OxEon Energy, LLC

Production of Liquid Hydrocarbons from Anaerobic Digester Gas

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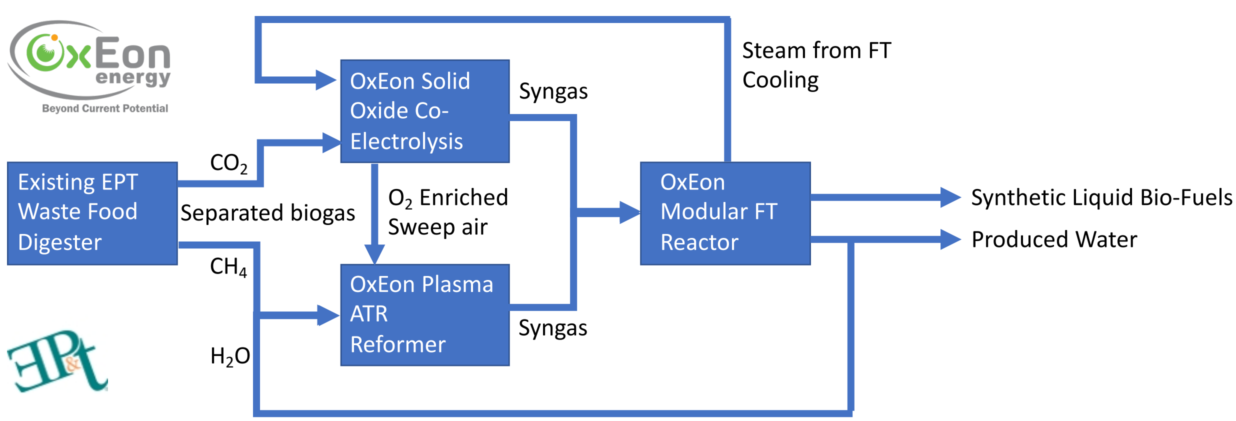
The proposing team of OxEon Energy, LLC (OxEon) and Environmental Products & Technologies Corporation (EPT) will conduct an engineering-scale demonstration, producing liquid hydrocarbon fuels using both the methane and CO_2 generated in EPT's food waste digester. The EPT food waste digester in Burley Idaho sells produced biogas into a natural gas pipeline after separating and venting the bio-CO_2. The proposed project will convert the bio-methane to synthesis gas (syngas, as CO & H_2) using OxEon's non-thermal plasma catalyzed autothermal reformer. To achieve high bio-carbon utilization, OxEon's high temperature solid oxide co-electrolysis (HTCE) system will electrochemically generate additional syngas from a proportional fraction of the bio-CO_2 combined with steam raised by cooling the Fischer Tropsch (FT) reactor. Syngas from the reformed methane and co-electrolyzed CO_2, will be converted to liquid fuels using a proven OxEon FT reactor design. Each of the technology components have been field tested independently and will be combined for the first time in this project. The project outcome will be an engineering scale demonstration of liquid hydrocarbon bio-fuel production achieving > 50% conversion to liquids of the biogenic carbon in both CH_4 & CO_2 produced by an anaerobic digester.

Each of the three technology elements of the integrated engineering test incorporates numerous innovations. The plasma reactor is designed to be fuel flexible, sulfur tolerant, and economically scalable to small, distributed bio-gas resources. It is also very efficient using a low power non-thermal plasma. High temperature electrolysis has demonstrated efficiency at the thermodynamic limit as shown by analysis and testing at DOE and NASA laboratories, and is unique in its ability to co-electrolyze steam and CO_2 directly to syngas. The HTCE stacks use innovations proven for the NASA Mars 2020 project which required exceptional ruggedness and effective high temperature seals. The FT reactor enables economical fabrication of smaller size synthetic fuel plants designed to match the scale of distributed renewable biomass resources. This is achieved with large diameter standard piping combined with a novel internal thermal management structure. Test data from these three previously demonstrated technology elements shows that the EERE program target capacity and biogenic carbon-to-fuel efficiency goals can be achieved.



Simplified block diagram of proposed process for existing site with biogas CO_2 removal