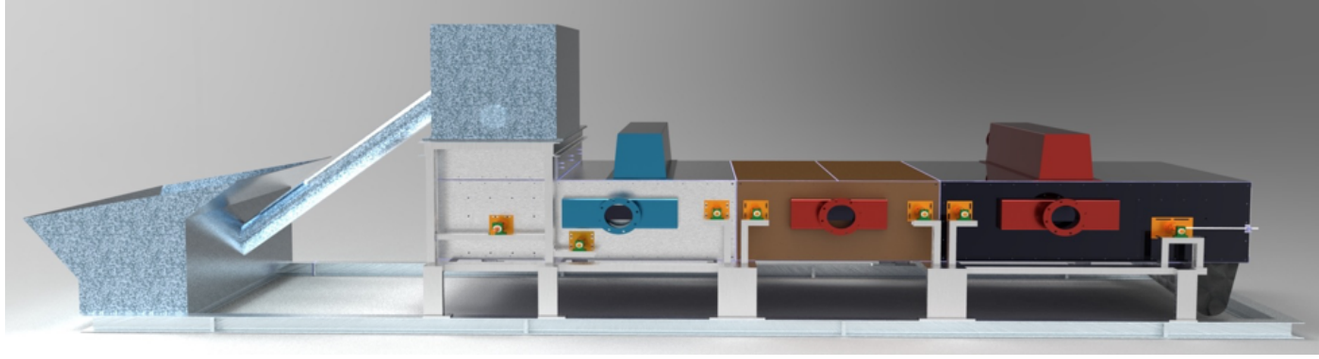
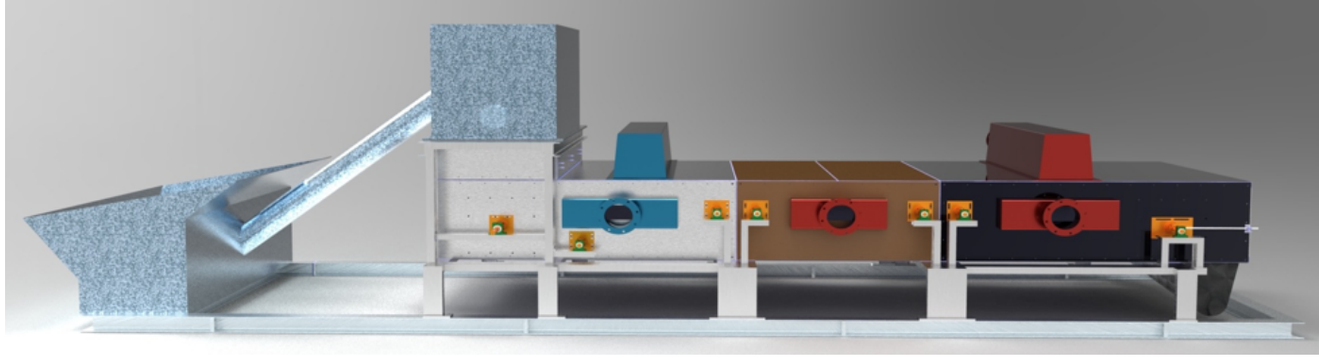
Versatility



- Since the design is modular, stages and/condensers can be added, divided, or removed at any time to:
  - Increase capacity, even after installation
  - Segment the drying stage into multiple steps to extract essential oils
  - Segment the condensible gas stage into multiple steps to extract valuable chemicals like phenols from the gas stream
  - Add steam activation as a final step after pyrolysis
  - Extract heavy tars from the syngas produced

Versatility



- Once started, the kiln uses about 10% of the syngas produced to maintain operation. The remaining syngas can be used to:

  - Generate electricity

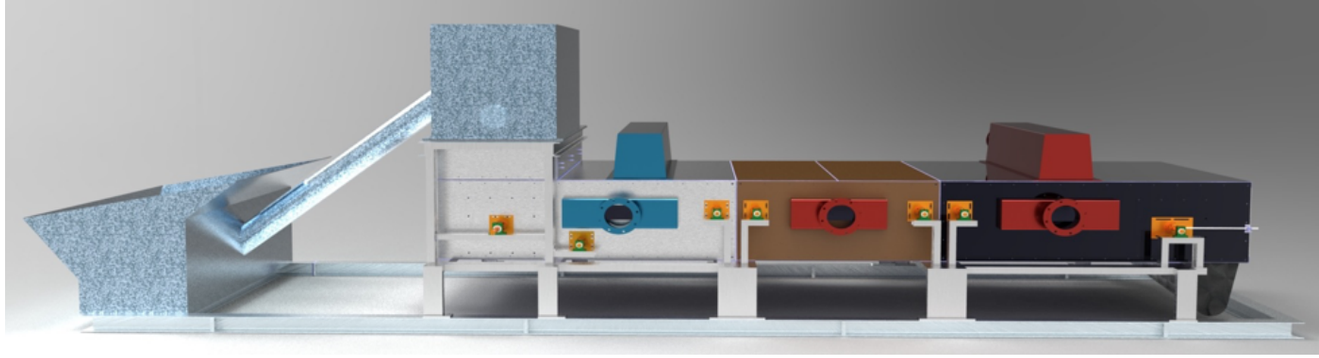
  - Provide district heat or heat to farm buildings like chicken sheds

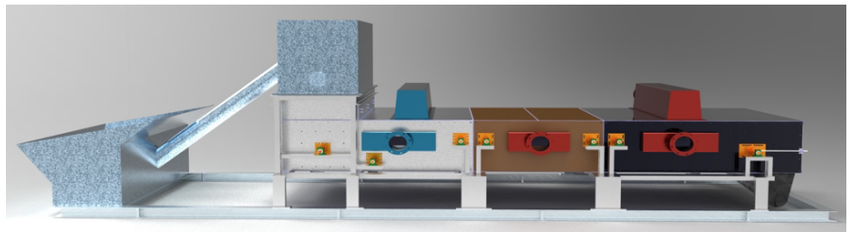
  - Dry lumber in sawmill operations, etc,

  - Provide heat to additional horizontal bed kilns operating at torrefaction temperatures

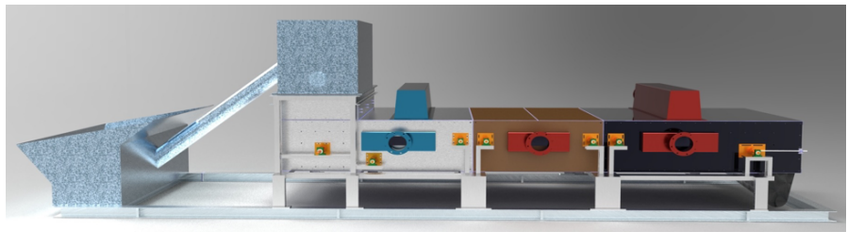
Versatility

Torrefaction array



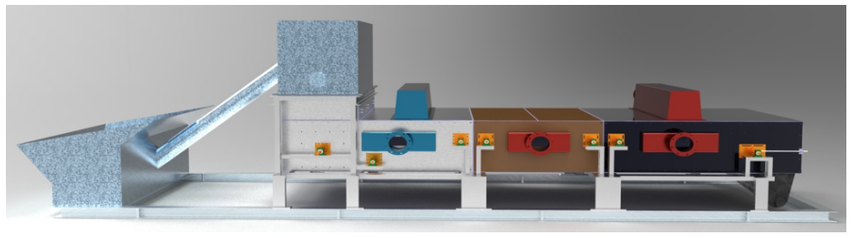


300° C

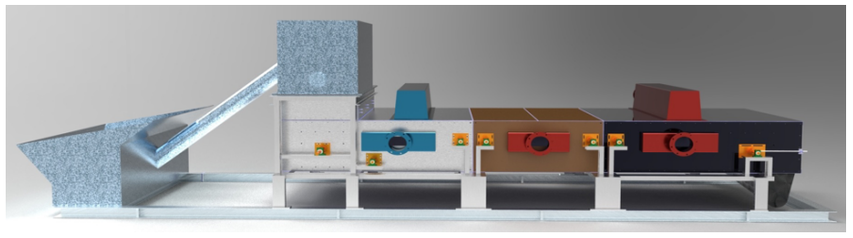


300° C

450° C +



300° C



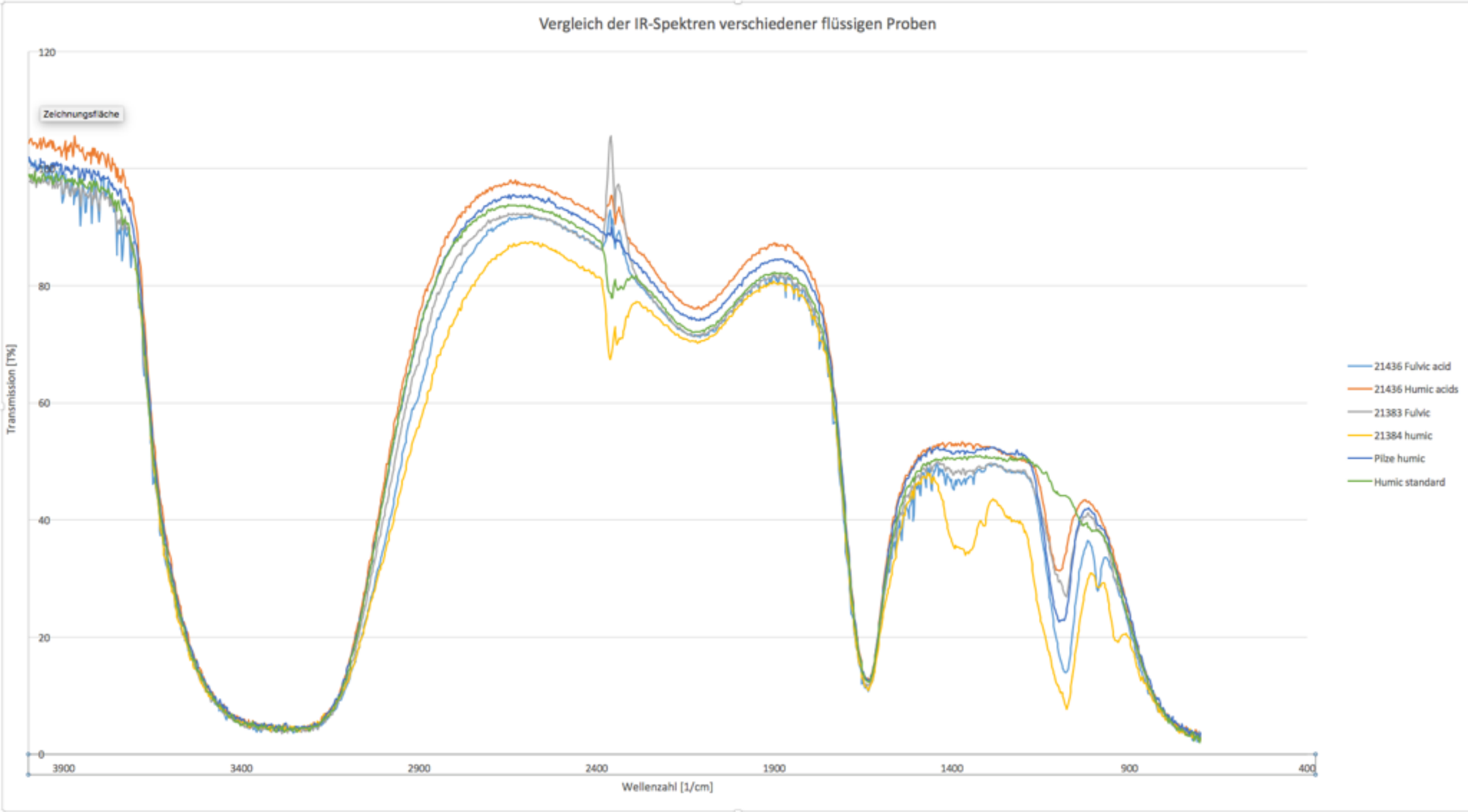
300° C

Torrefied biomass

- Provides soil fertility benefits, same as (or better than) biochar
- Minimal carbon losses - 90% conversion rate
- Can be ground and mixed with biochar produced
- Can also be used to produce pure humic substances direct from biomass, including humic and fulvic acid

Fulvic acid
CEC 500 to 700 meq / 100g

Humic acid
CEC 600 to 1200 meq / 100 g



Infrared spectrum analysis of humic and fulvic acids produced by Nikolaus Foidl compared to the Sigma-Aldrich humic standard

Humic substances

- Existing market of hundreds of millions of dollars in annual sales.

- Currently produced from brown coal and known in the market as “humates”. Raw material is contaminated with heavy metals and radioactive material that must be removed at high cost.

- Nikolaus’ novel method produces humic substances from torrefied biomass free from contamination at higher purity rates for a fraction of the cost. We can call them bio-humates.

Advantages of bio-humates

- Affordable cost in commercial agriculture. Treatment costs per hectare estimated to be 120 - 160 Euro annually.
- Use can substantially reduce fertiliser, insecticide, fungicide and herbicide costs, potentially leading to overall savings before productivity gains are factored in.
- Can be applied using existing spraying equipment. Think of it as liquid biochar.
- Plentiful existing data on the effectiveness of humates in a wide variety of agricultural applications
- Fulvic acid has a wide array of industrial uses where purity is essential.

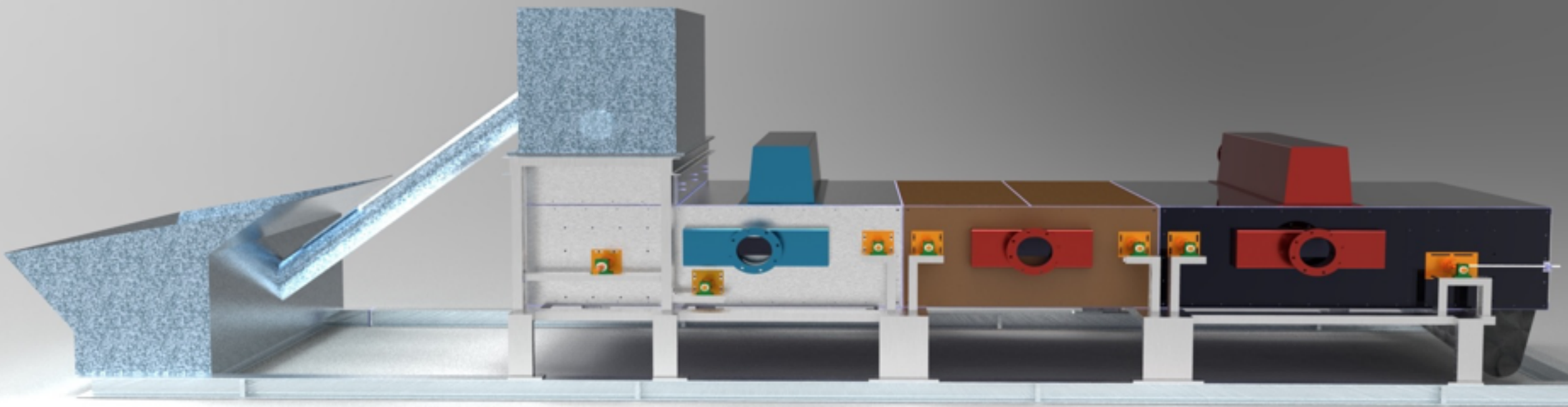
Biochar producer

- Our technology allows the biochar producer to offer a full range of soil carbon substrates, suitable for a variety of markets and conditions.

- Hopefully it might also help to fulfil biochar's promise.

Biomass to bio-humates. The future of full C recovery from any biological waste.

–Nikolaus Foidl



CarbonZero®

Biochar Production Technology

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