Hydrothermal carbonization of sewage sludge: estimation of energy balance

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Agenda

- Introduction and motivation
- Objectives
- Experiments
- Results
- Conclusions

INTRODUCTION

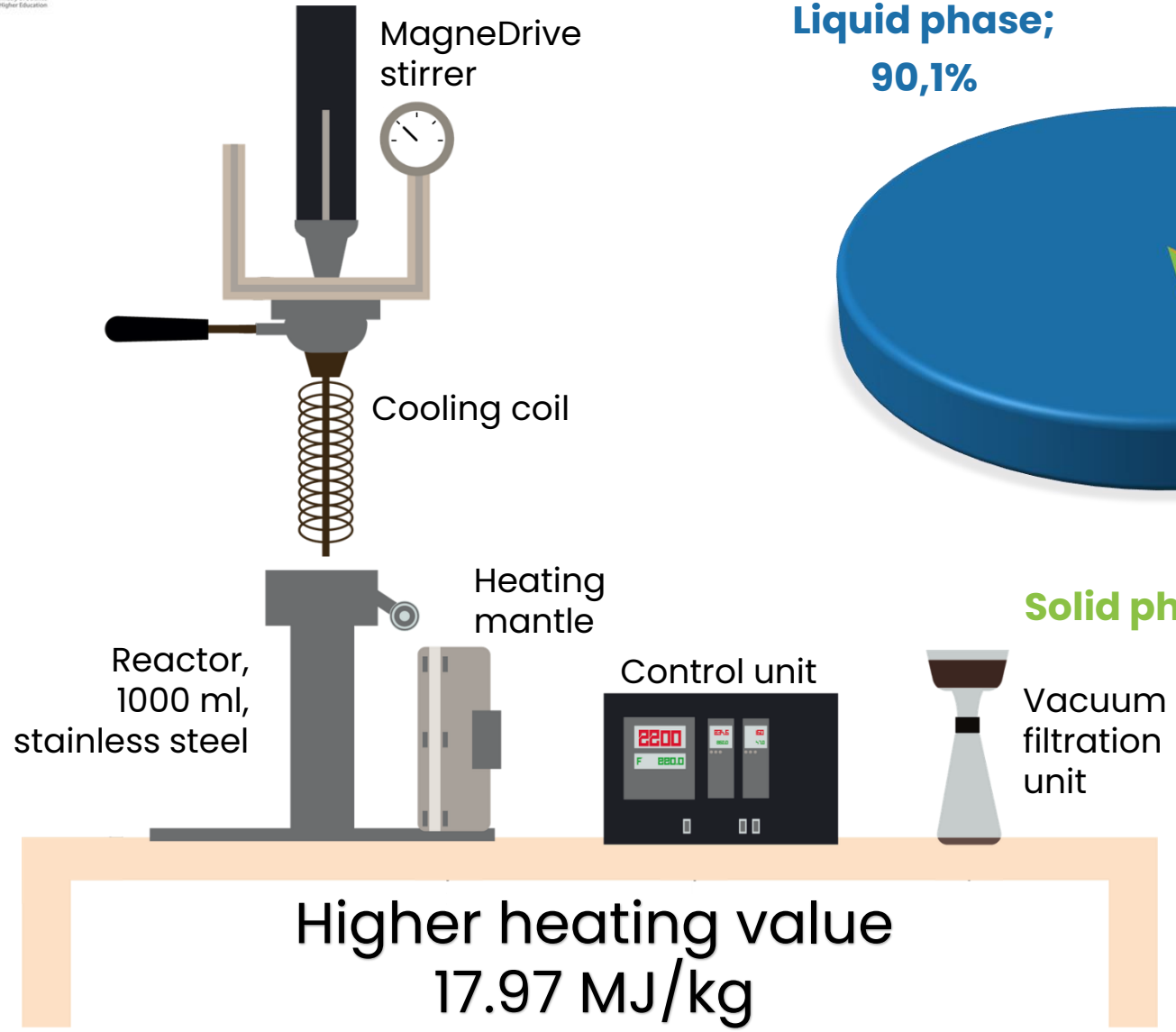
SEWAGE TREATMENT PLANT PŁASZÓW IN KRAKÓW, POLAND

source: *https://wodociagi.krakow.pl/o-firmie/infrastruktura/zaklad-oczyszczania-sciekow-plaszow.html*

OBJECTIVES

- Increase dewaterability of sewage sludge
- Improve efficiency and decrease cost of sewage sludge treatment
- Proposal of industrial layout for HTC unit in wastewater treatment plant
- Assess energy balance for this layout
- Introduction step to LCA

EXPERIMENTS



Higher heating value
17.97 MJ/kg

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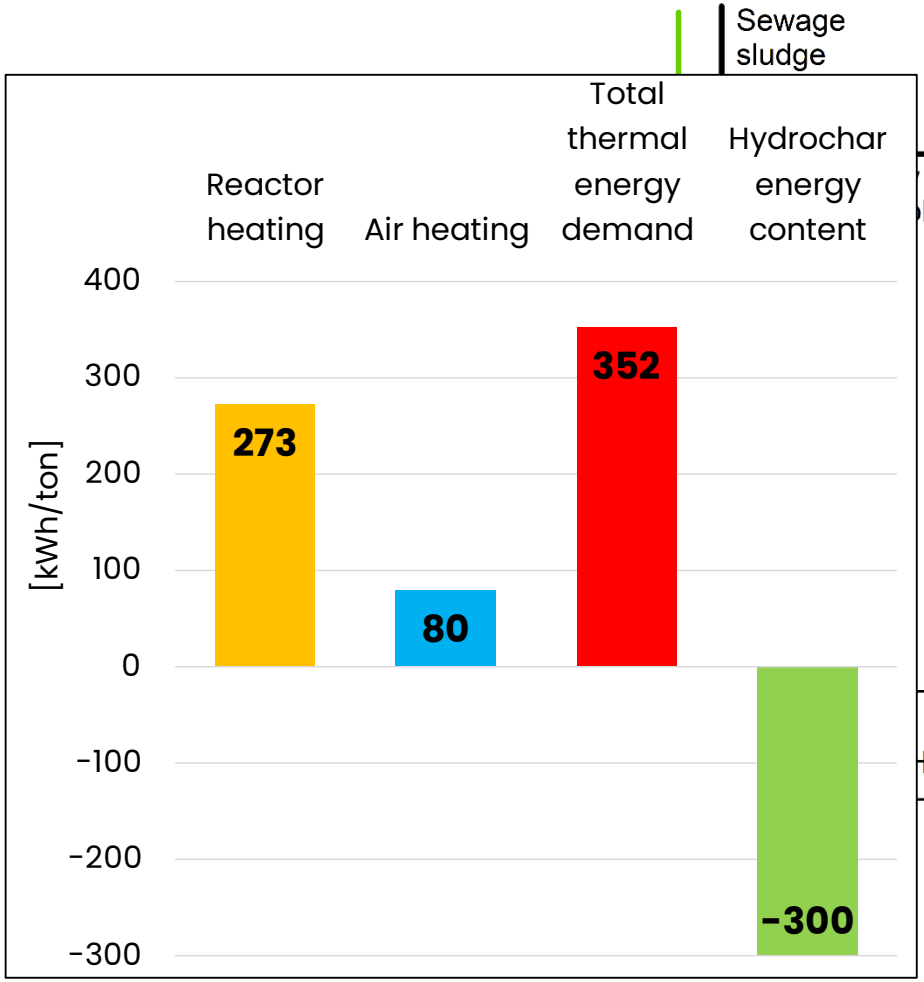
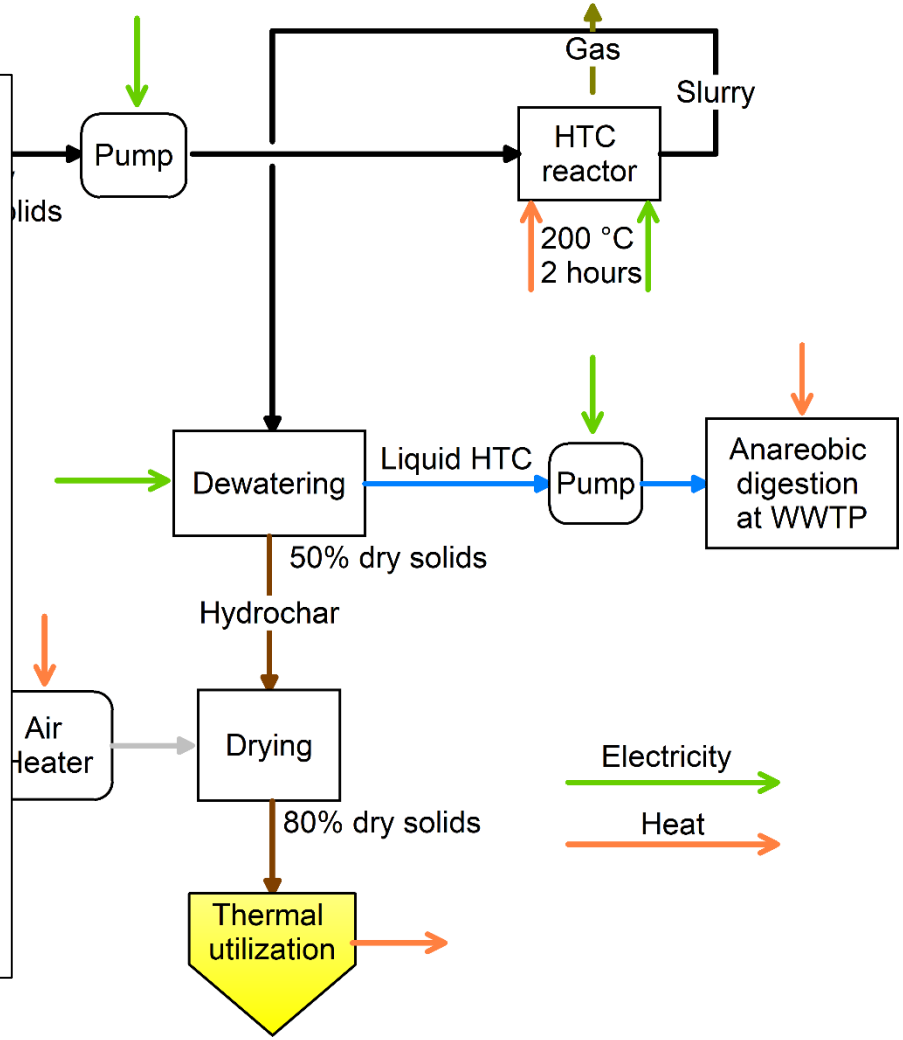
Source: *Michoń, A., 2021. "Investigation of physical and chemical properties of hydrochars derived from municipal solid waste" Master thesis. AGH University of Science and Technology.*

INDUSTRIAL SCALE HTC UNIT





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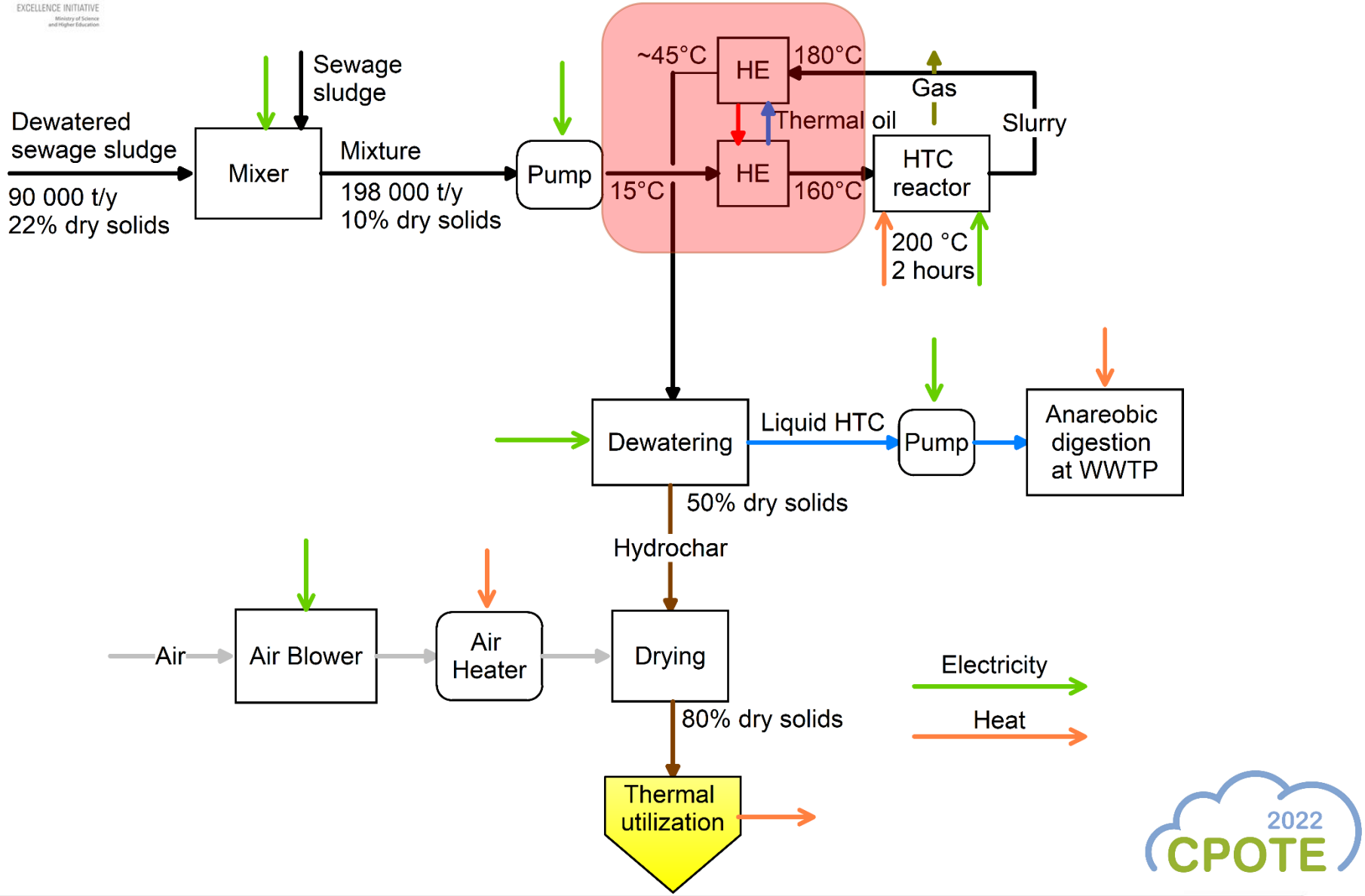
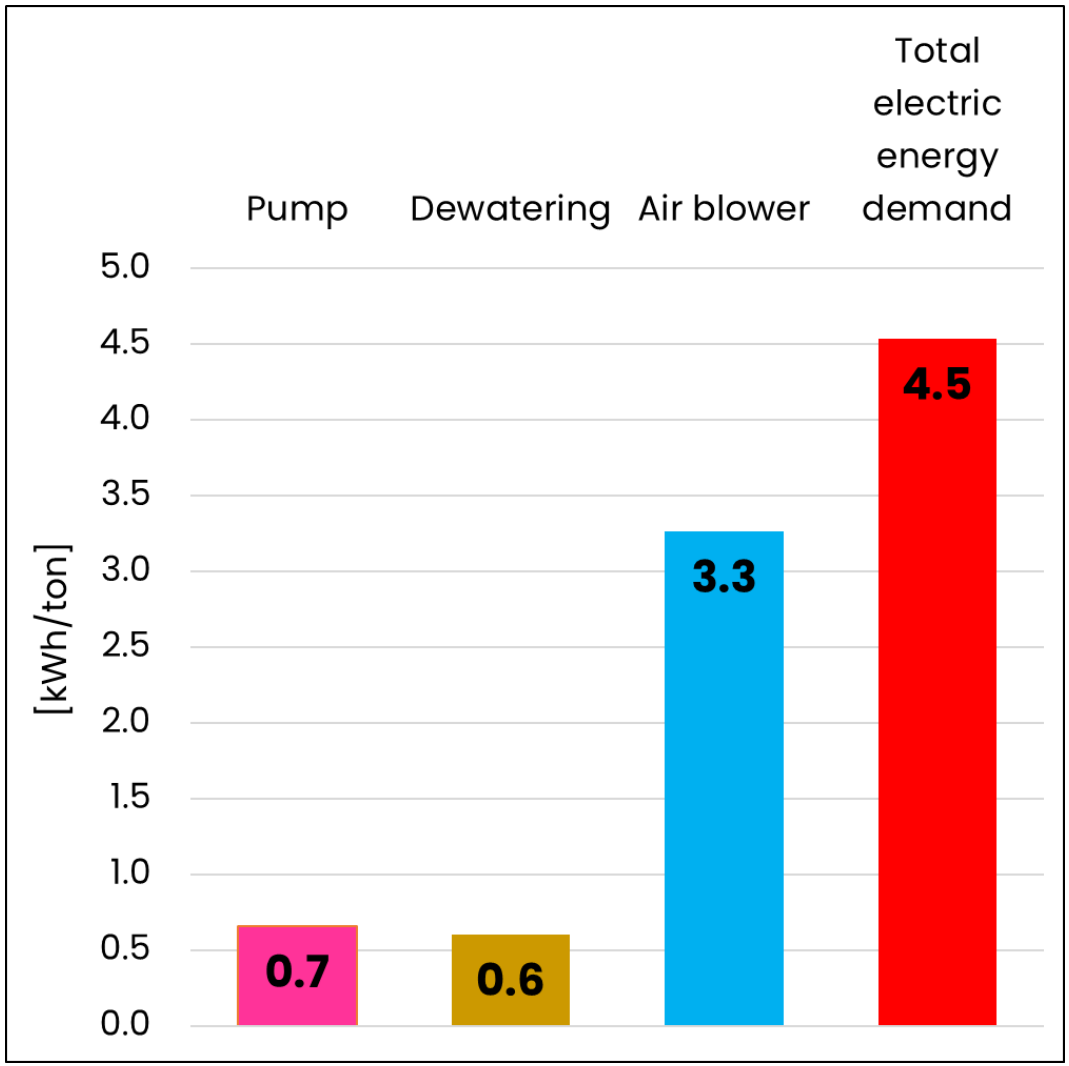
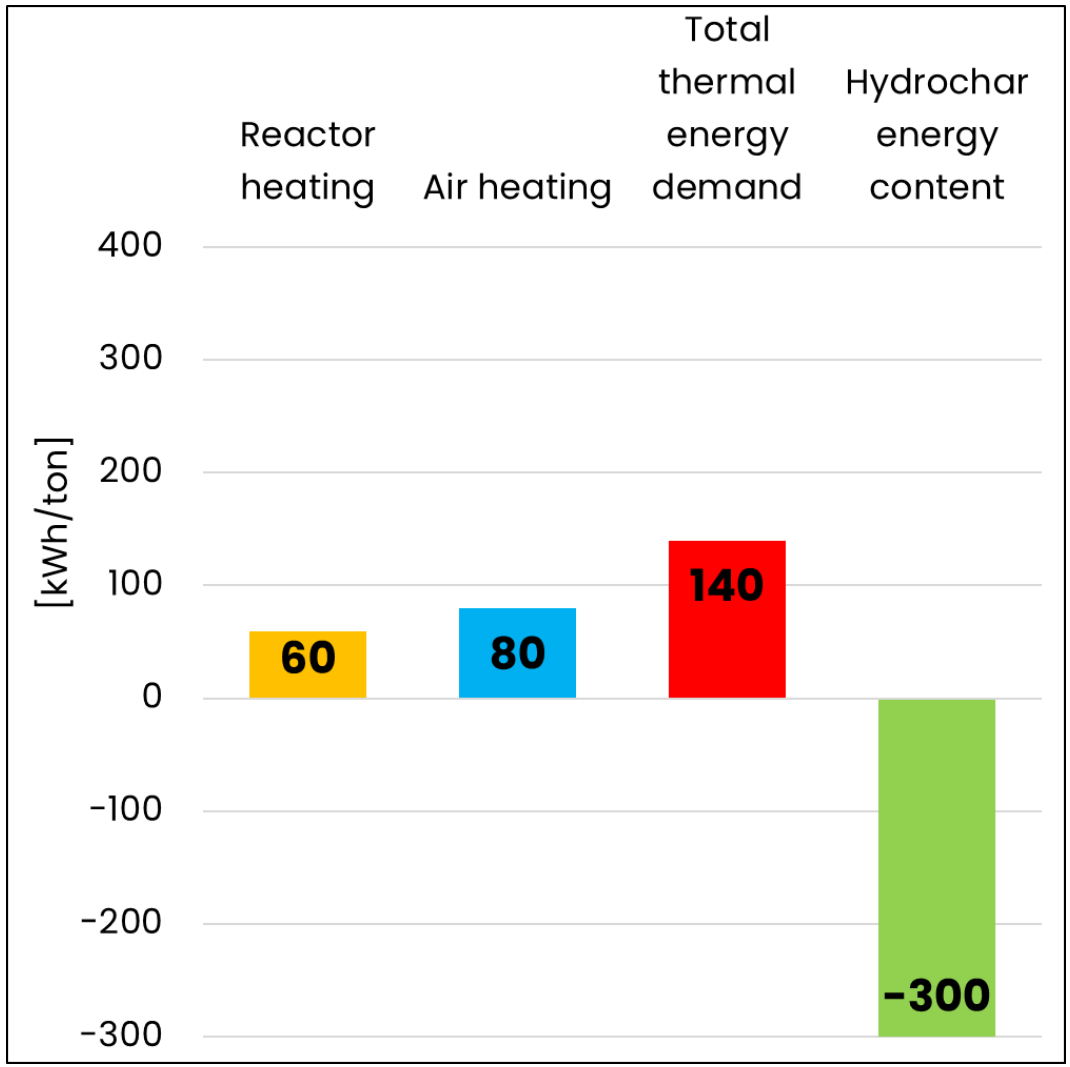
INDUSTRIAL SCALE HTC UNIT



Results


Pump
Dewatering
Air blower
Total electric energy demand
[kWh/ton]
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.7
0.6
3.3
4.5


Reactor heating
Air heating
Total thermal energy demand
Hydrochar energy content
[kWh/ton]
400
300
200
100
0
-100
-200
-300
60
80
140
-300

CONCLUSIONS

- A scale-up of the HTCprocess was proposed.
- If sewage sludge would be processed with 22% ds. the number of reactors could be twice lower.
- A heat exchanger needs to be introduced to decrease the thermal energy demand
- The energy potential of the hydrochar is more than capable of covering the energy requirements of the proposed installation.

THANK YOU FOR YOUR ATTENTION!

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QUESTIONS

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