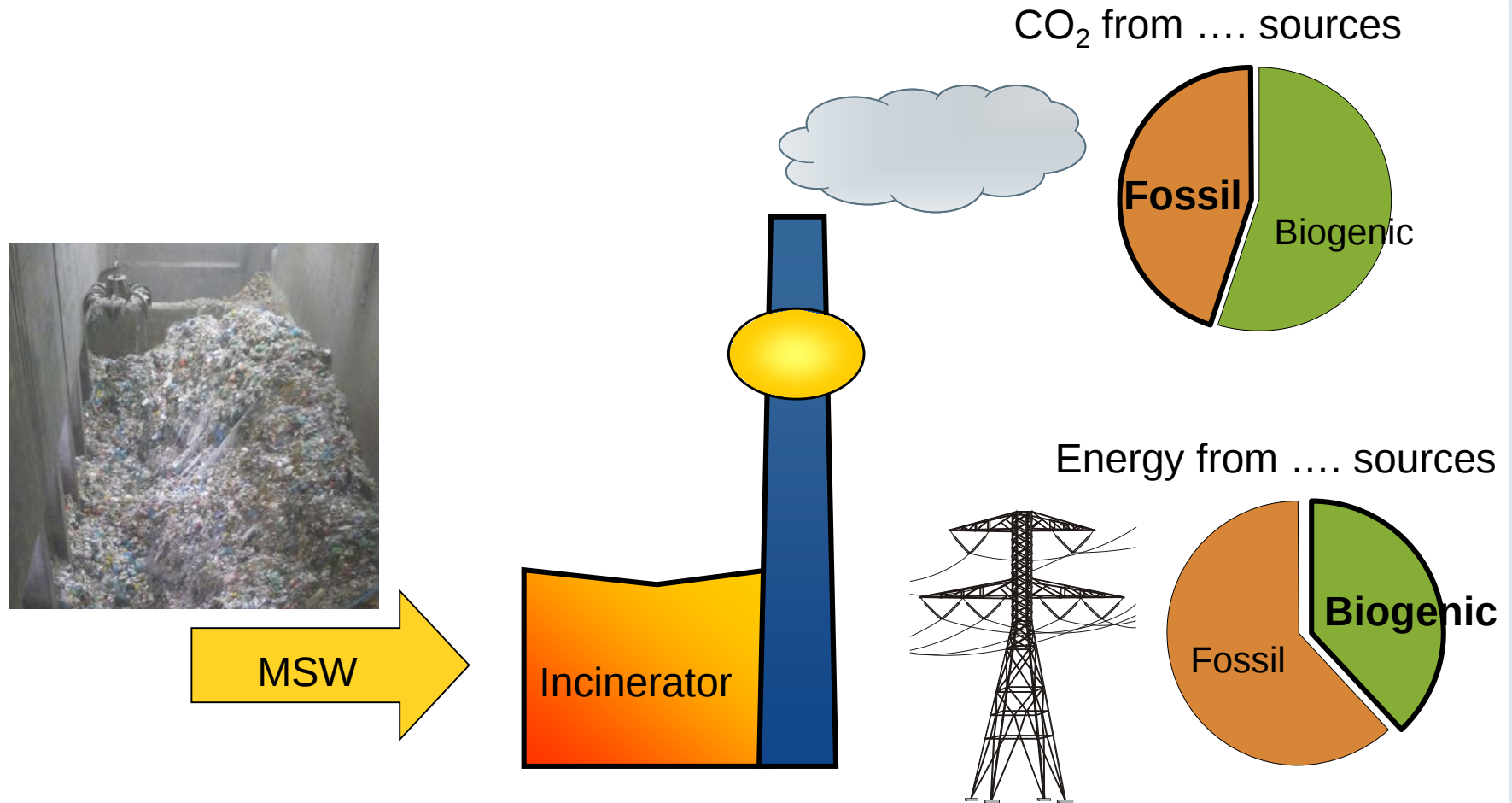


One-year monitoring of biogenic and fossil fractions of CO₂ emissions from all WTE plants in Austria

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The problem to be solved



Waste Incineration in Austria: 11 plants



Methods for determining the biomass/fossil content in mixed waste

Sorting analysis

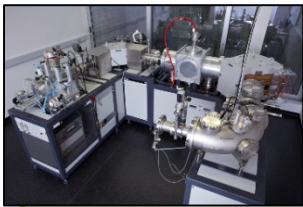


Selective dissolution method

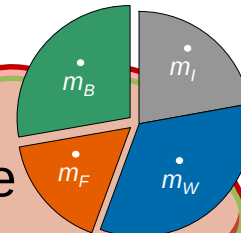


Sampling!
Minimum frequency of
analysis: every 5,000 t*

^{14}C -Method



Balance Method



For details on methods see Staber et al. 2008 and Fellner & Rechberger 2009;
List of References last slide

**European comission (2012): Monitoring and Reporting Regulation*

1. Mass balance
2. "Ash"-balance
3. Carbon-balance
4. Energy-balance
5. O₂-consumption
6. Difference of
O₂-cons. + CO₂-prod.

Unknowns

$$\begin{aligned}
 &m_B + m_F + m_I + m_W \\
 &\qquad\qquad\qquad m_I \\
 &c_B \cdot m_B + c_F \cdot m_F \\
 &HV_B \cdot m_B + HV_F \cdot m_F - 2.45 \cdot m_W \\
 &O_{2,C,B} \cdot m_B + O_{2,C,F} \cdot m_F \\
 &d_{O_2-CO_2} \cdot m_B + d_{O_2-CO_2} \cdot m_F
 \end{aligned}$$

$$\begin{aligned}
 &= 1 \\
 &= a_{\text{waste}} \\
 &= c_{\text{waste}} \\
 &= HV_{\text{waste}} \\
 &= O_{2,C}^{\text{waste}} \\
 &= d_{O_2-O_2, \text{waste}}
 \end{aligned}$$

Coefficients (given by the chemical composition of biogenic and fossil matter)

Derived from operating data

For details see List of References last slide

Table: Chemical Composition of Biogenic and Fossil Matter

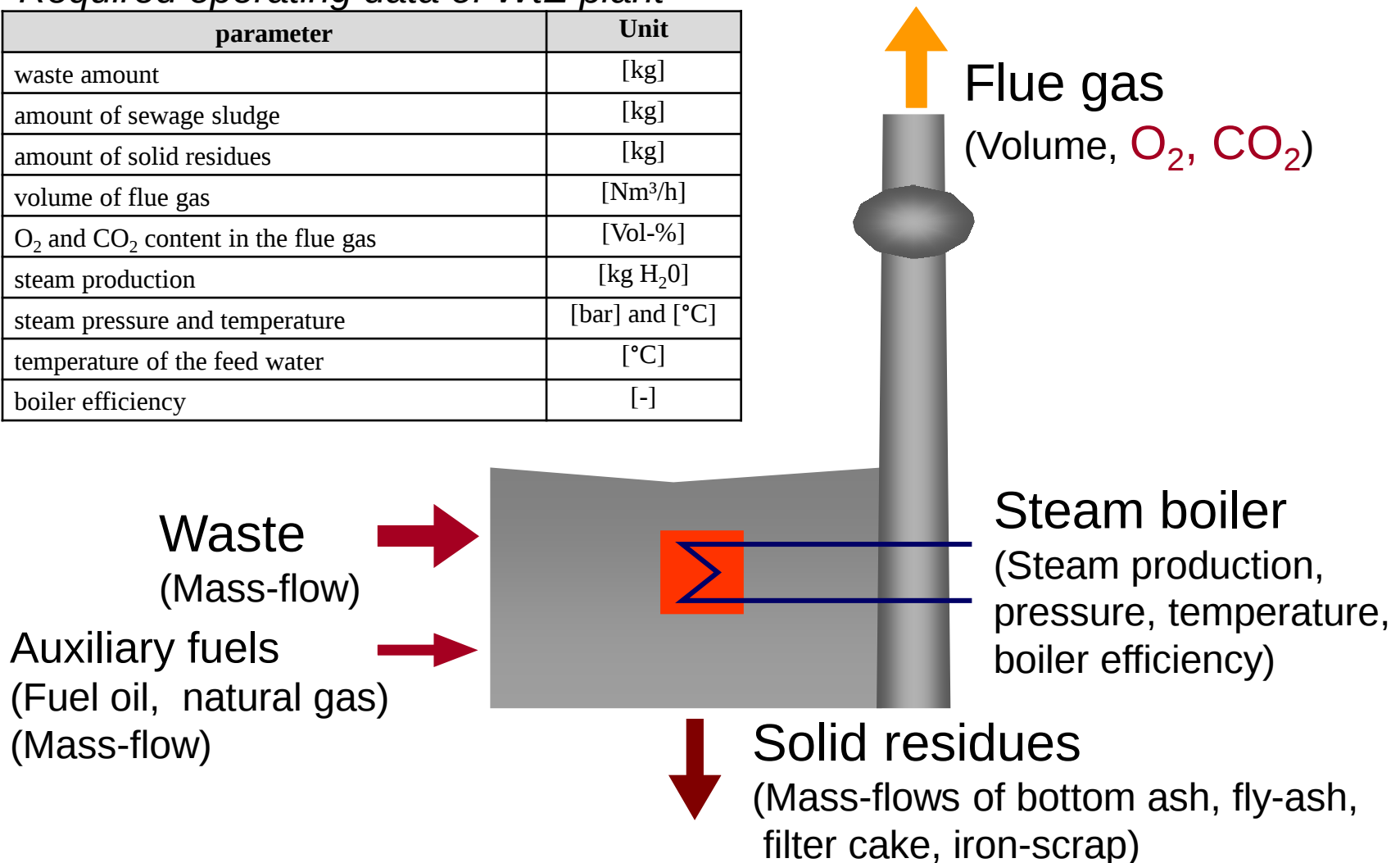
Material group	C-content		H-content		O-content		N-content		S-content		Cl-content	
	[g/kg moisture-and-ash-free]											
	av.	sd	av.	sd	av.	sd	av.	sd	av.	sd	av.	sd
Biogenic matter	483	10	65	0,8	441	10	8	3	1,2	0,3	-	-
Fossil matter	768	20	109	7	88	22	13	5	3	1,1	19	15

Fellner et al., 2007

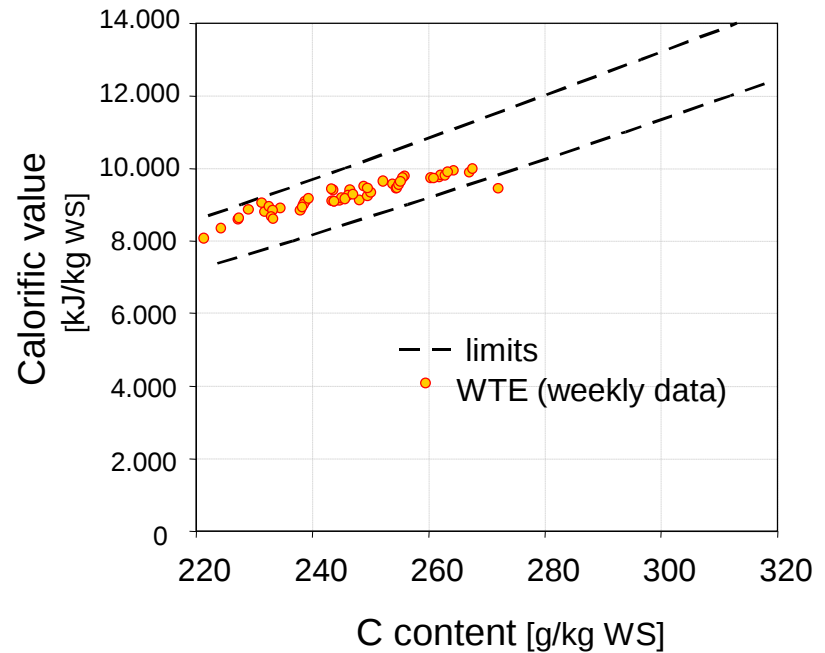
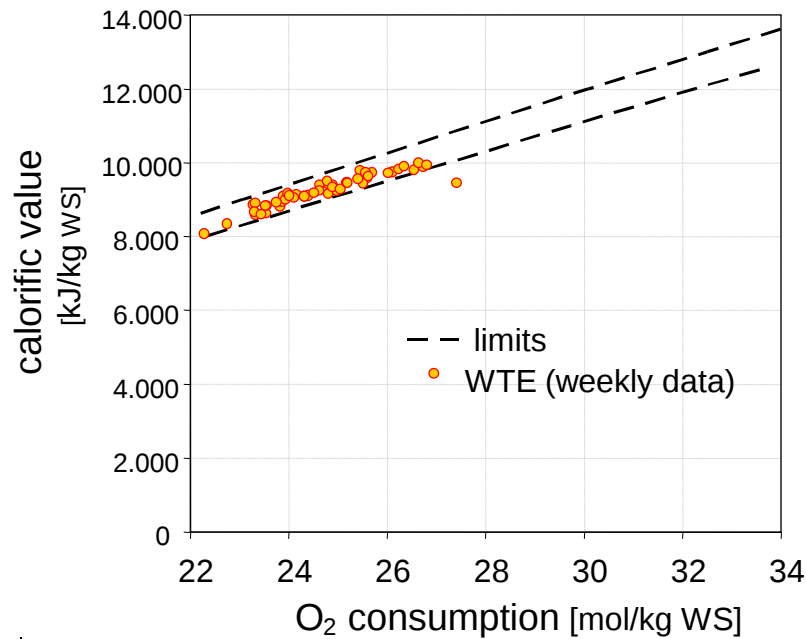
Required operating data

Required operating data of WtE plant

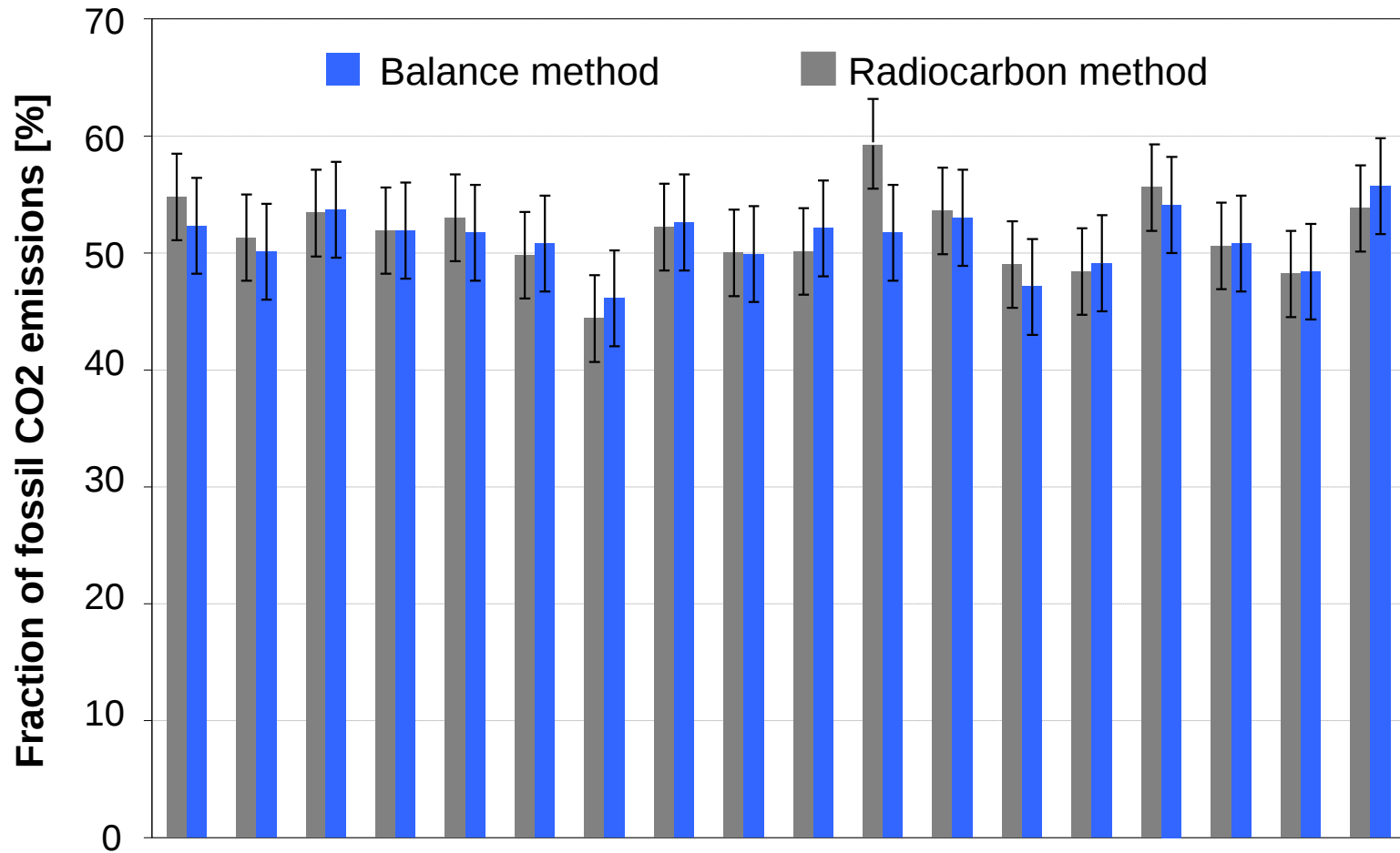
parameter	Unit
waste amount	[kg]
amount of sewage sludge	[kg]
amount of solid residues	[kg]
volume of flue gas	[Nm ³ /h]
O ₂ and CO ₂ content in the flue gas	[Vol-%]
steam production	[kg H ₂ O]
steam pressure and temperature	[bar] and [°C]
temperature of the feed water	[°C]
boiler efficiency	[-]



Plausibility check of operating data

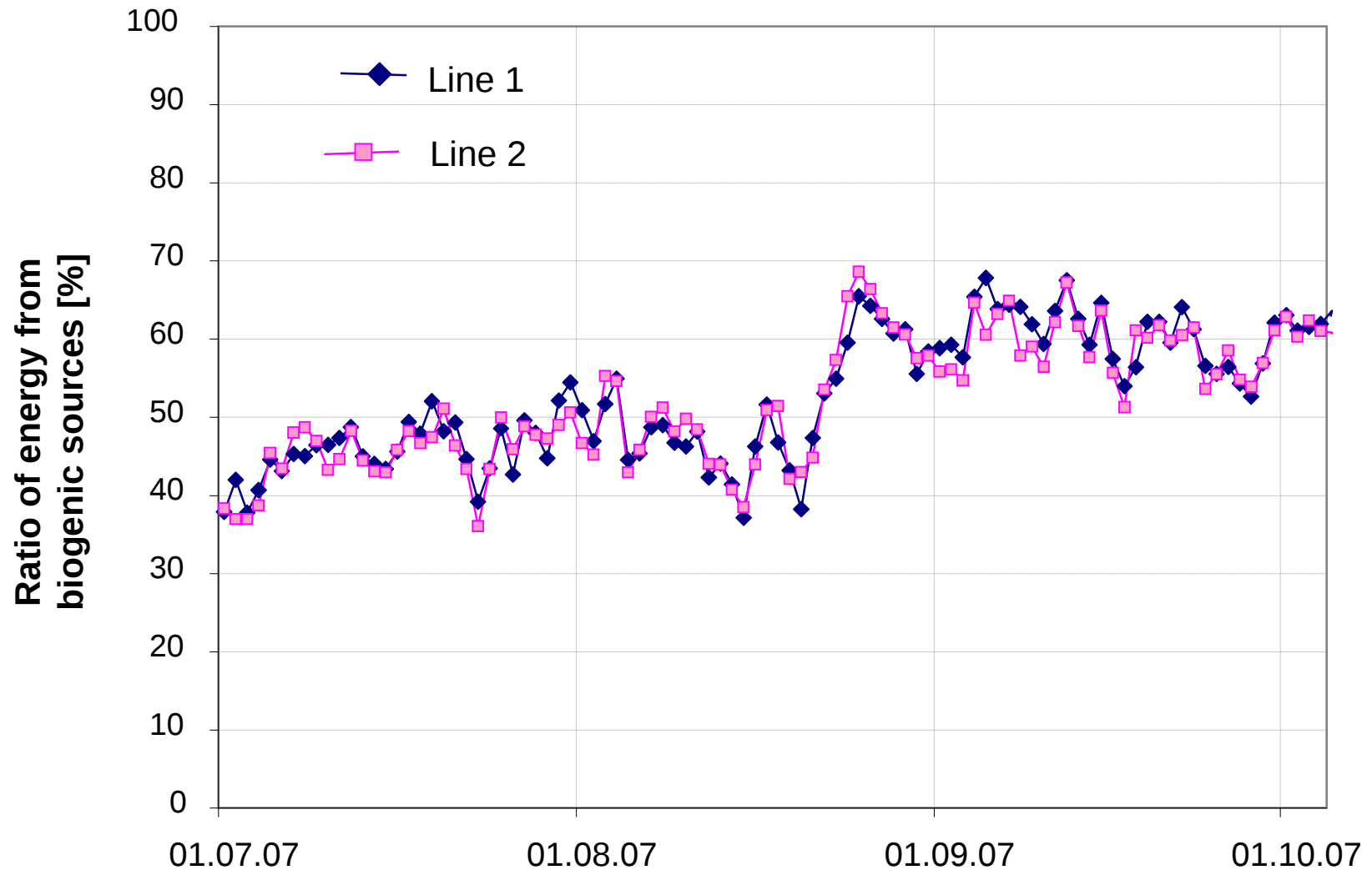


Fellner et al., 2007



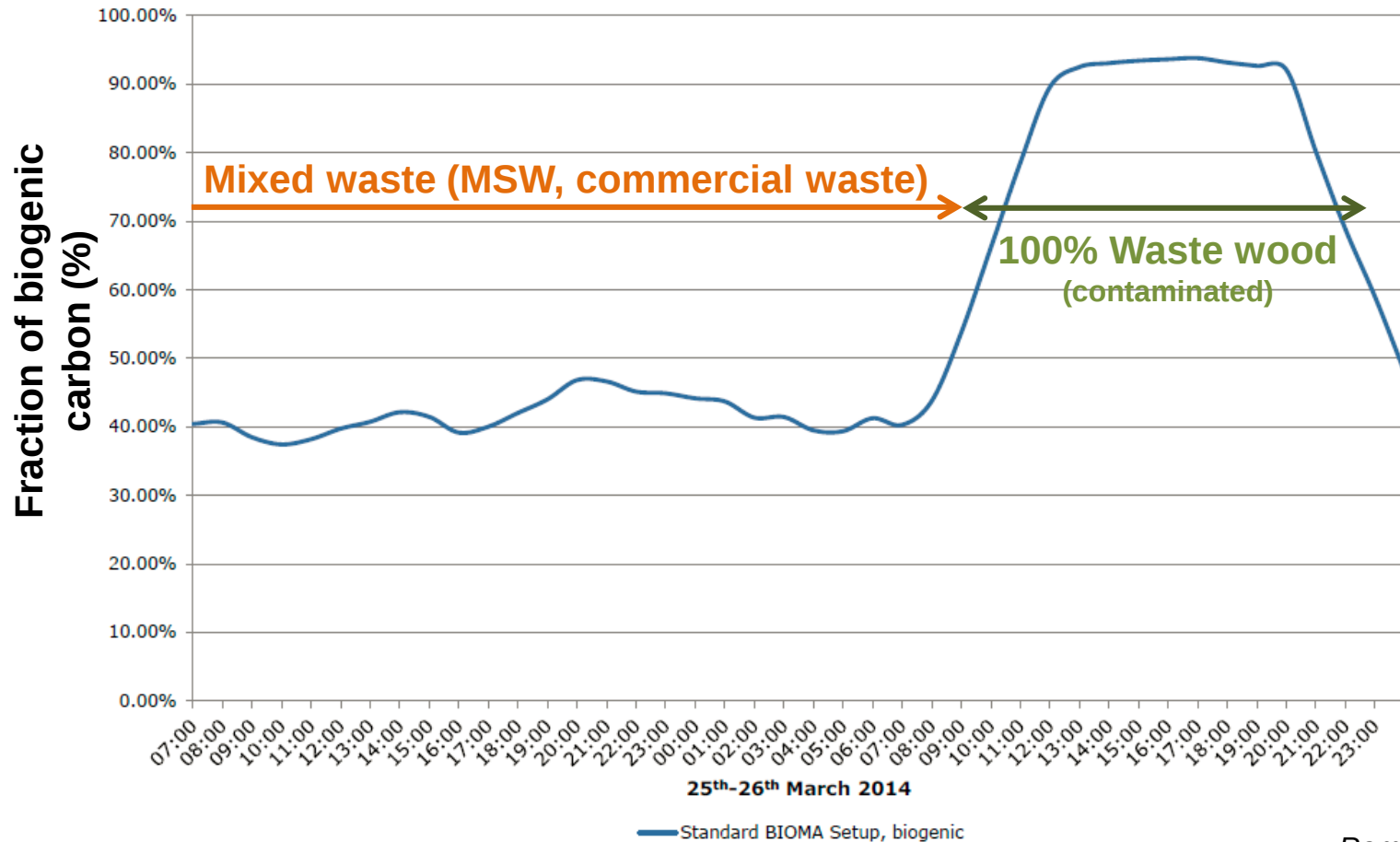
Mohn et al., 2008

Validation 2



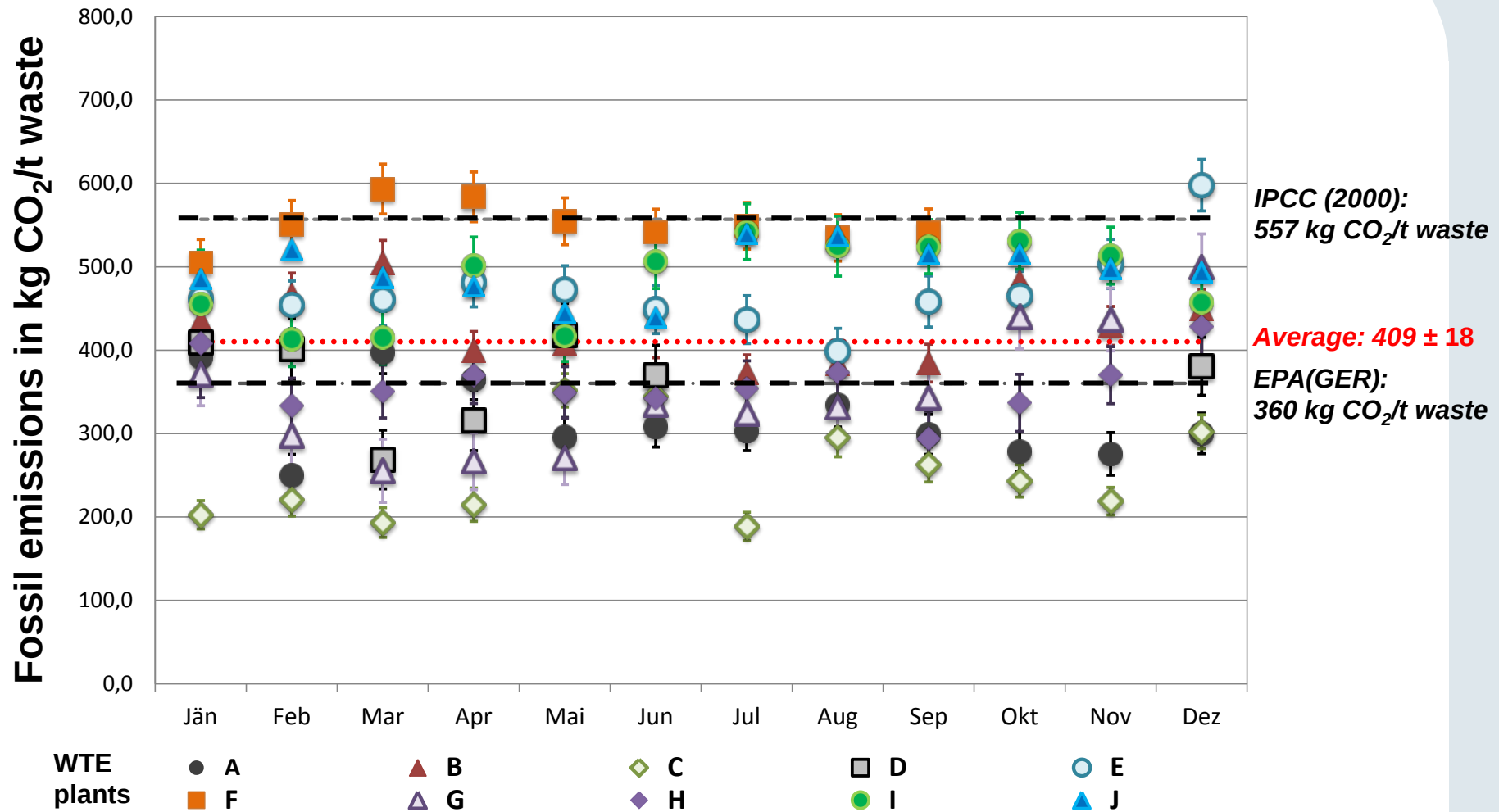
Obermoser et al., 2009

Temporary combustion of waste wood



Ramboll, 2014

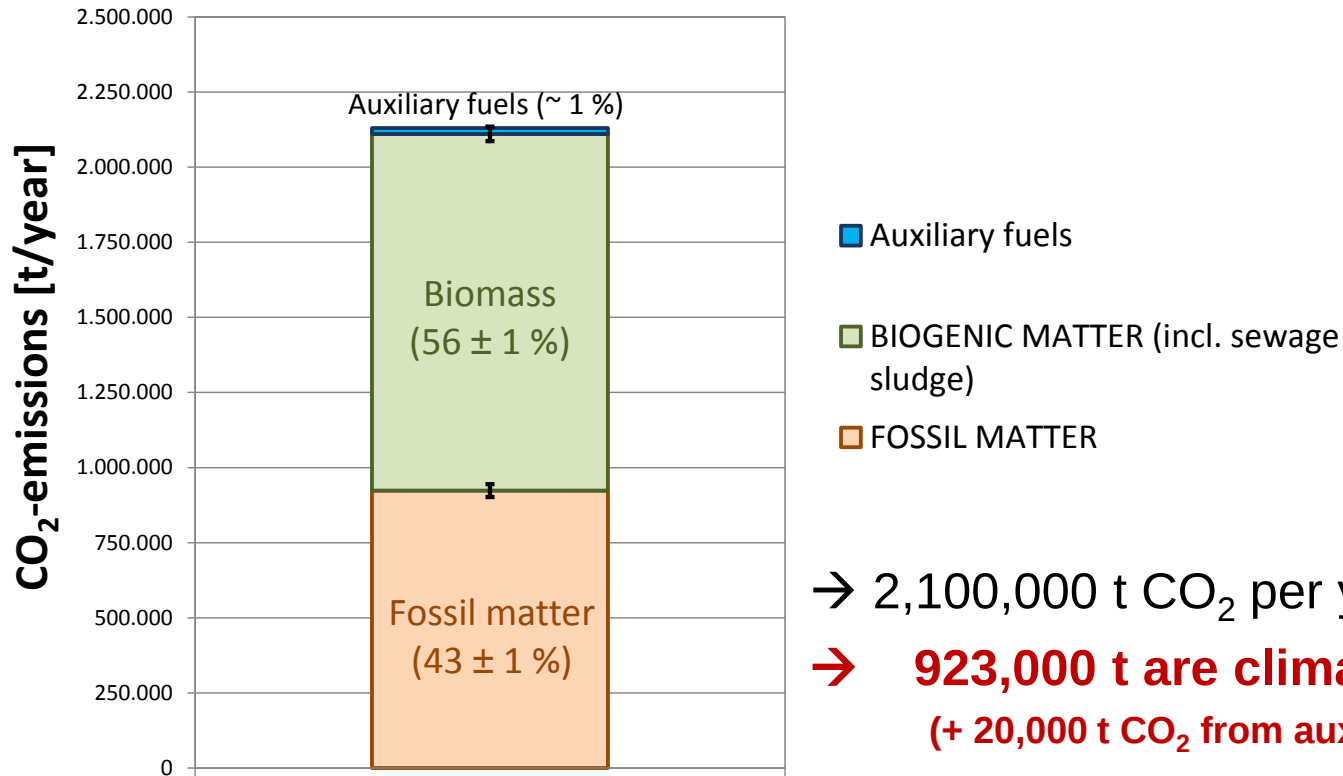
Monthly results



▶ High temporal and spatial variation: 189 ± 17 to 620 ± 30 kg CO_{2,foss}/t

Final result for 2014

Total CO₂-emissions from Austrian WtE plants (2014)

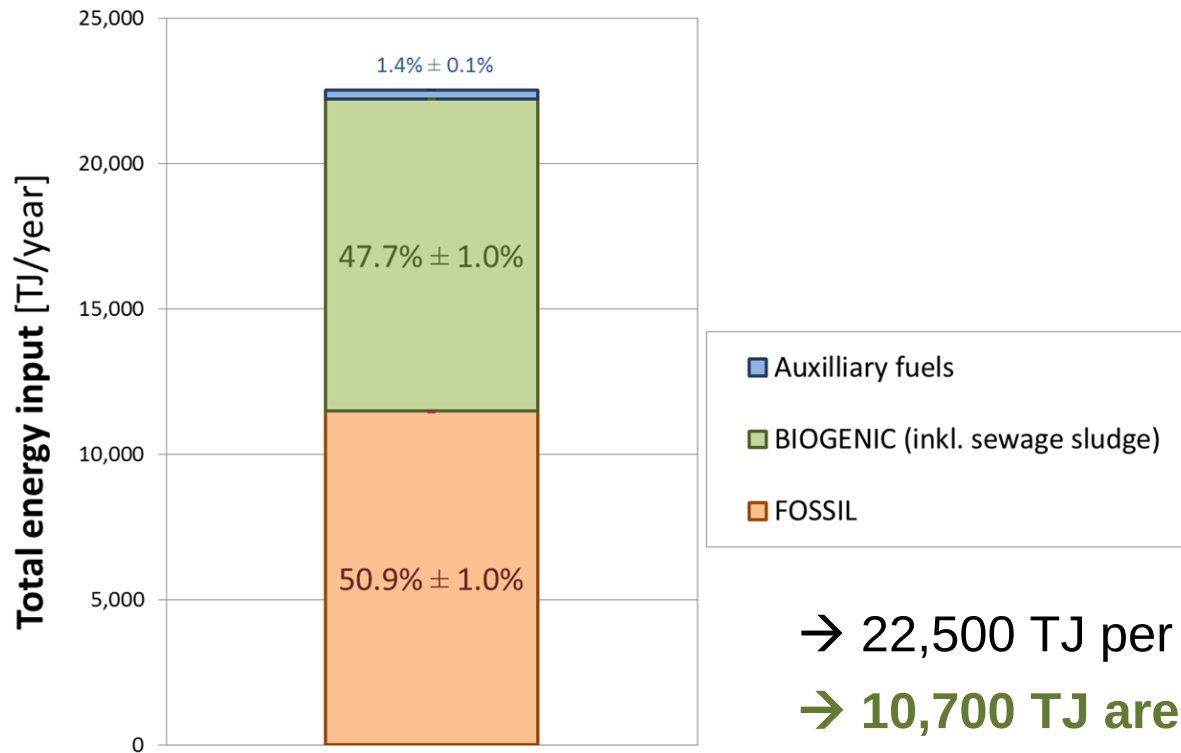


→ 2,100,000 t CO₂ per year in total

→ **923,000 t are climate relevant (fossil)**
(+ 20,000 t CO₂ from auxiliary fuels)

▶ ~ 3 % of Austria's greenhouse gas emissions stem from waste incineration

Total energy input into Austrian WtE plants (2014)

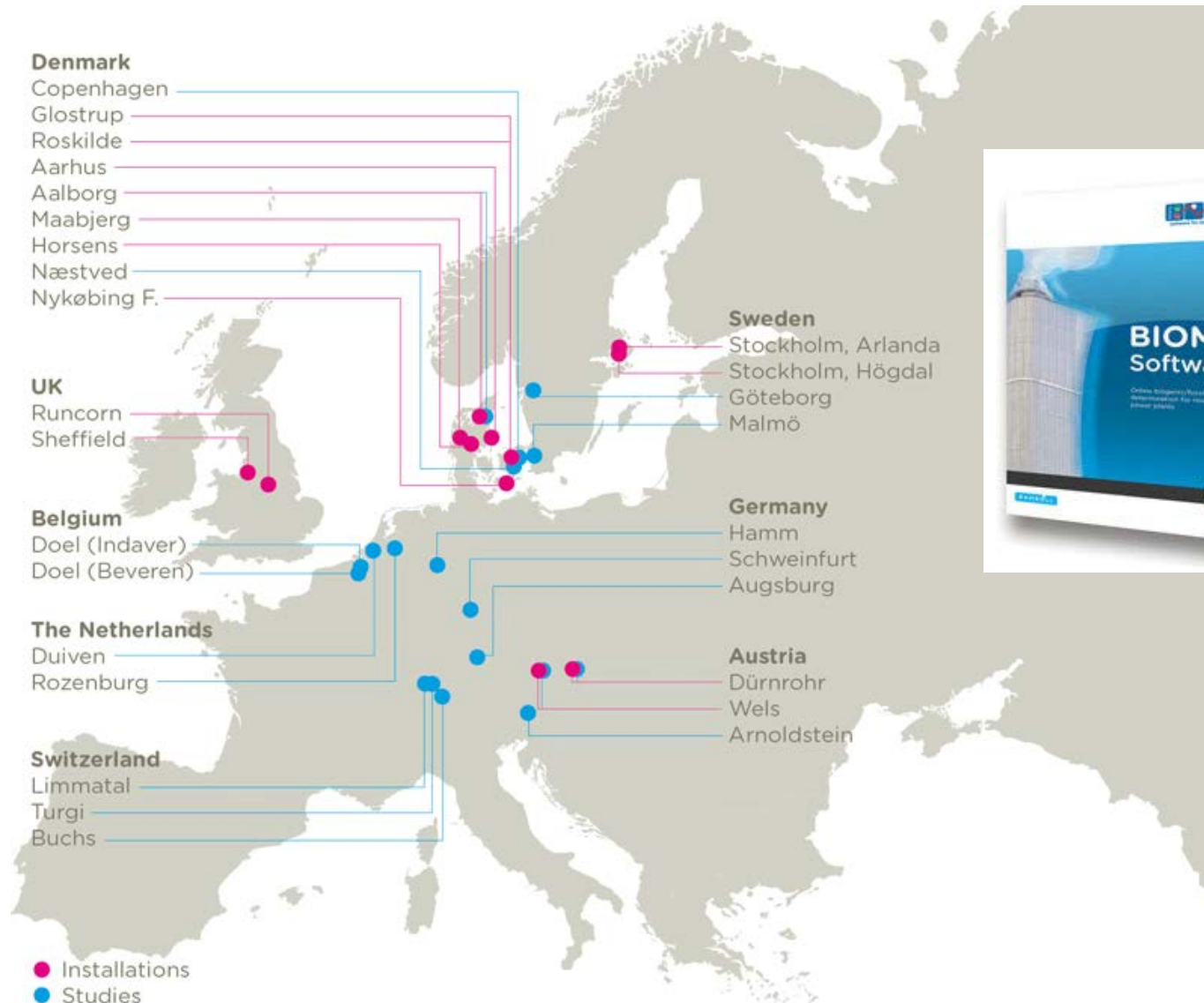


→ 22,500 TJ per year in total

→ **10,700 TJ are “renewable”**

- ▶ 1.6 % of Austria's overall energy demand is covered by waste incineration
- ▶ 2.3% of Austria's renewable energy consumption is covered by biomass in waste

Applications of BIOMA in Europe



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Thank you



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