

INDUSTRIAL CHARCOALING

with the

CLEAN FUELS CONDENSING RETORT

Existing production technology

Artisanal

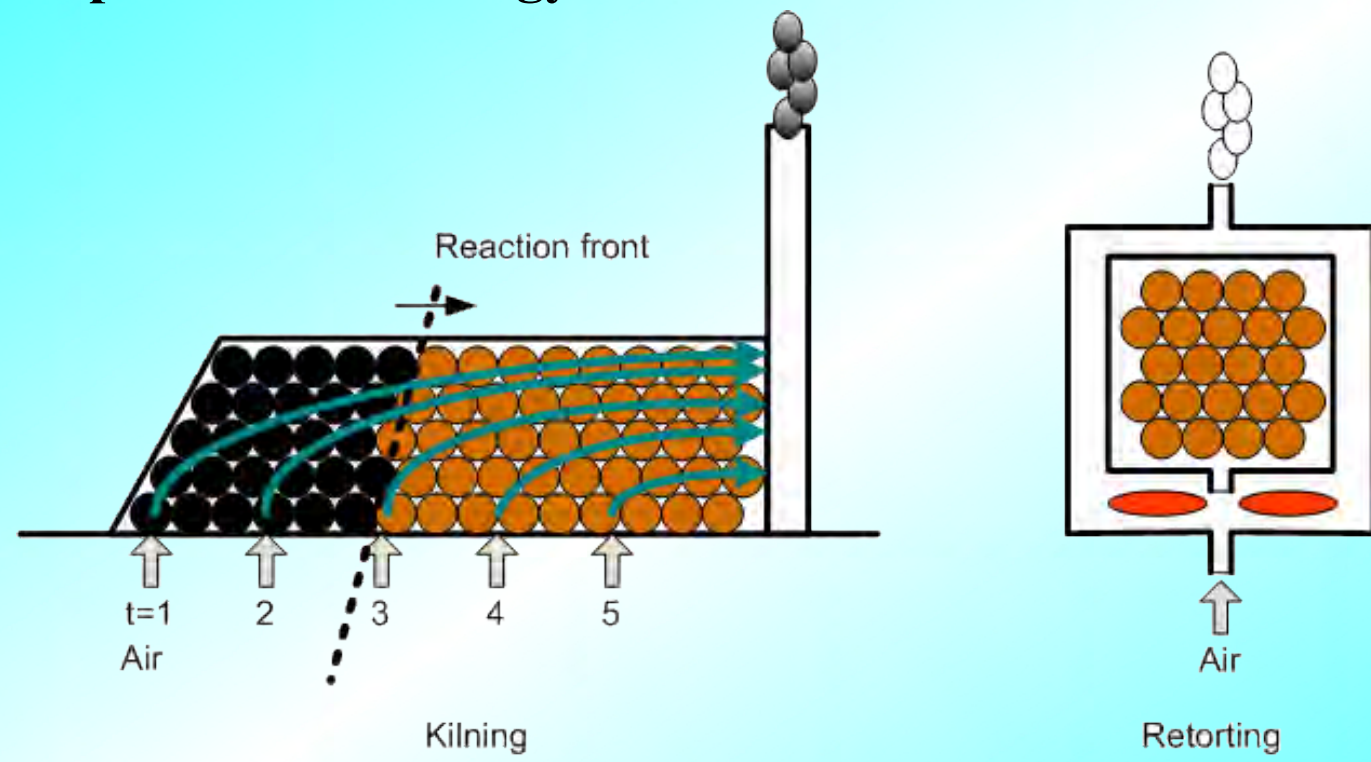


Small & Medium & Large Industrial

Very large



Actual emissions depend on technology



- **Kilning:** Air valves are controlled to provide combustion air at the required periods ($t = 1-5$). Uncombusted vapour cools down on the heating load. The cooled vapour cannot ignite and gives dirty emissions.
- **Retorting:** Released vapour is combusted to 1/ indirectly provide heat to the load, and 2/ to prevent dirty emissions.

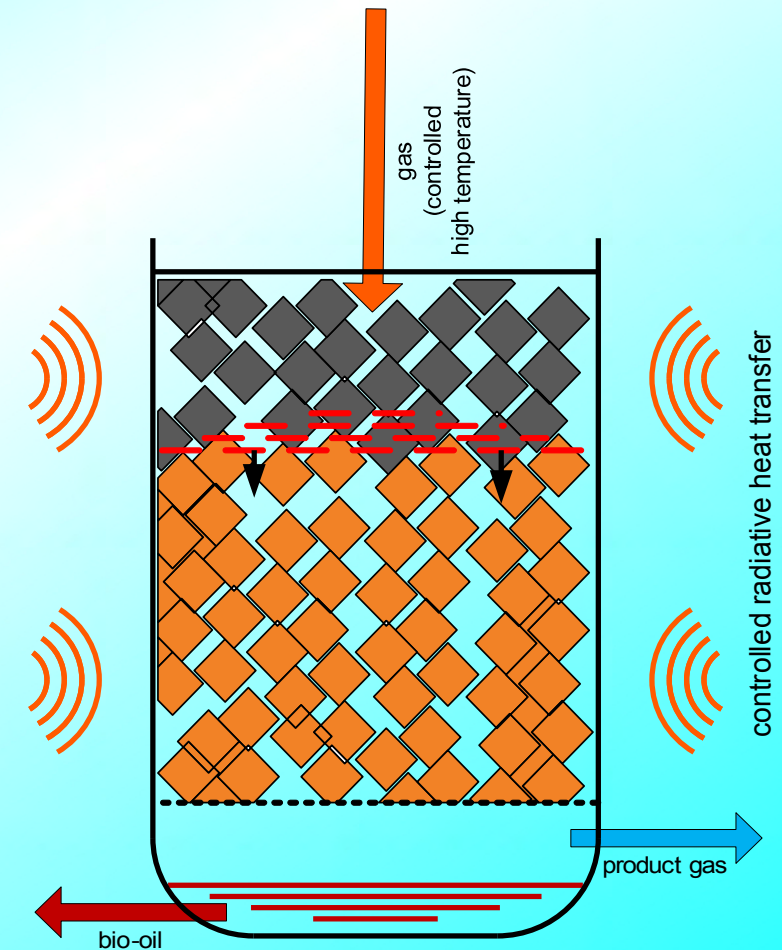
Principles of the Condensing Retort

- Batch process (2 x 5 m³ retorts processed simultaneously)
- Vapour combustion and energy storage sustain the process
- Combined direct and indirect heating to boost capacity, and to apply and control process temperature
- Fixed bed, controlled moving reaction front
- Bio-oil condensation inside retort:
 - secondary carbonisation increases yield
 - secondary carbonisation reduces ash content
 - surplus liquid bio-oil

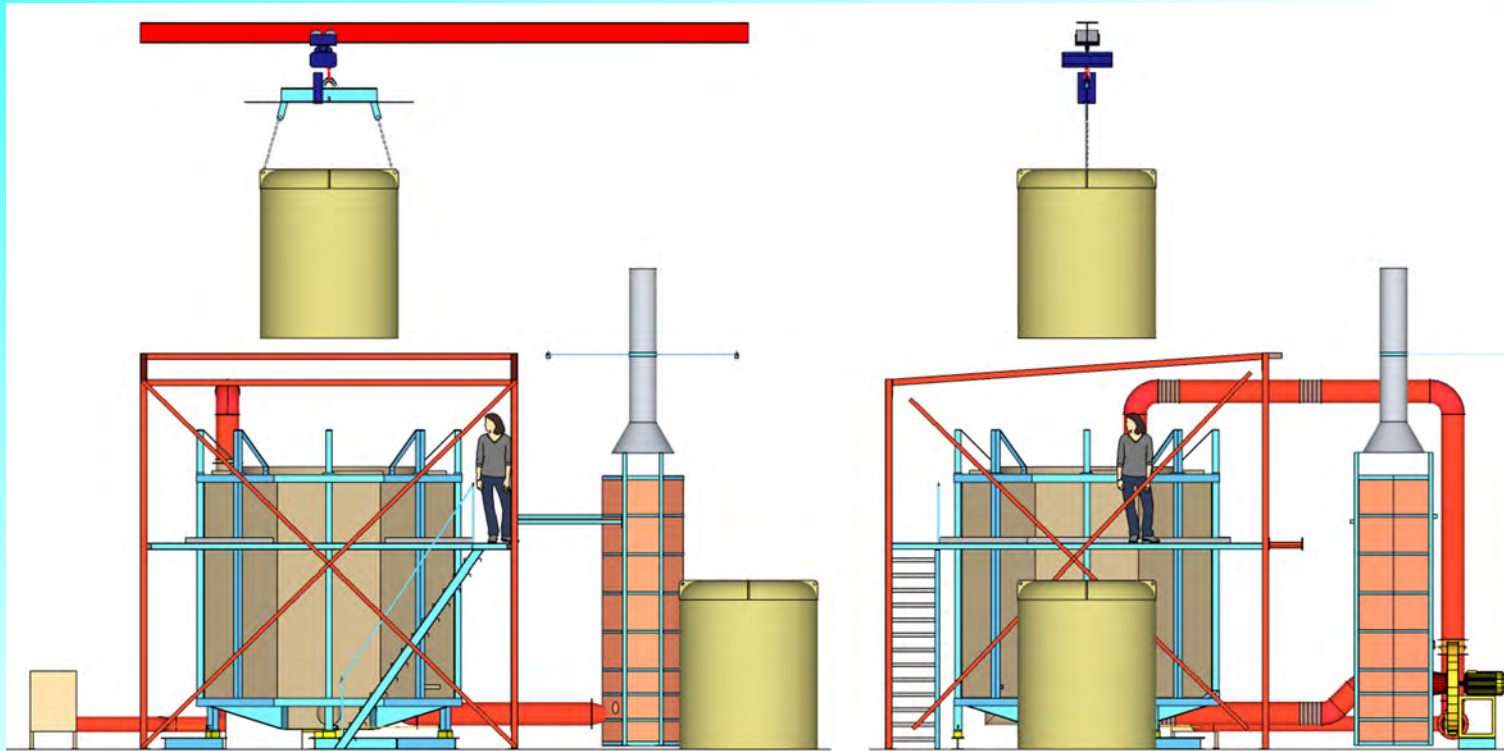
Results:

- Increased production capacity
- Suitability for many feed materials (from nut shells to lump wood)
- Increased yield (process efficiency)
- Controlled and increased product quality
- By-product (bio-oil)
- No harmful emissions (proper combustion of product gas)

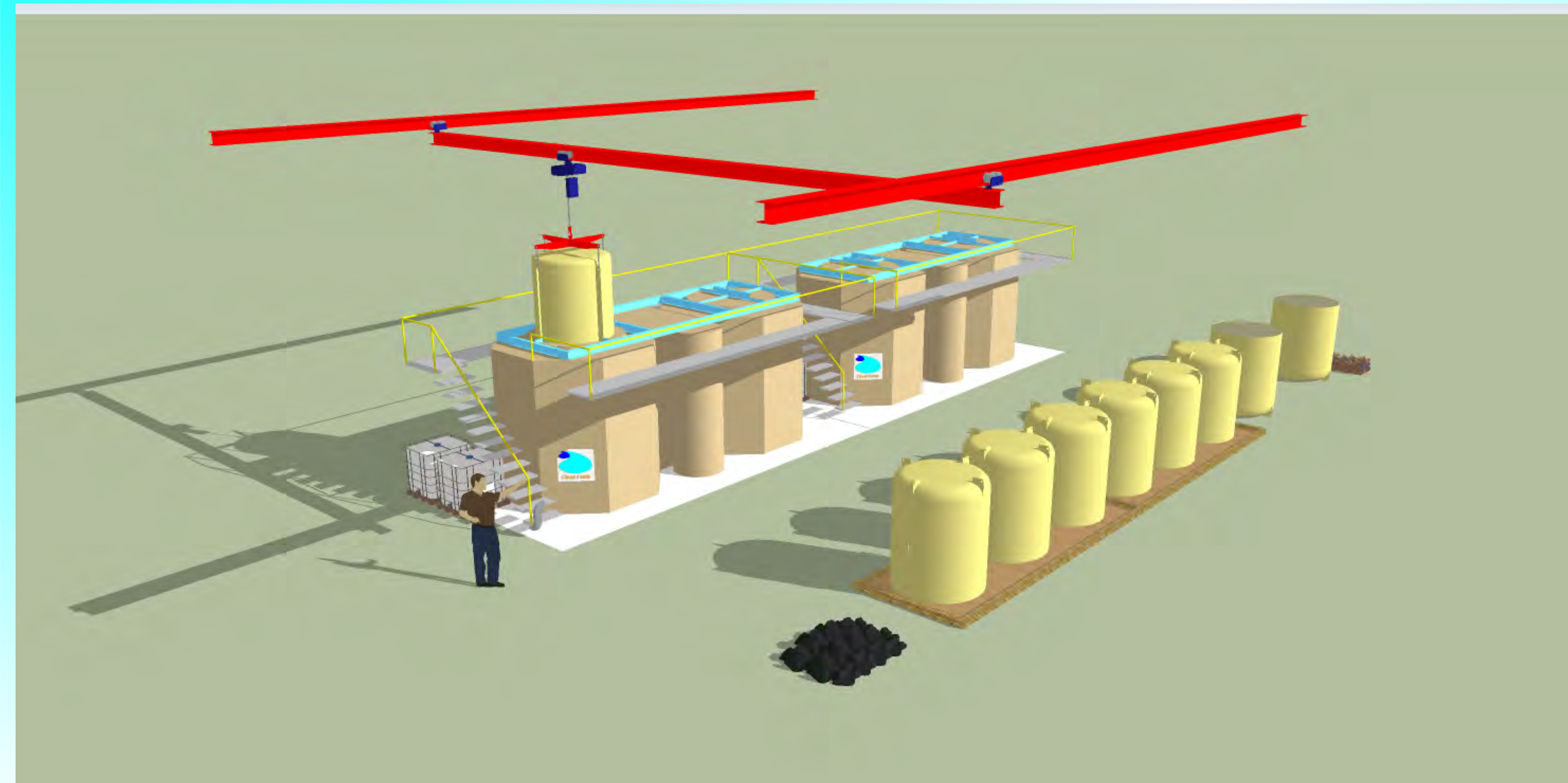
Patent pending



Implementation: true scale test facility



A small Condensing Retort plant



Our technology characterisation

Improved material use	Small wood pieces and larger (not only large pieces) Nut shell
Increased yield	35%-40% (vs 10%-30%) (mass % charcoal / dry wood)
Clean emissions	No noxious gases No GHG gases
High charcoal quality	Controlled All qualities demanded (up to 0 volatile matter)
By-products	Electricity (80 kW _e) (topping cycle) (to come 2014) Residual heat for steam or drying (1 MW _{th} , 500 °C) (bottoming cycle)
Capacity 1000-1500 t/yr	for Medium, Large & Very Large Industries Modular

No harmful emissions

A new reaction equation (for our nerds)



We make better & more



We get rid of the dirty cloud!