What is the Concept Behind the Community BioRefinery?

To use a BioRefinery to create Sustainable communities.

- To decentralize the local production of many of the essential necessities of life (e.g., food, energy, water, power) rather than rely upon large massive-scale manufacturing or processing facilities located thousands of miles distant that depend upon petroleum to produce and get these products to the local supper table.
- To produce the highest quality foods and nutraceutical products, including revolutionary new branded food products, including organic aquaculture and vegetables that will be sold in local markets.
- To produce, in the same biorefinery, advanced (true*) biofuels that will be “drop-in-place” clean biofuels that will replace the use of petroleum fuels (diesel fuel, gasoline, avgas, jet) in the local community. *A true biofuel contains no petroleum.
- To produce green electric power that will not only make the facility energy self-sufficient but also serve to sustain the local community, with purified water as a by-product.
- To make the local community safer and more sustainable through the local production of more safe products that will help reduce the dependency of the community upon these “unsafe” products. These “unsafe” products are usually produced in large centralized manufacturing plants located thousands of miles away (such as oil refineries, nuclear power plants, cereal and food processing plants, and foreign vegetable and seafood operations) that sometimes produce products of questionable safety.
- Why do we have a dedicated division to process industrial hemp via the Hemp-BioRefinery? Until late 2018, hemp was legally prohibited in the US. Only the government could do R&D on it, which it chose not to do. With its “liberation”, CBR was asked if it could process hemp as it does other feed stocks and biomass. The CBR process makes no distinction as to what plant material is passing through it, so the easy answer was ‘yes’. Our subsequent research revealed a host of possible products to be gleaned from hemp – some made possible because of the unique CBR process. However, CBR chose specifically NOT to pick up where it was left off in the 1930s; CBR will apply all its current and cutting-edge technologies to create the best possible outcomes from this feed stock/biomass.

CBR’s focus will be accomplished through the vertical integration of several applied technologies to produce much higher value-added foods, nutraceuticals, and other products in concert with the production of advanced (Next Generation) biofuels in the same biorefinery.

- These products will be produced from local feed stocks with such products sold in local markets. CBRs will decentralize the production of these products in the local community to generate economic development (“economic development clusters”) throughout the agriculture sector and in participating local communities. CBRs will offer energy independence to our local communities, as CBRs serve to replace petroleum fuels, including diesel fuel, gasoline, aviation fuel, and jet fuel, as well as plastics and biochemicals.
- CBRs will enable the local communities to have their own “green oil well” and “green power generating plant” that cannot be disrupted.
- An end benefit of the CBR Project is the production of hydrogen which can be used to not only produce green electric power, but distilled water, organic fertilizer, and infused to create bio-jet fuel. The supply of safe, drinkable water is becoming an increasingly crucial factor in this country and globally where “dust bowl droughts” are predicted in the decades that lie ahead. CBRs can help in solving this problem.

- Finally, the CBR process uses a cold process, closed system with no waste. No heat; no chemicals; zero pollution.
- All of this with a laser-focus on sustainability.

Why Should I Care?

- Today, traditional biofuels factories cause many problems for the industry;
- These facilities produce very few economic benefits for their local communities while polluting the surrounding environment;
- Their operations destroy crucial food ingredients to produce only fuel supplements and low-value animal feed;
- Tremendous amounts of water are used and largely wasted in such facilities;
- CBR facilities create many hundreds of well-paying jobs;
- CBRs can produce both food and fuel from the same feedstock;
- CBRs are less vulnerable to economic swings since they can produce a wide variety of higher value products;
- CBRs are smaller biorefineries that can be located closer to the feedstocks they process;
- CBR biofuels are based on biobutanol and esters that can be directly distributed in the local community.

What is a "biorefinery"?

Since the 1980s, the US population has been conditioned to think of a 'biorefinery' as an ethanol plant, or perhaps even a biodiesel blending facility. A true 'biorefinery' does far more than make a simple biofuel like ethanol. A fully capable biorefinery uses every aspect of its source plant materials to "refine" them into a host of end products with minimum to no waste. A Community BioRefinery is such a biorefinery.

The concept of fully utilizing the potential of biorefineries started in the late 1990s. The U.S. Department of Energy defines a biorefinery as an overall concept of a processing plant wherein biomass and feedstocks are converted and extracted into a spectrum of valuable products.

- The Community BioRefinery has, for over 35 years, used the biorefinery to create sustainable plant-based products to include fuel, food, energy, and clothing.
- The biorefinery is analogous to today's petroleum refinery, which produces multiple fuels and products from petroleum (*from below ground*) whereas the CBR does much the same with source materials *from above ground.*

What will the deliverables be?

- In addition to food and nutraceutical products, cosmeceuticals, biofuel, bioplastics, fish feed for aquaculture leading to hydroponics, food grade biochemicals and more, deliverables can include intangibles as well as tangibles. Examples: outreach events, grant applications, trained individuals/groups, new or improved products, patents, partnerships, paradigms, process improvement, dissemination products, etc.
- The capabilities of the CBR process will enable the isolation and recovery of pharmaceutical grade elements as well.

CBR Product Examples:

- Pure Plant Protein Isolates (90%+ purity);
- Specific plant proteins for nutraceutical/pharmaceutical applications;
- Specific cannabinoids for nutraceutical/pharmaceutical applications
- High Oleic Oils
- Resistant Starch
- Food Grade Organic Acids (acetic/propionic);

- Biofuels (true biodiesel; true aviation ‘gas’; true bio-jet). “True” = No petroleum present
- Fish Feed for Aquaculture
- Biodegradable Plastics
- Hydroponic Vegetables and Berries

What Issues/Problems does the CBR seek to resolve?

- The lack of awareness on the impact of diet and nutrition on the overall health while improving the length of quality of life.
- The dramatic increase in food prices due to the production of ethanol from corn forces supermarkets and fuel stations to compete for the same grain (i.e., the food vs. fuel debate).
- The potential political and social unrest due to the increasing competition among nations over the dwindling supply of oil.
- The dependency of the biofuel industry on freshwater supplies when there is a worldwide prediction of severe droughts and water shortages.
- The decline in economic opportunity in communities across the U.S. due to the loss of jobs.
- With its breakthrough innovations, a CBR can solve these issues. We can help you learn more about the benefits that CBRs can bring to your community.

How did the CBR come to be?

The founder of the CBR is the original inventor and patent holder of biodiesel fuel (all from fermentation). He even trademarked the term “biodiesel”. Even so, the cost of his process made his biofuel prohibitively expensive. He therefore continued his work to make the process more efficient and cost effective. He enlisted the assistance of and partnered with the US Department of Agriculture as well as that of several major universities. The efficiencies and value-added products created resulted in a process that even he did not originally envision.

What can we expect from the CBR?

- The Vision of the CBR Project is to successfully finalize the research, demonstration and commercial scale up operations of a CBR manufacturing plant (factory) in a selected local community. CBR further intends to create networks of economically sustainable CBR Projects in local communities throughout the U.S. and globally. CBRs will help establish sustainable green communities by providing food, energy, biofuels, green electrical power, and bio-products to help meet the goal of energy independence of local communities and our nation, from foreign oil.
- To accomplish these objectives, the CBR Project will initially focus on the construction of the CBR Food Phase to produce higher quality Pure Protein Isolates, along with other grain or plant-based protein isolates, as value-added alternatives for the well-established milk and animal-based proteins (milk, egg, and meat) currently used in the food additive markets. This approach is designed to mitigate, eliminate, and even recover -several times over- the cost of the feedstock or biomass, including upfront processing costs of such feed stocks, in the ultimate production of true biofuels. (“True” biofuels contain zero petroleum content, per Department of Energy.)
- Feedstock costs typically account for between 30-60% of the total costs of producing biofuels. Protein isolates produced by CBRs will have values ranging from $20,000 up to $100,000 per ton, vs. the value of Dried Distillers Grains (DGS), the damaged protein byproduct from ethanol plants which are currently used in animal-feeds and valued at $200-$300 per ton.
- CBR pure protein isolates will not only possess superior functionality traits, but also provide greater nutritional values; they are tasteless, odorless, and less expensive to produce than other protein isolate products currently available in the marketplace.
- The CBR Project will introduce the first commercially viable Corn, Soy, Rice and other Pure Protein Isolates to the marketplace. CBR protein isolate products will provide a fat-free, tasteless, odorless product that will have food functionality traits superior to existing protein additive products. Further, CBR Perfect Plant Protein isolate products will also offer improved nutritional and nutraceutical values over conventional soy proteins and animal-based protein supplements by offering a complete amino acid balanced protein across all age-groups - the only plant-based protein capable of making such a

claim. CPI will also have an extremely high level of antioxidant properties known to combat muscle wasting and diet deficiency diseases (cachexia, sarcopenia, and kwashiorkor).
- To utilize what would otherwise have been considered to be waste products (by other processing techniques) into useful end item products.

How will the CBR be configured?

The CBR is designed to be smaller in scale to enable placement at or near the source of the feed stocks or biomass destined to be processed. They will not resemble the large, monolithic ethanol plants scattered around the countryside. The facility will have a “food side” and a “fermentation side”.

- Since the CBR/HBR is smaller in size and designed to be place at or near its source materials, each CBR/HBR will have multiple production lines: some for corn, soy, rice, hemp, etc. Up front mill settings will reflect the differences in the plant material; however, once broken down, all sugars will go to the fast fermenter.
- This enables the source materials to be introduced into the plant and broken down to micron-sized particles enabling the isolation and recovery of any food elements present. This preserves the proteins and oils present and prevents them from being burned up (and wasted) as a biofuel later. The food-vs.- fuel argument becomes a non-issue.
- After food elements have been recovered, the “waste stream” is conveyed to the ‘fermentation side’ of the process. This waste stream is principally sugars/carbohydrates which were present in the feed stock. This stream is sent into a continuous flow fast-fermenter where, in a matter of hours, the sugar substrate is turned into ethanol (of which we have little interest), but after a few hours more and it becomes bio-butanol. The CBR fermentation focus is on bio-butanol as it is at the heart of “The Next Generation of Biofuels” (per the United Nations’ Encyclopedia of Life Support Systems - EOLSS). Please note: Bio-butanol was first used as a fuel in WWII when the British RAF used it to fuel their fighter planes (Britain had been blockaded). When oil once again flowed freely, the world lost interest in bio-butanol. CBR’s founder dusted off the old research material; improved upon it, and brought it forward for today’s applications.
- From CBR’s fermenter comes the only actual “waste” product of the process – which is hydrogen. This hydrogen is captured to enable in-house electrical generation, making the facility energy self-sufficient; and/or, applied to create true bio-jet fuel. From the fermenter also come two biochemicals, created during the fermentation process – PLA and PHA. Instead of dumping the fermenter effluent into the local streams or rivers as many ethanol plants do (incurring hefty fines from the EPA). CBR recovers these biochemicals and combines them with leftover fibers from the beginning of the process to create either fish feed for aquaculture, or, biodegradable plastics. The product depends on whether the source material is a feed stock or a biomass. Nothing gets wasted.

What sort of economics can be expected from a CBR?

Initial costs of feed stocks and biomass used will be recouped many times over from the food and nutraceutical components isolated and recovered by the process. Everything thereafter is “free” as it is part of the waste stream treatment. Unlike the horrific waste of corn protein by the current ethanol production methods, CBR wastes nothing; every molecule is used. CBR’s Corn Protein Isolate (CPI), for example, is worth hundreds of times more than the tons of Dried Distillers Grains (DDGs) dumped on the ground behind the ethanol plants. Similarly, DDGs contain unused C5 sugars which the ethanol fermentation process cannot use; CBR’s process uses C5 and C6 sugars to enable a far more efficient biofuel yield.

- Two financial studies were conducted by two large and reputable accounting firms on the CBR process: one focused on the “food side” and the other on the “fermentation side”. Their results were validated and collated by the USDA using a proprietary computer program. Their Forecasted P&L Statement projections showed that a CBR operating with a USDA non-GMO corn hybrid, corn stover, and sweet can sorghum as source materials created an average of 33% Return on Investment (ROI) when the plant operated at full capacity.

How do we know the CBR actually works?

- The multiple technologies applied to enable the CBR process were developed by our founder, the USDA, and several major universities over a period of nearly 35 years. Key elements were developed independently from the others, using a “Manhattan Project” approach to the process development. For example, the developer of the unique fermentation system had no idea where we got all the sugars for use in his equipment; the developer of the unique water separation function had no idea where we got all that fermented bio-butanol. In the end, it all worked out very well and helped to protect the integrity of the CBR process.
- When CBR was ready to move forward, a process engineering firm was retained by a California county to validate and verify all. After an incredibly thorough review, the engineering firm’s report stated that 1) the process did exactly what CBR said it would; that 2) it produced all the products* CBR said it would; and 3) the process could potentially be scaled up to almost any size. Even though the engineering team observed the bio-butanol production, they felt they could not comment on it since the team did not have a fermentation specialist. Shortly thereafter, the continuous flow fermenter was scaled up elsewhere, so that aspect has become moot.
  *Note: The lead engineer, after focusing on one of the products (resistant starch), stated that, in his opinion, that single product could economically carry the entire operation all by itself.

Who makes up the CBR team?

Scott Hewitt, CEO/President and COO: Degree in Food Science and Technology and Microbiology from Iowa State University; leadership, management and project management abilities via a US Army career as an Intelligence Officer; 15 years affiliation with CBR as an advisor/assistant/VP to the founder until his passing.
Dr. Vincent James, PhD - CTO and Director of the Hemp-BioRefinery division. Academic degrees in Chemical Engineering and Zymology (fermentation science) via UC California system facilities at Davis and Berkeley; first to design and build microbreweries following repeal of their prohibition (over 30 worldwide). Sought out by Founder to design what is now the scaled down and modular CBR “foot print”; over 30 year’s affiliation with CBR as an advisor and trouble shooter.
Gary Halstead, PE: Management Board Member and Engineering Advisor
Dick Fehseke: Advisory Board Member and Legal Advisor
Merle Walter: Advisory Board Member and Ag Advisor
Dublin Hennigar: Advisory Board Member and Technical Advisor
Thomas Ely: Management Board Member and Technical Advisor
Scientific/Technology Advisory by members of USDA-ARS and CBR’s affiliate universities.