A Transitional Energy Philosophy
- A Vision -

Agro Tech Solutions, LLC proposes a disruptive new energy philosophy that focuses on a measured transition away from the use of fossil fuel hydrocarbons, rather than a chaotic rush to alternative solutions that are still incomplete in their development and have failed to produce adequate levels of replacement energy. This transitional strategy would continue the use of current energy forms and technologies, while decreasing the amount of new fossil fuel emissions added to the atmosphere, thereby slowing the accompanying rise in global temperatures. This will be accomplished by harvesting, and more efficiently using, the energy generated by Earth's own generator, the Carbon Cycle.

The Carbon Cycle captures energy from the Sun, and stores it in plant material from which it is transferred to other organisms when they feed on this plant "biomass." These plants represent the base of the planet-wide food chains and, thus, the foundational energy of life on Earth. This transfer of energy occurs on a wide scale, but generally involves very small fractions of the total energy store; allowing the vast majority of the captured energy to be lost, and wasted, as heat. It is Agro Tech's goal to salvage the greater part of this wasted heat energy and divert it to renewable forms that can directly substitute for new inputs of traditional fossil fuel energy resources. The mechanism of this energy reclamation is the collection, and subsequent conversion, of non-food, non-economic, agricultural waste into renewable, non-fossil natural gas, gasoline, diesel, aviation fuel, and a variety of other specialty fuels. This non-food, non-economic agricultural waste generally accounts for 50-75% of the total above ground plant mass, depending on the species. As such, it represents a huge energy storehouse.

Currently, the majority of such waste is often 1) burned to eliminate it or generate steam to produce electricity, 2) returned to the soil to support high levels of "health" and fertility or, 3) occasionally used as low-quality animal feed or bedding, after which it is discarded to slowly decay. All of these represent the largely unproductive dissipation of this potential energy as heat. Agro Tech's plan for the diversion of this wasted energy is to collect, and subsequently treat, the accumulated biomass by Anaerobic Digestion (AD), Gasification, and Fischer-Tropsch (FT), technologies; either singly or in combination.

These three processes are well-established and widely accepted as methods of processing organic or biological materials. AD produces "biogas", a combination of methane (CH_4) and carbon dioxide (CO_2), in conjunction with some contaminants, and a residual "digestate" that can be employed as an organic soil amendment – a high-quality fertilizer. Gasification uses combustion in the absence of oxygen (O_2) to yield "syngas", a mixture of primarily carbon monoxide (CO) and hydrogen (H_2), with a relatively small amount of inorganic ash-type material. Fischer-Tropsch is a complex combination of chemical reactions and catalysts that can combine CO and H_2 into larger molecules (carbon chains) depending on the conditions used. Many of these correspond to the fuel types listed above, or into much more complex carbon-based substances that can be processed into a wide variety of chemicals and materials that are commonly supplied by fossil fuels.

Additionally, Gas To Liquids (GTL) is another process that is, effectively, a hybrid of those described above. Starting with methane/natural gas, GTL "reverse engineers" a syngas very similar to that produced as the result of gasification. This *methane-derived syngas* is then subjected to the Fischer-Tropsch process, just as the syngas from gasification is, producing the same spectrum of hydrocarbons.

Anaerobic digestion potentially holds the greatest promise. It can utilize any type of plant material, albeit higher levels of lignin in the plant tissue results in lower yields of CH_4. The digestate is, in effect a new type of fertilizer; it retains the micronutrients absorbed by the crop during growth, as well as a substantial

component of partially-digested plant material which conventional fertilizers do not, - a new CARBON fertilizer. Similar to composting, this process avoids the negative attributes associated with compost such as odor, pathogens, and uncontrolled escape of greenhouse gases to the atmosphere. Additionally, with proper supplemental treatment, most of the CO_2 produced by AD can also be converted to CH_4. This process is, in reality, Bioregenerative Agriculture "**2.0**"; all of the advantages of conventional bioregenerative agriculture with the added benefit of renewable, sustainable, energy recovery, the potential economy of scale, and essentially little to no waste.

The important distinction to be made here is that these processes, when using plant biomass, produce energy from carbon-based fuels and chemicals that are both renewable and sustainable; not from additional fossilized carbon-based materials. Every molecule of these renewable forms is a RECYCLED molecule instead of a NEW molecule of fossil fuel. As such, it does not increase total carbon in the environment, and thus temperature; it is part of the pool that has established the current dynamic, and provides a moderating effect.

Prior to the onset of large-scale combustion of fossil fuels to power the Industrial Revolution, the Carbon Cycle circulated energy and maintained a relatively stable level of carbon throughout the biosphere exactly as described above. The facilitated digestion of non-food, non-economic agricultural waste as described here is simply an acceleration of that process.

The elegance of this new strategy is that it utilizes existing technologies and infrastructure to help maintain current levels of energy availability while slowing increases in atmospheric carbon and temperature. Ultimately, this transitional energy philosophy could be the primary driver in the movement toward more circular economies, and stabilizing carbon-mediated temperature increase.

J David Cornett, PhD
President
Agri Tech Solutions, LLC
(303) 807-9322
david.cornett@agrotechsolns.com

Max Howell
Chief Executive Officer
Agri Tech Solutions, LLC
(662) 260-0418
max.howell@agrotechsolns.com