biosweet
Biomass for Swiss Energy Future
Swiss Competence Center for Energy Research

In cooperation with the CTI

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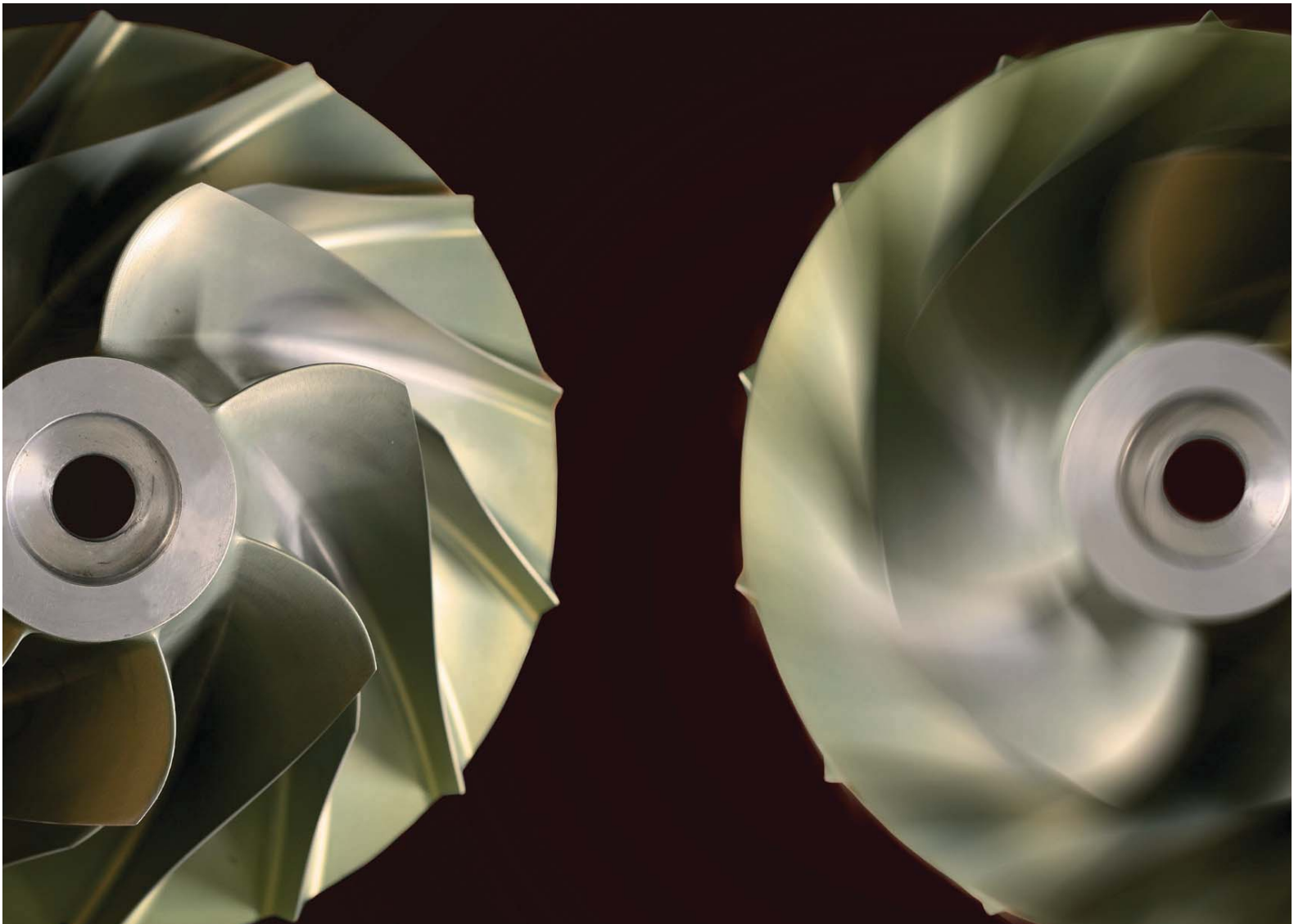
Hot Air Turbine

Externally-biomass-fired, micro gas turbine



Combined Heat and Power from Biomass Combustion

With decentralized, combined heat and power (CHP) production, high primary energy efficiencies are achievable for biomass. SCCER BIOSWEET pursues in cooperation with Micropower Technology GmbH an innovative concept, in which heated air produces power in a modified gas turbine. Promising applications, with a capacity of 30 – 200 kW electrical power, are residential and industrial buildings, small district heating systems, hotels, hospitals, etc. which have a constant heat or cooling demand.

Gas turbines are robust engines, which are used for efficient power generation. In the modified, externally-fired micro gas turbine, the working fluid is heated air instead of flue gas. This leads to low material stresses and as a consequence promises low maintenance costs and extended lifetime. Moreover, turbines are quieter and less vibrating than internal combustion engines and therefore, more suitable to use in residential areas.

Technology Readiness and Roadmap 2020

In 2016 – 2017, the concept is being realized in a pilot plant in Germany.

In 2018, the model of the heat transfer in the combustion chamber will be validated.

In 2019, the potential to extend the range of biomass fuels to improve the economics of the process will be determined.

Marketable Product

> Heat
> Power
> Cooling (optional)

Suitable Feedstock

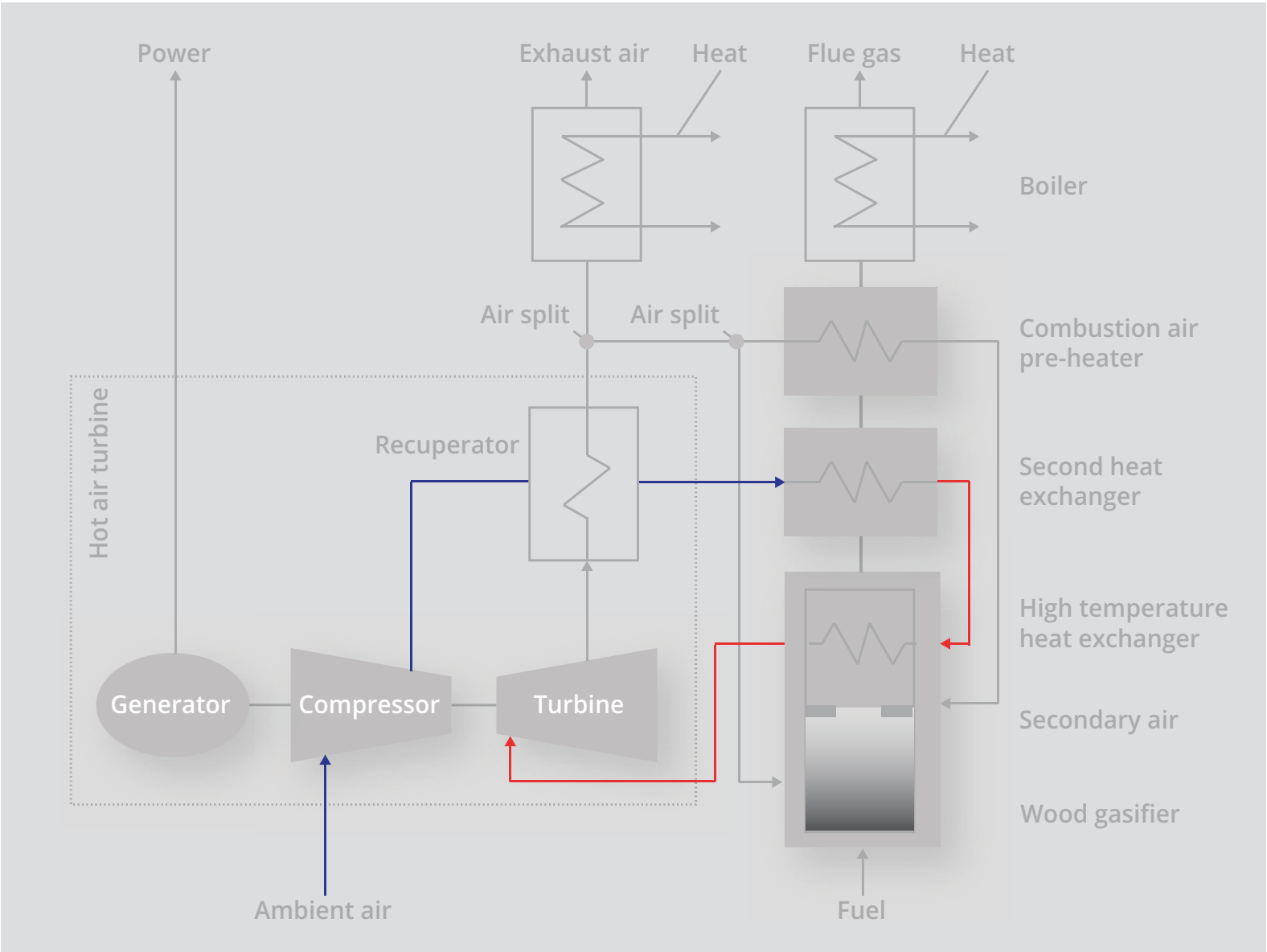
> Wood chips
> Woody residues from digesters

Low Emissions Combustion and High Efficient Heat Transfer

Within the concept the enthalpy of the hot flue gas is transferred to the compressed air using a high temperature heat exchanger. The heated and compressed air is then expanded in the turbine to produce mechanical work and finally electrical power. The remaining enthalpy in the flue gas can be recovered in a second heat exchanger for highly exergetic, high temperature heat to achieve overall high exergetic efficiencies.

Due to the spatial separation of combustion and the working fluid, the fuel can be burnt in a furnace for which low emissions, atmospheric combustion concepts are available. Here, a staged combustion with highly turbulent, homogenous temperature profiles in the combustion chamber, integrated with a novel heat exchanger design, is promising.

Future research and development are necessary to further investigate and optimize improvements in the integrated combustion and heat exchange process.



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