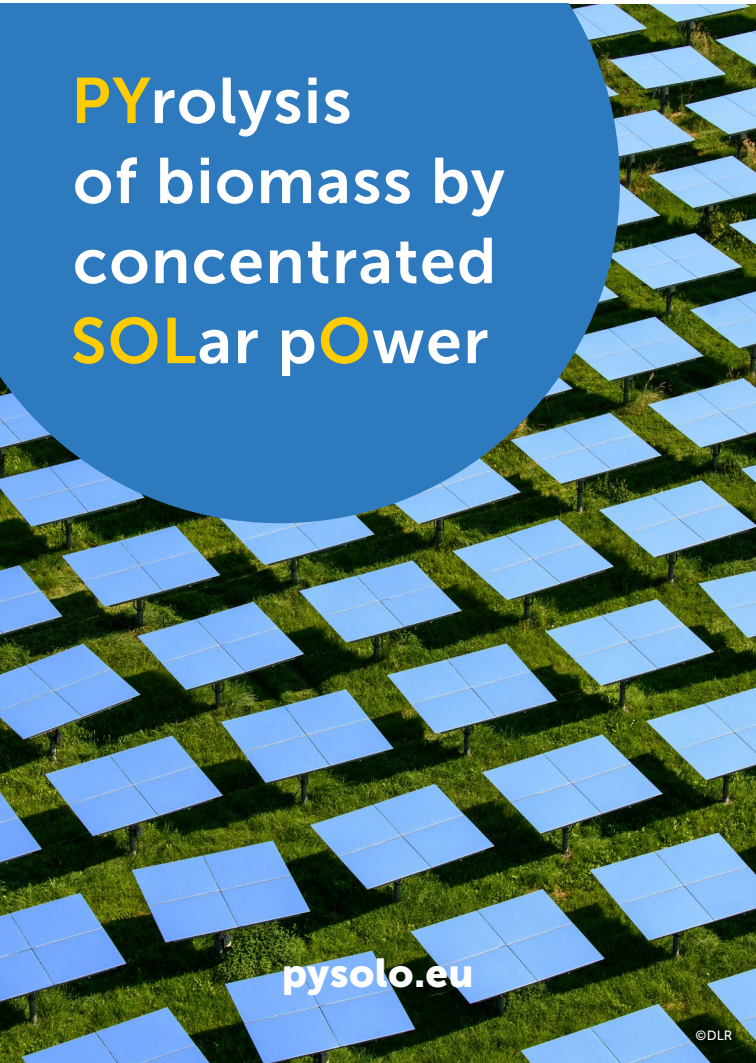
PYSOLO

PYrolysis
of biomass by
concentrated
SOLar pOwer



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Background

In order to reduce CO_2 emissions, the energy and heat needed for industrial processes can be derived from renewable energy sources such as solar energy. However, this decarbonisation through electrification is not the solution for the chemical industry, which is entirely dependent on carbon. Therefore, the chemical industry must defossilise, which means that the carbon needed for chemicals and materials must come from renewable instead of fossil sources, e.g. from biomass such as wood residues (2nd generation biomass).

The PYSOLO Approach

PYSOLO (PYrolysis of biomass by concentrated SOLar pOwer) offers a solution for both decarbonisation and defossilisation of the chemical and materials industry. This will be achieved by developing a fully renewable process combining concentrated solar power (CSP) and biomass pyrolysis. Thanks to the use of solar heat in the pyrolysis process, the production of valuable products such as bio-oil, biochar and pyrogas can be maximised and the associated CO_2 emission minimised. This offers both economic and environmental benefits compared to conventional pyrolysis.

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Balance for the Electric Grid

The combustion of pyrogas and char is not completely ruled out in the PYSOLO project. A key innovation of the PYSOLO technology is that the pyrolysis process can be operated in two ways: It is run by CSP during sunny hours, while it is fuelled by burning pyrolysis gas and char when the (stored) CSP heat is not sufficient. The PYSOLO technology can also balance the electric grid: if necessary, the pyrolysis gas can be converted into electricity and fed into the grid. On the other hand, if cheap and surplus renewable energy is available from the electric grid, it can be converted into high-temperature heat energy to sustain the pyrolysis process. The PYSOLO process is thus a uniquely flexible system that can cope with many different conditions.

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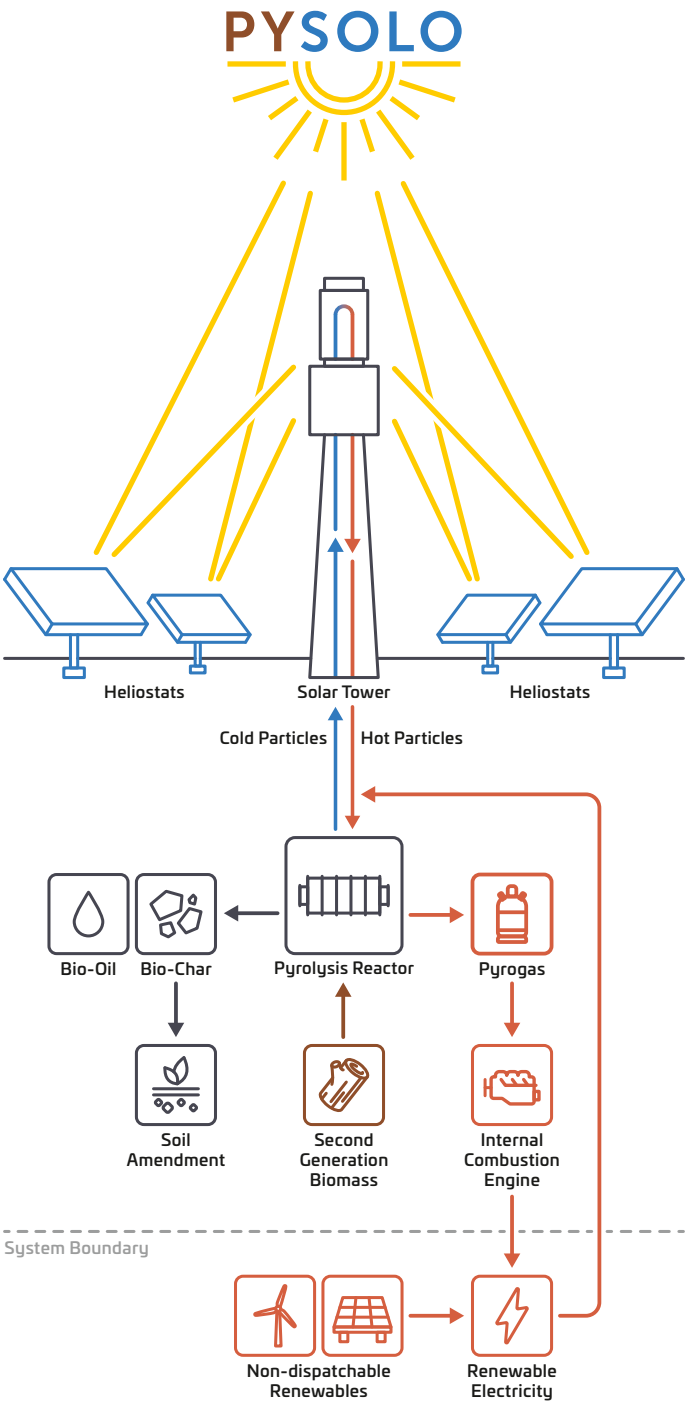
PYSOLO
Heliostats
Solar Tower
Heliostats
Cold Particles
Hot Particles
Bio-Oil
Bio-Char
Pyrolysis Reactor
Pyrogas
Soil Amendment
Second Generation Biomass
Internal Combustion Engine
System Boundary
Non-dispatchable Renewables
Renewable Electricity

The Technology

Concentrated Solar Power (CSP)
is a technology in which sunlight is captured by several movable mirrors (heliostats) and directed onto a solar receiver. The selected receiver technology is a rotary kiln particle receiver, in which solar radiation is concentrated to heat up a solid particle heat carrier (PHC). The particle receiver is being further developed and refined within the PYSOLO project in order to use the heat produced for downstream heat-intensive biomass pyrolysis.

Biomass pyrolysis
is an endothermic thermochemical process that enables the conversion of wood into high-value products such as bio-oil, biochar and pyrolysis gas with high conversion yields. These renewable products can be used for both energy and non-energy applications, e.g. as biofuels for the transport sector and as biochar for agricultural purposes (for soil amendment). In conventional pyrolysis, the required heat is generated by burning char and pyrogas. As char and pyrogas are also high-value pyrolysis product, their combustion is an economically and ecologically inefficient step which also results in additional CO_2 emissions. Generating heat through CSP instead of burning a fraction of the pyrolysis products is therefore a logical and sensible step.

The efficiency and sustainability of both technologies are continuously analysed during the developmental process by means of accompanying **modelling** and **Life Cycle Assessments (LCA).**

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