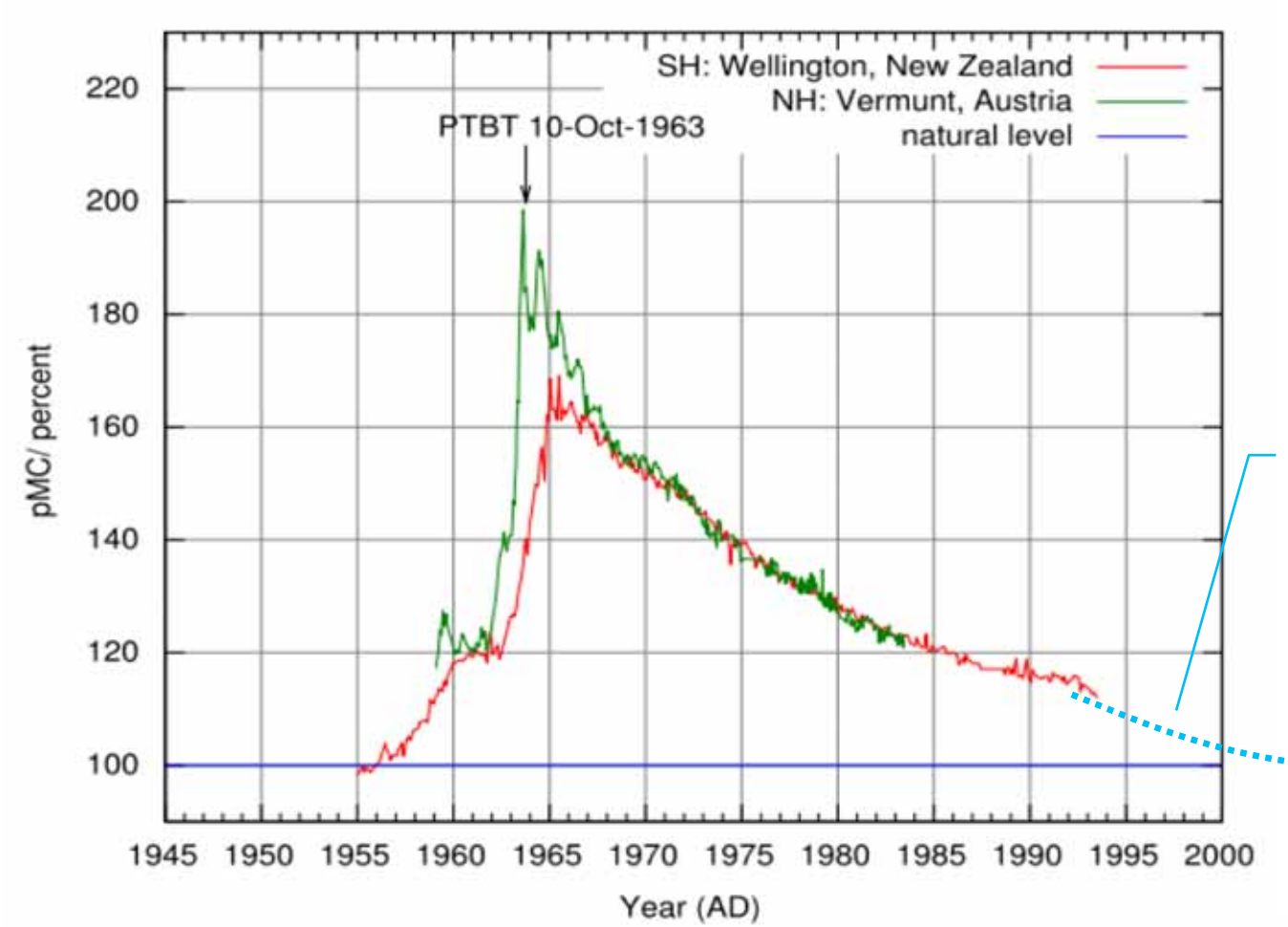
pmC(ref)



possible average ”consensus”

percent modern Carbon

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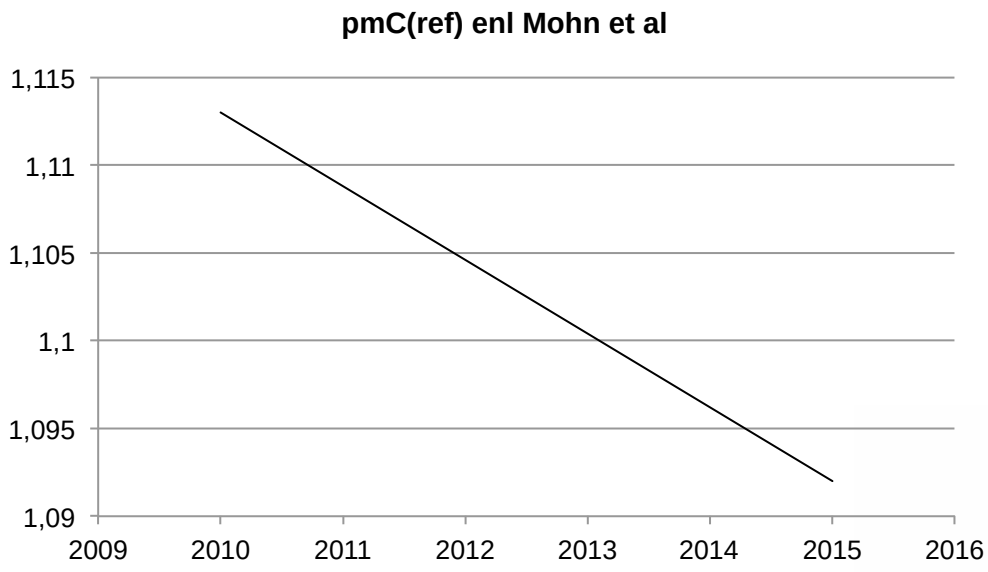
Chosen Background reference pmC(ref)

Monitoring consultant	2011	2013
A		104
B		107 and 112
C		105
D	111	110 (107)
E		105

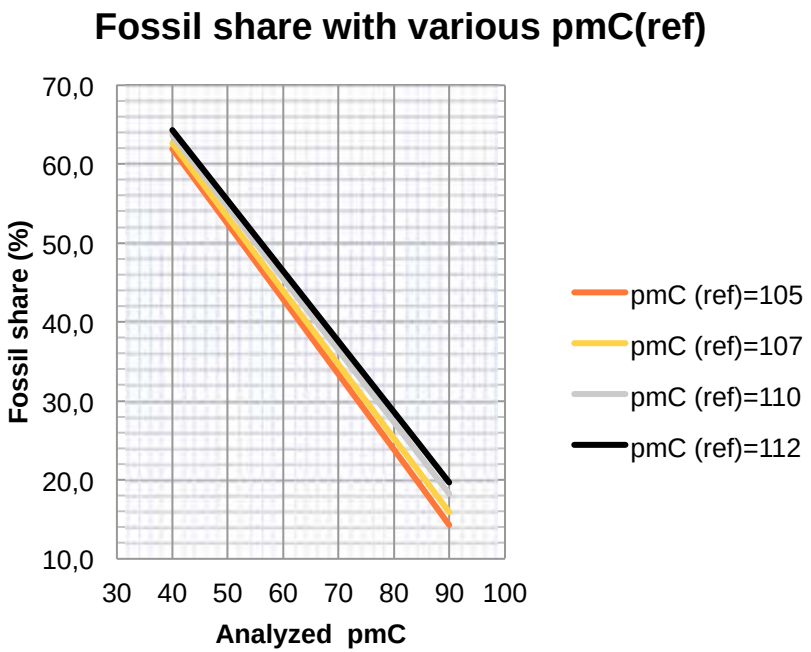


Recalculating fossil share to various pmC(ref)

$$biogen1 = \frac{\text{pmC(measured1)}}{\text{pmC(ref1)}}$$

$$biogen2 = \text{biogen1} \times \frac{\text{pmC(ref1)}}{\text{pmC(ref2)}}$$

$$fossil = 100 - \text{biogen}$$

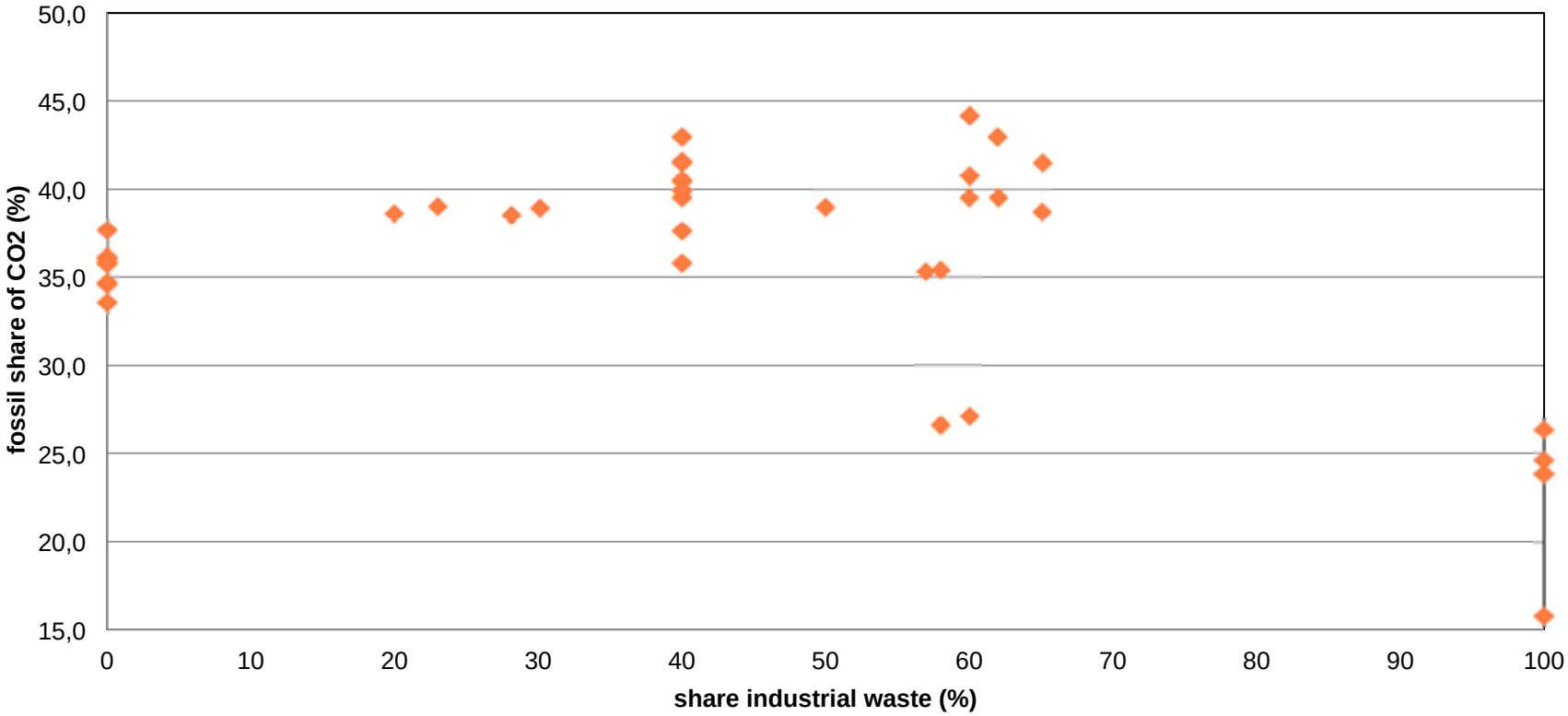


Ex Effects on a Specific Plant

- A difference of 3 %-units of fossil share
- 500 000 tonnes waste a year and 5€/EUA

ETS costs about 70 000 € more a year

Fossil share depending on type of waste (household/industrial)



Some Experiences

- Flue gas
  - Starting-up issues
  - Equipment co-operating
  - Inleakage of air
  - Power outage
- Mass-and energy balance
  - High sensitivity to monitoring values of eg O2, fluegas flow
- Waste sampling
  - High spread of results

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And finally a surprise…

Biogenic share 140% ?!

- Research company using C14
- Reported sent the isotope to WtE
  - Swedish Radiation Safety Authority (Strålsäkerhetsmyndigheten)
- But didn´t report to the WtE-plant

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