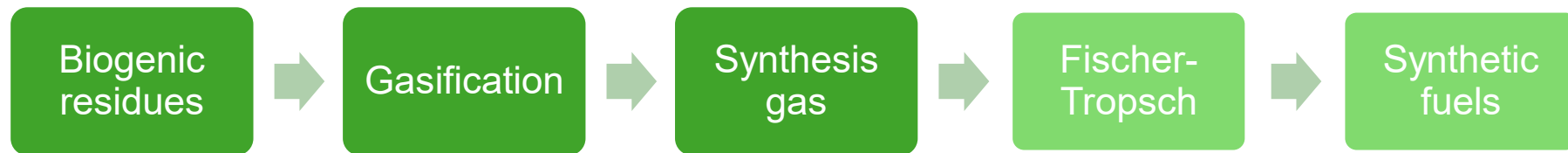


Model-based Scaling of Waste Gasification Systems

Graz, 30.09.2026

Magdalena Krainz, Thomas Steiner

Introduction

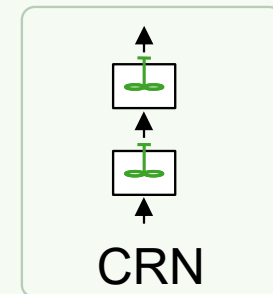
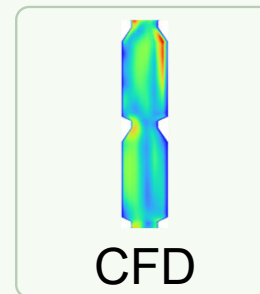


STUDY CASES

1.5 MW Floating fixed bed gasifier
long particle residence times

1.0 MW Dual fluidized bed gasifier
circulating heat carrier

SIMULATION FRAMEWORK





Key Challenges in Reactor Modelling

Reactive flow	Heat and mass transfer, fluid dynamics
Feedstock variability	Moisture, particle size, feedstock composition
Scale-up effects	Residence time, mixing, heat losses
Synthesis gas quality	Tar, particulate matter, H_2/CO -ratio



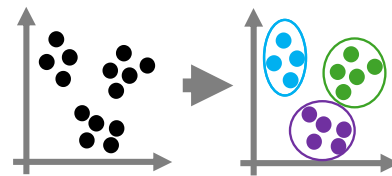
Methodology

CFD



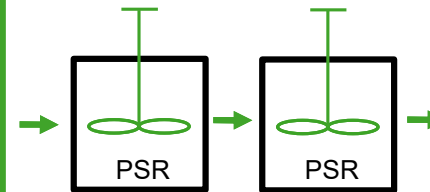
Computational
fluid dynamics
simulation

CFD2Net



Mapping CFD
results to 0D/1D
reactor models
(Clustering)

Process Simulation



Simulation of
CRN (chemical
reactor network)

Application

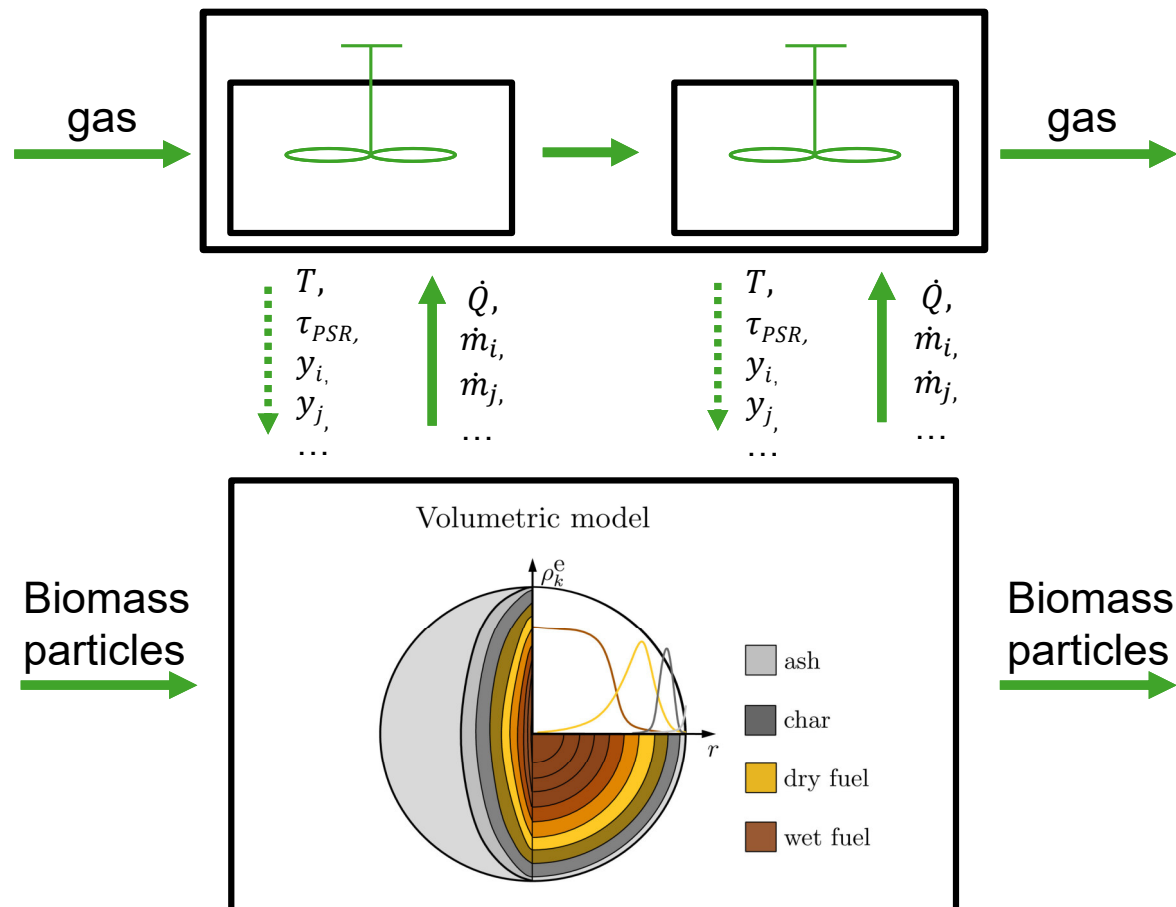


Calibration and
validation using
operational data ^[1]

[1] ÖkoEnergie eGen. (o. D.). Vom Reststoff zum Wertstoff. <https://www.oekoenergie.cc/vom-reststoff-zum-wertstoff/>



Coupled CRN with Detailed Particle Model



Gas phase - Cantera:

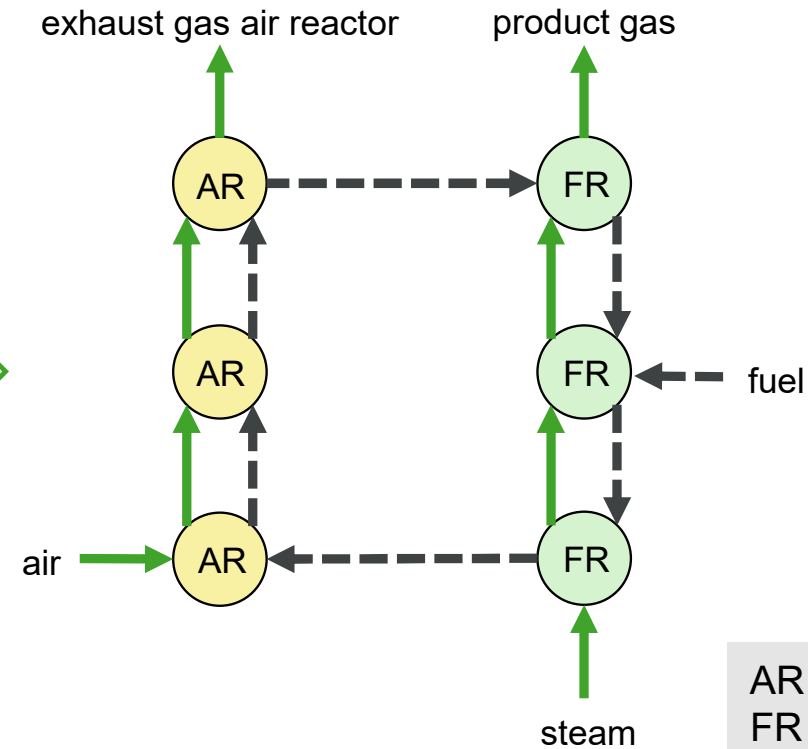
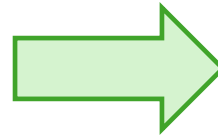
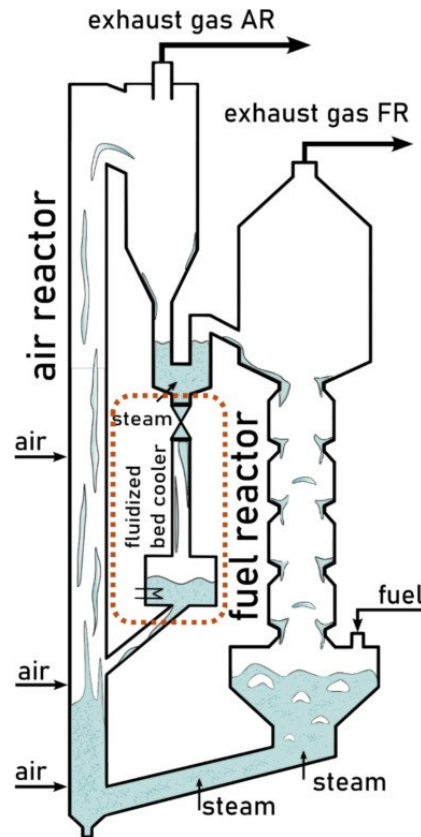
- Detailed gas phase kinetics

Solid phase - volumetric model:

- Heat conduction
- Drying
- Pyrolysis
- Char conversion



Advanced dual fluidized bed plant - CRN



AR	air reactor
FR	fuel reactor
→	solid stream
→	gaseous stream

Summary



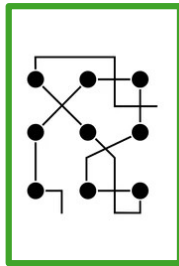
Understand and predict

Representation of hydrodynamics



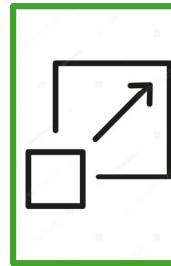
Fuel flexibility

Quantification of fuel-dependent effects



Reduce computational complexity

Transfer detailed CFD results to simpler models



Industrial scale-up

Identification of relevant indicators

Overall Goal: Develop a validated **multi-scale** modelling framework for **reliable** and **fuel-flexible** scale-up of industrial gasification systems.

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