PyroGas
Techno-economic Analysis of a Decentralized Disposal Concept for Sewage Sludge by Pyrolysis and Subsequent Entrained Flow Gasification for Gas Engine Use

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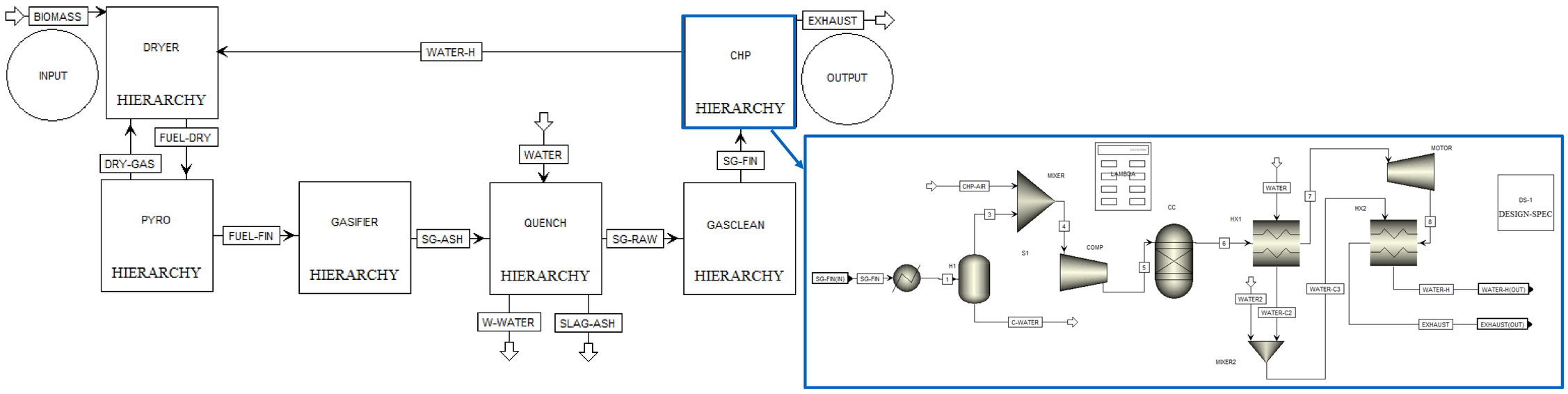
Motivation and Project Approach

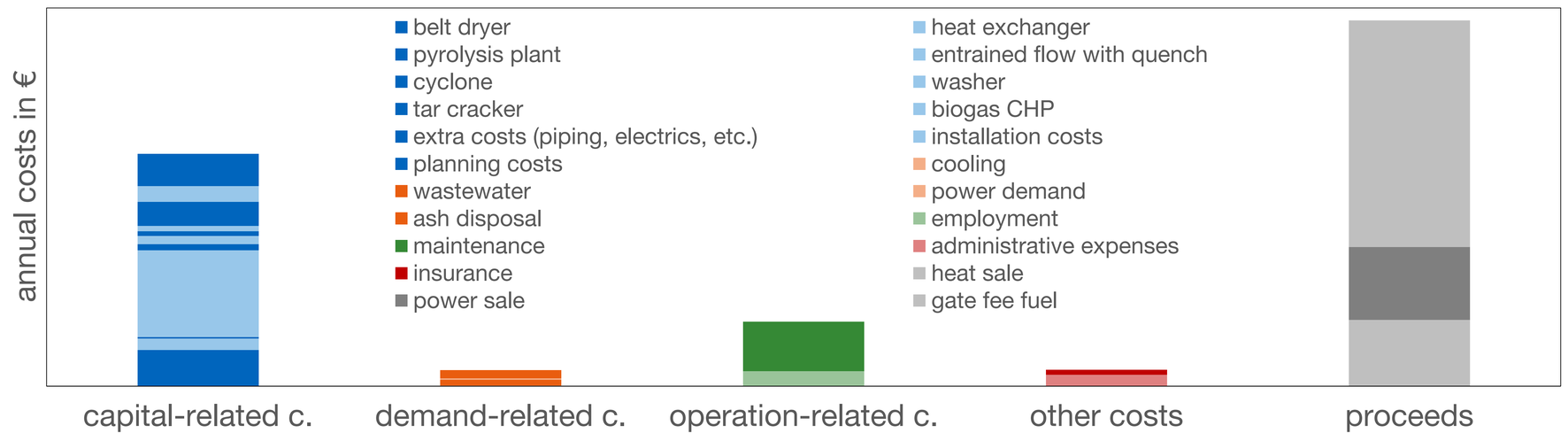
The project PyroGas examines the decentralized exploitation of biomass-derived waste and residues by pyrolysis and subsequent entrained flow gasification for gas engine use. The application of an autothermal entrained flow gasification ensures a synthesis gas with a minimum of impurities and tars due to the high gasification temperatures. The concept provides the coupling of thermochemical conversion of biomass with a downstream gas engine processing of the produced synthesis gas for combined heat and power generation. The gas engine enables a highly scalable overall concept. This opens up the opportunity for a decentralized integration of the system. The main raw materials for the experimental considerations are sewage sludge and poultry waste. Both offer the option of charging a gate fee for disposal, so we expect the whole process to be economical. For a more detailed examination, a model of the entire process chain in Aspen Plus® enables a techno-economic assessment.

Techno-Economic Assessment of PyroGas

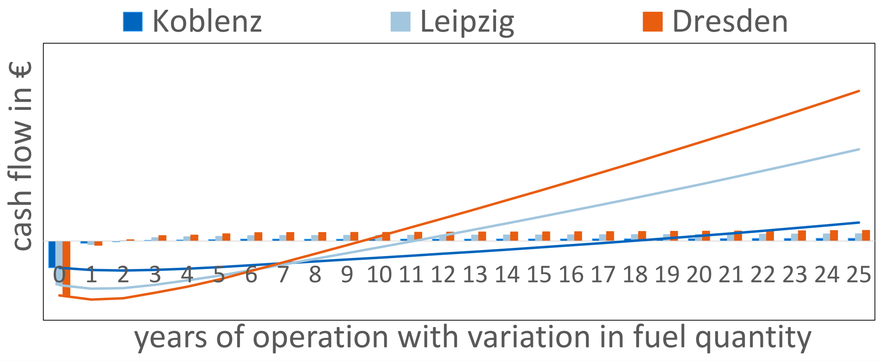
1) Overall Aspen Plus® simulation of the PyroGas process with CHP unit as an example for the detailed design of the model.

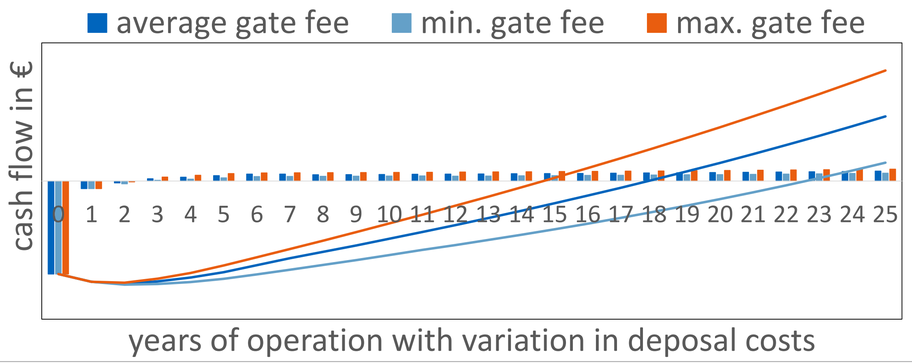


2) Determination of costs according to VDI 2067.
Example with data from the base case showing all components taken into account.
(Read from left to right, and from top to down.)



3) Calculation of economic efficiency using the annuity method for creating cash flow charts.





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Goals and Outlook

- Simulation of the entire process chain in Aspen Plus®
  - Combination of experimental data and thermodynamic process simulation
  - Comparison of different types of fuel such as sewage sludge, poultry waste and wood
  - Analysis of the sensitivity of plant size, fuel costs and performance of the main components
- Determination of costs according to VDI 2067 for capital-, demand-, and operation-related costs
- Calculation of economic efficiency for creating cash flow charts to show the sensitivity

➢ Outlook: Validation of simulation results through experiments in a 120 kW pilot-scale test rig

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