

## UTILIZATION OF BIOGENIC AND LOW-RANK FOSSIL FEEDSTOCKS: A SUSTAINABLE WIN-WIN APPROACH

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### INTRODUCTION

The co-utilization of low-rank fossil feedstocks and biogenic residues to produce high-value energy carriers for material and energy utilization pathways is a sustainable solution to meet environmental and energy political targets. The advantages of both feedstock sources could be combined to reduce fluctuations with the seasons, increase capacities of the plant, and to obtain optimum product qualities and yields.

Fraunhofer UMSICHT is carrying out research for a robust technology for fossil and biogenic feedstock mixtures. Experimental investigations regarding possible interactions between the co-pyrolysis of lignite and biomass have been performed.

### RESULTS

The robustness of the technology enables us to utilize a wide range of low-rank fossil and biogenic feedstock mixtures. The optimum mixing ratio of low-rank fossil feedstocks and various biogenic feedstock is directly correlated to the needs of the downstream processing of the products and to the economic and ecologic framework conditions.

It is therefore possible to produce a syngas that meets the demands of the downstream processes regarding hydrogen concentration or  $H_2/CO$  ratio with a variable renewable footprint. The composition and yields of the product's oil and char can also be optimized by the selection of the feedstock and process parameters.

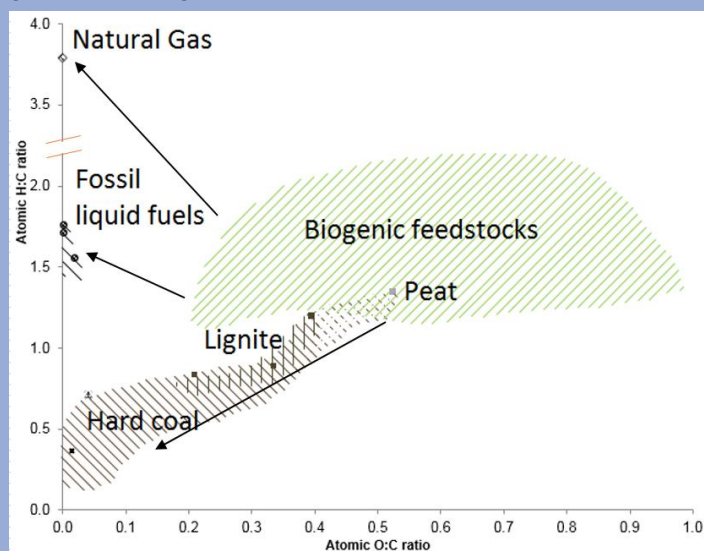
To conclude, the TCR<sup>®</sup> technology is broadening the raw materials base of the chemical industry and converting low-rank fossil fuels or residues into high-quality products like hydrogen, synthesis gas, and transport fuels.

### CONCLUSION

- Co-utilization of low-rank fossil feedstocks and biogenic residues within the thermo-catalytic reforming process opens various opportunities beyond an ecological upgrading of fossil fuels.
- The Production of tailor-made solid, liquid, and gaseous fuels is possible.
- Products can be easily integrated into downstream processes.



Granulated lignite (left) sewage sludge (middle), pelletized low grade wood (right)



Van-Krevelen diagram of various biogenic feedstocks and fossil fuels (calculated on water-free basis)

Gas		Lignite	Sewage Sludge	Low grade Wood
$H_2$	vol%	46.6	38.8	33.4
CO	vol%	21.9	10.5	15.6
CO <sub>2</sub>	vol%	7.3	15.5	27.2
CH <sub>4</sub>	vol%	22.2	3.6	11.4
C <sub>x</sub> H <sub>y</sub>	vol%	0.3	2.4	1.2
HHV	MJ/kg	24.5	19.0	16.5

Gas characterization of the feedstocks straw and wood (\*calculated by difference)