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February 15, 2019

Mr. Bill Gates
1835 73rd Ave NE,
Medina, Washington, USA.

Subject: Gates Notes October 17, 2018--- Climate Change and the 75% Problem.

Dear Mr. Gates:

I am an avid follower of your “Gates Notes” and recently read your “My Plan for Climate Action” and your case for urgency to address this. Also, I noted that you are seeking technological solutions which will address not only mitigating 25% of CO2 emissions resulting from energy production but also 75% from other sources such as agriculture, transportation, manufacturing, building and cows. I would like to share with you our breakthrough HUMAXX MicGAS™ Coal Biorefinery products and solutions that can mitigate 25% in near term and sets a path to solution for the remaining 75% while also addressing sanitation issues which continue to be one of the root cause of infectious diseases your Foundation is addressing worldwide.

Technology Brief: Our team at ARCTECH Inc. in Virginia have developed this breakthrough biotechnology approach of use of coal to produce clean fuels and organic humic with the use of microbes derived from the wood eating termites. We tricked various species of termites to digest saw dust mixed with increasing amount of coal powder and then isolated the microbes from the guts of the species which survived primarily on coal. Almost over 30+ years, ARCTECH has systematically adapted these microbes along with specific nutrients to efficiently convert various coals by using total value chain of coals with zero wastes. We convert mined coals into clean fuels and organic humic products by capitalizing on plant originated humic matter in coals. Also, we have proven feasibility of use of these microbes of injecting into deep unmineable coals for producing gas. The US EIA reports that unmineable coals account for 97.7% of all the fossil fuels combined in form of oil, gas and coal. Our technology is especially applicable to lower rank low grade coals, which are lower in heat content, most abundant worldwide and underutilized. To date, no viable approach has emerged to monetize these huge resources. Feasibility of use of our humic product made from these coals is proven for direct capture of CO2 and other pollutants emissions from existing fossil fuels plants and recycling into a water filter product for mitigating contamination of the groundwater from ash residues produced at coal plants. A need for solution for coal has become front and center of the worldwide controversy for addressing climate change concerns without adversely impacting economies. Our technology offers path forward for both. As you may know mineable coals occur worldwide on all the landmasses and can continue to be source of lowest cost energy for masses for next 3-4 centuries at current rate of coal use with ARCTECH nonpolluting technology. I have attached a technology brochure giving more details. ARCTECH has already proven following products can be made from coals and proven their feasibility for meeting real world needs:

1. HUMASORB®, a multipurpose adsorber for toxic metals, organics, radionuclides for cleaning up drinking waters, wastewaters, nuclear wastes, soils and fossil fuel emissions

including CO₂ along with SO_x, NO_x, Hg etc. Depending upon contaminants, in the spent HUMASORB®, is converted into solid resin for use in cleaning waters. ARCTECH has proven that carbon from CO₂ is permanently and irreversibly sequestered along with pollutants in the resin. It can be used for cleaning waters in active treatment systems and as well as passive subsurface permeable filter for removing contaminants from groundwaters for long periods. We received a Grand Challenge Award from Alberta, Canada based on worldwide competition for technologies for recycling of CO₂ into useful products. The US PTO awarded a patent to ARCTECH in 2015 within 90 days and it has been accepted in Russia, South Africa, Turkey and under review in other countries.

2. Actosol®, organic fertilizer/bio stimulant for improving soil health, improve delivery and efficiency of mineral fertilizers while increasing crop yields, quality, and replenishing carbon into the soil. (soils are the 4th largest storehouse of carbon in the form of humic matter after sedimentary rocks, fossil fuels, and oceans; fifth is our atmosphere). Actosol use as organic fertilizer is approved per the USDA - OMRI. Also, approved by the US EPA to combine with pesticides as adjuvant, UV Protection and essentially to make them safer.
3. ActoHAX™, a reagent which is proven to safely destroy explosives and convert into fertilizer (Actodemil®), eliminate pathogens in sewage waste waters and recycle these to organic fertilizer waters, mitigate ammonia and pathogens in turkey poultry houses (ActoCLENSE™) and poultry manures into organic fertilizer (3PM™--Pollution Prevention and Profits from Manures).
4. Clean Fuels, the microbes bio convert coals into biogas. It can be used as is or converted to methane gas same as natural gas or converted to liquid fuels or even into hydrogen with existing technologies. Liquid fuels can be sold for as low as \$0.50 per gallon while producing 35% IRR from combined value of fuel and organic humic products. Our integrated approach of producing gas and humic products allow gas production to be < \$1 - 2 per million BTU. This lower cost gas can then be converted to hydrogen which will cost about \$3-6 per million BTU. Producing hydrogen from electrolysis with electricity at 5 cents/kWh will cost \$28/million BTU, so our solutions allow for the transition of energy systems to hydrogen, which paves the way to zero carbon emissions This low fuel price shall remain competitive with oil even if it goes down to >\$ 5 per BBL, which continues to be cost of production of almost 70% of the worldwide oil, especially in middle east. A challenge continues to be unmet with myriad of coal conversion technologies advanced since the first oil embargo of 1973.

Coal biotechnology overcomes this by creating economic value from both energy and non-energy products, a business model successfully fostered by Mr. Rockefeller. The oil industry still uses this model and produces myriads of energy and non-energy products with oil refinery technologies. With coal biotechnology, we capitalize on inherent plant derived humic matter in coals and produce carbon rich non-energy products, which cannot be made from oil, but are needed today to meet needs of growing populations, for safer foods, clean water, air and safer wastes disposition.

This biotechnology utilizes every component of coal. Even heavy metals, such as mercury (Hg) and arsenic, which must be captured in thermal coal conversion processes, in this approach remain part of the solid co-product; and remain permanently bound and thus are not released to the environment. No process wastes are generated. Above stated products made from coals offer:

DIRECT ELIMINATION OF 25%:

With use of HUMASORB by capturing CO₂ and other contaminants from existing fossil fuel plants and converting into a water filter product will provide self-sustainable economic value generation for containment of pollutants from coal ash residue impoundments and waste waters, while permanently sequestering carbon in our planet. Multiple other recycling technologies of CO₂ to products by others such as to concrete, polymers and even to fuels are ready to take to market to scale for both preserving existing generation capacity while meeting the IPCC goals to be on the path in next ten years. Uniqueness of our HUMASORB technology is that it addresses CO₂ and other pollutants while producing a product which addresses huge need for ensuring supply of clean waters, another increasing huge challenge, must be addressed.

PATH TO INDIRECTLY MITIGATING 75%:

I agree that multiprong approaches needed to be advanced such as transitioning transportation to lower cost hydrogen made from coals and other sources, industrial sectors to electricity made from nuclear and renewables. However, a lower hanging fruit is to emulate the nature for substantial mitigating with trees which capture 3 to 9 tons of CO₂ per acre/ year depending upon tree species and release 4 tons of oxygen. Even on average of 5 tons per acre would require only trees on 6% of total worldwide land of 127 Billion acres to capture all the current yearly 40 Billion tons of CO₂ emissions. Approaches to tree cultivation are commonly practiced but challenge is to cultivate trees in impaired lands, in arid conditions, without incurring high cost of irrigating these to sustain. Uniqueness of Actosol use is proven to establish sustainable trees on farm lands, impaired lands, sand in arid conditions and in high salinity soils and even on use of saline waters. Another uniqueness of Actosol® use is proven to increase crop yields by 10-50% while improving soil health by increasing organic humic matter in depleted soils. Humic matter in soils is the fourth largest storehouse of carbon after sedimentary rocks, fossil fuels, oceans and fifth is air. The UN Sustainable Development guides to plant trees over one meter in height on 10% land and rest can be farm land or other uses. The UN experts also project that trees capture of CO₂ can be qualified for 80 years, average lifespan of trees. I am making a case that at the end of the lifespan of trees, they can be buried in engineered landfills and then injected with microbes and nutrients to convert into gas for ongoing human need for energy. Note: www.ihccs.org.

Mitigation of Methane from Cattle: Some researchers are proving out that use of humic acid in the cattle feed impacts microbial activity in the rumen for improving milk and protein yields while controlling gas formation. Though there are many strategies for reducing CH₄ emissions from ruminants with use of feed additives can be promising method of mitigation in intensive livestock production systems. Recent research on genomics of gut microbes are opening new possibilities

to address this one major contributor of ubiquitous source of emissions. Though these paths may be promising but require altering the nature and so need to consider unintended consequences. Again, the lower hanging paths to address this will be both offsets by trees and other approaches ready for deployment in near term.

SOLVE CHRONIC SANITATION NEED WITH ECONOMICAL SUSTAINABLE SOLUTION: Feasibility proven to recycle sewage wastewaters into organic fertilizer waters for use in agriculture while eliminating pathogens and water borne diseases such as malaria etc. Instead of high costs cleaning sewage wastewater based on traditional approaches of cleaning to reduce COD, BOD, and release the partially cleaned water into local water bodies and pollute them, ARCTECH proved feasibility of use of HUMASORB® and ActoHAX™ for removing toxins and pathogens in Sadat City, Egypt sewage wastewater and recycled into organic fertilizer water. This was shown to establish cotton and sorghum crops along with intercropped with trees in an area where for millions of years nothing was growing, while resulting in positive cash flow.

PROVIDE MUST HAVE NEEDS OF HUMANS AT AFFORDABLE COSTS:

Products made from coal and proven feasibility of their use offers to not only avert climate change concerns but also provide for “Must Have” needs of humans of pollutants free air, water and energy at lower costs while also protecting the ecology of planet for its all inhabitants. I call it “Balanced Sustainable Solution”. I believe lowering the costs of these must have human needs will result in parity as Mr. Ford’s Model T did for automobiles and many of you in IT field have done with chip for access to information for masses. This challenge remains unmet since early human inception which must have started with struggles between strong and weak. Then led by approaches of royalty/subjects, landlord/tenants and now in recent times with democratic capitalism, democratic socialism and communism. Our technology offers a path to long held human aspirations for parity.

While eliminating all 100% emissions can now become feasible, it surely is not required as a certain amount of CO₂ is needed in the atmosphere to sustain the greenhouse effect essential for maintaining life on earth. However, as you stated ***“to prevent the worst effects of climate change, we need to get to zero net greenhouse gas emissions in every sector of the economy within 50 years—and as the IPCC recently found, we need to be on a path to doing it in the next 10 years. That means dealing with electricity, and the other 75% too”***. Our above stated approach can set us on the path. In fact, China has stated per their submission to UN Paris Agreement to plant trees on 350 million acres and so are majority of the signatories to the Paris Agreement have offered to plant trees as one of the major paths except USA who wants to bury CO₂ underground. Due to its high costs has resulted in opposition by industry and current controversy.

ARCTECH coal biotechnology is a “Green Chip” akin to computer chip which has allowed you and other pioneers to produce a myriad of information products and services now increasingly in use worldwide. Also, mindful of concerns that technological solutions can lead to unintended consequences. So, ARCTECH has sought wisdom from the Iroquois Indians 7th Generation impact for long term viability of its solution spanning over next 140 years. ARCTECH concludes that this approach of coal use would have given our next generations a safer approach of our one

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of the most abundant carbon in form of coal for removing excess carbon from being emitted as well as sequestering it in useful ways and for them to pass on to the next seven generations by passing on a legacy of facing challenges with creative value generating solutions. The US EPA Director of Air Pollution Control Division after his technical team of due diligence of ARCTECH Coal Biotechnology stated in a letter to me that this approach offers ***“the potential to yield a smaller environment footprint than conventional approaches of coal use and a creative and value generation approach for mitigation of emissions of carbon.”*** Some time ago Senator Vance Hartke, from the coal fields in Indiana had characterized ARCTECH coal biotechnology business model akin to genius of John D. Rockefeller and Thomas Edison approach of fostering new ideas into practically applied and cost competitive innovation of possibilities.

I appreciate your “Call for Action” and seeking solutions to this huge worldwide conundrum of our times. It has become divisive issue because of concerns of adverse impacts to the advanced economies and need for allowing huge populations for economic growth. As outlined above we already have the nuts and bolts and our technology is ready for rapidly taking to market to scale to meet the short- and long-term time frame set forth by IPCC as bolt on to improve and increase use at the industrial, agriculture and forestry practices already in place. Our solutions while mitigation of the largest greenhouse gas CO₂ emissions, generate economic value and thus would become sustainable as well as amenable to adopting policies which will provide public benefit without hindering the advanced economies while providing for basic needs of populations of developing economies.

I very much appreciate the opportunity you have afforded to bring to your attention our “Game Changer Breakthrough Technology”. We request your consideration for supporting its advancement and deployment of HUMAXX MicGAS™ Coal Biorefineries. We will be very happy to brief you and your experts about status of our solutions and activities we already have in several countries. My apology for mailing you this directly. I registered to post but did not get email to confirm my registration and so could not post.

Looking forward to hearing from you.

With my Best Regards,

ARCTECH Inc.



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Offering " Balanced Sustainable Solution”

CC: Mr. Adam Wallen at Breakthrough Energy Ventures, LLC