AVA-CO2 Schweiz AG

Industrializing the hydrothermal carbonization (HTC) process which is able to convert biomass into carbon dioxide (CO2) neutral biocoal and CO2 negative biochar

http://www.ava-co2.com

AVA-CO2 Schweiz AG
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Founded in	2009
No. of employees	22
State of Ownership	Private
Primary stock exchange	N/A

February 2012: Started by three founders supporting reduction of extra CO2 emissions fueling the greenhouse effect, AVA-CO2 develops and markets modular hydrothermal carbonisation (HTC) plants to convert biogenic residues into a high grade CO2-neutral biocoal as well as CO2-negative biochar. Venture Valuation (VV) interviewed Mr. Thomas M. Kläusli, Chief Marketing Officer.

AVA-CO2
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VV: **AVA-CO2's core competence is the efficient and profitable industrial scale application of the hydrothermal carbonization (HTC) process.**

Kläusli: We are globally the first company that has successfully developed the HTC process at industrial scale. We inaugurated in October 2010 the world's first HTC-Demonstration plant.

The HTC process is, briefly speaking, a process in which wet biomass is being transformed under pressure and heat into carbonaceous materials without adding any net carbon. It transforms over 90% of the carbon from the vegetable waste to carbonaceous materials. This means that almost no CO2 and no methane are released into the atmosphere in the process. The HTC process has the highest carbon efficiency among any similar technologies.

For instance, different from pyrolysis, HTC does not require dry biomass. Biomass with added water or just wet biomass is put into a pressure container and heated up. After 3-5 hours biochar or biocoal, depending on the level of coalification, are produced.

HTC imitates natural coalification. Coal, petroleum and natural gas were created from dead plants over millions of years. The HTC process is comparable to the natural coalification but in an extremely short period: 3-5 hours.

In October 2010 we opened an industrial scale model plant in Karlsruhe in Germany. It is able to process 8,400 tons of biomass per year. We welcome industrialists, investors, and government officials who are interested in implementing our technology.

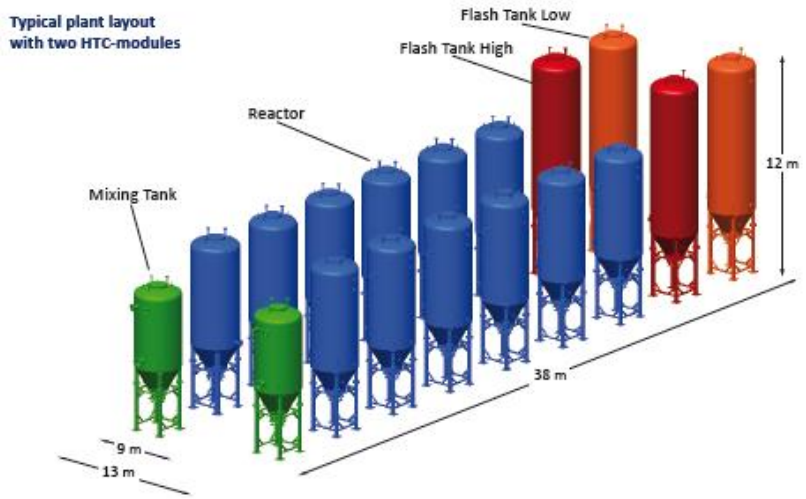
The model plant is designed for demonstration purposes and has a simplified structure. As the photo shows, our model plant houses three components. On the right side, a five-meter high tank mixes and heats biomass up to 150°C; The middle tank is the actual HTC-Reactor with a capacity of 14.4 cubic meters. In this tank, reaction occurs at approx. 220°C with a pressure of 22 bar. On the left side, the largest tank stores extracted energy for recycling and carbonaceous end products such as biocoal and biochar prior to the separation procedure.

VV: **You offer a modular HTC-Plant structure which allows users to customize their own HTC system.**

Kläusli: Our modular structure gives a lot of flexibility. A customer can start with a smaller plant and increase the capacity over time by adding additional HTC-Modules. A HTC-Plant is relatively simple to set-up. Its size is in fact only limited by the amount of available biomass waste. The module is easily integrated into existing infrastructures. For instance, it can be built adjacent to a fruit juice processing factory and be efficiently integrated into the continuous process.

Furthermore, as the HTC process requires the relatively low temperatures and pressure, the tried-and tested industrial standard components (vessels, valves and pumps, and so on) can be applied, making the technology very robust.

Our HTC plant is primarily made up with one or more main modules called a HTC-Line, along with upstream and downstream units such as biomass reception and storage, steam generation, separation and drying, post-treatment and logistics, and process water treatment system.



The illustration shows an exemplary plant layout with two HTC-Lines, each consisting of 6 HTC-Reactors. One module is 38m long, 9m wide and 12m high. It consists of one Mixing Tank, six HTC-Reactors, one Flash Tank High and one Flash Tank Low. Each HTC-Line handles 40,000 tons of biomass yearly and produces almost 8,000 tons of biocoal.

VV: **Does HTC work with any kinds of biomass?**

Kläusli: HTC is suited for various different types of biomass but works best with wet biomass based on cellulose and hemi-cellulose. Therefore, unlike pyrolysis, biomass is not required to be pre-dried. Wet biomass, serving as aqueous solution, absorbs and spreads out the heat generated by the decomposition of the molecules. Sugar building blocks which form biomass hold a great deal of energy. When the chemical process breaks them down into carbon and water, additional energy is released, which is called an exothermic reaction. This surplus energy contributes to saving energy for the whole operation cycle.

VV: **What are the characteristics of the biocoal produced by your HTC method?**

Kläusli: The quality of biocoal depends on the type of biomass. For instance, when using brewers' spent grains, the caloric value is between 25 and 27 MJ/kg and the carbon content per kilogram is 65%. Its quality is classified substantially higher than regular brown coal.

Because minerals and ingredients other than carbon are carried away by the process water, the biocoal generally contains a very low percentage of ash; the ash melting point is 1,400°C; the sulfur content is insignificant (0.1% to 0.5%). It also has an extremely fine particulate morphology (99% per kilogram is smaller than 300 µm). Based on those scientifically evidenced values, the biocoal's nitrous oxide emission level is proven to be low.

VV: **What are the major advantages of the HTC process compared to other renewable energy technologies?**

Kläusli: The HTC process is simple and cost efficient as our modular plant structure describes. From a technological point of view, the avoidance of a pre-drying treatment, relatively low temperature, low pressure, and exothermic reaction are cost savers. As a result, the net-energy balance is high.

Different from bioethanol production which involves additional costs for farming machinery, transportation, pesticide and fertilizer, the HTC process is, once the plant is established at a convenient location to collect biomass, a self-sufficient operation.

Compared to biogas, investment and operation costs are low. This is partially due to the very robust process as opposed to biological process used in biogas plants.

The pay back period for good projects is estimated to be shorter than five years whereas solar and wind power plants are around 10 years or more.

VV: **What is your growth strategy?**

Kläusli: As a young company offering innovative technology, we have to build credibility as quickly as possible in the renewable energy market. Our current objective is to construct several commercial plants and further develop the business case. We are currently building the first commercial HTC-Plant in Germany. We look forward to developing our business globally.

VV Comments after the interview:

AVA-CO2 is one of a handful of companies that have applied HTC technology and get involved in reducing additional CO2 emissions and sequester the atmospheric CO2 accumulated for years. The company's competitive advantage is its flexible and expandable module-based plant structure and the proprietary multi-batch process.

The HTC process was initially described in 1913 by Dr. Friedrich Bergius, a German Nobel laureate in chemistry. His research on chemical reactions under high pressure is meant to create synthetic gas which can be turned into gasoline.

In recent years, the almost 100 year-old HTC process has increasingly become the focus of public attention. In June 2011, companies in clean technology, industrial users, and research institutions in Germany and Switzerland founded an organization called "Federal Association Hydrothermale Carbonisierung e.V". Its objective is to promote HTC technology, and the standardization and approval of biocoal as biofuel.

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