

WELCOME TO THE BIOGENIC CO₂ MEASUREMENT WEBINAR

CO₂

+++ the **webinar** will start shortly at 11:00 am (CET) +++

Organization



Webinar will be recorded (presentations only)



Presentations will be shared after the webinar



Duration: 60 min (thereof 15 min for Q&A)



Questions? Comments? Use the chat function on the right



Please provide your feedback after the end of the webinar



Biogenic CO₂ Measurement Solution for the Waste Industry

Felix Schaub / Dr. Gerhard Kahr / Daniel Pereira



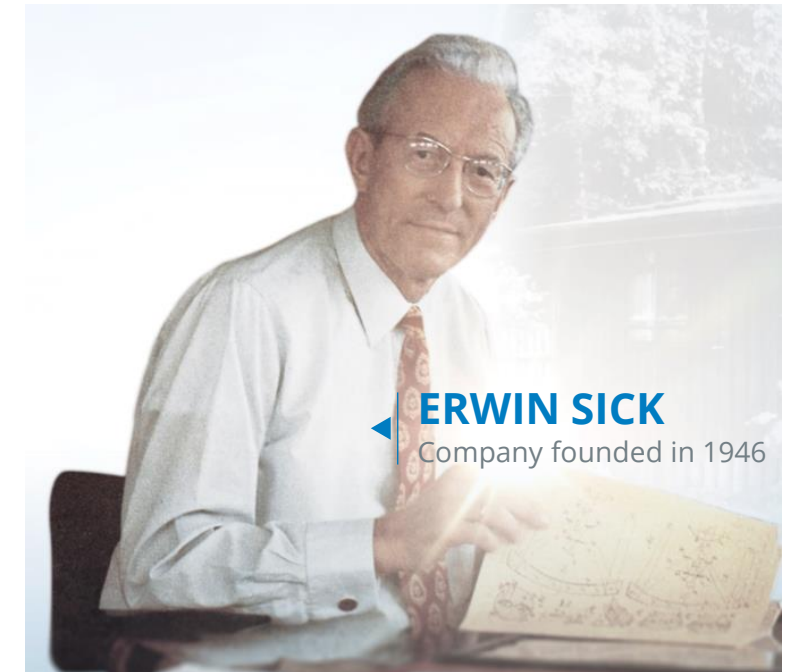
Introduction SICK solutions for the waste incineration industry

Felix Schaub

Environmental protection

A fundamental part of the SICK philosophy

- › 1956 first **flue gas monitor**
optical dust measurement device for industrial emissions
- › 1978 first **in-situ analyzer** for SO₂ and NO_x measurement
- › 2004 first ultrasonic **gas flow meter**
- › Today SICK is a leading manufacturer of **dust monitors, gas analysis**
and ultrasonic **gas flow** measurements



SICK at a glance

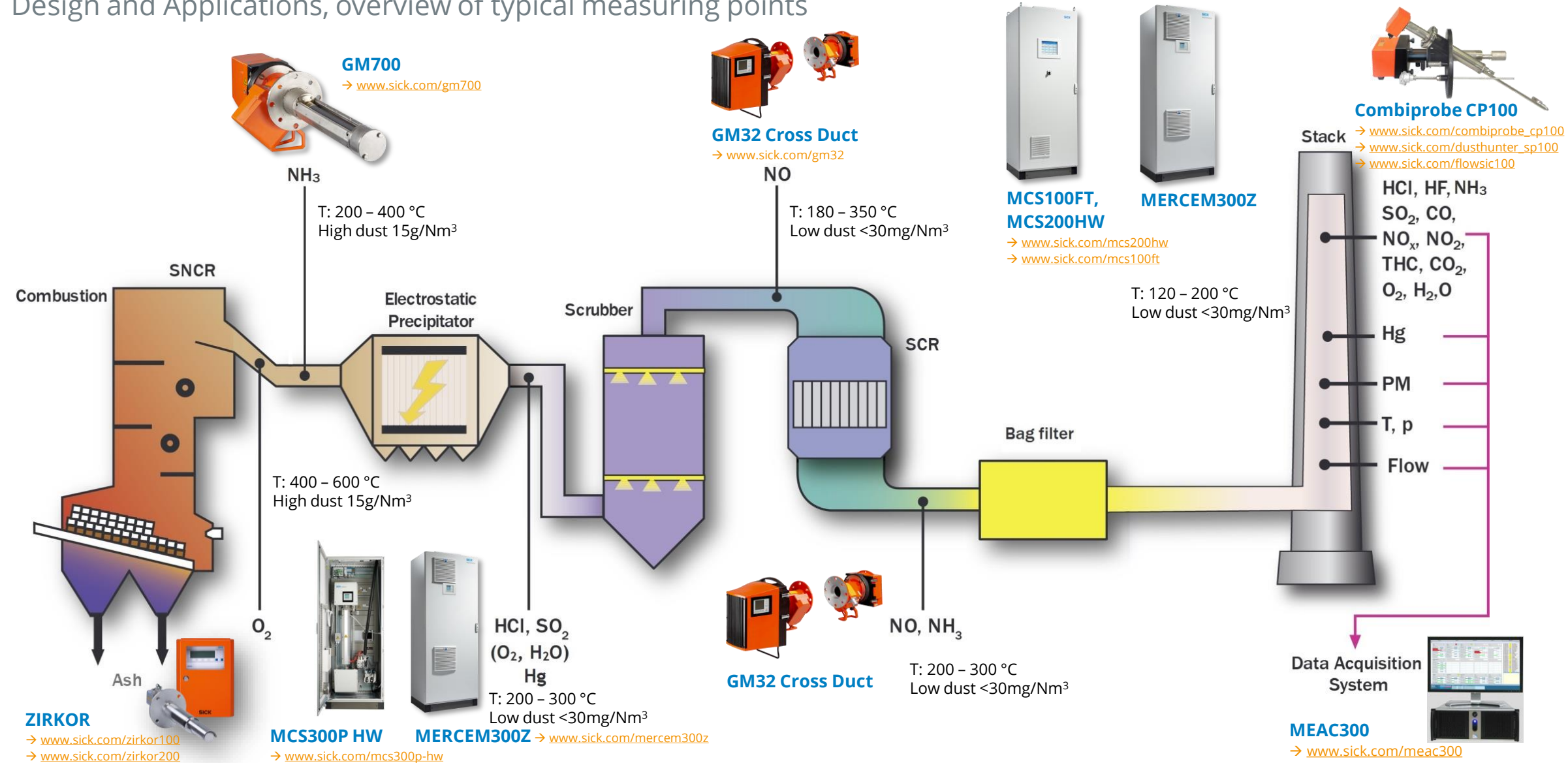
Key figures (fiscal year 2023)



[SICK Corporate Video](#)

Waste to Energy plant

Design and Applications, overview of typical measuring points



Solutions for the Waste industry

Continuous Emission Monitoring Systems (CEMS)



Analyzer shelter

→ www.sick.com/shelter-solutions

Data acquisition and handling system (DAHS)

→ www.sick.com/meac300

Measurement of dust, volume flow, pressure, and temperature

→ www.sick.com/combiprobe_cp100

→ www.sick.com/dusthunter_sp100

→ www.sick.com/flowsic100



Hg measurement

→ www.sick.com/mercem300z

Measurement of SO₂, NO, NO₂, CO, CO₂, HCl, NH₃, N₂O, HF, TOC, O₂, H₂O

→ www.sick.com/mcs200hw

→ www.sick.com/mcs100ft

Dust measurement for wet gases

→ www.sick.com/fwe200dh

Biogenic CO₂ measurement

→ [PmCTrace \(genius5-instruments.com\)](http://PmCTrace.genius5-instruments.com)



DECARBONIZATION



Difference between fossil and biogenic CO_2 and benefits of the measurement of biogenic CO_2

Felix Schaub

Biogenic CO₂ Measurement Solution for the Waste Industry

What is biogenic and fossil CO₂

- › Burning **fossil fuels** releases carbon that has been locked up in the ground for millions of years, while burning biomass emits carbon that is part of the **biogenic** or **bio-based, carbon neutral cycle**.
- › **Fossil carbon** is released from **coal, oil** or **natural gas**, while **renewable** (**biogenic** or **bio-based**) materials are produced from recent, modern plants or animals.
- › **Waste incineration facilities are part of the biogenic carbon cycle**, emitting a mixture of biogenic and fossil CO₂.
- › The PmCTrace system measures the portion of the biogenic CO₂ fraction exactly, using continuous proportional sampling from the flue gas stream, collection in a cartridge and analyzing in a laboratory based on the radioactive carbon isotope C14.

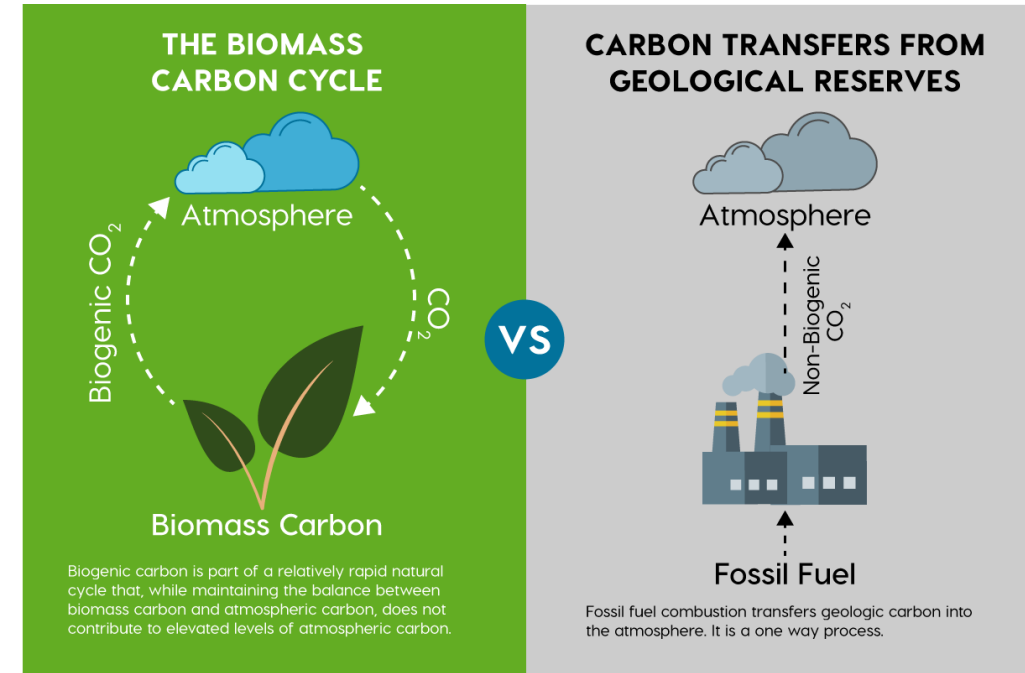


Image source: Plant Based Products Council

Biogenic CO₂ Measurement Solution for the Waste Industry

Main reasons for biogenic CO₂ measurement

- › **Emission Trading Systems (ETS)**

like EU ETS, UK Environment Agency's Pollution Inventory Guidance, German BEHG and China Certified Emission Reduction (CCER) are in operation.

- › All laws differ between fossil and renewable carbon.
Carbon tax has only been paid for fossil carbon, to increase the use of renewables.

- › EU ETS currently covers about 40 % of GHG emissions in the EU and will step by step be extended to cover all emissions. Most probably the inclusion of waste incineration plants will be from 2028. The conditional impact assessment will be in July 2026. https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/what-eu-ets_en

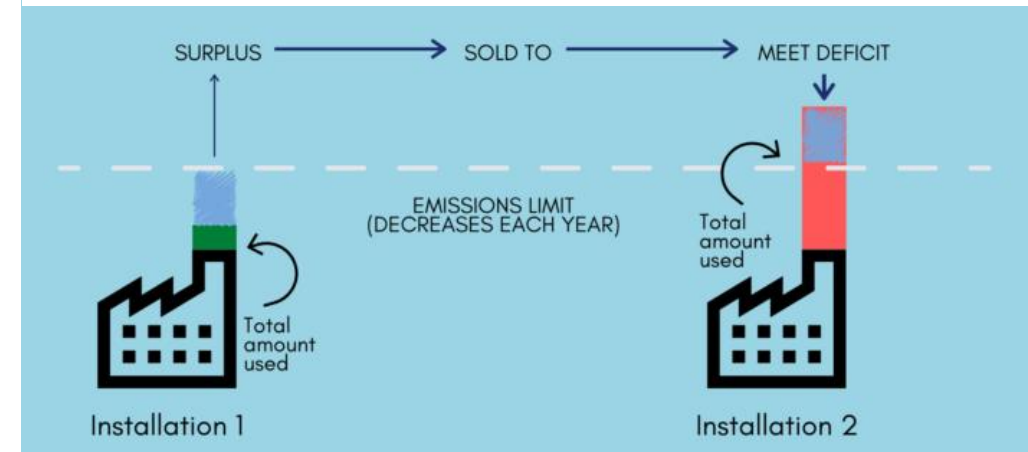


Image source: Investigate Europe

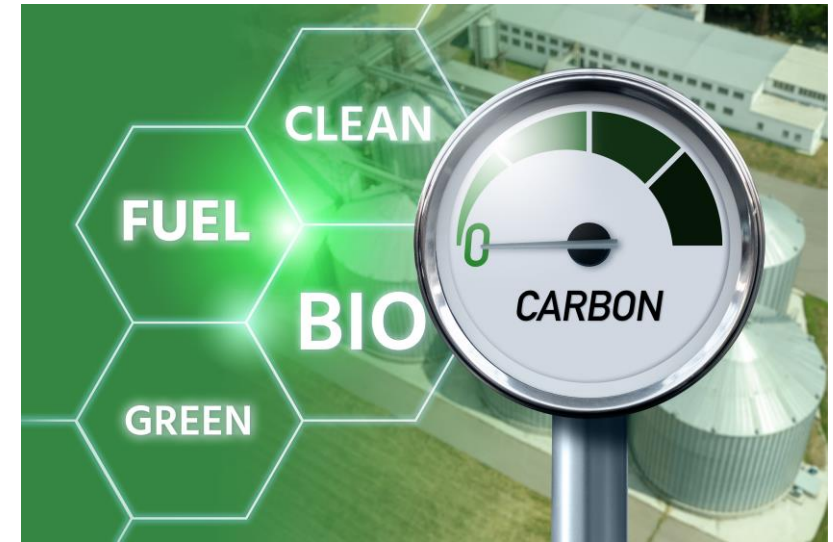
Biogenic CO₂ Measurement Solution for the Waste Industry

Main reasons for biogenic CO₂ measurement

- › Thermal waste treatment facilities with **Carbon Capture** units will provide a major contribution of **negative CO₂ emissions** due to the **biogenic portion** of the heterogeneous feedstock.

Knowing the negative CO₂ emissions with best possible accuracy is desired → requires biogenic CO₂ measurement.

- › For further processing (utilization) the **green portion** is important for ecological, bio-based evaluation.
- › Furthermore, the **renewable share of the recovered energy** by WtE plants is of high public interest.
- › In some European cities the **management of waste per capita** is based on the fossil portion. Also for this purpose the determination of the fossil and biogenic CO₂ fractions is required.





Presentation of the biogenic CO₂ measurement solution

Dr. Gerhard Kahr

Biogenic CO₂ Measurement Solution for the Waste Industry

PmCTrace System

SICK
Sensor Intelligence.

EN BS ISO 13833 conform sampling

- › proportional to the flue gas flow
→ flow measurement with velocity measurement
- › sampling from 24 h to 3 months with low flow rate
0,5 to 5 ml/min and documentation of sampling
- › using alkaline absorber to absorb total CO₂
with PmCTrace cartridge
- › C14 analysis in C14 laboratory with respective report

Stationary source emissions — Determination of the ratio of biomass (biogenic) and fossil-derived carbon dioxide — Radiocarbon sampling and determination

Émissions de sources fixes — Détermination du rapport du dioxyde de carbone de la biomasse (biogène) et des dérivés fossiles — Échantillonnage et détermination du radiocarbonate



Biogenic CO₂ Measurement Solution for the Waste Industry

PmCTrace System

SICK
Sensor Intelligence.

Method description

PmCTrace® takes a small amount of flue gas, proportional to the volume flow in the stack, 8,000 hours per year to have 12 representative monthly samples. Quantitatively and proportional to the flue gas flow and CO₂ concentration, the CO₂ is absorbed in a closed cartridge inside the control unit - typically 3,000 to 10,000 ml of CO₂ per 1 month.

In the refill lab the absorbed CO₂ is transferred to a gas bag, which is sent to the accredited C14 laboratory, which measures the biogenic fraction from the sample.



Beta Analytic®
TESTING LABORATORY

Beta Analytic, Inc.
4985 SW 74th Court
Miami, FL 33155 USA
Tel: 305-667-5167
Fax: 305-663-0964
info@betalabservices.com

ISO/IEC 17025:2017-Accredited Testing Laboratory

Summary of Results - % Biogenic CO₂ Determination
ISO-13833:2013 Annex A(AMS)

Certificate Number: 587855698159150407

Validation:

A handwritten signature in blue ink, likely of the analyst or reviewer, placed over a horizontal line.

Biogenic CO₂ Measurement Solution for the Waste Industry

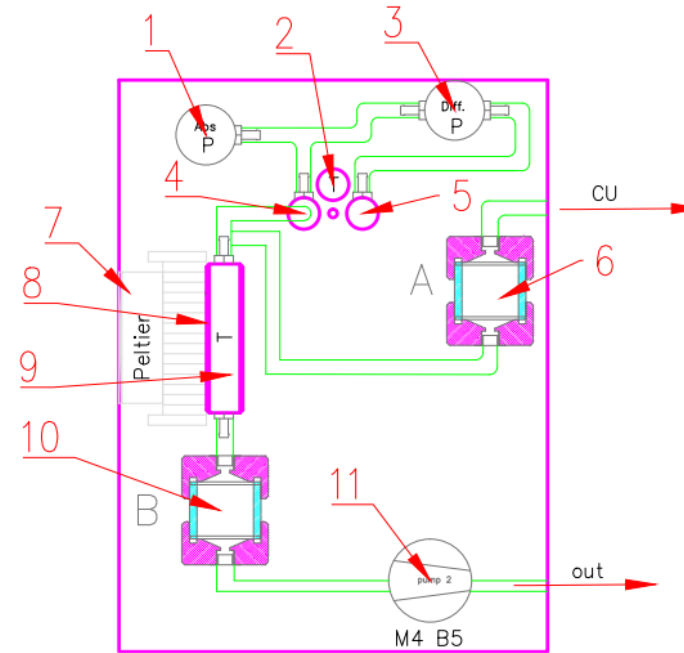
PmCTrace System

SICK
Sensor Intelligence.

Components of the Extraction Unit,

available as Indoor and Outdoor version

- › Flange, fitting to the plants flange (1, 2, 3, 4, 5)
- › Condenser system, to adjust humidity (7, 8, 9, 10, 11)
- › Protection filter, to remove (6)

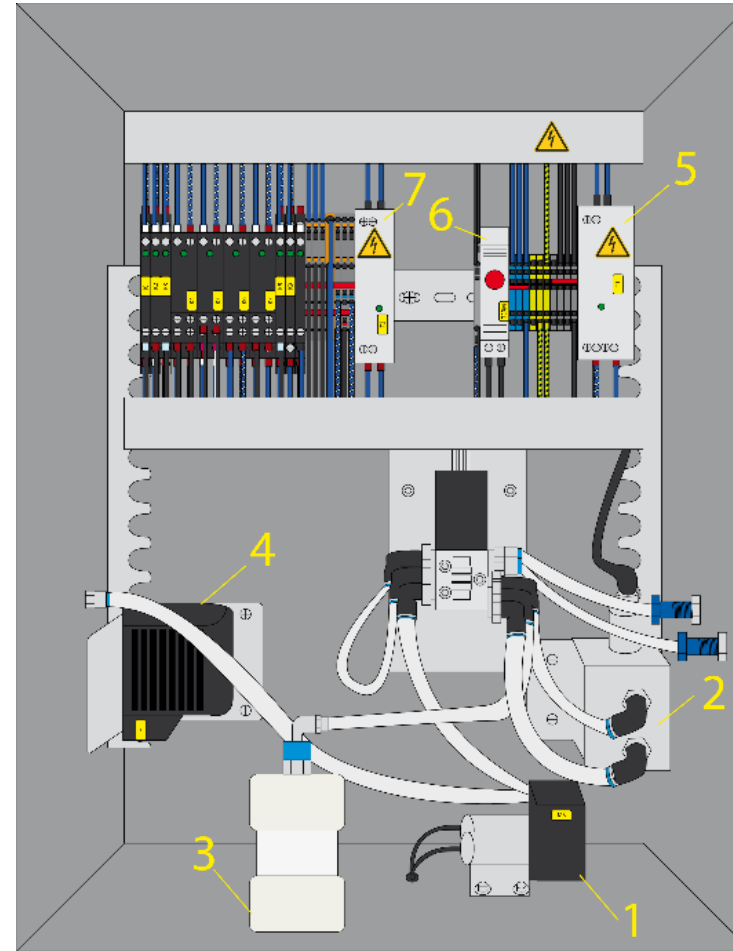


Biogenic CO₂ Measurement Solution for the Waste Industry

PmCTrace System

Components of the Control Unit, available as Indoor and Outdoor version

- › Touchscreen controller
- › USB-memory stick for data storage
- › Sucking system (1)
- › Mass flow controller group (2)
- › Temperature management system (4)
- › Cartridge (3)

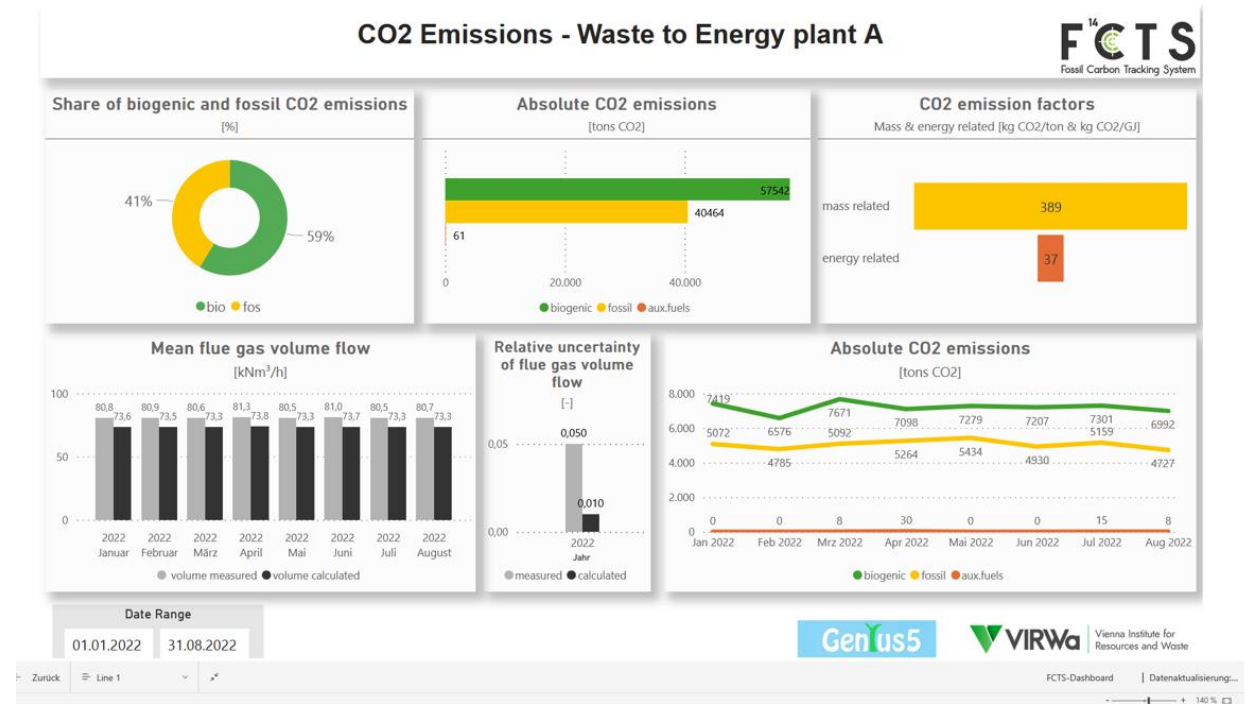


Biogenic CO₂ Measurement Solution for the Waste Industry

PmCTrace System – Reporting Tool

- › RAM of controller
 - “Sampling report” data are stored for 100 days
 - 10 reports are stored as jpg file
- › USB Stick
 - Every hour the sampling data are stored on USB stick in the directory “Daily results”
 - Every day at 0:00 hours, the report data are stored in the directory “Samplingreport”
- › Cloud network (optional with modem)
 - 12 sampling parameters are stored every minute
- › FCTS Dashboard
 - Calculating the absolute value tons fossil CO₂

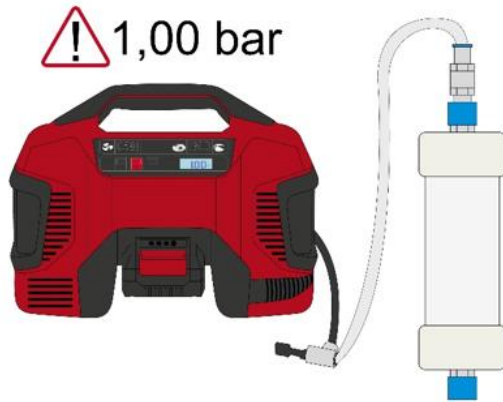
| | Lab-ID | 14C (in pMC) | ± (1-sigma) |
|------------------------------|-----------|--------------|-------------|
| 001 13.06.2022-18.06.2022 | GrM-29829 | 53,41 | 0,17 |
| 002 18.06.2022 to 22.06.2022 | GrM-29854 | 55,17 | 0,17 |
| 003 22.06.22 to 29.06.22 | GrM-29856 | 51,58 | 0,17 |
| 004 29.06.22-06.07.22 | GrM-30139 | 53,19 | 0,14 |
| 005 29.06.22-13.07.22 | GrM-30140 | 52,98 | 0,14 |



Biogenic CO₂ Measurement Solution for the Waste Industry

PmCTrace System – Cartridge Concept

- › CO₂ is absorbed on solid alkaline absorbent
- › Two cartridge types: 10 and 15l CO₂ absorption type
- › Leak test after refill in laboratory
- › Breakthrough test for every absorbent batch



leak test after refill



abs. 4l CO₂



adding H₃PO₄



CO₂ transfer to gasbag



breakthrough test



Biogenic CO₂ Measurement Solution for the Waste Industry

PmCTrace System References

- › Austria:
 - Wien Energie, WtE plant, 1 mobile unit
- › France
 - Nancy biomass plant, 1 unit
- › Germany
 - GKS Gemeinschaftskraftwerk Schweinfurt GmbH, 1 unit
 - EEW Energy from Waste plant, 1 mobile unit
 - MVV EfW plant Mannheim, 1 unit
 - MVV Biomass Power Plant Königs Wusterhausen, 1 unit
 - Infraserb Höchst WtE plant, 1 mobile unit
- › Netherlands
 - Attero BV, WtE plants Wijster and Moerdijk, 2 mobile units



Biogenic CO₂ Measurement Solution for the Waste Industry

PmCTrace System References

› UK

- Coventry & Solihull Waste Disposal Co Ltd., 1 unit
- Veolia ES Staffordshire Ltd., 1 unit
- Viridor Glasgow, 3 units
- Viridor Dunbar, 2 units
- Viridor Peterborough, 1 unit
- Viridor Runcorn, 4 units
- Vital Energi, Burton on Trent, 3 units



Biogenic CO₂ Measurement Solution for the Waste Industry

PmCTrace System in combination with

Material & Energy Balances

Fossil Carbon Tracking System

NEW

VIRWa

Relative uncertainty

±2.5%

±1.5%

±1%

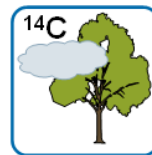
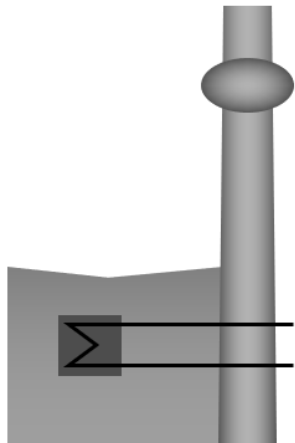
Fossil CO₂

=

**Fossil fraction of
CO₂**

X

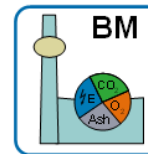
Total CO₂



Radiocarbon Method
(ISO 13833)



PmCTrace



Balance Method
(ISO 18466)

Balance equations

- Mass
- Solid residues
- Carbon
- Energy
- O₂-consumption
- Difference in O₂-consumption and CO₂-production
- Biogenic carbon via Radiocarbon method

Biogenic CO₂ Measurement Solution for the Waste Industry

PmCTrace System References

Reference list for FCTS



already applied

- WtE Andernach - Germany (EEW – Energy from Waste)
- WtE Flötzersteig - Austria (Wien Energie)
- WtE WSO4 - Austria (Wien Energie)

in preperation:

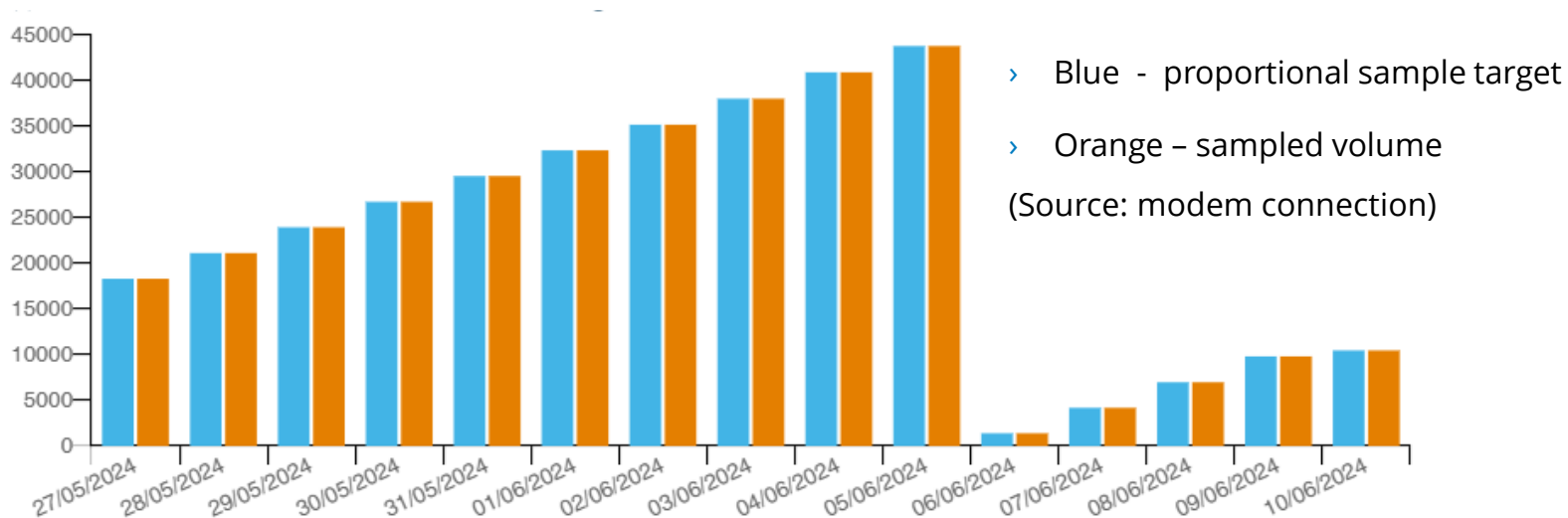
- WtE Zistersdorf - Austria (FCCC)
- WtE Spittelau – Austria (Wien Energie)
- WtE Arnoldstein – Austria (KRV)



Biogenic CO₂ Measurement Solution for the Waste Industry

PmCTrace System cartridge for longtime use

- › This cartridge type has the flexibility to increase the sampling time
 - up to 3 months, sampling 20,000 to 200,000 ml of flue gas
- › CO₂ is absorbed on sodium/lime absorbent
 - for each CO₂ molecule, one H₂O molecule is formed
 - to avoid wet plugging PU-foam is used



Biogenic CO₂ Measurement Solution for the Waste Industry

Advantages of the PmCTrace System

› Simple installation

- no instrument air required
- no signals from plant required

› Simple use

- range of applications enables 25, 12 or 4 samples per year
- statistical evaluation of sampling data (inclusive leak test) ensures high accuracy of proportional CO₂ sampling
- automatic report storage in 4 ways

› Low service expenses with robust design

- less connections fitted with tight Festo screw connections
- 5 types of leak tests to fix the leak if any
- only one mass flow controller whose components can be tested and replaced individually at site

› Low energy consumption

- small design using 100 W only (control and extracting unit)
- design needs no heated probe saving 500 W, sample gas line temperature 70 °C reduces energy consumption to <24 W/m

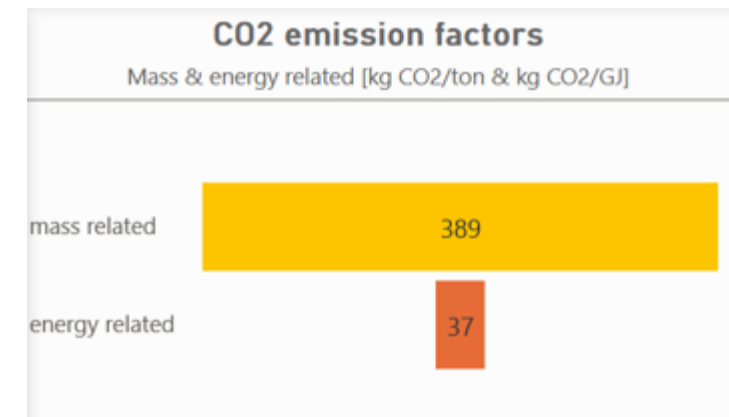


Biogenic CO₂ Measurement Solution for the Waste Industry

Advantages of the PmCTrace System in combination with FCTS



- › **Highest accuracy of 1% for the result tons fossil carbon/year**
 - correction of single data point (outlier analysis)
 - correction of CO₂ and flow results based on energy, oxygen, mass balance
- › **Yearly report for the authority**
 - four C14 samples per year requested
 - statistical evaluation of PmCTrace results in combination with plant operation data
 - reliable data management
- › **Monthly dashboard to reduce emissions of fossil carbon**
 - twelve C14 samples per year requested
 - influence of changes in waste composition visible
 - trend analysis
- › **Calculation of CO₂ emission factors**
 - for comparison of different plants





Summary

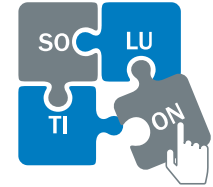
Biogenic CO₂ Measurement Solution for the Waste Industry

Summary



SICK can offer the complete package

- › including the PmCTrace system for biogenic CO₂ measurement
- › is a leading supplier for CEMS and process measurement in the waste industry
- › with a global service structure serving the complete system and product portfolio





Many thanks for your attention.

Felix Schaub

Global Industry Manager
Waste and Recycling



Telephone: +49 7681 202-6760

Mobile: +49 172 6327 365

E-Mail: felix.schaub@sick.de

Website: www.sick.com/waste-and-recycling

LinkedIn [Felix Schaub](#)

Dr. Gerhard Kahr

Managing Director Owner
Genius5-Instruments GmbH



Mobile: +43 6764 304383

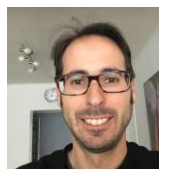
E-Mail: gerhard.kahr@genius5-instruments.com

Website: [About us \(genius5-instruments.com\)](http://About.us%28genius5-instruments.com%29)

LinkedIn [Gerhard Kahr](#)

Daniel Pereira

Product Manager Analyzers & Flow
Sales & Service Benelux



Telephone: +32 2 46655-66

Mobile: +32 470205778

E-Mail: daniel.pereira@sick.be

Website: <https://www.sick.com/be/en/>

LinkedIn [Daniel Pereira](#)