The waste heat concept to increase the process efficiency within the XTL-process\(^1\) consists of a ceramic high temperature heat exchanger, an indirectly heated gas turbine and a heat recovery boiler.

The results of mass and energy balances show a potential of up to 9.6 MW additional technical power with an integrated open gas turbine cycle which is indirectly heated. Besides, the defined models provide the total amount of steam needed to run the gasifier. Thereby the gasification fluid (steam) uses the waste heat of the gas process within the gasification process.

### Methods

The two following schemes of the investigated models show the best results for the waste heat concept:

[Diagram of Model 1 (open) and Model 2 (closed gas turbine cycle) with steam generation as gasification fluid and the boundary conditions.]

To realize such waste heat concepts, an innovative high temperature heat exchanger, resistant to corrosion, is needed. The approach of research therefore is based on ceramic heat pipes:

[Diagram of Demonstration plant of a high temperature heat exchanger with ceramic heat pipes.]

### Perspective

The simulation results show the high potential of the waste heat concept. For the implementation of this concept, a heat exchanger technology is needed, which is resistant to temperatures over 900 °C and to the highly corrosive atmosphere of the raw gas containing alkaline components especially by using biomass. High durability under these conditions can be performed by a heat pipe heat exchanger made of SiC, which has been recently built as a test rig at the TU Dresden. For this, geometrically simple ceramic heat pipes with regard to the manufacturing process have been developed. Sodium and zinc are adaptable as working fluids for the intended temperature range. After several tests of single heat pipes, they will be used to validate a mathematical model of the heat pipe heat exchanger performance.

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\(^1\) p. 41 ff. in: Schmalfeld, Jörg: Die Veredlung und Umwandlung von Kohle; Deutsche Wissenschaftliche Gesellschaft für Erdöl, Erdgas und Kohle e.V., Hamburg 2008.

\(^2\) The point balance for Model 2a and 2b has to have 100% efficiency due to the closed gas turbine and without considering energy losses to the environment. In that case no energy is lost to the environment. So that value is calculated to check the balancing.