

Hemp Consultant Report

Hemp Industry Infrastructure Report

Per HB 1359 Act 263:

The purpose of this report is to identify the infrastructure needs of Hawai'i hemp farmers and the hemp industry, considering the unique needs and geographic spread of Hawaii's licensed hemp farmers and the various hemp sector needs.

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A. Executive Summary

In 1999, Hawai'i became the [first U.S. state](#) to legally cultivate hemp, led by Rep. Cynthia Thielen. Thielen co-sponsored the Industrial Hemp Act of 2014 and launched a hemp project at the University of Hawai'i. Governor Ben Cayetano signed the pioneer bill, commencing a successful hemp research project under Dr. David West. Progress stalled under Governor David Ige due to misconceptions about hemp. After 25 years, little progress has been made since the initial trials.

Introduction

A state-supported hemp industry in the Hawaiian Islands could revitalize the local economy by filling the gap left by the decline of the sugar, pineapple, and seed corn industries. Unlike these export crops, cultivating hemp creates raw materials for secondary industries, fostering a circular economy and producing various products that could significantly reduce imports. Key products include:

- Prefabricated housing materials
- Locally-made hemp blocks for construction
- Locally-made insulation and wood replacements
- Biodiesel and Renewable Natural Gas (RNG) to replace imported fuels
- Locally-produced high-end health food products

Environmental and Agricultural Benefits

Hemp is a powerful phytoremediation plant, capable of detoxifying agricultural fields by removing heavy metals and working with soil microbes to metabolize residual agricultural chemicals. Notably, hemp has been shown to increase the yield of subsequent crops by 20%.¹ Given Hawai'i's limited arable land suitable for food production, this is one of the most critical benefits of developing a statewide industrial hemp industry.

Enhancing Food Security

Hemp prepares land for other beneficial rotational crops, including corn, soybeans, colored beans, adapted wheat varieties, oats, squash, potatoes, sweet potatoes, melons, silage, and other crops that could significantly contribute to Hawai'i's food security. Before the best agricultural lands are sold for luxury homes, it is imperative that Hawai'i adapts mechanized agriculture to support food

¹ Biomass Connect: <https://www.biomassconnect.org/technical-articles/hemp-as-a-biomass-crop/>

security. As a pioneer crop, hemp can play an instrumental role in this transition.

Recommendations for Establishing a Hemp Industry

The State of Hawai'i must build its hemp industry within the framework of food security while simultaneously developing local industries to utilize the raw materials produced by hemp. Our recommendations for establishing a hemp industry within an agricultural circular economy are based on four key reasons:

1. **Integrated Crop Cultivation:** Developing a hemp industry in isolation is ineffective; other rotational crops must also be cultivated as hemp cannot be grown continuously on the same land.
2. **Enhancing Food Security:** Hemp is an ideal crop to prepare fields for other food and animal feed crops, thereby enhancing food security in our islands.
3. **Mechanized Agriculture:** Supporting hemp cultivation using mechanization similar to traditional field crops like corn, small grains, beans, and forage crops will facilitate the transition to mechanized field crop production—a system that Hawai'i has scarcely utilized. Large-scale mechanized row crop farming is the basis of the American diet and must be developed in Hawai'i to increase island food security and support a circular economy.
4. **Soil Enrichment:** Hawaiian soils, which are low in organic matter, will benefit from the addition of animal manures from either pasture-raised animals, direct application, or composted additives. Feeding poultry and livestock to obtain manure while increasing food security is a necessary step.

Economic Impact and Local Industry Development

The demand for locally grown construction materials, industry-based jobs, and locally produced food products is undeniable. The state can leverage its power to help private industry meet these needs through various means, including:

- **Grants and Loans:** Providing financial support to farmers and processors to establish a robust hemp industry.
- **Tax Incentives:** Offering tax breaks to businesses involved in the cultivation, processing, and utilization of hemp.
- **State Expertise:** Providing technical assistance and resources to ensure the success of hemp-related projects.

Immediate Actions

To effectively kickstart a hemp industry in Hawai'i, the state must support farmers, processors, and end-users of hurd and bast fiber concurrently. This can be achieved through the following steps:

- **Processing Plant Development:** Establish a single processing plant on one island before expanding to others. Farmers can begin growing dual-purpose hemp, selling seeds, and storing hemp straw for future processing.
- **Industry Partnerships:** Secure off-takers for primary products from the hemp decortication process—hurd and bast fiber—and support the development of industries prepared to create value-added products from these materials.
- **Construction and Biofuels:** Promote the use of hemp in the construction industry to address housing needs and develop biofuels like biodiesel and renewable natural gas from hemp seed oil and stalks.

Conclusion

Supporting the development of a hemp industry in Hawai'i within the framework of food security can provide significant environmental, economic, and agricultural benefits. By implementing strategic recommendations and leveraging state support, Hawai'i can create a sustainable and prosperous future centered around the versatile and valuable hemp plant.

Background

We were hired to investigate the potential for establishing a hemp industry in Hawai'i. Our primary focus was on Industrial Hemp, which involves cultivating hemp for the production of construction materials, biofuels, food products, fiber products, and rejuvenating Hawaiian soils for ecosystem restoration, food security, and carbon sequestration.

However, during our investigation, approximately 80% of our interactions were with the sector of the hemp community focused on producing hemp for cannabinoid extraction. While this sector is vital and offers significant benefits in supporting small farmers and cottage industries around the island, conflating Cannabinoid Hemp with Industrial Hemp creates confusion. Although both can be classified as "Industrial Hemp," merging them confuses the general public, legislative bodies, and policymakers. Therefore, in this report, we will refer to hemp used for industrial uses as 'Industrial Hemp' and hemp grown for cannabinoids as 'Cannabinoid Hemp.'

We acknowledge the efforts of Cannabinoid Hemp farmers and their contributions to food security through supplementary farm income. However, we recommend establishing a dedicated task force⁴

to address the unique issues related to Cannabinoid Hemp, including the production and marketing of CBD products. This task force should have direct access to State employees who can propose changes to State laws and policies to facilitate their success. With the data collected and shared by this consulting team, the Cannabinoid Task Force will be better equipped to suggest State funding to support the growth of a "Made in Hawai'i" cannabinoid industry.

For the purpose of this report, our focus will remain primarily on Industrial Hemp. This includes the large-scale, mechanized cultivation of the hemp plant for producing renewable fuels, human food, construction materials, fiber products, the rejuvenation of Hawaiian agricultural soil, and carbon credits.

Overcoming the Chicken-and-Egg Dilemma in Hemp Cultivation

A significant barrier to hemp cultivation in Hawai'i is the classic chicken-and-egg dilemma: farmers are hesitant to grow hemp unless there are businesses willing to purchase the seeds and fiber, while businesses need a steady supply of hemp products to justify their investments. Currently, Pacific Biodiesel and potentially Agripelago are prepared to buy hemp seeds, but a sustainable solution for the straw byproduct is still needed.

For long-term success, Hawai'i requires processing plants on each island to separate hemp straw into hurd and bast fiber. Additionally, maintaining a processing plant with four shifts per week will necessitate the cultivation of 3,000 acres of hemp, with access to water, rotated with food crops.

Strategic Steps for Development

1. Initial Processing Plant

- The state should support the development of a single processing plant on one island as a pilot project before expanding to other islands.
- Farmers can start growing dual-purpose hemp even before the processing plant is operational. The seeds can be sold, and hemp straw can be stored for up to two years if properly protected. The goal is to have straw ready for processing when the plant opens.

2. Securing Off-Takers

- It is crucial to secure off-takers for the primary products from the hemp decortication process—hurd and bast fiber. This ensures a market for the processed materials.

3. Developing Supporting Industries

- The state can immediately support the development of industries prepared to buy hurd and fibers from the processing plant. These industries will create value-added

products that replace imported goods, such as construction materials for the many needed housing units in Hawai'i.

Maximizing Hemp's Potential

- **Biofuels:** Hemp seed oil can be processed into biodiesel or used as an ingredient in food and beauty products. Anaerobic digesters can convert freshly chopped hemp stalks into renewable natural gas, with the digestate serving as an agricultural amendment or precursor to building materials.

Comprehensive Support Framework

To effectively kickstart a hemp industry in Hawai'i, the state must concurrently support farmers, processors, and end-users of hurd and bast fiber. This comprehensive support should include:

- **Grants and Loans:** Financial assistance to lower the initial investment barriers for farmers and processors.
- **Tax Incentives:** Tax breaks to incentivize the cultivation, processing, and utilization of hemp.
- **State Expertise:** Providing technical assistance and resources to ensure successful implementation and operation.

By taking these strategic steps, Hawai'i can develop a robust hemp industry that supports food security, economic growth, and environmental sustainability.

Potential of Industrial Hemp Industry in Hawai'i: Economic Implications

Hawai'i has 1,930,000 acres zoned for agriculture, of which only 8% (155,000 acres) is used for food production and 39% (753,000) used for pasture. This leaves around 1,000,000 acres unused.²

Bob King, co-founder of Pacific Biodiesel, stated his company could process up to 3 million gallons of biodiesel annually from hemp seeds. Each acre of hemp produces about 83 gallons of biodiesel, meaning 36,000 acres could supply Pacific Biodiesel's capacity. These 36,000 acres can also produce 144,000 tons of hemp straw annually, which can be converted into Renewable Natural Gas (RNG) and other products.

² Civil Beat-Hawai'i Has a lot of Agricultural Land. Very Little of It is being Used to Grow Food: <https://www.civilbeat.org/2021/02/hawaii-grown-maps/>

Agripelago, a Hawaiian startup, aims to adapt European biogas technology locally, promoting energy independence. Hemp straw can also be processed into building materials like hempcrete. One 1,500 sq ft house requires about 14.5 tons of hemp materials, enabling the construction of about 8,000 homes from 36,000 acres of hemp, also producing 3 million gallons of biodiesel.

Hemp can be a rotational crop with corn and soybeans, producing over 600 million pounds of feed annually, supporting 50 million broilers and meeting local chicken consumption needs. Surplus can be used for egg production. Chicken manure can enrich Hawai'i's soil, and hemp byproducts can be used as poultry bedding, converted into compost, and feed.

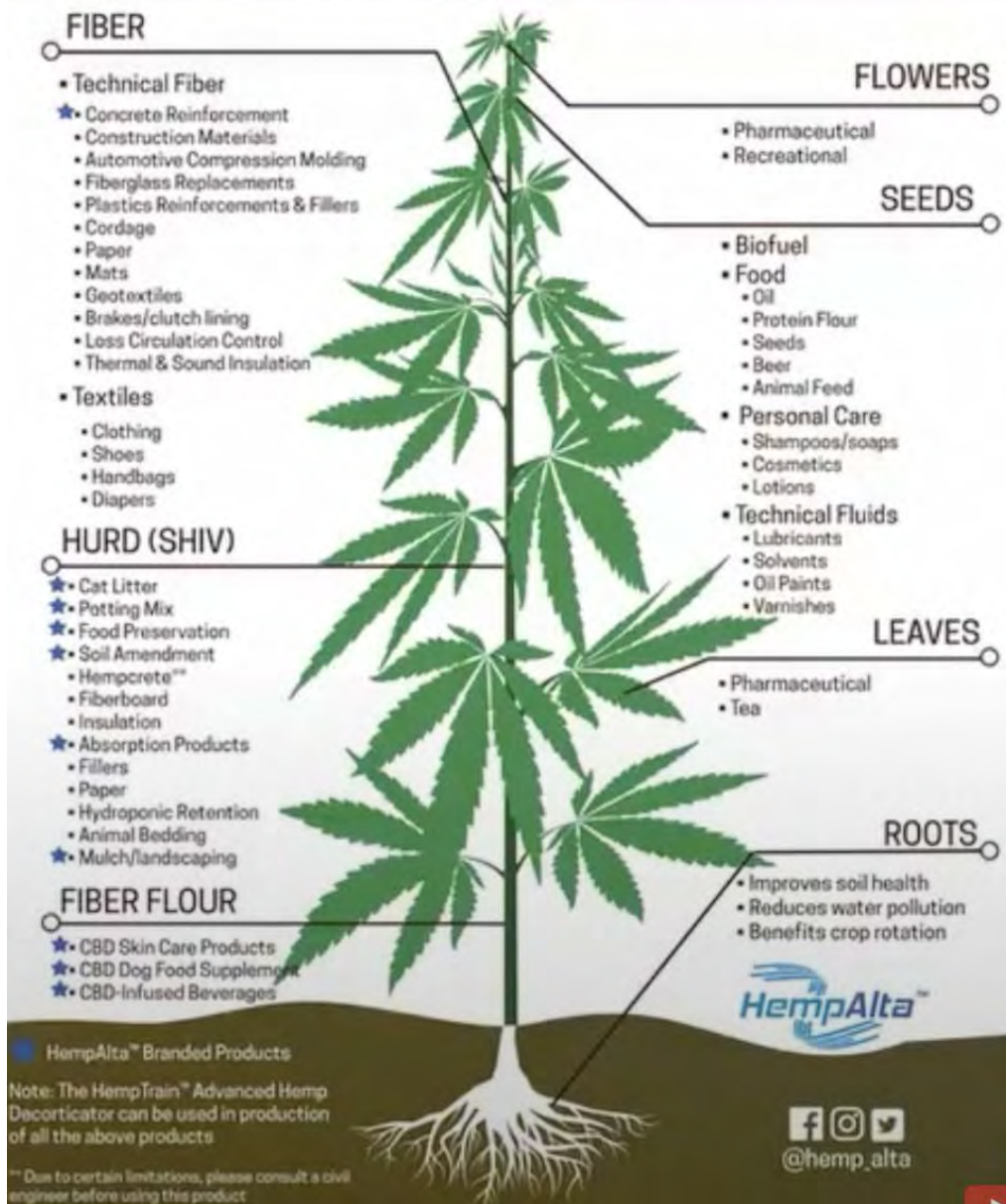
Adopting hemp could revitalize Hawai'i's agriculture, enhance food security, reduce import dependency, and support sustainable practices over tourism. The state legislature should prioritize food security and sustainability by identifying agricultural land, educating the public, and subsidizing local crops. Let's prioritize food security and sustainability before it is too late!

B. Infrastructure Needs of Hawai'i Hemp Farmers

B1. Hemp-Derived Products That Can and Are Being Made

Hemp, with its versatile properties, offers a multitude of uses across various industries. There are three main categories when looking at the different uses/processing methods for hemp. Fiber, Seed/Grain, and Cannabinoids. Primarily valued for its fibers, hemp finds application in textiles, providing durable and breathable fabric for clothing, upholstery, and accessories. Beyond textiles, hemp fibers are utilized in construction materials, such as insulation, fiberboard, and hempcrete, offering sustainable alternatives with excellent thermal properties. Additionally, hemp seeds are rich in nutrients and can be processed into oil, used in cooking, skincare, protein powders, seed milk and nutritional supplements. Hemp seeds can also be used to make biodiesel and hemp straw can be used to make biofuels. The plant's strong and lightweight composition also lends itself to manufacturing biodegradable plastics, reducing dependence on fossil fuels and combating plastic pollution. Furthermore, hemp serves as a renewable resource for paper production, requiring fewer chemicals and less water compared to traditional wood pulp. Its potential extends into the automotive industry, with hemp-based materials being explored for car interiors and panels. The cannabinoids found in hemp including CBD have been known to help treat chronic pain, inflammation, anxiety, insomnia, depression, and PTSD. Moreover, hemp cultivation contributes to soil health and carbon sequestration, making it an eco-friendly choice for farmers. With its myriad applications, hemp emerges as a sustainable solution across diverse sectors, promising a greener and more resilient future for Hawai'i.

THE MANY USES OF HEMP



*Infographic via Hemp Alta

Products That Can Be Made From Hemp

FIBER SECTOR:

Industrial Textiles:

Twine, rope, nets, canvas, tarps, carpets, geotextiles, agro-fiber composites, brake/clutch linings, caulking

Consumer Textiles:

Apparel, diapers, fabrics, handbags, denim, shoes, fabrics

Paper:

Printing paper, newsprint, cardboard/packaging

Building Materials:

Hempcrete, hemp blocks, hempcrete prefab panels, hempcrete spray, fiberboard, insulation, fiberglass substitute, flooring, sound abatement

Industrial Products:

Oil paints, varnishes, printer ink, fuel, solvents, lubricants, putty, coatings, biodiesel, Hemp ethanol/methanol, graphene/biochar, batteries, surfboards, car doors, bioplastics, mulch, chemical spill cleanup, biodegradable single use plastics

Animal:

Animal bedding, kitty litter

Fuel:

Biofuel

SEED/GRAIN SECTOR:

Foods:

Hemp seed oil, food supplements, cooking oils, birdseed, hemp seed hearts, animal feed (chicken feed), protein powder, hemp mylk

Personal Hygiene:

Soap, shampoo, bath gels, lotions, balms, cosmetics

Fuel:

Biodiesel

CANNABINOID SECTOR

Health:

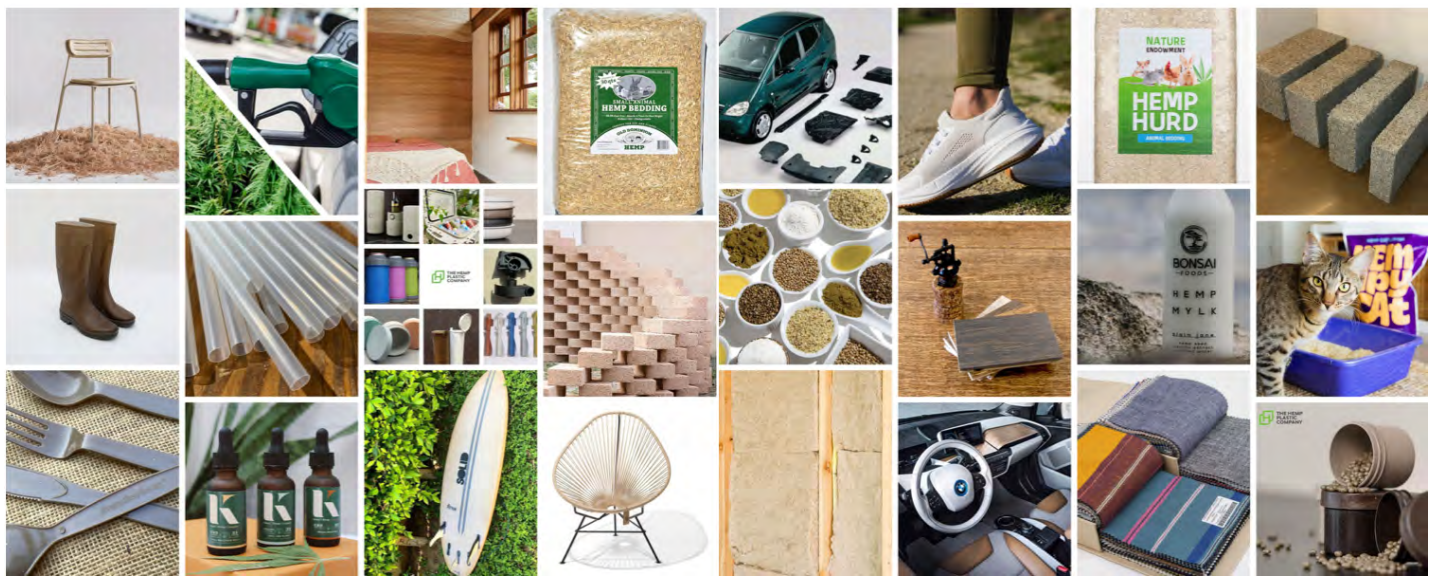
Cannabinoids (CBD, CBG, CBN...)

Topicals

Tinctures

Edibles (*not yet legal in Hawai'i)

Capsules



The multitude of products that can be made from hemp

B2. Low Hanging Fruit Products For Hawai'i

In Hawai'i, Industrial Hemp offers a multitude of applications that could contribute to the state's economy and sustainability efforts. With its ideal climate and fertile soil, Hawai'i boasts a conducive environment for hemp cultivation. The versatile plant finds extensive use across various sectors, including agriculture, construction, biofuels and bioplastics and health. In agriculture, hemp serves as a valuable rotational crop, enhancing soil health and biodiversity while requiring minimal water and pesticides. Moreover, hemp fibers are utilized in construction materials, such as hempcrete, providing eco-friendly alternatives for building homes and infrastructure that can help solve the housing crisis in Hawai'i. Also, animal bedding would benefit the many hobby farms that have animals such as horses and chickens across the islands. Additionally, hemp cultivation promotes carbon sequestration, aiding in Hawai'i's commitment to combating climate change.

Cannabinoid Hemp, a high value crop grown by small farms can supplement income from their food crops while adding to food security for our islands by being planted as a rotation crop or alongside other food crops. As the state continues to explore sustainable practices, Industrial Hemp can emerge as a promising asset, fostering economic growth and environmental stewardship throughout the islands. Based on what is currently being produced on the mainland utilizing newly built Industrial Hemp processing facilities, the below items are recommendations for what could be made relatively easily in Hawai'i should we have the hemp processing plants in place.

Building Materials:

- [Hempcrete prefab walls](#)
- [Hempcrete bricks](#)
- Traditional hempcrete using forms

- [Spray hempcrete](#) (Ereasy spray)
- [3D printing with hempcrete](#)
- [Hemp insulation](#)
- [Sound abatement](#)

Pet:

- [Kitty litter](#)
- [Chicken, farm animal feed](#) utilizing biomass waste from CBD hemp
- [Animal bedding-chickens](#)

Health:

- Cannabinoid based products such as: [CBD tinctures](#), [topicals](#)...

Industrial:

- [Bio plastics](#)
- [Hemp biodiesel/ethanol](#)
 - [Pacific Biodiesel](#), the first biodiesel company in the nation, is ready to press hemp seed on the Big Island and Kauai
- [Hemp for clean up](#) of oil spills, solvents, coolants...
- [Bio char graphene for batteries](#)

Food:

- [Hemp seed hearts](#)
- [Hemp seed oil](#)
- [Hemp protein powder](#)
- [Hemp mylk](#)

Body Care:

- Soaps
- Shampoos
- Lotions
- Balms
- Cosmetics

*Food grade hemp seed oil can be processed today on Big Island and Kauai via Pacific¹³

Biodiesel and supply the many producers of *Made in Hawai'i* beauty/body products

Agriculture:

- Rotation crop
- Soil remediation
- Carbon sequestration
- Garden mulch
- Potting soil additive

Primary hemp products that can be made immediately without further processing at the hemp processing facility:

- Hemp hurd for hempcrete
- Kitty litter
- Animal bedding
- Premium soil enrichment made from hemp
- Garden mulch
- All-natural chemical spill absorbent
- Biodiesel: Pacific Biodiesel processing facilities are ready to process hemp seed into finished biodiesel on both the Big Island and Kauai.

Secondary hemp products that can be made once appropriate infrastructure is in place

The below products are ones that utilize different parts of the hemp plant but need additional processing or know-how to execute. The below products could potentially spawn many small businesses and stoke innovations in the hemp industry in the Hawaiian Islands.

Building Materials:

- 3D printing with hempcrete
- Hemp insulation
- Hemp blocks
- Prefab industry for building houses and apartments

Health:

- Cannabinoid based products such as tinctures and topicals

Industrial:

- Bio plastics products that are currently being imported can be replaced with hemp bioplastics such as school chairs, tables, [single use plastics and straws](#), ...
- Hemp bioethanol
 - Agripelago is an advanced startup in this area
- Biochar
- Hemp batteries

Food:

- Hemp seed hearts
- Hemp seed oil
- Hemp protein powder
- Hemp mylk

Body Care:

- [Soaps](#)
- [Shampoos](#)
- [Lotions](#)
- [Balms](#)
- [Cosmetics](#)

A Deeper Look at Each Sector**Fuel Sector**

In recent years, there has been growing interest in exploring renewable energy sources to mitigate the adverse effects of fossil fuel consumption on the environment. One such promising avenue is the utilization of hemp biomass as well as pressing hemp seeds for biofuel production. Hemp offers a sustainable solution to meet the escalating energy demands while reducing greenhouse gas emissions. Below we will dive into the feasibility, benefits, and challenges associated with using hemp biomass for biofuel production.

Feasibility of Hemp Biomass for Biofuel Production:

Hemp has garnered attention for its high biomass yield and versatile applications. It can be cultivated in various climates with minimal water and pesticide requirements, making it a highly sustainable crop. Hemp biomass, consisting of the plant's stalks, leaves, and flowers, contains cellulose, hemicellulose, and lignin—key components suitable for biofuel production.

Both biodiesel and RNG (Renewable Natural Gas) can be made from locally grown hemp. Biofuels can be made from both the hemp seed and the hemp straw by entirely different processes. Biodiesel has been made from hemp seeds for over 100 years and was used to power the first Ford cars. This is the easiest commercial process and the industrial infrastructure already exists in Hawai'i through the forward thinking efforts of Pacific Biodiesel. Hemp biodiesel has been shown to produce 207 gals/hectare (83 gals/acre).

RNG is made from the biomass of the hemp plant (stalks, stems, leaves and flowers) through anaerobic digestion of the cellulosic biomass. Anaerobic digestion is a commercially mature technology used throughout Europe and its application to a future Hawaiian hemp industry is under development by Agripelago, a Hawaiian company hoping to use industrial hemp for the dual purpose of food products and RNG production. In trials in Northern Europe hemp for biogas yielded 12,860 pounds per acre with an energy content of 118GJ/A of biogas.³

Agripelago makes an interesting argument for anaerobic digestion in that it can use green leaves currently lost in today's harvesting techniques. However, they are quick to point out that even collecting leaves from Industrial Hemp with a confirmed THC content below 0.3% raises suspicions. This lack of understanding is impeding progress in not only biofuels but alternative animal proteins that could be grown locally. According to Grant Overton, CEO of Agripelago, for his industry to move forward “the State of Hawai'i must align our hemp regulations with the US federal law as described extensively under the Farm Bill and as regulated by the USDA. We should never exceed federal regulations, now or in the future.”

Pacific Biodiesel produces over 6,000,000 gallons of biodiesel per year for the local Hawaiian market. They began nearly 30 years ago making biodiesel from recycled cooking oil on Maui and later expanded into using grease trap waste and animal renderings. More recently, this innovative company has been growing sunflowers and safflowers to demonstrate the island's potential for growing oil seed crops to reduce Hawai'i's dependence on imported fossil fuels.

³ Biomass and Energy Yield of Industrial Hemp Grown For Biogas and Solid Fuel:
<https://www.sciencedirect.com/science/article/abs/pii/S096195341100208X>

They attempted to experiment with growing hemp seeds but were deterred by the political and social stigma associated with the lack of understanding of the many differences between Industrial Hemp and Cannabis. According to Kelly King, Vice President at Pacific Biodiesel, no local bank was willing to fund any hemp biodiesel projects for fear of public pushback. So the founders of Pacific Biodiesel, Bob and Kelly King, had to create a business entity in their personal names even to proceed with experimentation.

If these two successful business leaders in the field of climate change technology and environmental concerns were affected, then consider the pressures on the Hawaiian Cannabinoid Hemp growers. This has been a recurring concern expressed by the task force members not only in terms of banking assistance but commercial insurance under-writing. Once Industrial Hemp is accepted as a valuable crop in Hawai'i, it is important to note that the large Pacific Biodiesel processing plant on the Big Island is capable of producing hemp seed culinary oils as well as biodiesel in the same way that it currently processes from macnut waste culls and purpose grown sunflower and safflower oil seeds. When production of Industrial Hemp begins in the Hawaiian Islands we will be very fortunate to have this infrastructure already in place. Pacific Biodiesel has the status of being the first biodiesel plant in the nation. The company employs over 100 people in meaningful jobs. We spoke with an employee on Maui returning from his 3:30am route of cleaning out grease traps around the island. He said he felt fortunate to work for Pacific Biodiesel because he felt his work was making a difference. His pride was palpable as he showed us around the sunflower farm.

Conclusion: Harnessing hemp biomass for biofuel production offers a promising pathway towards achieving sustainable energy goals. The renewable nature of hemp, coupled with its environmental benefits and economic opportunities, underscores its significance as a viable alternative to fossil fuels. Pacific Biodiesel's processing plant is currently able to process hemp seeds for biofuel and culinary oils and they are able to grow potentially many acres of hemp as a rotation crop with other seed crops. Agriplelago has been working on developing Biogas projects: specifically RNG (Renewable Natural Gas) with CCUS (Carbon Capture Utilization and Storage) and if the uncertainty surrounding hemp cultivation laws were removed, they would be able to secure the investment needed to bring this project to fruition. This is why addressing regulatory, technological, and market challenges is essential to realize the full potential of hemp biofuels. With concerted efforts from policymakers, researchers, and industry stakeholders, hemp biofuels can emerge as a cornerstone of the transition towards a cleaner and greener energy future.

Building Sector

Due to the recent wildfires in Lahaina and upcountry Maui, we are at an inflection point with much needed affordable housing. The Maui county council estimated in 2016 that it needed to build 14,000 housing units⁴ over the next decade to keep up with demand and now due to the wildfires in August 2023, that burned over 2000 businesses and residences, the situation is even more dire. Hempcrete could potentially offer several benefits in helping address the building crisis on Maui following the Lahaina wildfires as well as the state-wide housing crisis. If we are able to grow and process hemp in Hawai'i, a large portion of that hemp could be used to build affordable, healthy homes. Due to the need for expediency, utilizing [hempcrete blocks](#), [prefab hempcrete panels](#), [3D printing](#) hempcrete building, [spray hempcrete](#) and all manner of wood replacement products would be the best solution to build homes quickly. It would also create new businesses and jobs in the state. All of the products that we reference as hemp replacement for currently imported construction materials are currently in production and can typically be licensed for local production. You will see in our recommendations that we are recommending that HPM be supported to determine which of the many products should be produced in the islands for the biggest impact on reducing imports.

Joe Smith, a builder and founder of [Hemp Home Hawai'i](#), just completed the second hempcrete home on Maui. Since launching his hempcrete focused business this year, there has been a lot of interest in building with hempcrete, the problem is that the hemp hurd still needs to be imported which is an added expense. Joe paid \$0.66/ pound to transport hurd to Maui. With a processing plant even on another island that inter-island cost would drop to about \$0.07/pound. [Hemp Solutions Kauai](#) is looking to make hempcrete bricks in order to build homes faster. Ohana Nui Ventures is looking to partner with them to grow the hemp on potentially 1000 acres on Kauai.

Below are some reasons why building homes with hemp grown in Hawai'i would be beneficial:

Sustainable Material: Hempcrete is made from the inner woody fibers of the Industrial Hemp plant mixed with lime and water. The hemp hurd used for hempcrete comes straight out of the decorticator with no additional processing needed. It's a renewable resource that grows quickly and requires minimal water and pesticides compared to other building materials. Using hempcrete can contribute to sustainable rebuilding efforts and reduce the environmental impact of construction.

⁴ Measuring Housing Demand in Hawaii 2015-2025: <https://files.hawaii.gov/dbedt/economic/reports/2015+805-housing-demand.pdf>

Fire Resistance: One of the key benefits of hempcrete is its fire-resistant properties.⁵ While it's not completely fireproof, hempcrete is significantly more fire-resistant than traditional building materials like wood. This could be particularly beneficial in areas prone to wildfires, such as the dryer areas of the islands, helping to minimize the risk of future fire damage.

Insulation: Hempcrete provides excellent insulation properties, regulating temperature and humidity within buildings. In a tropical climate like Hawai'i, proper insulation is crucial for maintaining comfortable indoor conditions without relying heavily on energy-intensive cooling systems. Additionally, hempcrete's breathability can help prevent mold and mildew growth, which is important in humid environments.

Carbon Sequestration: Hempcrete has the ability to sequester carbon dioxide from the atmosphere during its production, making it a carbon-negative building material. By using hempcrete in construction projects, it's possible to offset carbon emissions, contributing to efforts to combat climate change.

Local Economic Development: Hemp cultivation and hempcrete production can create economic opportunities for local communities. By establishing hemp farming and processing facilities in Hawai'i, it would create jobs and support the local economy while also providing a sustainable building material for reconstruction efforts.

Regenerative Agriculture: Hemp cultivation can improve soil health and biodiversity, as it requires minimal inputs and can be grown in rotation with other crops. In areas affected by wildfires, regenerative agricultural practices can help restore damaged ecosystems and mitigate the risk of future wildfires.

Renewable Resource: Due to Hawai'i's climate, there is potential to harvest hemp year around, thereby creating a continuous supply of hemp to build homes with. Utilizing hemp as a rotation crop for smaller farmers can add to the supply chain as well.

Conclusion: Building with hempcrete in Hawai'i offers numerous environmental and practical benefits, making it an ideal choice for sustainable construction. The hemp hurd used for hempcrete comes straight out of the decorticator and does not need any additional processing. Hempcrete is highly sustainable due to its low carbon footprint. Hemp plants sequester large

⁵ Hempcrete Wall product Earns One-Hour Fire Resistance Rating From ASTM International:
<https://www.ganjapreneur.com/hempcrete-wall-product-earns-one-hour-fire-resistance-rating-from-astm-international/>

amounts of CO2 during their growth, which offsets the carbon emissions associated with construction. Additionally, hemp can be cultivated relatively quickly and abundantly in Hawai'i's tropical climate, providing a local and renewable source of raw materials. The use of locally sourced hemp not only reduces transportation emissions but also supports the local economy and agricultural sector and reduces the need for imported building materials.

Hempcrete also provides excellent thermal and acoustic insulation, contributing to energy efficiency and comfort in Hawai'i's warm climate. Its breathability helps regulate indoor humidity, preventing mold growth and improving air quality, which is particularly beneficial in Hawai'i's humid environment. The material is fire-resistant, pest-resistant, and durable, enhancing the longevity and safety of buildings. By incorporating hempcrete into building practices, Hawai'i can move towards more sustainable, resilient, and healthy living environments. In order to have a viable hempcrete industry in Hawai'i a processing plant will need to be placed on one of the islands to begin with followed by the other major islands. To supply one decorticator plant at full scale production (4 shifts) will require 3000 acres of land with irrigation in rotational crops.

General Fiber Sector

Hemp fiber, derived from the stalks of the hemp plant, is a versatile and eco-friendly material with a myriad of applications like textiles, paper, building materials, bioplastics, composite panels for cars, rope, mulch, and animal bedding. The downside is that some, but not all of these products need additional processing, but some can come straight from the decorticator. The upside is that once additional infrastructure is in place to process these types of products, Hawai'i can lessen its reliance on many imported goods that can be made from hemp fiber and create new industries in the state. Below are some benefits of replacing traditional products with hemp alternatives.

Hemp Based Building Materials

Economic Impact: Hemp biomass (straw) can provide the raw materials for many secondary industries to produce the construction materials currently imported creating a circular island economy.

Construction materials currently being produced from hemp hurd or fiber:

- Hempcrete
- Hemp blocks
- Hemp/cement structural blocks
- Insulation
- Hempwood panels

- Fiber board
- Sub-flooring

Pro: Hawaiian agriculture can focus on producing the raw materials for Hawaiian industries rather than a one-time export.

Hemp Paper

Environmental Impact: Hemp grows much faster than trees, maturing in just 3 months compared to 20-80 years for trees. This rapid growth rate means hemp can be harvested and replanted multiple times a year, leading to a sustainable supply of raw material.

Less Chemical Use: Producing paper from hemp requires fewer chemicals than from wood pulp, reducing environmental pollution.

Durability and Quality: Hemp paper is more durable and resistant to decomposition. It can be recycled more times than wood-based paper.

Con: Additional processing and equipment is needed to make hemp paper.

Hemp Kitty Litter

Absorbency: Hemp fibers are highly absorbent, making hemp kitty litter effective at controlling moisture and odors.

Biodegradability: Unlike traditional clay-based litters, hemp litter is biodegradable, reducing landfill waste.

Dust-Free: Hemp kitty litter produces less dust, which is beneficial for both cats and their owners, especially those with respiratory issues.

Pro: Hemp kitty litter can come straight from the decorticator with no additional processing equipment required.

Hemp Animal Bedding

Comfort and Safety: Hemp bedding is soft and comfortable for animals. It is also dust-free, reducing respiratory problems.

Absorbency and Odor Control: Its natural absorbency helps keep animal enclosures dry and odor-free, enhancing the living conditions for pets and livestock.

Biodegradability: Hemp bedding is biodegradable and compostable, making it an environmentally friendly option.

Pro: Bedding when used in a free-range poultry setting can absorb manure that can be further processed in Black Soldier Fly larvae to be used as poultry or fish food.

Hemp Textiles

Resource Efficiency: Hemp requires less water and fewer pesticides than cotton to grow. This makes hemp a more sustainable choice for textile production.

Durability: Hemp fibers are stronger and more durable than cotton, leading to longer-lasting clothing and fabrics.

Comfort: Hemp textiles are breathable and become softer with each wash, offering comfort comparable to cotton.

Con: Additional processing and equipment is needed to make hemp textiles.

Plastics

Biodegradability: Hemp-based plastics are biodegradable, unlike conventional petroleum-based plastics, which persist in the environment for hundreds of years.

Strength and Lightweight: Hemp plastics are strong, durable, and lightweight, making them suitable for various applications, including utensils, packaging, automotive parts, and construction materials.

Reduced Carbon Footprint: Producing hemp plastics emits fewer greenhouse gasses than traditional plastic production, contributing to a lower carbon footprint.

Con: Additional processing and equipment are needed to make hemp bioplastics.

Hemp Rope

Strength and Durability: Hemp rope is stronger and more durable than cotton rope. It resists rotting and degradation from UV light better than cotton.

Sustainability: Hemp cultivation is more sustainable, requiring fewer resources and having a lower environmental impact than cotton farming.

Versatility: Hemp rope is versatile and can be used in various applications, from maritime activities to crafting and home use.

Con: Additional processing and equipment are needed to make hemp rope.

Conclusion: Replacing traditional products with hemp fiber-based alternatives can lead to significant environmental, economic, and practical benefits. Hemp's rapid growth, low resource requirements, and biodegradability make it an excellent sustainable choice for a wide range of applications.

The con is that a lot of these products like rope, paper, textiles, and bioplastics need additional processing. The focus should first be on the low hanging fruit such as hemp hurd for hempcrete, kitty litter, and animal bedding as it can come straight out of the decorticator. Once Hawai'i is able to build a fiber processing plant and industrial hemp is being farmed at scale, then we can begin to look at producing some of the other products that can be made from the fiber.

Cannabinoid Sector

The cannabinoid sector is primarily focused on the extraction and utilization of compounds such as cannabidiol (CBD) and other cannabinoids like CBG and CBN. CBD, in particular, has gained significant attention for its potential therapeutic benefits, including anti-inflammatory, and analgesic, properties. Products derived from hemp cannabinoids include oils, tinctures, capsules, and topicals, which are used for managing a variety of health conditions such as chronic pain, anxiety, and epilepsy. There is already a boutique cannabinoid industry in Hawai'i made up primarily of small farms.

Growing Cannabinoid Hemp in addition to other food crops in Hawai'i offers several benefits for the small farmer:

- 1. Diversified Income Stream:** By adding a high value crop like Cannabinoid Hemp into their crop rotation, it can provide an additional source of revenue. The demand for CBD products is high, and prices for CBD hemp can be lucrative compared to other traditional crops.
- 2. Crop Rotation Benefits:** Incorporating hemp into crop rotation can improve soil health. Hemp has deep roots that can help break up soil, improve soil structure, and reduce soil compaction. This can benefit subsequent food crops by enhancing nutrient availability and reducing pests and diseases.
- 3. Pest Suppression:** Hemp's natural resistance to many pests also means fewer if any pesticides are needed, benefiting the environment, and reducing costs.
- 4. Soil Remediation:** Hemp is known for its phytoremediation properties, meaning it can help remove toxins from the soil. This can be particularly beneficial for land in Hawai'i that has been degraded or contaminated, improving its suitability for growing other crops in the future.

5. **Market Growth:** Selling “Hawaiian Grown Hemp” can be more lucrative than similar products from the mainland or overseas as Hawaiian grown products can usually be sold at a premium and are held in high regard by consumers for their quality. Establishing a reputation for high-quality Cannabinoid Hemp can lead to long-term business opportunities.
6. **Environmental Benefits:** Hemp is an environmentally friendly crop. It requires less water than many traditional crops and can be grown with fewer chemical inputs. This sustainable approach can appeal to environmentally conscious consumers and can potentially qualify for certain grants or subsidies for local farmers.
7. **Resilience Against Market Fluctuations:** By diversifying crops, farmers can mitigate the risk of market fluctuations. If prices for one crop fall, income from another can help stabilize the farm's revenue.
8. **Research and Development Opportunities:** Engaging in the cultivation of Cannabinoid Hemp can open up opportunities for collaboration with research institutions, universities, and companies interested in developing new strains or cultivation techniques.

Conclusion: Incorporating Cannabinoid Hemp into a small farm's crop portfolio can enhance financial stability, promote sustainable farming practices, and provide opportunities for innovation and growth. Being able to put “Hawaiian Grown Hemp” on the label can bring a premium price, thereby increasing the income of small farmers with a high value crop that can complement other crops grown on the farm. The cannabinoid farmers need to be supported better by the local government in order for it to grow and flourish as there are many barriers in the way and outside competition which we touch on in more detail in section L.

Grain/Food Sector

In Hawai'i, there is a prime opportunity to leverage Industrial Hemp for grain and food production. Hemp seeds, rich in protein, essential fatty acids, and minerals, offer a nutritious and sustainable alternative for human consumption. There is also potential to utilize the hemp seeds for nutritious animal feed as well once the laws around its use change. With Hawai'i's agricultural sector seeking sustainable food solutions, Industrial Hemp seed is a compelling option.

Benefits of Utilizing Industrial Hemp for Grain and Food in Hawai'i:

1. **Diversification of Agriculture:** Hawai'i's agriculture has historically focused on sugarcane, pineapple, hybrid seed corn and coffee. Introducing Industrial Hemp grown for seed adds diversity, reducing reliance on a few crops and enhancing resilience against market fluctuations.

- 2. Economic Opportunities:** Industrial Hemp grown for seed presents new revenue streams for farmers and stimulates economic growth through processing facilities, distribution networks, and value-added product development.
- 3. Nutritional Value:** Hemp seed hearts are a rich source of protein, omega-3 and omega-6 fatty acids, and various vitamins and minerals. Hemp mylk and hemp protein are also nutritious options that can replace traditional cow milk and other types of protein powders. Integrating hemp-based products into the local food industry can enhance nutritional diversity and promote wellness.
- 4. Animal Feed:** Hemp seed meal is a high-protein, high-fiber, and nutrient-rich byproduct of cold-pressing hemp seeds to extract hemp seed oil. Recently, hemp has moved one step closer to approval as a feed for laying hens after a key U.S. Food & Drug Administration (FDA) agency signed off on a definition of “hemp seed meal” (HSM).⁶

Challenges and Considerations:

- 1. Regulatory Framework:** Although hemp cultivation is legal in Hawai'i, there needs to be a clear delineation between Industrial Hemp and Cannabinoid Hemp in order to remove any uncertainty in the laws surrounding cultivating hemp grown for food for people or animals.
- 2. Market Development:** Establishing demand for hemp-based products requires education and marketing efforts to familiarize consumers with the nutritional benefits and culinary versatility of hemp seeds and derivatives.
- 3. Infrastructure:** Developing processing facilities for dehulling, and oil extraction is crucial to unlocking the full potential of hemp grain production. Fortunately [Pacific Biodiesel](#) has the infrastructure necessary to support the scalability of the industry.
- 4. Genetic Variability:** Selecting suitable hemp cultivars adapted to Hawai'i's climate and soil conditions is essential for maximizing yield and quality. Research and development initiatives focused on breeding resilient varieties are currently being undertaken by the [University of Hawai'i CTAHR](#).

Strategies for Implementation

- 1. Collaborative Research:** Foster partnerships between academic institutions, government agencies, and industry stakeholders to conduct research on hemp cultivation techniques, varietal selection, and product development tailored to Hawai'i's unique requirements.

⁶ FDA Agency Gives Go Ahead on Definition of 'Hemp Seed Meal' For Laying Hens: <https://hemptoday.net/fda-agency-gives-go-ahead-on-definition-of-hemp-seed-meal-for-laying-hens/>

- 2. Value-Added Products:** Encourage the development of innovative hemp-based food products, such as hemp protein powder, protein bars, hemp oil, and hemp milk, to create market demand and increase consumer acceptance.

Conclusion: The utilization of Industrial Hemp for grain and food production presents a promising opportunity for Hawai'i to foster agricultural sustainability, economic growth, and nutritional wellness. By clearly defining Industrial Hemp and Cannabinoid Hemp, addressing regulatory barriers, investing in research and infrastructure, and promoting market development, Hawai'i can position itself as a leader in the emerging hemp grain/food industry while contributing to the health and prosperity of its communities.

Findings/Recommendations Low Hanging Fruit: There are over 25,000 uses for the hemp plant. In order to get a hemp industry going in Hawai'i, the focus should be on the low hanging fruit first. By focusing on making products that come straight from the manufacturing facility, it can jumpstart the hemp industry and open up new avenues for additional products and businesses which can lead to the innovation of new hemp products like biodiesel, bioplastics, biochar and hemp batteries. After the recent wildfires on Maui, affordable housing is needed more than ever and it is needed quickly. Hempcrete has an opportunity to be utilized in the effort to rebuild Lahaina and build homes across the state and get safe, sustainable homes up quickly with the use of hemp blocks, spray hempcrete and hemp prefab walls. Access to large swaths of land to grow industrial hemp is essential for this industry to flourish. This could be tapping into leasing hundreds or thousands of acres of land from private landowners, working with state owned land to clean up fallow soil to be planted later with food crops and encouraging small farms to grow hemp as a rotation crop to bring in additional income. There are already several companies like Pacific Biodiesel, Agripelago, Hemp Home Hawai'i, Kauai Hemp Company, Ohana Nui Ventures and Hemp Solutions Kauai that are in the process or are currently able to address the low hanging fruit and jumpstart the hemp industry in Hawai'i. A hemp industry could be an economic engine that could provide meaningful jobs and support food security. It deserves the state's support and funding is needed in order for it to grow and prosper.

B3. Best Cultivation Practices

Distinguishing Between Industrial Hemp and Cannabinoid Hemp

For the purpose of writing the laws that will govern the growing of both Industrial Hemp and Cannabinoid hemp in the State of Hawai'i it is imperative that we understand the distinction between Industrial Hemp (fiber and grain) and Cannabinoid Hemp (< .3% THC) and Cannabis (> .3% THC). In the realm of hemp, cannabinoids, and cannabis, there are common misconceptions surrounding their origins and uses. Many believe they stem from the same plant, leading to assumptions about their categorization, regulations, and limitations. However, these substances are distinctly different despite being grouped under the umbrella terms of "hemp" or "hemp products." The prevalence of misinformation has persisted for decades, especially regarding the association of industrial hemp with high THC cannabis. It's time to clarify the disparities between Cannabis, Cannabinoid Hemp, and Industrial Hemp definitively. The confusion arises from interchangeable terminology, such as referring to hemp as "Cannabis"; and vice versa, along with using "CBD"; to denote a plant when it's actually an extract from the Cannabis plant, specifically the female variant. Let's delve into these explanations. For clarity we will use the terms "Cannabinoid Hemp" and "Industrial Hemp" throughout this report.

1. Hemp plants exhibit two genders: male and female. The male plant, commonly referred to as hemp (Industrial Hemp), does not produce flowers and consequently contains minimal THC levels. On the other hand, the female plant, often termed Cannabis (Recreational or Cannabinoid Hemp), is a flowering plant containing the psychoactive compound THC (delta9 tetrahydrocannabinol) alongside the non-psychoactive cannabidiol (CBD) and other non- psychoactive cannabinoids that can be extracted.
2. The cultivation of Industrial Hemp is diametrically opposed to the cultivation of Cannabinoid Hemp. Industrial Hemp is planted with extreme density – 350,000 to 550,000 plants per acre, whereas Cannabinoid Hemp is planted at 1600 to 2000 plants per acre for hand cultivation. This difference can be sited from the road and from a satellite photo.
3. Industrial Hemp looks like a tall hay field ready for tractor drawn equipment and a Cannabinoid Hemp field looks like little Christmas trees ready for hand trimming.

4. The high-density planting makes the plants grow tall and skinny which allows the hemp to not only out compete the weeds but increases the quality of the fiber.
5. If Industrial Hemp were grown like Cannabinoid Hemp it would not only require hand weeding but the additional space would create stalks so thick that they could not be harvested or processed mechanically and the fiber would be shorter and of a lesser quality.
6. Another obvious difference is that Cannabinoid Hemp is traditionally grown by hand and Industrial Hemp is grown with large scale equipment.
7. A Cannabinoid Hemp field is full of flowers while an Industrial Hemp field should be cut before there is any flowering as that reduces quality in both the fiber and in the soil microbiome.
8. The cutting of Industrial Hemp before flowering makes it function as a high value cover crop in that during the vegetative growth period it is actively exuding root sugars to its symbiotic Mycorrhizal fungi and soil bacteria. But upon flowering the plant naturally translocates more nutrients to the flower and seed production.
9. It may be these differences that will make it easy to create a system for identifying whether a farmer is growing hemp for cannabinoids or for fiber here in the State of Hawai'i. Our goal is to help the task force come up with simple ways of distinguishing between Industrial Hemp and Cannabinoid Hemp.
10. To date we think that these unique laws will include:
 - GPS registration of all fields when planted
 - Planting of varieties labeled exempt from THC testing similar to the exemptions given Canadian farmers by the Health Canada's List of Approved Cannabis Cultivars (LOAC)
 - Satellite monitoring of planting density and life cycle stages
 - Visual inspection of planting density and flower emergence
 - THC monitoring if Cannabinoid Hemp is suspected
 - Our logic is that even if you were to plant a high CBD seed in high density planting it would not produce flowers and if it did they would be of very low quality. It is easier to see whether a field has flowers or not than it is to send samples into a lab from flowers

that never developed.

11. Please notice the easy distinguishing qualities of these two fields



Hemp grown for the flower: Cannabinoids

Industrial hemp

Industrial hemp

12. Add to this obvious density difference and the absence of flowers in Industrial Hemp and it should not be necessary to deal with expensive and unreliable testing for THC. With a little education, law enforcement should easily see from the road whether the hemp is being grown for cannabinoids or fiber.

13. Furthermore, if Cannabinoid Hemp were to be grown at high densities the flowers would be no good.

These distinct pathways in the supply chain, farming practices, and distribution are primarily dictated by their intended uses: Cannabis is cultivated for its high THC levels, primarily sought after for its psychotropic and medical effects. Cannabinoid Hemp in which CBD and other non-psychoactive cannabinoids are extracted as an oil is used for health purposes, targeting pain relief, inflammation, anxiety, and other therapeutic applications. Industrial hemp is grown for its long stalks, which yield fiber and hurd (woody core), commonly employed in industrial settings.

Distinguishing seed characteristics for Industrial Hemp versus Cannabis/Cannabinoid seeds that are feminized, yielding flowers with high CBD and THC potential. They are costly due to their high yield value per acre. Industrial hemp seeds are male, utilized to maximize stalks or seed production with negligible THC content. They are therefore economical, aligning with traditional output values per acre.

It's crucial to note that all hemp-derived products, such as protein powders and oils originate from industrial hemp seeds. These seeds boast rich protein, vitamin, and mineral content. Contrarily, Cannabinoid seeds are not consumed but rather planted to facilitate flower growth.

Labor Dynamics in Farming

Cannabinoid Hemp and Cannabis cultivation demands significant labor inputs, requiring constant monitoring and meticulous care, especially for high THC content. Industrial Hemp, in contrast, thrives with minimal intervention during its 90 day growth cycles, necessitating modest water, sunlight, and fertilization. Most importantly Industrial Hemp is grown and harvested like other mechanized crops like small grains and hay.

Processing Methods for Hemp

Cannabis buds are trimmed for THC extraction, utilizing drying processes to preserve cannabinoids and eliminate vegetative flavors. Cannabinoid Hemp CBD extraction employs solvents like butane, CO₂, or ethanol to isolate oils, subsequently refining them into various products. Industrial Hemp undergoes mechanical processing to separate fibers and hurds, prioritizing scalability and environmental friendliness.

Impact Across Industries

Cannabis garners mixed publicity due to its psychotropic nature but shows promise in medical contexts for pain management and anxiety relief. Cannabinoid Hemp's versatility in health applications positions it as an anti-inflammatory and anxiety alleviator. Industrial Hemp's fibers and hurds offer sustainable alternatives across manufacturing sectors reducing Hawai'i's import dependence as well as offering locally grown building materials. Education of legislators and the general public will allow for informed conversations about the potential for Industrial Hemp as well as Cannabinoid Hemp cultivation to add to the circular economy on these remote islands. Industrial Hemp will allow new industries to replace imported goods. Mechanized cultivation will allow for other mechanized crops to follow in a rotation that will benefit food security on our islands. With the many factors that could result in shipping instability Hawai'i must join the 21st century of mechanical production of food staples. We must remove the roadblocks to the local production of protein – both vegetable and efficient animal conversion of grains to protein with beneficial manure cycling currently absent in the islands.

2024 Farm Bill Potential Nomenclature Delineation

The House Agricultural Committee introduced verbiage in the 2024 Farm Bill, H.R. 8467 (§10006), that was passed by the House and is now being considered by the Senate.⁷ This would add a new statutory definition of Industrial Hemp to mean hemp grown for fiber or for the 'whole grain, oil, cake, nut, hull, or any other non-cannabinoid compound, derivative, mixture,

⁷ 2024 Farm Bill, H.R. 8467 (§10006): <https://www.congress.gov/bill/118th-congress/house-bill/8467/text#toc-H55457B41D83D4C24B6A6DD4631184DE9>

preparation, or manufacture of the seeds of such plant,' among other related changes. H.R. 8467 (§10006) would relax certain regulatory requirements for producers of Industrial Hemp only, including to reduce or eliminate testing requirements and background checks. Should this verbiage end up in the final Bill, it will help to distinguish between true Industrial Hemp and Cannabinoid Hemp at the Federal level. If the 2024 Farm Bill passes with the above or similar verbiage to define Industrial Hemp, the Hawai'i Legislature needs to include this in the state definitions. There needs to be a clear definition/delineation between Cannabinoid Hemp and Industrial Hemp outlined in State law for the industry to move forward.

Characteristics	Industrial Hemp	Cannabinoid Hemp
Plant Gender	Male	Female
Flower Production	No flowers, minimal THC levels	Flowers, contains THC and CBD
Cultivation Density	Extreme density, 350,000 to 550,000 plants/acre <i>100 plants/sq. yard</i>	Very low density, 1600 to 2000 plants/acre <i>1/3 plant per sq. yard (3yds./plant)</i>
Field Appearance	Tall, skinny plants resembling a hay field	Sparse, fat plants resembling little Christmas trees
Growth Characteristics	Tall and skinny, outcompetes weeds	Thicker stalks, hand-weeding required
Harvesting	Mechanized equipment	Hand labor
Flower Presence	Cut before flowering	Full of flowers
Cover Crop Function	High value cover crop during vegetative growth	Translocates nutrients to flowers/seeds during bloom
Seed Characteristics	Male seeds, negligible THC content	Female seeds, high CBD/THC potential
Labor Inputs	Minimal intervention, mechanized cultivation	Significant labor inputs, hand care
Processing Methods	Mechanical processing	Solvent extraction for oils
Product Uses	Fiber and hurd for industrial purposes	Oil extraction for pharmaceutical applications
Seed Costs	Economical due to traditional output	Costly due to high yield value

Differences between Industrial Hemp and Cannabinoid Hemp

Hemp is often thought of as a weed because it will grow just about anywhere but that does not mean that it will produce well under poor conditions. Hemp requires about the same fertility as a small grain crop and the same attention. One advantage of hemp to Hawai'i is that it is a row crop that can be seeded and harvested mechanically without the tremendous hand labor required by pineapple and sugarcane. However, hemp cannot be planted continuously on the same acreage. Because Industrial Hemp is a known bio-remediator it will prepare the soil for other potentially profitable crops like corn, soybeans, mixed forages, sorghum, etc. It makes the perfect crop in rotation with other crops and is consistently shown to benefit the following crop by both increasing soil nutrition and stamping out weeds. In Europe research has shown that hemp preceding wheat increased the wheat yield significantly with increases in both the first- and second-year post hemp.⁸

If we are to reduce our reliance on imported food, the State must invest in helping farmers transition to more mechanized agriculture. Hawai'i, long known for its hand cultivation of tropical fruits, must adopt 21st century agricultural production practices for food staples if it is to feed its growing population. Hemp could be instrumental in this transition to mechanization as its cultivation is similar to a high producing forage crop using the same equipment. With a few additions to this equipment a farmer can add corn and soybeans to a three-crop rotation. Not only can corn and soybeans be processed into many foods for human consumption, but they are the basis for all animal and poultry feeds.

Given that Hawai'i imports over 30 million broiler chickens per year based on USDA per capita consumption and 4.5 pounds of meat per bird,⁹ we would recommend that the State support a poultry industry on each island which would further support food security by supplying nitrogen rich manure that when added to low carbon green waste can produce microbial rich compost without which regenerative agriculture is doomed. Our Hawaiian soils are low in organic matter and rich in soil minerals that are unavailable without microbial release. Both of these issues can

⁸ Hemp Yields And Its Rotation Effects on Wheat Under Rainfed Mediterranean Conditions: https://www.researchgate.net/publication/317293049_Hemp_Yields_and_Its_Rotation_Effects_on_Wheat_under_Rainfed_Mediterranean_Conditions

⁹ Per Capita Red Meat and Poultry Consumption Expected to Decrease Modestly in 2022: <https://www.ers.usda.gov/data-products/chart-gallery/gallery/chart-detail/?chartId=103767>

be addressed with a ready source of manure on each major island.

What's more, a ready source of nitrogen high quality soils could be produced for the use in large shade houses for high intensity vegetable production on each island. These vegetables could be sold fresh, processed or in a value-added product leading to a local processing industry.

Local processing of foods and drinks currently imported are eligible for carbon offset payments in a straightforward analysis that the State could oversee and manage. If the tiny country of the Netherlands can become the second largest exporter of food by using energy intensive, glass covered greenhouses then certainly Hawai'i can supply itself with its own vegetables using the same technology Whole Foods growers use at the same latitude as Hawai'i in Mexico. All that is needed is a simple shade house with regularly renewed soil beds boosted with rich compost. Intensively growing food in shade houses will provide comfortable and meaningful jobs.

Hemp is possibly the best-known crop for phytoremediation. It uptakes heavy metals into its biomass. When this hurd is used to make houses the heavy metals are safely sequestered. Hemp also stimulates the metabolism of residual agricultural chemicals like Atrazine. This breaks down the residues so that they no longer reduce crop production yields. Hemp is a valuable ally in this transition because of its positive effect on the soil remediation and land preparation.

It can be confusing to learn about hemp as it is like the story of the blind man who walked into an elephant and tried to understand what he was touching. So far most American small-scale farmers have been excited about growing hemp that produces the best CBD oils. The Canadian farmers have developed varieties that excel at producing seeds for human consumption such as seeds, protein products or high quality culinary oils. The Europeans and Asians are way ahead in producing and processing Industrial Hemp fiber.

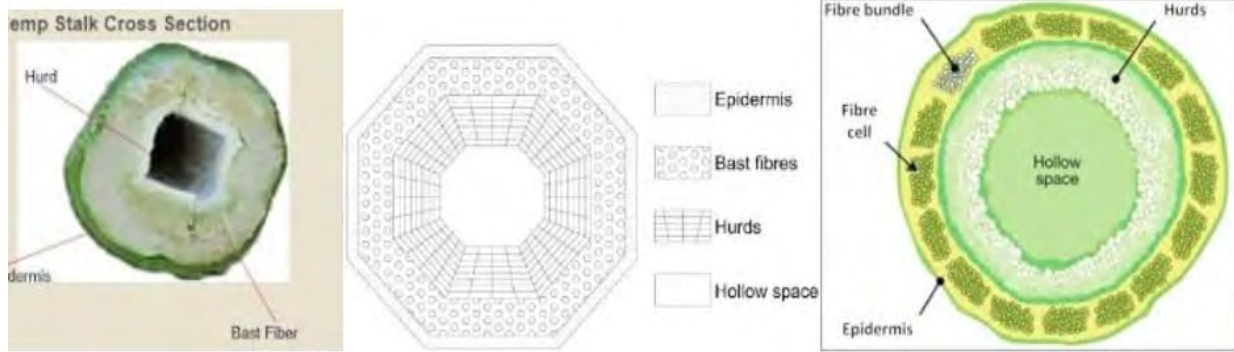
There are basically three types of Industrial Hemp varieties:

- Seed varieties (extensive regulations for human consumption)
- Fiber varieties (for hurd and fiber)
- Dual Seed and Fiber varieties (not recommended for optimal fiber production)

Even though it is possible to grow a dual purpose plant it is not wise to do so for the sake of the

health of the plant and for the sake of attaining maximum yield. This report is going to stick to the potential for Statewide Industrial Fiber Production for producing the raw products needed to kickstart several industries that could drive a significant economic sector and diversify the Hawaiian economic landscape. Our State could be replacing commodities currently imported with locally grown hemp. Additionally, locally grown hemp can be the raw material for a plethora of locally made export items. Hemp is planted like wheat, uses less water than barley and grows easily.

Please note in these graphics that industrial hemp is unique in that the valuable part of the plant is the stem. The stem is the source of both the bast fiber and the hurd. This stem is only valuable if it is less than 1/2 inch in diameter.



Good land preparation for hemp cultivation is key in Hawai'i where broadacre farming is rare. Fields must be brought under mechanical cultivation in many places for the first time. Hemp can be planted with a grain drill, a no-till drill or an air drill. The seed should be planted between a half inch deep and one inch depending on the soil density. Immediate irrigation is key to germination and a uniform stand. Even though in the first month there may be many weeds in the field hemp is sure to outgrow them and eventually so deprive them of light that they die and become food for the microbiome. Hemp could be ideal for No till planting into a high nitrogen fixing cover crop that is crimped and rolled for weed suppression.

When growing Industrial Hemp for fiber production (both bast fiber and hurd) a seeding rate of 40 to 75# per acre in 5-to-8-inch rows for a plant density of 90 to 140/sq meter. The pH ideal of 6.2 to 6.5 with a recommended nutrient availability in the soil of 50#/A available nitrogen, 60# available phosphorus, and 300# of available potassium. The Dutch believe that hemp does not require large amounts of fertilizer because it has a tap root that retrieves nutrients from the depths of the soil.

A Dutch processor, [HempFlax](#), who employs 3 cultivation specialists to help their contract farmers told us that if too much nitrogen is put on the hemp field it becomes impossible to harvest. The contract harvester who uses large equipment refuses to even try as it gums up his machinery.

The goal is to grow a stand that is dense enough to produce smaller diameter stems (3/8 to 1/2 inch diameter) which produces a better quality and higher yield of fiber. A wider stem produces more hurd but may be tough and make the crop too difficult to harvest and process.

All of the hemp grown in The Netherlands has been grown on lesser quality soil – sandy soils – and rotated with potatoes and sugar beets. They report that when hemp follows potatoes that invariably leave little potatoes to sprout in the spring, they do not need to worry about it because the hemp out competes the new potato sprouts.

Because hemp and CBD oil are valuable crops in the Netherlands one of their major banks – The Rabo Bank with an emphasis on food and agriculture funded a study of why the price of CBD oil had fallen so precipitously after the 2018 boom.¹⁰ They found that in the excitement of a potentially lucrative crop farmers had over produced by 2.5 times the market needs. The conclusion was that the price will come back up over time.

¹⁰ The Future of CBD in Food and Beverage:
https://research.rabobank.com/far/en/sectors/beverages/Future_CBD_Food_Beverage.html

HempFlax is the largest processor of hemp in The Netherlands with three processing plants. In 2020 they were purchased in part by an international corporation called [Kingspan Group, PLC](#) that supplies building materials to over 80 countries, with 210 factories and 22,000 employees. This company wants to commercialize the production of natural hemp insulation. Like both the John Deere Co. and the New Holland equipment company they see the future of the value of hemp. According to Manager Tony deVeyra of the Rodale Institute in California, Industrial Hemp has few pests primarily because it is best to harvest the hemp before flowering. This makes for the highest fiber quality. Flowering takes nutrients from the plant which lowers the quality of the fiber by shortening the length and quality of the fiber.

Whereas, the University of Hawai'i, Manoa used a 115 day life cycle for their experiments the Rodale Institute in California in a longer research project found that it only took 90 days to produce 12 ft tall plants with an optimal yield.¹¹ The fiber had less lignin content and was not old and not coarse. The younger plants produced longer fiber that was easier to peel and there was more of it. Once any plant flowers it stops making biomass and it uses lots of NPK in making protein. This hurts the fiber production and uses more lifecycle fertilizer.

By harvesting before flowering it is like terminating a cover crop before flowering so that the nutrients stay in the soil. Typically, with all cover crops the microbiome increases in vitality until flowering and then it plummets because all of the nutrients are going to the flowering process. So fiber hemp acts like a cover crop in terms of soil building. Another way that specifically fiber hemp does this is that it sheds its leaves as it grows and returns them to the soil to boost microbial activity. Growing fiber hemp increases soil organic matter, soil tilth, mycorrhizal fungi, porosity, drainage and makes for a more vibrant microbiome for the next crop.

Fiber hemp produces lots of root biomass in a ratio of 5.46:1.¹² So if a field is producing say 8 tons of biomass/A then it is contributing 1.47 tons/A of root biomass to boost soil organic matter and feed the microbiome. For a wonderful and [free guide to growing hemp for fiber](#).

**Please remember that Canada is the primary source of edible hemp seeds. The seed hemp varieties do not produce as much fiber and perhaps not the same type of fiber as the fiber hems. The University of Hawai'i is currently undertaking additional research to help resolve these questions.

¹¹ Rodale Institute Industrial Hemp Trial: <https://rodaleinstitute.org/science/industrial-hemp-trial/>

¹² Rodale Institute Industrial Hemp Trial: <https://rodaleinstitute.org/science/industrial-hemp-trial/>

Charateristic	Detail
Growth Requirements	Similar fertility needs as small grain crops; Requires the same level of attention.
Mechanization Benefits	Can be seeded and harvested mechanically, reducing labor requirements compared to crops like pineapple and sugarcane.
Soil Benefits	Acts as a bioremediator; Prepares soil for subsequent crops; Increases soil nutrition and weed suppression.
Crop Rotation	Ideal for crop rotation; shown to increase yield of subsequent crops such as wheat by 20% in Europe.
Cultivation Reasons	Seed production; CBD production; Fiber production.
Sowing Methods	Can be planted with a grain drill, a no-till drill, or an air drill; Seed depth between half-inch to one inch.
Irrigation Requirements	Immediate irrigation is crucial for germination and uniform stand.
Weed Competition	Outcompetes weeds by depriving them of light, becoming food for the microbiome.
Seeding Rate	40 to 75 #/A in 5-to-8-inch rows; Plant density of 90 to 140/sq meter.
Soil pH and Nutrients	Ideal pH of 6.2 to 6.5; Requires 50#/A nitrogen, 60#/A phosphorous, and 300#/A potassium.
Cultivation Reasons	Best harvested before flowering for highest fiber quality and quantity Flowering depletes nutrients needed for optimal fiber.
Stem Characteristics	Smaller diameter stems preferred for quality and yield; Wider stems produce more hurd but may be too tough to process. <1/2" ideal
Pest Concerns	Minimal, especially if harvested before flowering
Root Biomass Production Phytoremediation Pest Concerns	High ratio of root biomass (5.46:1) contributing significantly to soil organic matter. Bioaccumulates heavy metals and metabolizes
Soil Impact and Microbiome	Increases soil organic matter, mycorrhizal fungi, porosity, drainage; Enhances micro-biome vitality.

University of Hawai'i Research Into the Potential for Industrial Hemp

In a peer reviewed study done in 2014 to 2015, undertaken by 5 individuals from The University of Hawai'i Manoa in conjunction with a participant from The Academy of Agricultural Sciences from Guangzhou, China and a contributor from The University of Chinese Medicine from Guangxi, China which was published in 2021, many things were learned about growing Industrial Hemp in Hawai'i.¹³

- The group studied 3 different sub-tropical, Industrial Hemp varieties.
- Variety V75 was highly daylight sensitive and failed to thrive.
- Seed variety CHY yielded an estimated 2.5 tons/yr/A or about 1.25 tons/crop.
- Fiber variety, CHG, performed very well in yield, drought resistance, additional animal feed, low need for fertilizers and the ability to metabolize Atrazine in Maui soils.
- The commercial seed that was imported from EcoFibre from Australia.
- Hemp in Hawai'i which produced 6.3 tons/acre in the straw crop out performed hemp in The Netherlands (3.2 tons/acre/crop) and hemp in Canada (4 tons/acre/crop) leading the authors to conclude that Hawai'i is an ideal location to grow industrial hemp.
- On an annual basis the best variety, CHG, yielded 19 tons to the acre/ year for stalks, with 1.7 tons of seed and an additional 16 tons/acre/year for animal feed from the leaves. The U of H team was figuring 3 crops per year in those figures. So to put it by the crop that is 6.3 tons/A for straw and 5.3 tons/A for leaves and .85 tons per A of seeds (max 2 crops/yr when growing seed).
- This translates to 36.7 tons/A/year if you hand harvest or use special harvesting equipment. What is still unknown is how many of the leaves will be lost to mechanical harvesting. So for this report we are assuming 6 tons of straw and 4 tons of leaves/A/crop.
- Given that Hawai'i imports all of its grain and most of its fodder this could be a new and important revenue stream for Hawaiian farmers.
- Hemp can be harvested earlier to focus on harvesting the green leaves for poultry feed and then using the lesser quality hurd as bedding so that once it was mixed with chicken manure it would become ideal feed for Black Soldier Fly larvae. Imagine if animal feed were a bi-product of processing construction material and if fish food were a bi-product

¹³ ComparatHawai'ialuation of Industrial Hemp Varieties: Field Experiments and Phytoremediation in Hawaii: <https://www.sciencedirect.com/science/article/abs/pii/S0926669021004477>

of feeding poultry and the 35% waste from gutting fish in turn were used to either feed poultry directly or fed to Black Soldier Fly larvae (BSFs).

- The U of H team did preliminary testing for commercial planting density which helps determine yield/acre/crop.
- They found CHG to be drought resistant -using only 10mm (.4inches) of rain per week. Furthermore, the irrigation of CGH actually reduced both height and weight in the plants harvested.
- In a 90 day crop that is a little more than 5 inches/crop of industrial hemp compared to 70 inches for sugar cane.
- The addition of 100 kg/ha (88#/A) of Nitrogen fertilizer did not increase the yield of CGH over non-fertilized hemp
- When CGH was planted in pots it showed the ability to metabolize Atrazine in the soil. The authors concur that Industrial Hemp can be used to remove 75% of the Atrazine in the soil in as little as 30 days. This is a potentially useful attribute given that Hawai'i is known to have an increased correlation between Atrazine exposure and the birth defect called *gastroschisis*.
- Industrial Hemp is well known for its ability to uptake heavy metals left in soils by agricultural chemicals or in the recent case of Lahaina – an urban fire.
- The maximum yield was obtained when using 100 plants/sq meter density which was in line with the ideal planting rate reported during our visit to a very large hemp grower in The Netherlands.
- The maximum yield also created a stalk that required less energy to process because the stalks were thinner growing under increased population density.

In an in-person interview in The Netherlands with the owner of DunAgro, a farmer who has grown 1300 Hectare (3250 acres) of hemp for 30 years in a rotation with potatoes and sugar beets the farmer noted that crops grow better following hemp but cautioned against using hemp as a mono-crop.

- He averages 8 tons per hectare per crop (3.2 tons/acre) with top yields of about 11 tons per hectare on what is considered less than ideal cropland – sandy soils
- Holland cannot grow a dual-purpose crop that is harvested for both the seeds and the straw because the growing season is too short and the falls are too rainy for retting
- He uses a seeding rate of 35 Kg/Ha (31#/A) with an ideal germination rate of 140 plants per square meter with as little as 90 plants/sqM being acceptable.
- He uses a planting spacing of slightly less than 5 inches row width and about 2-2.5

inches between plants.

- He uses 140 kg of nitrogen fertilizer per hectare or 125#/A.
- This approach to growing a fiber variety of hemp (which is daylight sensitive requires 100 growing days in the long days of the north as well as weeks of retting (a process where the straw is allowed to lay on the ground so that microbial activity loosens the bond between the hurd and the outer fiber portions of the stalk).
- Even before the 20% loss of biomass to the hammermill – this process destroys potentially valuable leaves. Dutch farmers have begun feeding the entire plant to cattle. Although this wastes the hurd we believe there is a bright future for feeding chickens on the young plants once hemp is okayed for chicken feed.
- Albert of DunAgro says his processing plant spends 100 Euros (\$110)/ton to process.
- They pay their farmers 207 Euros (\$230)/ton before any payments for carbon credits which will soon be added onto this price.
- As with all locally produced products for local consumption we can expect to add to this end price due to the avoidance of shipping as well as high carbon credits due to our remote location. The potential end price expected to be paid to farmers should be part of a State Dept of Economics into the potential of a State supported hemp industry.

The Best Varieties of Industrial Hemp to Grow in Hawai'i

The best varieties for Hawai'i depend on whether one is looking for fiber production, seed production or cannabinoid production. It should not matter which island is being cultivated but it should have irrigation. Even though hemp is a low consumer of water it is needed at crucial times – in particular during seed germination. For this reason, transplanting greenhouse starts should be thoroughly compared to broadacre seeding in the future.

1. From July 2014 to Dec 2015 the University of Hawai'i¹⁴ tested 3 sub-tropical varieties purchased from [EcoFiber Industries of Australia](#) that were believed to stem from Asian Growers.
2. Sub-tropical seed variety F75 was tested and being daylight sensitive it grew to two feet and died.
3. The U of HI tested the variety CHY successfully for seed production and estimated that it will yield about 1.25 tons/A/crop in Hawai'i with two crops per year possible for a total of 2.5 tons/A/yr. This is 25% more yield per acre than the average of the Canadian seed hemp grown with irrigation.

¹⁴ Comparative Evaluation of Industrial Hemp Varieties: Field Experiments and Phytoremediation in Hawaii: Hawai'i/www.sciencedirect.com/sciencHawai'icle/abs/pii/S0926669021004477

Most of the hemp seed for human consumption is grown in Canada where it garnered \$.061/# in 2018 and averaged nearly 1 ton/A with irrigation plus 1.5 tons of straw at \$200/ton. The cost of production including labor and depreciation was \$751/A leaving a margin of \$890/A. Hawai'i entrepreneurs could benefit from direct sales of specialty foods like energy bars to tourists.

4. Fiber varieties from Europe are almost always daylight sensitive and require a 14 hour day during their growth cycle; making their use nearly impossible here in Hawai'i.
5. The University of Hawai'i tested sub-tropical fiber variety CHG in their July 2014 to December 2015 trials.

- Variety CHG made yield records far in excess of any varieties grown in Europe or the mainland of the US and Canada proving that Hawai'i is the ideal environment for hemp cultivation.

- While more agronomic testing is certainly called for, the University of Hawai'i at Manoa has already identified two varieties that could set the stage for new industrial hemp industry in Hawai'i.

- According to a report written by the Dean of the College of Tropical Agriculture and Human Resources Hawai'ian grown sub-tropical fiber hemp could yield between 27-38 ton of stalk biomass per year with three crops, depending on the density of the planting with higher densities yielding more per acre.¹⁵

- In addition, the report found that Industrial Hemp could produce 31 to 35 tons dry weight of stems and leaves/A/year for forages. Oregon State University is leading the charge in further research into using hemp for cattle and sheep forages.¹⁶ Dutch farmers are feeding the entire stalk to their cattle. Hemp leaves could also be fed to poultry (see the section on hemp feeds).¹⁷

¹⁵ University of Hawaii System Report: https://www.hawaii.edu/offices/eaugovrel/reports/2016/act56-slh2014_2016_industrial-hemp_report.pdf

¹⁶ Hemp Byproducts are Good Alternative For Lambs, Oregon Study Finds: <https://today.oregonstate.edu/news/hemp-byproducts-are-good-alternative-feed-lambs-oregon-state-study-finds>

¹⁷ Other Agricultural Uses For Industrial Hemp: <https://hempgazette.com/industrial-hemp/agricultural-uses-41-hemp/#:~:text=With%20regard%20to%20fiber%2C%20Dutch,feed%20for%20thousands%20ofHawai'irs.>

- Care must be taken that the hemp used for phytoremediation does not get into the forage stream. It is perfectly safe to be used in construction. And with enough removal of phytoremediating hemp and plant residue testing we will be able to harvest it for food.
 - The University of Hawai'i researchers had trouble getting the hemp seeds to sprout and tried starting the seeds in the greenhouse for 15 days and then transplanting. This could be advantageous in that it could potentially mean that only 75 days are needed for field growth and that would allow for more crops per acre per year.
 - Alternatively, the researchers were able to direct seed into the field as long as:
 - They prepared the seedbed carefully for good soil to seed contact
 - They waited for enough rainfall to moisten the soil and then followed it up with hand watering.
 - All in, all care has to be taken to assure that the seeds germinate into seedlings for if the density falls below optimum it may affect yields and make it necessary to use an herbicide to control weeds normally controlled by competition with the virulent hemp plant.
 - Further research needs to be given to the benefits of greenhouse cultivation of hemp starts vs. field planting from seed.
6. A new researcher in the Hawaiian space is [Kanda Hemp Seeds](#), a US based company that is working throughout the mainland. Kanda Hemp Seeds has a research arm in China and an experienced seed geneticist in Colorado. Together with [Ohana Hui Ventures](#) and [Friends of Waimanalo](#), this group is doing seed trials on the farm of Friends of Waimanalo where they are currently testing several seed varieties for use in the new Hawaiian hemp industry.
7. Hemp production for cannabinoids is very personalized with growers preferring their own cultivars and typically saving their own seed.

In Conclusion Industrial Hemp Varieties

1. The University of Hawai'i has successfully identified two superior varieties, one for fiber

and one for seed production that are promising for the start of an Industrial Hemp industry in the islands.

2. Dual purpose varieties produce seeds for either food or biodiesel plus straw for hurd and fiber raw materials for secondary products. It is our understanding that to use hemp for anaerobic digestion that it is beneficial to plant a fiber variety and harvest the crop well before seed production to maximize biogas production.
3. The good start of U of H should be followed up with additional testing of sub-tropical fiber and seed hemp varieties.
4. CBD seeds are up to the individual small scale farmer
5. Further research is needed to compare field seeding to transplanting greenhouse starts.
6. Care must be taken to ensure that hemp used for phytoremediation is only used for construction biomass or after the field is remediated of heavy metals.

B4. Field Equipment

Flower and Seed Harvesting

- We have visited with two companies that have developed commercial harvesting equipment that can simultaneously cut and collect the flowers and green leaves or the seed head while cutting the stalk into 60cm lengths (ideal for European processing equipment but not for the Hemp Train or Formation Ag Track 660.)
- Another benefit of this equipment is that the stalk is windrowed between the wheels of the machine so that it is not driven upon as in a standard sickle bar style hay cutter.
- This equipment is on loan to Cornell University where they are testing its viability and production capacity. This will give us a third party non-biased assessment of its value as Cornell also researches using normal hay making equipment to harvest hemp.
- New Holland and John Deere are both developing this equipment for commercial use. It is obvious that these two giant ag equipment manufacturers believe that the day of hemp is on the horizon, or they would not invest in the necessary R&D.
- In general, all that is required to harvest industrial hemp in the beginning is a common hay sickle mower, a hay rake and a standard hay baler. The baler can make large square bales, small square bales or giant round bales for the Canadian [Hemp Train](#) equipment.
- The Formation Ag CEO says his equipment works best with the long length as it unrolls the big round rolls.
- Until the day comes when research shows which seed varieties are commercially viable in Hawai'i the focus will be on fiber varieties which do not require a separate flower harvesting equipment.
- While the new equipment is impressive and will one day be needed in the islands to begin with, we will stick with the recommendation of Cornell University and stick with the tried and true method of using a side sickle bar mower until the day comes that a seed harvester is needed.
- In the case of harvesting for anaerobic digestion the biomass is simply cut with a hay chopper and shot into a wagon for immediate transport. There is no need to keep long fibers or to go through the retting process if one is making RNG (Renewable Natural Gas).

Baling Equipment

- The baling equipment for baling hemp straw is the same for baling hay.
- The baling style must be selected after deciding whether the commercial scale processing equipment will come from Hemp Train or [Formation Ag Track 660](#).
- Hemp Train has a sophisticated bale opener that can use small square, large square, small round or large round bales.
- Formation Ag Track 660 on the other hand only works with round bales so this must be sorted out before a baler is selected.
- In Canada they primarily use the large square bales in the Hemp Train.
- However, storage must be considered. It is possible to buy a baler with a good wrapping system that allows the bale to be stored outside for up to a year without serious deterioration while the processing facility is getting up and running. So the storage issue must be considered before a baler is purchased.
- There are also advantages of starting with a smaller tractor and small square or round bales before getting locked into the giant tractor that is required for some large balers.
- Minimum tractor size is something to consider when using regenerative ag principals.

No-Till Grain Drill

- While a common grain drill is all that is needed for planting hemp seed we highly recommend a No-till drill with a tank and nozzles for adding microbes during planting at a rate of 2 gals of inoculant per acre.
- Once a field is cleared of heavy metals and residual chemicals, hemp should be grown in a three crop rotation. But until that day hemp should be used as a phytoremediation plant with a short term cover crop mix (8 variety minimum) in between each crop to avoid hemp on hemp.
- For this a No-till planter is ideal. We like the 96 inch [1st Products Multi-drill](#) out of Georgia for its design and versatility. It can be ordered with corn plates for planting corn, sweet corn and beans with the drill which normally requires a separate corn planter.
- Note: Having been a commercial sweet corn grower, harvester and value added marketer we have been watching the prices on poor quality imported sweet corn over the past 6 years and would estimate that good quality sweet corn could wholesale for \$12/doz. With sweet corn yields of 1500 dozen per acre that would pay for the extra hand labor needed and supply a loved vegetable to the islands.
- Field corn should also be considered for a rotational crop for a variety of reasons.

- The farming entity - ideally a coop will need extra crops that produce extra income and corn has a built in margin because of the avoided shipping charges.
- Corn can also be easily ground in a simple hammer mill and balanced with a protein source and minerals for a simple chicken feed that could feed broilers that graze cover crops between the hemp crops for a maximum benefit and return.

Conclusion: The University of Hawai'i has established that Hawai'i has extremely favorable conditions for growing 3 plus crops per year at potentially the highest production rate in the world. Industrial Hemp has the potential to be an economically important agricultural commodity:

1. That once processed can replace currently imported products
2. That can provide the raw materials for many start up businesses
3. That through large scale processing and manufacturing Hawai'i could become an exporter of high value products based on a locally grown crop
4. That can prepare the fields for other high value crops such as field corn, sweet corn, forage crops, sweet potatoes, melons and soybeans

In a 2012 study done by the Office of Planning in the State of Hawai'i Department of Business Economic Development and Tourism they said: *Replacing just 10% of the food Hawai'i currently imports would amount to approximately \$313 million dollars (in 2012 dollars) which would remain in the State. The Strategy recommends actions to market "Buy Local/It Matters" and to brand and label local food products.*¹⁸ Mechanized production of commodity crops has not taken off in Hawai'i and yet grain production is necessary for food security. Grains are the basis for both a poultry industry as well as locally farmed fish in an aquaponics system that fertilizes surrounding fields.

*Farmer [tool](#) for figuring out the cost of production from University of Pennsylvania.

¹⁸ Increased Food Security and Food Self-Sufficiency Strategy:
https://files.hawaii.gov/dbedt/op/spb/INCREASED_FOOD_SECURITY_AND_FOOD_SELF_SUFFICIENCY_STRATEGY.pdf

B5. Analyze Shipping of Biomass Amongst the Islands and to the Mainland.

Biomass, Processed, Finished Goods

As the Industrial Hemp industry gains traction across the United States, Hawai'i stands poised to leverage its agricultural potential. Setting up an Industrial Hemp industry will take some time. An initial manufacturing facility will need to be set up, as well as partnerships with local farmers established and additional research on viable seeds to be utilized in our tropical climate. To jumpstart the hemp industry, hemp will need to be imported for the R&D needed to develop secondary industries that use hemp hurd or hemp fiber as a raw material in the production of their end product. At a historical \$0.66/ pound of top quality hurd this is a small price for the State to support to jumpstart a hemp industry until Hawai'i has the infrastructure in place. Below we will look at the pricing and implications of importing hemp hurd from the mainland, as well as approximate costs to ship hemp inter-island once we have the infrastructure in place. Let's delve into how hemp bales are shipped and the associated costs.

Shipping Process:

Packaging and Preparation:

Industrial hemp fiber is typically harvested and processed into bales for transportation. These bales are compacted bundles of hemp fibers, weighing anywhere from 100 to 1,000 pounds each, depending on the processing method and intended use. Hemp hurd is typically compressed into high density blocks to enable 40,000 pounds to fit into a standard 40ft shipping container. Or it can be put into reusable super sacks and fit 20,000 pounds of hurd into a 40ft container.

Transportation Modes:

Shipping hemp between the islands of Hawai'i and from the Mainland to Hawai'i primarily relies on maritime transportation. Barges, freight vessels, and container ships are commonly used to transport goods between islands. Trucks will then be needed to get the hemp from the port to a storage facility or final destination.

Regulatory Compliance:

Given the legal complexities surrounding hemp, it's crucial to have a clear delineation between the transportation regulations for Industrial Hemp versus Cannabinoid Hemp. There should be no need for THC testing nor movement reports for Industrial Hemp. This will allow the transport of Industrial Hemp between islands to be a smooth process and encourage growth across all islands.

Storage and Handling:

Hemp bales require careful handling to prevent damage and maintain their quality during transit. Adequate storage facilities at both the departure and arrival ports are essential to safeguard the integrity of the product. Bales can typically be stored up to 24 months as long as the packaging around the bales is not punctured.

Transporting Hemp Within The State of Hawai'i:

Per the 2018 Farm Bill, hemp and hemp products may be transported across state lines. Hence, hemp and hemp products in Hawai'i may be transported inter-island, intra-island, or exported. However, [for commercial hemp operations in Hawai'i](#), only hemp producers licensed by the USDA [may transport hemp outside](#) of a field of legal cultivation per state law.

The following hemp parts may be transported:

- Live hemp plants, propagative parts of the hemp plant, and viable seeds
- Harvested hemp leaf material in raw botanical form (including dried)
- Harvested hemp leaf flora material in raw botanical form (including dried)

Hemp transportation must be reported ahead using an [HP-1 Transportation Report form](#).

However, a report is not required for the transportation of the following hemp materials:

- Retted fiber
- Non-viable seed
- Mature hemp stalk material
- Hemp products or processed hemp

Hawai'i requires any transportation of hemp to abide by all applicable laws and regulations, including but not limited to state requirements regarding the importation, inter-island transportation, or exportation of live seed, live plants, and cut flowers. Further instructions can be found on the [planned transportation page](#) of the Hawai'i Department of Agriculture for more information on the importation, exportation, and in-state movement of live seed, live plants, and cut or fresh hemp plant materials.

Cost Considerations:

- 1. Freight Charges:** The cost of shipping hemp between islands as well as from the mainland depends on various factors, including the distance, volume, and mode of transportation. Freight charges typically encompass handling fees, fuel surcharges, and port dues.
- 2. Insurance:** Transporting valuable cargo like industrial hemp necessitates insurance coverage to mitigate the risks associated with loss or damage during transit. Insurance premiums vary based on the declared value of the shipment and the level of coverage desired.
- 3. Regulatory Compliance Costs:** Obtaining the requisite permits, licenses, and regulatory approvals incurs additional expenses. Compliance-related costs may include testing fees for THC potency if applicable, inspection charges, and administrative fees.
- 4. Storage Fees:** If storage facilities are required at the departure or arrival ports, storage fees may apply. These fees are contingent on the duration of storage and the space occupied by the cargo.
- 5. Handling Charges:** Loading and unloading hemp bales onto ships entail handling charges, which contribute to the overall shipping costs. Efficient handling practices help minimize delays and expenses.

Rough Costs to Ship Hemp Hurd From The Mainland:

Hemp Homes Hawai'i Shipping Costs Kula, Maui Build

Joe Smith, the builder for Hemp Homes Hawai'i /Hawai'i Hemp Task Force Member we reference in section 'C', who recently built the hemp home on Maui gave us some insight into what it cost for him to ship hemp hurd from the mainland for this project. He ordered 20,000 pounds of hemp hurd because that is how much will fit in a 40-foot container. It's also the most efficient way to get it here. The Maui hemp house only used about half of that (10,500 pounds to be more precise). The hemp hurd cost about \$15,000 for the 20,000 pounds and shipping it through Matson from Kansas to Maui, cost \$13,250. That \$13,250 is the cost of a 40-foot container no matter how much you have in it.

Shipping cost = \$0.66/pound Total

landed price = \$1.41/pound

Rough Costs to Ship Hemp Hurd From Canada:

Hemp Alta Shipping Quote

960 65L (2.2 cu.ft) bags of hemp hurd for hempcrete \$24.90/bag=\$23,904

Shipping from Calgary to Honolulu; \$7812

Total Cost: \$31,716

Rough Costs to Ship Hemp Hurd Inter-Island:

Quote from Young Brothers

Shipping Container size: 18 ft X 8 ft

Flat rate-\$1420. Anything that can fit in the container, no matter the weight. Shipping to Oahu is cheapest as all shipments go through Oahu, but the price difference is not much different by island.

Reusable Super Sacks are the most efficient way to ship interisland and at 44 sacks/40ft containers each weighing 320 pounds that is a payload of 14,080 pounds for an inter island transport cost of \$0.10/pound.

This would bring the cost of shipping bulk hurd inter island down to \$.10/pound as opposed to the \$.66/# paid by Contractor Joe Smith to build the recent house on Maui which would have reduced a \$6930 for shipment cost for that house to \$1050.

Conclusion:

Shipping Industrial Hemp between islands in Hawai'i as well as from the mainland involves navigating regulatory frameworks, logistical challenges, and cost considerations. Despite these complexities, the burgeoning hemp industry holds promise for Hawai'i's agricultural sector. By streamlining transportation processes and fostering collaboration among stakeholders, Hawai'i can capitalize on the economic opportunities presented by industrial hemp cultivation and distribution. As Hawai'i continues to chart its course in the hemp industry, addressing transportation hurdles will be pivotal in realizing the full potential of this versatile crop. While the Industrial Hemp industry is in its infancy, farmers on all islands can start growing hemp and depending on where the first processing facility pops up, (Hemp Alta is currently looking to potentially open a manufacturing plant on Maui and a processing plant may be opening on Kauai for building materials) the hemp can be shipped inter island for processing. The state could provide subsidies for the shipping costs for the first 3-5 years, enabling farmers on all islands to start growing hemp to help spur the growth of the industry.

B6. Contribution to the State Economy

Industrial Hemp was once widely cultivated in the United States. However, in the 20th century, hemp became entangled with marijuana prohibition, leading to its classification as a Schedule I controlled substance under the 1970 Controlled Substances Act. This effectively made the cultivation of hemp illegal, stifling the industry for decades. The landscape for hemp changed dramatically with the passage of the 2018 Farm Bill. This legislation federally legalized the cultivation of hemp and defined it as cannabis containing less than 0.3% THC. The bill allowed for the establishment of state and tribal plans for hemp production, leading to a resurgence in the crop's cultivation and an explosion of interest in hemp-derived products, particularly cannabidiol (CBD).

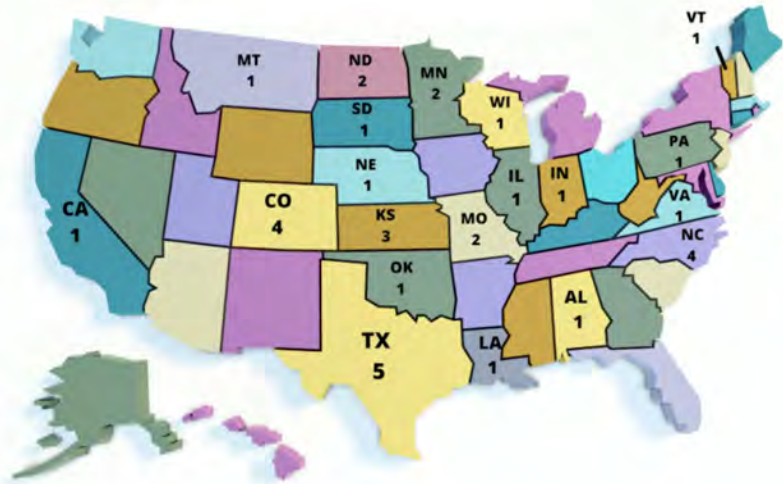
Initially, the CBD market boomed, driven by consumer interest in its purported health benefits. However, this rapid growth led to market saturation, price drops, and regulatory uncertainties, causing the CBD market to collapse. Despite these challenges, the broader Industrial Hemp market began to gain traction. Industrial Hemp has diverse applications, including textiles, bioplastics, construction materials, and biofuels. Recognizing these opportunities, more and more processing plants are opening across the country, equipped to handle the various parts of the hemp plant.

Consequently, more farmers are dedicating land to industrial hemp cultivation. The plant's potential for soil remediation and its relatively low environmental impact make it an attractive option for sustainable agriculture. The growing interest in industrial hemp is fostering innovation and investment in processing technologies, which in turn is creating new markets and economic opportunities. As the industry matures, it holds the promise of revitalizing rural economies and contributing to a more sustainable future.

The growth of hemp processing plants on the mainland is an indicator that this industry is just starting to take off and with the loosening of regulations surrounding Industrial Hemp and clearly defining it versus Cannabinoid Hemp, it is on an upward trajectory and Hawai'i needs to jump aboard and reap the benefits for our local community and farmers.

Below are some examples of Industrial Hemp focused businesses that have launched or expanded into the North American market in recent years:

- [PanXchange reported](#) that 20 U.S. hemp fiber processing plants are now operating and capable of the initial processing or decorticating hemp biomass, and six exist in Canada. An additional 8-to-12 are expected to start production in the U.S. by 2028.



US Hemp Processors In Operation/Planned 2022-2025 (Source: PanXchange)

- This year Canada based Hemp Alta completed its acquisition for the controlling interest of 50.1% of Hemp Carbon Standard Inc. The acquisition is of a controlling interest in the world's leading carbon platform for industrial hemp farming.
- In June [Panda Biotech](#) opened a 500,000 sq ft hemp processing facility in Texas. It is the largest hemp processing facility in the Western Hemisphere and the second largest in the world.
- [Renaissance Fiber](#), based in North Carolina, processes raw, domestic hemp fiber into forms suitable for textile production using an Ecologically Invisible degumming process.
- [The Hemp Plastic Company](#), based in Boulder, CO, creates premium hemp-blended biocomposites and bioplastics.
- [Every Day Hemp Company](#), based in Portland, OR, makes compostable cutlery and straws made with hemp.
- [Texas A&M](#) received a \$3.47 million grant for 3D hempcrete building research.
- As New York's Land Grant University, Cornell CALS's [School of Integrative Plant Science](#) has assembled an interdisciplinary [team of researchers](#) and [extension specialists](#) to study how the state can move forward in developing its hemp industry and is a great example of what we should be doing here in Hawai'i.

- [Hempitecture](#), based in Idaho, makes hemp insulation and just rolled out a \$5 million equity raise
- [IND Hemp](#), Headquartered in Montana, has built their processing infrastructure and agricultural programs to be the leading USA source for industrial hemp food ingredients and natural fiber biomaterials. They recently earned B Corp Certification.
- [Formation Ag](#), located in Colorado, engineers and fabricates equipment solutions for harvesting, processing, and decortication. We work with our farmers to develop cost-effective and cutting-edge technology to make crops such as hemp possible at an industrial scale.

While we are not economists, common sense dictates that if an island state can produce the raw materials it needs for secondary industries in 90 days there is money to be made in a circular economy. Let's take a simple example of the local production of hemp wood replacement materials. How many times would money change hands if hemp were to be:

- Locally grown
- Locally processed
- Raw materials shipped to different islands and different secondary processors
- Hemp hurd and fiber would then be further processed locally by companies that don't even exist now
- Made into products made with local jobs to replace products currently being shipped in
- Biofuels can be produced that keep all of the production money in the State
- Food products can be produced

Let's take toilet paper for example. How much do we import per year? What size paper mill would it take to produce that much toilet paper? How much hemp would need to be grown? What other products could that mill also make? How many offset carbon credits could the State earn for supporting the local production of such a lightweight product to eliminate the CO2 pollution from shipment? This sort of analysis is beyond the scope of this report but this report and our recommendations point to the need for a deeper analysis. We already have the low hanging fruit products for biofuels and construction materials - both of which are in huge demand.

The benefits seem obvious, and we have repeatedly said that the State should begin immediately to support the development of an integrated hemp industry in our State. And as part of that support, we would assume that the Dept of Business Development would do a thorough investigation into the potential benefit to the State's economy and job creation.

The potential of a circular economy is way beyond the simple growing and exporting of an agricultural crop that the State depended upon in the past. The development of secondary processing is almost without end as hemp raw materials can be used to replace so many of the products that we currently bring in on ships. The State should do a detailed analysis of what is being imported as compared to the ease of making that particular product in order to understand where best to spend its money.

C. Recommended Infrastructure By Island

Where to Begin? Which island? Who Should the State Support?

Let's Start With the Who?

Through a public State grant we would hope that the State will support an entrepreneurial group ready to efficiently run a processing plant. Once an RFP is made public we anticipate that many applicants will show up - some with experience and some without. It will be up to the State to give support to that group who can most efficiently help the State towards its important goals of food and local employment security.

And Then Where?

The applicant for support in building a processing plant will need to show that they have lined up farmers capable of growing hemp in a three-crop rotation. These farmers must demonstrate the know-how to grow at least 1000 acres with irrigation to begin the process and three crops a year. If they are a local group that lacks the background in large scale mechanized farming, then they must commit to hiring people from the mainland with the necessary skills. In short it does no good to support a processing plant if there is nothing to process. So, the "where" is dependent on land with access to water being available. The island must have a minimum of 3000 acres available for lease once the processing plant is up to full speed of 4 shifts per week. We hope that local farmers will step up to the plate but will not be surprised if there are mainland farmers willing to relocate to via for the crop subsidies.

We believe that Kauai is the best island to start on but are not ruling out any of the islands. Kauai has the advantage of having thousands of acres recently farmed for seed corn now vacated. It also has the advantage that Pacific Biodiesel has recently put up a processing plant capable of the initial processing of hemp seeds. It also has the advantage of being the home of many Industrial Hemp enthusiasts wanting to develop businesses around this new crop.

And How?

We believe that the State should start by supporting the building of one processing plant on one island. This must be an open bidding process for State support so it will depend on which group, whether it is a coop or a new business entity or an out-of-state group can show the best path to success. It should be noted here that if the equipment that is being used is a Hemp Train the learning curve should be rather painless. A good mechanic will have no problem understanding the equipment and any trouble shooting that needs to be done. Regardless of the island that starts, all of the hemp entrepreneurs on all of the islands can start developing products because

the raw materials will be readily available on each island by a short barge ride. For example, if a surfboard making company on Maui wants to design and market hemp surfboards they can comfortably do so because they will be confident that the hemp fiber that they will need is within easy reach. Likewise if HPM wants to experiment with buying hemp hurds and bast fiber from the mainland to begin R&D on a variety of products they can do so with the confidence that once they get their manufacturing concepts ready to build in 3D that the processing plant will be ready to produce their raw materials.

And Why?

It is crucial that the State address the issues of food security with all of its power for the very future of our State. As we are attempting to show a hemp industry could be foundational in furthering true food security. Because of the severity of the situation the State must support simultaneous growth in:

A processing plant

- Large scale mechanized agricultural production
- Development of off takers for the primary raw materials of hemp
- Development of secondary processors to strategically replace imported construction materials and consumer goods
 - Hempcrete blocks
 - 50/50 hemp concrete blocks
 - Prefab housing made in a factory
 - Hemp wood and hemp insulation products
 - Hemp paper products
- Feed mill development to make poultry and fish feed

Cultivation and Harvesting Equipment Needs for Each Island

To begin with, the processing plant and all of the cultivation and harvesting equipment must be on the same island. Please see Section B4.

Once the State believes that a second island is needed to keep up with expected production then a second processing plant with a full set of cultivation and harvesting equipment needs to be on a second island.

The First Processing Plant in the Hawaiian Islands

1. Regardless of which island is the first island we will be recommending the [Canadian Hemp Train](#) as the first model of processing. By starting with one set-up and one 40hr shift per week output can be enlarged by one shift per week up to a maximum of 4 shifts per week for full time use. Once the plant is at full capacity that plant can add another Hemp Train line or the State can support the building of another processing plant on another island.
2. Based on a conservative estimate of yield from the University of Hawai'i of 5 tons per acre per crop of hemp grown for each shift a processing plant will require 500 acres of industrial hemp.
3. $1.5 \text{ tons/hr} * 2000 \text{ hrs/shift} * 80\% \text{ efficiency} = 2400 \text{ tons of hemp straw/year}$ or roughly 500 acres under cultivation at 5 tons of straw per acre
4. 4 shifts per year will require a minimum of 2000 however throughout this report we have consistently used the figure that an island must have a minimum of 3000 acres (with access to water) from which they can harvest hemp once per year as not all of the hemp will go to the processing plant. This also allows the efficiency factor to increase with experience.
5. Hemp should be one crop in a three crop rotation. However, until crop lands are cleaned of heavy metals and residual agricultural chemicals we recommend that hemp be grown twice a year on the same acreage separated by incorporated cover crops until the hemp land is clean enough to grow food crops. When hemp seeds go to biodiesel and hemp straw goes to construction materials there is no fear of human contamination. Hemp should be used judiciously to clean up soil before that soil goes into a full rotation with food crops.
6. For the purpose of starting up a new processing plant with hemp being grown twice per year on the same soil only 250 acres of hemp is needed.
7. Once the soil is clean we would keep hemp as one crop in a three crop rotation with corn and soybeans being the primary crops but additional crops of high value crops in rotation like: sweet potatoes, sweet corn, squash, sorghum sudan for green chop and silage, soybeans, specialty small grains and pulses
8. Eventually 3000 acres should be available for hemp production 12,000 tons/year to make the factory run 24:7 all week long for maximum efficiency.

9. Bob King, co-founder of Pacific Biodiesel, said in a task force meeting that they have room to make 3 million gallons of hemp biodiesel/ year in their current infra-structure. Given that research has shown that hemp seeds produce 207 gals of biodiesel per hectare (83 gals/acre).¹⁹ Simple math 3,000,000gal/83 gals shows us that Pacific Biodiesel could process 36,000 acres of hemp seeds. Ironically this is the amount of land that the last sugar mill, A&B farmed for sugar on Maui.
10. At any time that this system has proven itself successful the same system can be established on another island or several islands
11. It should be noted that currently contractors are importing hurd for the use in building one off hempcrete houses and this hurd could be imported from the first processing plant from day one to any island at an estimated \$0.10/pound for transport which is way better than \$0.66/pound from the mainland.
12. Wherever the first plant is placed there also should be developed a hemp block plant.

To put this in perspective please review the photos below of a hempcrete house built on Maui in 2023 by contractor Joe Smith using a simple style of custom hempcrete made by packing forms so that the hempcrete surrounds and petrifies the wooden structure. By using the simple mixer you see below they mixed 1# of hemp hurd with 1.25# of lime and mineral binder and 2# of water and then hand carried the mixture into the house and tamped it into the forms.

- That means that by growing hemp locally we would only need to import 30% of the materials needed to make hempcrete as the hemp hurd and water would be sourced locally.
- To create their 1400 cubic ft of walls they used 10,500# of imported hurd.
- So if our ongoing production of hurd from one Hemp Train at full production is 1.5 tons per hour * 80% efficiency is 2400 tons of hurd/yr * 40% processed as hurd = 960 tons * 2200#/ton = 2,100,000 pounds of hurd/yr/10,500# for the walls in a 1250 sq ft house we could build 200 houses per year shift using this style of building shown below

¹⁹ Industrial Cannabis Sativa: Hemp Oil For Biodiesel Production:
https://www.researchgate.net/publication/375577652_Industrial_Cannabis_sativa_Hemp_oil_for_biodiesel_production





Because hempcrete is a relatively unknown building material in Maui County the Permit office forced them to add extra structural support. By weight only 30% of this material would need to be imported if we were to grow hemp locally. And it is possible that with all of the new bio epoxy (possibly created from mining calcium from sea water) being developed that an alternative to lime will be developed. It is also possible to build with prefab panels that are set in place by cranes or use HempBlocks or shoot a Hemp Shot over a form or onto the underside of a roof.



What you see here is the house with the rough hempcrete. From here they will add a lime finish coat that is smooth and beautiful. Although some people prefer this rough look.



Even with the extra expenses this hempcrete house in Kula cost about \$275/sq ft. to build. With the imported hurd the hempcrete walls cost \$19.25/cu ft and used 8.25# of hurd/cu ft.



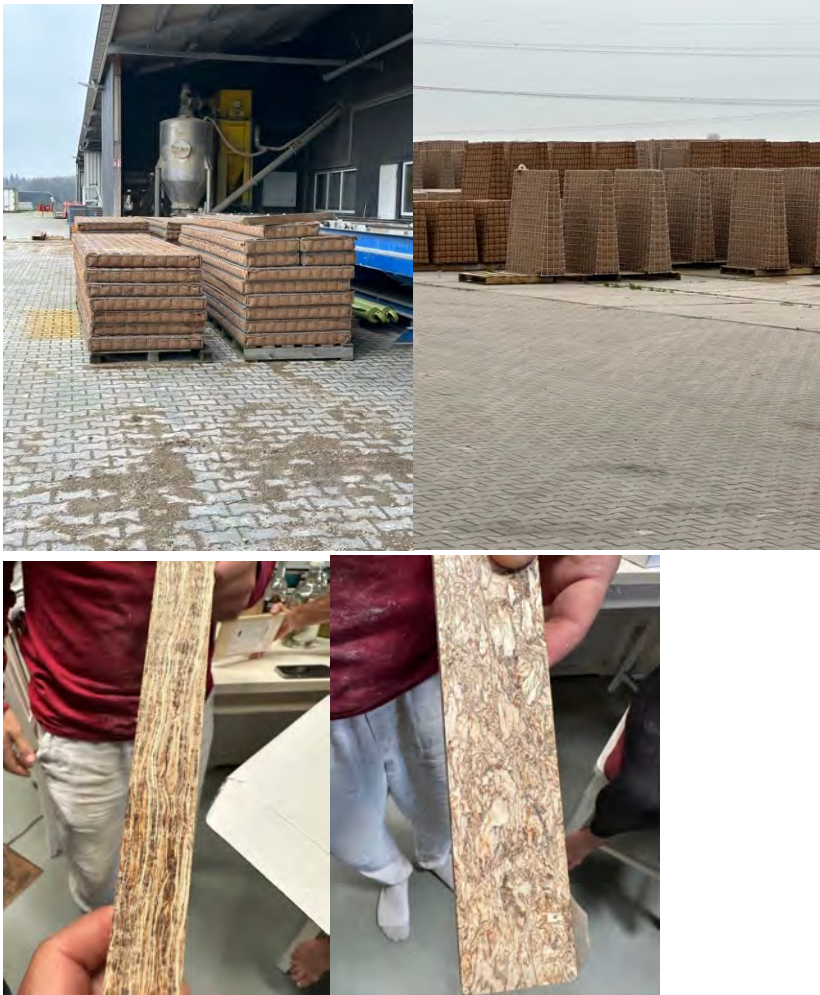
Here is an example of a bamboo house with ferro cement built with a permit here on Maui 25 years ago. The cement roof is coated with a polymer every 5 or so years in half a day and has been totally problem free. This is another potential use for hempcrete as it makes very insulating roofs that can be coated or sheathed in traditional metal roofing.

This particular house was built by the two architects that went on to create Bamboo Technologies – a company that started here on Maui and is the only company in the world to take bamboo through the ICC building code. The County of Maui gave them 7 years of exemptions to the local building code to allow them to get this done while also continuing to build houses on Maui. Today they have built over 500 buildings around the world. They are very interested in incorporating hempcrete into their designs.

Few people know that [Whispering Winds Bamboo](#) grows structural bamboo locally and could and should be incorporated into hempcrete buildings if we are going to reduce our dependence on imported goods. Surely the Office of Innovation and Sustainability could orchestrate the exemption of local building codes once again so that some experimental houses could be built with the owners signing waivers that clear the county of responsibility.

In addition to using hurd (40% of the straw biomass becomes hurd) the other 40% of the straw is fiber which can be made into breathable, non-toxic soft fiber batons for insulation or into fiber board insulation. Hemp is great for sound abatement between floors and rooms.

[DunAgro](#) of The Netherlands came up with another use for its fiber and makes these [Sound Barriers](#) which they sell for sound abatement along freeways. See photos below.



In addition to hempcrete; hurd can be made into a wood like product in 4'X8' sheets that is also useful for cabinetry, tongue and groove flooring, trim, doors, etc.

Phase One

Research has shown us that there really is no such thing as a mobile hemp decorticator for Cannabinoid Hemp. There are small decorticators that are appropriate for research purposes or for growing and building one's own house. There is no machine that we could find that could take in Cannabinoid Hemp stalks and create a second income stream for Cannabinoid Hemp growers as we had hoped. The problem is that given the way that Cannabinoid Hemp is grown the stalks become 2 to 3 inches in diameter and the little machines can only accommodate one inch on the outside.

However, according to Formation Ag they [have experience in growing](#) Cannabinoid Hemp in narrow rows while maintaining flower quality. If Hawaiian Cannabinoid Hemp growers were to adopt this planting regime then they could use one of the two mobile decorticators that we will be reporting on.

In general, we are recommending only large-scale processing as practical for Industrial Hemp in the Hawaiian Islands at this time.

Furthermore, with inter island shipping of 1000# round straw bales (see shipping prices in section B5) it will be possible for any farmer on any island to grow and sell hemp stalks. This will also provide an easy entry for anyone wanting to experiment with hemp bioplastics, hemp surfboard manufacturing, hempcrete and so much more once one large plant is up and running. Then the other islands can build processing plants as hemp takes off as a sought-after product.

Maui, Lanai, Molokai, Oahu

[Hemp Alta](#), a very successful hemp processor and marketer in Calgary, BC is currently formulating plans to come to Maui to set up a Hemp Train style processing plant. This plant will be able to process about 2400 acres (at an estimated 5 tons per acre/ crop yield) worth of hemp straw/ year if it works 24/7 at an 100% efficiency. This plant could buy hemp straw from Mahi Pono, Lanai, Molokai, Big Island and Oahu to begin with.

This would allow the other islands to get into the business slowly and provide proof of concept for that island.

This would also allow large landowners like Mahi Pono, Maui Land and Pine and Larry Ellison of Lanai to grow hemp as a rotational crop to regenerate and cleanse their soils. It is like growing a cover crop while still realizing a profit in addition to the ecological benefits.

In addition, Oahu has many large vegetable farms that could benefit from growing hemp for the same reason. They could form an equipment co-op to purchase and share the specialized equipment needed:

- Grain drill
- Mower Hay rake
- Straw baler

This would allow them to rejuvenate their soils while also earning a handsome profit per acre renewed. In addition, the Europeans report a 25% increase in wheat when it follows a crop of hemp.²⁰

The large vegetable farms on Oahu are:

1. [Sugarland Growers, Inc.](#) – large scale fruit and vegetable farming for 43 years on both Molokai and Oahu

²⁰ Hemp: A More Sustainable Annual Energy Crop For Climate and Energy Policy:
<https://www.sciencedirect.com/science/article/abs/pii/S0301421513001523?via%3Dihub>

2. [Aloun Farms](#) – family owned for 45 years with 180 full time employees and 3000 acres under production
3. [Kuiliima Farms](#) owned by Turtle Bay Resorts with 468 /acres of gardens
4. [MA'O Organic Farms](#) in Wai'anae with about 300 acres
5. [Kualoa Ranch](#) – old family ranching farm that is now growing fruits and vegetables
6. [Ohana Nui Ventures](#), 430 acres in Wahiawa on Oahu

Rebuilding of Lahaina and Other Needs for Affordable Housing

By processing the straw from 4800 acres (a double Hemp Train at 3 tons per hour) Maui could build and insulate about 1650 houses per year from nearly 100% locally grown and processed materials (see Section J.)

Many builders are surprised to see that it is less expensive to build with hempcrete while greatly reducing the heating and cooling costs of a house which represents 42% of the lifetime carbon impact. Leaving the potential for housing developers to earn carbon credits just by building ecologically sound houses.

Kauai

Because of the departure of the sugar industry, the pineapple industry and most recently the seed corn GMO industry; Kauai has in excess of 20,000 acres of available agricultural land. The larger farmers are [Robinson Farms](#), [Grove Farms](#), [Pacific Biodiesel](#) and a mainland farmer in the Kekaha area.

Because Pacific Biodiesel has recently set up a processing plant with 1000 acres under cultivation this is a perfect place for a co-op to set up a hemp processing plant. Bob King, co-founder of Pacific Biodiesel, is anxious to grow and process hemp seeds for culinary oil as well as biodiesel. Bob always makes an animal feed from the pressed cakes of any seed. At a demonstrated 1.25 tons to the acre production of hemp seeds hemp out produces sunflower seed production by 25% adding to both food security through human and animal feed and fossil fuel independence.

Hemp seeds

- 25-30% oil
- 25-30% protein
- 30-40% fiber

Sunflower

- 40-50% oil

Safflower

- 29-45% oil

Soybean

- 18-21% oil

[Hemp Solutions Kauai](#) is looking to partner with Ohana Nui Ventures to grow approx 1000 acres of Industrial Hemp to make hemp blocks to build homes with. They are in talks with hemp brick companies in order to bring the processing to Kauai.

How This Affects Kauai Farmers

Additionally, using hemp to clean the soils of the former GMO/ Round-up system of raising seed corn becomes very important for future crops. Round-up has a 22 year half life with a secondary metabolite called AMPA or Aminomethylphosphonic acid which research has repeatedly shown²¹ is actually more toxic to life forms than the original Glyphosate. This metabolite is often found in the sediment, surface and groundwater surrounding old Seed Corn fields. Hemp has been shown to uptake heavy metals associated with Seed Corn production as well as help to break down residual agricultural chemicals. In a study done by the University of Hawai'i Manoa hemp was shown to break down Atrazine by 75% in one growing season.²²

Therefore, we see growing hemp in Kauai as the most important island in the State so that it can facilitate food security on a large scale. Hemp in a rotation allows for other small grains and legumes to be grown for local consumption as well as animal protein. We would like to point out that when A&B Sugar was experimenting with potential crops back in 2017 they were able to grow field corn that yielded 185 bushels to the acre which was 12% above the national average. We do not have a link to this as it was a figure given in public testimony by the then CEO of A&B Sugar.

²¹ Toxic Effects of Glyphosate on The Nervous System:
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9101768/>

²² ComparaHawai'ivaluation of Industrial Hemp Varieties: Field Experiments and Phytoremediation in Hawaii: <https://www.sciencedirect.com/science/article/abs/pii/S0926669021004477>

Phase Two

Given that each Hemp Train set up only provides the building material for 800 medium sized homes per year it is logical that other processing plants will quickly follow on each of the islands in order to produce this wonderful building material that reduces the need for large scale importation of building materials while making healthier homes that should require zero heating and cooling in Hawai'i.

How the Hemp Industry Can Grow or Develop Into These Five Different Sectors (Fuel, Building, General Fiber, Cannabinoid and Grain Food) Per Island

Maui

We spoke with Darren Bondar, the CEO of Hemp Alta that is based in Calgary, Canada. Hemp Alta is one of the only commercial-scale hemp processors in North America that manufactures high-value hemp products using a state-of-the-art process known as HempTrain™. They have expressed interest in opening a hemp processing facility on Maui. Due to this development, if they move forward, Maui would be the first island with a commercial hemp processing plant. This would be a huge benefit because they are already a successful, knowledgeable company to get this accomplished. (see sections D-I for estimated costs and time frame as well as more information on Hemp Train and its capabilities). With the urgent need to build houses on Maui due to the wild fires, the timing could not be more perfect. They are also looking into acquiring the necessary equipment to make hempcrete blocks which would aid in building hempcrete homes faster which would result in reduced labor costs and homes can be built quicker as you do not have to wait for the hempcrete to dry after casting in place. By having this infrastructure on Maui, a number of other items can be made immediately (see above for low hanging fruit).

While the infrastructure is being built, Industrial Hemp farms can get up and running. The hemp can be dried and stored on Maui so that it is ready to be processed once the facility is completed.

Kauai

If Hemp Alta does build on Maui that would not preclude the need for a processing plant on Kauai. There is a need for both. Kauai is the most logical island to support the development of either a locally owned processing plant or one owned by a farmer's coop. According to Bob King, President of Pacific Biodiesel Kauai has thousands of acres of agricultural land available for lease left over from the seed corn industry. This has been confirmed by Scotty Wong, River Young and Marcus Serrano, all of whom are making plans to grow hemp on the island.

Kauai Hemp Solutions is working with a Hemp Block company to develop factory made hemp blocks that will make hemp construction faster and easier. Another big advantage of starting the industry on Kauai is that Pacific Biodiesel has a new plant already established on the island that is capable of pressing hemp seed for the production of biodiesel. This will give farmers another outlet for their product. Research is needed by the University of Hawai'i and Kanda Seeds to find hemp varieties that are good for both a seed crop and straw yields as is done in Canada. Done correctly this should increase the income of the farmer's net profit.

Oahu

The public/private partnership between Friends of Waimanalo and Ohana Hui Ventures has demonstrated a remarkable quality of leadership that is moving the hemp industry forward on Oahu by:

- Partnering with Kanda Hemp to test hemp fiber varieties in local conditions
- Partnering with Plant – It Hemp in specialized hemp equipment development
- Training young people in building with hempcrete at Friends of Waimanalo [Build and Trades Academy](#)
- Training young farmers in the cultivation and harvesting of industrial hemp holding educational workshops

While focusing on seed trials, hempcrete experimentation, workforce training and public education on Oahu, Ohana Hui Ventures is working with River Young and Kauai Hemp Solutions and planning to grow 1000 acres of industrial hemp for house construction on Kauai.

Agripelago Industries is headquartered on Oahu and is working in startup mode to buy industrial hemp crops for making both hemp seed products like hemp mylk and hemp protein powder and hemp straw for the use in large scale anaerobic digestion for the purpose of producing RNG (renewable natural gas) at scale.

Big Island

From the many farmer discussions that we have had, the farmers on the Big Island are mostly focused on growing hemp for its cannabinoids. The Big Island is also the home of the Hawai'i Hemp Farmers Association with several members ready to engage in educating the public about the advantages of a hemp industry in Hawai'i should funding become available as we are recommending. Task force member, Greg Smith is interested in opening up his Kau area farm for educational opportunities and research. He has been farming Cannabinoid Hemp for many years and has extensive knowledge in growing hemp in Hawai'i.

D. Schematic Diagrams Showing The Various Processing Steps And Infrastructure Needed From Harvest To Product For Various Sectors

Understanding the Uniqueness of Hemp - A Short Intro to Processing Hemp

Hemp is confusing not only because there are two main systems for processing it but because there are so many different products that are made from one plant.

The hemp plant produces:

- Bast fiber (with different finished qualities)
- Lightweight biomass called hurd (large and small finished sizes)
- Seeds
- Leaves (most of which are lost in harvesting however, with a simple haylage chopper and wagon the leaves on young plants 75 to 90 days can be captured for both RNG and animal feed production when hemp is okayed for poultry feed for example)

As you can see in the photo below, an Industrial Hemp field is filled with closely planted hemp plants which forces them to grow tall with a low fiber stalk because it has a small diameter from the competition for sunlight. This is necessary to get the highest yield/acre, suppress weeds and to keep the stalks from being too tough to process.



To harvest the field, it is simply cut like a normal field of hay allowing the stalks to lie on the ground to dry down to 13- 15% moisture or 20% moisture content depending on the type of

equipment chosen. This process is known as retting. However, New Holland and John Deere are both innovating expensive combines that harvest the seed and top leaves while simultaneously clipping the straw into 60 cm sections and then creating winrows that are never driven upon. This is expensive equipment, and the 60 cm sections are ideal for the European style of decortication but not for the American or Canadian.

Once the straw is dry it is simply baled into 1000# square bales and transported to the processing plant where it can be stored for years if it is kept dry – even with a tarp.

Growing, baling and storing hemp before a processing plant is built could be very advantageous for a new venture in Hawai'i.

Hemp straw bales can be put into the European style equipment or the Hemp Train or Formation Ag style equipment.

The fiber portion that comes from the equipment can be sold as is or it can be further processed and packaged for a variety of consumer and industrial goods depending on the focus of the processor and the market. The fiber can be packaged as a high value garden mulch or further processed into insulation for construction as either fluffy batons or as fiberboard used for insulation and sound abatement. This fiber is also very valuable for bioplastics with endless uses like surfboards, skis, furniture, insulating car panels, textiles, papermaking, and on and on.



The hurd portion is ready for making hempcrete for construction or can be further processed into a variety of consumer goods that help keep the price down on the hurd needed for local construction. The islands are currently importing many of these products. Making consumer goods is key to keeping construction goods affordable by earning more on specialty products while the bulk of the harvest goes to housing. The micro-hurd is simply hurd that is too small for hempcrete but can be used in other end-user products. The green microfiber and seeds are ideal for locally grown and highly nutritious chicken feed.

We must keep in mind what the end products are going to be before we can choose the type of equipment we want to invest in. In a later section we will analyze the needs of the islands against the economics of the potential products that can be made from hemp. Obviously locally grown and made building materials are of utmost importance.

Note: In addition to these large scale processing systems see Section G for information on small decorticators that could hand process the stalks from small grow lots.

Processing Equipment

Two Styles: Traditional European Hammermill and Modern Canadian Engineered

In short, the European Hammermill style is large and complex, 20% of the incoming biomass becomes low value dust and generally requires an extra 3 to 5 weeks of lying in the field to complete the separation process called *retting*. It is unknown how much biomass is lost per acre during this *retting* process. The two companies who dominate the market are [Cretes](#) from Belgium and [Laroche from France](#).

The smallest of these systems process 4 tons per hour in a very complicated manner using a lot of dust handling and conveying equipment. The cost is \$6 million plus an estimated set-up fee of \$1 million but the price does not include the US installation team, site work or infra-structure, extensive ductwork or electrical supply, or the shipping of 45 containers from Europe at a cost of \$10,000 each. This estimated cost is from Cretes of Belgium (*See the bid in the Addendum).

The modern engineered Canadian solution is called [The Hemp Train](#) and was designed by an engineering firm to be simple and dust free, so zero waste. Each unit is stand alone and processes 1.5 tons per hour and delivers 4 finished products from the initial go around whereas the European style passes the biomass from one system to another to get to the finished products.

Another modern engineered American solution is manufactured by [Formation Ag](#) and called the Track 660 out of Colorado. They are an interesting company as they also manufacture cultivation and harvesting equipment.

Hemp Train - visited in Calgary, Canada December 2023

- Hemp Train™ - is a new type of hemp processing equipment in development since 2011 by a Canadian engineering firm. This system does not use a hammermill, does not require retting of the hemp stalk, can handle biomass with a higher moisture content and produces 20% more finished product per ton of straw than a hammermill set-up as well as the longest in tack fiber on the market
- In cooperation with their sister company, Hemp Alta™, they have created marketable products from 100% of the hemp straw with zero waste and zero dust. An accomplishment the Europeans refuse to acknowledge. This system is currently being used with hemp grown for seed as opposed to fiber hemp. In other words a dual use variety hemp with a primary crop of seeds and a secondary crop of straw. After they remove the top 18 inches of the plant with a common combine to harvest the seeds they go through the field again to cut the stalk with common hay making equipment.
- After the biomass dries down to 20% moisture they bale it in 1000# bales with standard hay baling equipment.
- However, unlike the Cretes equipment their equipment can handle small square bales, large round bales and 1000# square bales without supervision by a human being.
- These bales can then be stored for years before processing even under a tarp. This is an important insight as a hemp industry could be developed in Hawai'i with farmers starting to grow and store dry bales while the processing equipment is being installed.
- This style of processing equipment runs 1.5 tons/hr and yields:
 - 40% hurd
 - 40% fiber
 - 10% Hurd Microfiber
 - 10% Green Microfiber

There is no waste. Once the large bales are put into the Hemp Train in these photos the processing equipment automatically spits out 4 different products.



40% Hurd from the inner core



40% Bast Fiber from the outer sheath



10% Green Micro-fibers

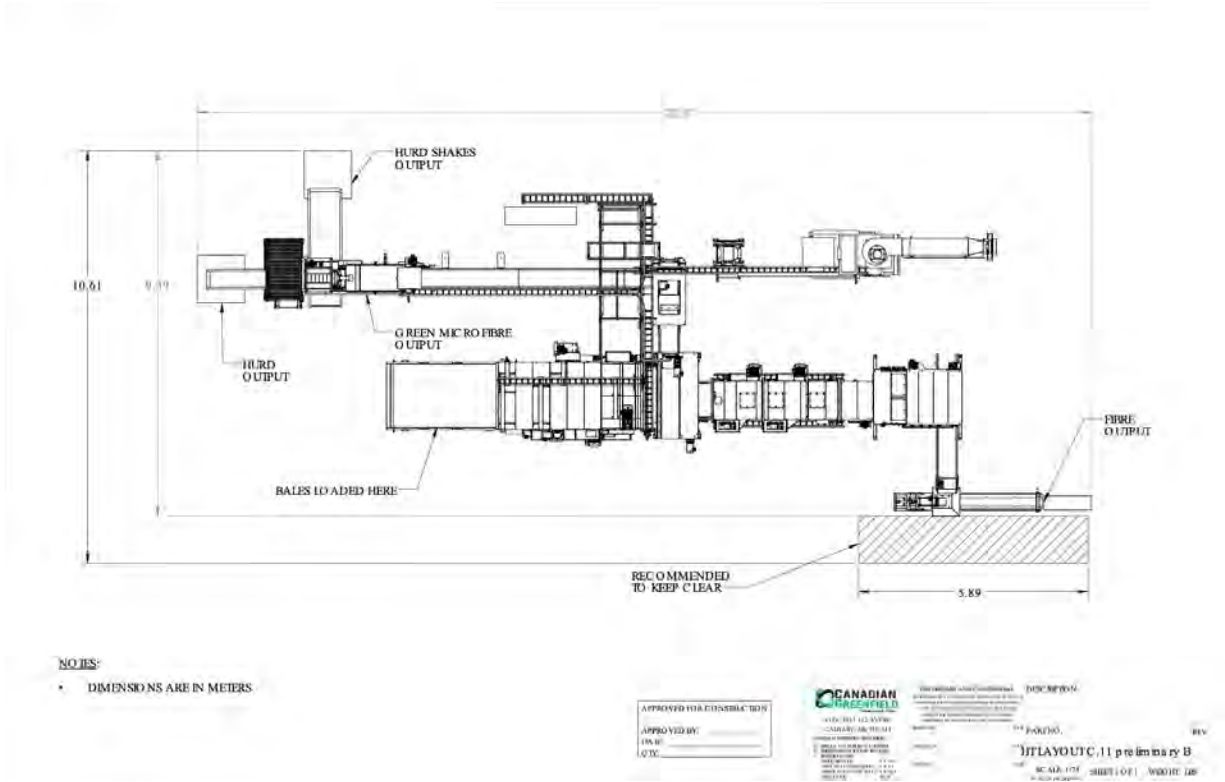


10% Micro-hurd

- The cost of the equipment installed in a local facility will be **\$3,300,000**
- And require 5 – 40ft containers to ship at buyers' expense of an estimated \$6000 per container
- A building of 6000 sq ft with a 110 ft to 120 ft length and a 50 to 60 ft width and not less than 19 ft tall is recommended by the manufacturer - 2000 sq ft for the Hemp Train, 2000 square feet for packing and shipping and 2000 sq ft of covered hay storage with minimal infrastructure needs.
- This compares favorably to the European hammer mill equipment which produces:
 - 55% hurd
 - 25% fiber
 - 20% dust
- Therefore the Canadian equipment is producing an additional 20% more product for every 1000 # of baled hemp straw.
- In addition, several finished products come straight off of the production line.
- This company is doing R&D to produce construction insulation from the fiber portion of the plant and/or an insulating fiberboard.
- The type of unbroken fiber that is produced in this mill without the use of a hammermill makes the fibers ideal for making surfboards and many types of useful bio-plastics fibers.
- Animal feed potential: Please note that when processing seed hemp varieties there in Canada they are still getting 10% by weight of what they call green micro-fibers. These are leaves and stems that can be used as animal feed for poultry, hogs, small ruminants, or cattle once hemp for animal feed is legalized. Poultry feed is very close.
- Because today the majority of hemp is not handled for leaf production it is lost to the ground during growth and harvesting. Although this is important for the soil microbiome an intermittent cover crop would more than replace the value of the fallen leaves while creating an animal food industry of species-specific pellet manufacturing. It is possible to buy a containerized plug and play grain mill made in The Netherlands and deployed to areas wanting to make animal feeds and with an additional leg for also making floating fish food.

Here is a [video of the Hemp Train](#) in action.





Formation Ag is similar to the Hemp Train in its throughput and potential for the Hawaiian Islands. Formation Ag is a wholly owned subsidiary of [Global Fiber Processing](#) out of Colorado. Formation Ag produces hemp processing equipment as well as hemp cultivation and harvesting equipment. We believe that Formation Ag Fiber Track 660 is very advanced but not as commercially proven as the Hemp Train. It can process 1.5 to 1.8 tons per hour. Unlike the Hemp Train the Formation Ag system comes in modules that can mix and match according to the end product needs. The primary advantage here is in the potential for additional processing of the bast fiber to prepare it for different markets by simply adding on additional fiber cleaners. This can also be done with the Hemp Train by special order.

Although they advertise that their equipment can process both green and retted straw their general manager, Randy Wright, was honest and said that it works best with at least a nominal amount of retting to let the soil microbes begin the separation of the outer skin layer. Randy Wright was also honest enough to say that 1.8 tons per hour requires optimal feedstock and processing conditions and we should figure on 1.5 tons per hour.

In general, I believe that the roller system used by Formation Ag is similar to Hemp Train. Hemp Train is in one long enclosed unit that produces very little dust and has an excellent bale opener. The Hemp Train has also been longer in development. Formation Ag has versatility including the ability to process Kanaf (however they report Kanaf is highly flammable and potentially dangerous). They can also easily add dust collectors early on in the production line. We will

consider both of them as outputting 1.5 tons per hour in my calculations elsewhere.

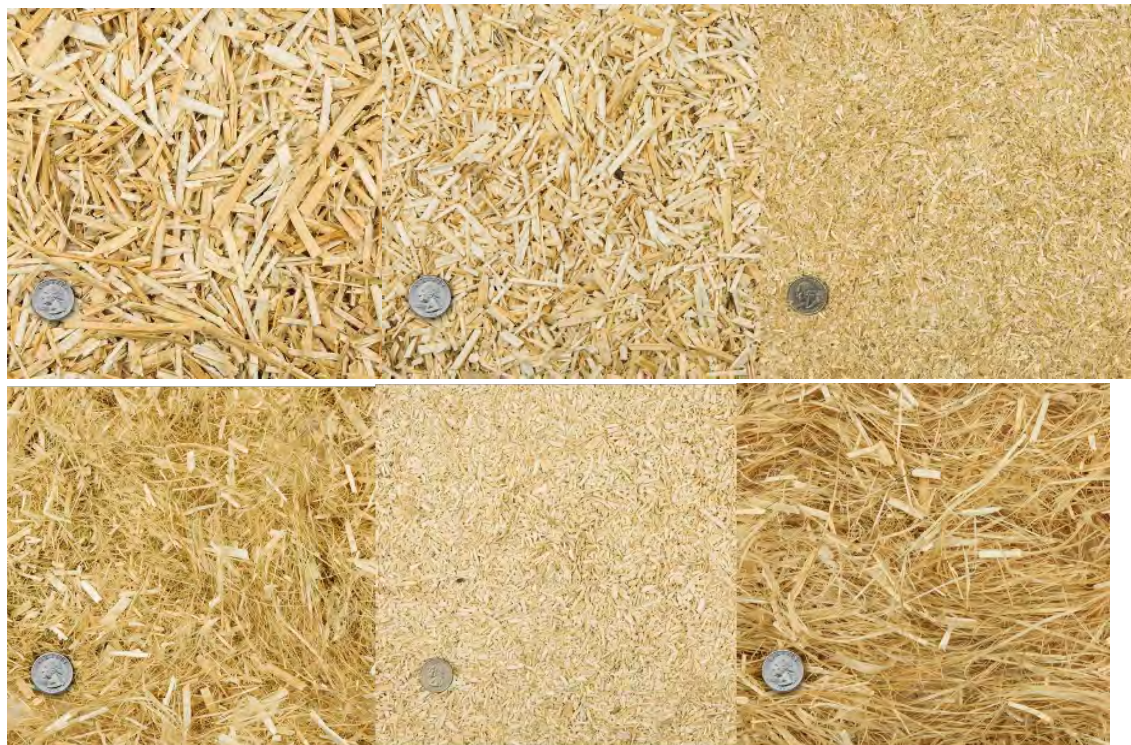
Before a startup venture chooses between these two manufacturers, we would recommend visiting them both to ferret out the differences. A big part of the decision will come down to the intended end use of the products that come from each system.

Two advantages that Formation Ag has over Hemp Train is cost: A stripped-down entry-level system is only \$800,000 and one with all the bells and whistles is \$1.2 million. They recommend a 5000 sq ft building for the processing plant and agree that an open-air building would be best. They also recommend two additional 5000 sq ft spaces for the storage of straw bales and the storage of product and shipping. They are estimating that a full-blown system will take 4 – 40ft HC containers to transport. It will take 3 people to run the system and it will produce 75% hurd, and 25% fiber. They tend to grow fiber hemp in their area of the country which accounts for the different percentages.

They are a fully owned subsidiary of Global Fiber Processing and are ahead of The Hemp Train in creating end user products from the bast fiber. They are also working with the largest consumer and processor of hemp fiber in China and have much better looking bast fiber when it is refined in their equipment. Please see the photos below.

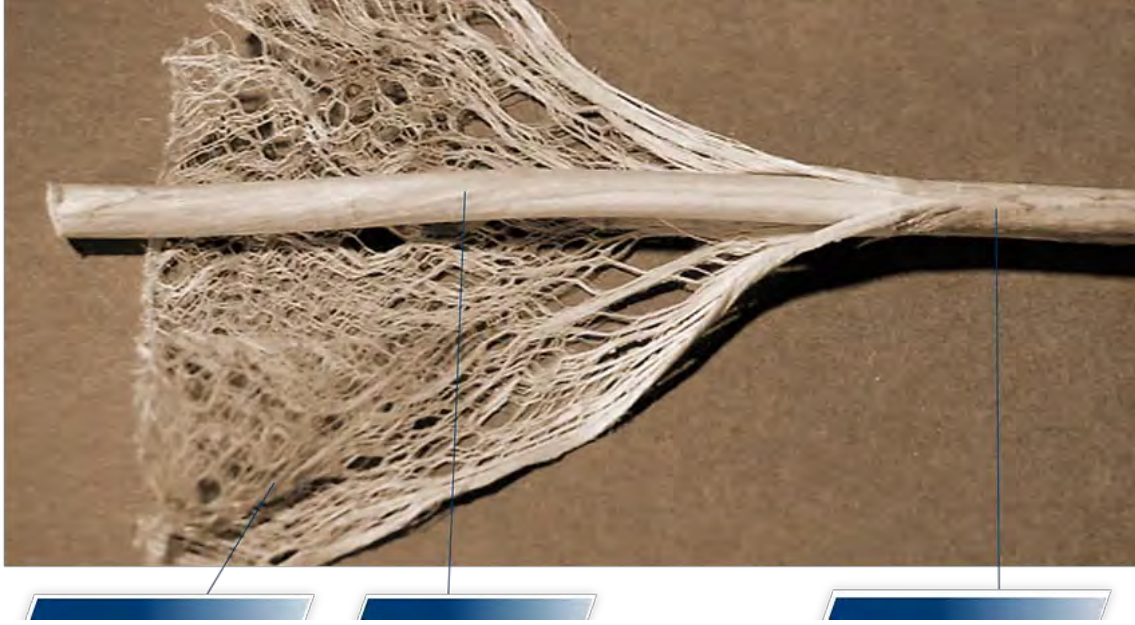
We believe that they are on the cutting edge of hemp innovation and diversification. This company is exciting because they are about to bring structural hemp/concrete blocks to the market together with the [University of Nebraska](#).

Traditional European Hammermill Processing – two major manufacturers



Cretes™ of Belgium and Andritz Laroche SAS of France

- The advantage of decades of use
- Ideal for the European system of field retting
- We don't yet know if hemp will ret properly in Hawai'i
- They don't know how much biomass is lost to retting before it is baled
- The hammermill literally beats the hemp straw and causes a reduction of 20% to 25% of the straw to be reduced to a low quality dust with 20%– unfortunate!
- Products expected:
 - 20% dust
 - 55% hurd (high and low quality combined)
 - 25% fiber
- Processing 4 tons per hour with an electrical use of 610 kilowatts of electricity per hour not including the ventilation system and packaging units
- Requires very extensive air ducting systems that are designed by Cretes but are to be built locally at the owner's expense
- Needs a 100 ft by 300 ft by 33 ft tall processing building
- In addition needs a building that will hold one week of straw
- Plus needs a building for storage and shipping of finished products
- Uses only a large round bale of hemp straw – no square bales
- Very fussy on percent moisture – warns of equipment breakdown if over 20%
- Operators: 4 – 1 dedicated to feeding the straw bales and removing the strapping of the bale (Note: on the Hemp Train one person quickly lifts a bale onto the machine and leaves the machine to do the rest) 1 person for operating the bale and straw cutter. 1 line supervisor and 1 for finished products removal
- Cost of the equipment to process 4 tons per hour
 - Equipment \$6 million
 - Shipping \$5 million
 - Technical Assistance \$1 million
 - Locally contracted installation, infra-structure. They are very vague but are very clear that they will send their technicians at \$1500/day/per person plus food and lodging.
- Hemp needed to run for one plant for one shift per day to start with 1000 A at 4 tons/A and two crops per year with a cover crop in the interim
- Remember that the 8000 tons/year throughput only yields 6400 tons of product because of the old fashioned hammer mill they lose 20% of the biomass



The Raw Bast Fiber Unfurled



It takes 4 passes through the equipment to arrive at finished fiber for sale

Note: this is similar to the Formation Ag equipment in that you can add single specific pieces of processing equipment to go from virgin fibers to cleaned fibers and another to go all the way to cottonized fiber.



This is a close-up photo that we took of the wasted dust. As you can see it is 20% uncaptured hurd and fibers that are wasted. The Canadian Hemp Train does not have any wasted material. In the first pass the entire straw biomass comes out of the machine in 4 materials as shown in the upcoming photos. This is a significant difference between the two styles of equipment.

Dunn Agro Traditional European Style Processing Plant with Pre-fab manufacturing - visited in The Netherlands

- We visited with a traditional hemp processor who uses the common place hammermill system of processing with high throughput. The European systems have always focused on fiber production and their equipment is designed to that end. While the construction insulation they produce is beautiful it will take a deeper dive to evaluate whether or not that output is worth the additional cost of equipment and operational expenses.
- This company processes between 6 and 7 tons an hour and 10-12,000 tons/year working 2 shifts a day. The factory employs 35 people and produces diversified products including CBD products, sold in drugstores throughout the country as well as hurd in super sacs, sound abating structures, prefab houses, etc. The processing plant itself only requires 2.5 people per shift (one being split with the shipping department).
- Because this factory uses the European hammermill style of processing equipment, they end up with 20% of their raw hemp straw being turned into dust. The dust can ⁸⁰

be pelletized (it had a caloric value of 14.9MJ/ton) and can be used for process heat or pyrolysis into BioChar with a heat by-product.

- Their equipment produces virgin fiber that is currently shipped to Romania for further processing into beautiful natural, non-toxic insulation that you can literally take a nap on, it is so soft and non-itchy.
- There is one more equipment manufacturer whose equipment is very similar to the Cretes. They are [Laroche](#) from France. This company has sold and installed 2 large processing plants, on tribal lands in the State of Texas. According to one of the Dutch CEOs this project is unfortunately doomed to fail because he says that area of Texas has never grown fiber hemp and that, in fact, the type of fiber hemp that this equipment was made for cannot grow in the Texas climate. In addition, it is not possible to do the retting process in that region due to low humidity.
- As this style of processing equipment is used throughout Europe this claim needs to be investigated.

DunAgro in The Netherlands processing plant for 6 to 7 tons/ hour plus making prefab houses. In addition, they rented two huge buildings for product and cultivation equipment storage nearby. They also farm 8000 acres of hemp themselves and plan on expanding to 12,000 acres.





Additional Processing into [Prefab houses](#) – an ideal process for Hawai'i



The equipment photographed at DunAgro below, which allows for a very wet hempcrete to be poured into a form in a horizontal position could easily be figured out by clever Hawai'i based contractors. Making prefab houses would be a tremendous help for Maui and each of the islands. Minnesota's Lower Sioux Indian Community is pioneering green building with its fully integrated 20,000 sq ft, \$6.2 million [hempcrete facility](#) – a first in the country. They are looking to start manufacturing prefabricated wall panels and blocks and build homes quickly for their community and could be an example of what is possible here in Hawai'i.



The processing of hemp into general fiber and building materials are discussed above. Through an RFP the first hemp processing plant will be built on one island. See diagram above. Commercial competition together with State selection and land availability will determine which island will benefit from this State support. The small decorticators are for university research only so it will do no good to distribute them. The biofuel industry is prepared to process hemp seed into biodiesel as soon as the hemp seed is grown. No additional infrastructure is needed for this. The seed can be delivered to either Kauai or Big Island for processing. The cannabinoid industry has many diverse and individual needs and we are recommending that they be given a dedicated task force to address them more efficiently and directly with the offices of government that regulate that industry.

E. Approximate Costs Per Infrastructure Component

HempTrain, Calgary, Canada

- The cost of the equipment installed in a local facility will be \$3,300,000
- And require 5 – 40ft containers to ship at buyers' expense of an estimated \$6000 per container
- A building of 6000 sq ft with a 110 ft to 120 ft length and a 50 to 60 ft width and not less than 19 ft tall. We are recommending 10,000 sq ft for expansion into 4 shifts
- Process capacity/installed unit 1.5 tph

Item	Cost
Equipment	\$3,300,000
Shipping	\$40,000
Industrial setup (10,000 sq ft, partially enclosed)	\$2,500,000
Small equipment for factory and office	\$250,000
Indirect and management costs	\$500,000
Total	\$6,590,000

- Consider structuring the grant/loan for state ownership, with a potential transfer to the factory's workforce over time.

***Formation Ag Track 660 Made in Colorado - very similar estimate as Hemp Train**

Traditional European Hammermill Processing – two major manufacturers

Cretes™ of Belgium and Andritz Laroche SAS of France

- Cost of the equipment to process 4 tons per hour
 - Equipment \$6 million
 - Shipping \$5 million
 - Technical Assistance \$1 million
 - Locally contracted installation, infra-structure ????
 - See Cretes bid in the addendum

F. Infrastructure Sizing and Capacity Options Based on Different Processing Needs

We are only recommending two different processing systems for the starting of a hemp industry. They both process 1.5 tons of hemp straw per hour.

One is the Canadian Greenfield Technologies Hemp Train and the other is the Formation Ag Track 660. The only real size requirement difference is in the space the actual processing equipment requires. The Hemp Train is one complete unit that takes in any type of hay bale (small square, small round, large square or large round) on one end and spits out hurd, micro-hurd, fiber and micro-fiber on the other.

The Formation Ag 660 although newer to the market appears to also be a good set-up made by a company dedicated to all things hemp. It does about the same output per hour but requires 15,000 sq ft because it uses several sequenced pieces of equipment to do the same thing that the Hemp Train does with only 6000 sq ft of work space because it is all in one unit.

Hemp Train is recommending 2000 sq ft of covered storage for hay and 2000 sq ft of enclosed space for shipping and product storage. This is probably true for just one shift per day which limits output.

Whereas Formation Ag is recommending 5000 sq ft for each of the above. If we are to forecast a growing hemp industry the initial processing plant should plan to expand to full time which is 4 shifts per week. Then the Formation Ag recommendation is more in line.

When the RFPs are sent out for State support each applicant will choose their own system that they want to work with and will defend their reasoning. These two systems are similar and in many ways and any group wanting to process hemp on a large scale should visit each of them before making their own decision.

The Hemp Train has been in development longer than the Track 660. We would like to note that there are some rumblings in the hemp community about the Hemp Train but we have no way of knowing if they are founded or not. So we will simply note them here. When we visited the Hemp Train engineers we found them to be very professional and their equipment was running smoothly at Hemp Alta.

G. Suitability of Mobile Versus Fixed Infrastructure For Hemp Processing

The only way to start a new statewide hemp industry is to have large scale processing equipment as discussed above. However, there are those farmers who are growing Cannabinoid Hemp who may also want to add another income stream by running their stalks through a mobile decorticator. This is only possible if they grow Cannabinoid Hemp with an unusually slim stalk under one inch in diameter. Artisan builders may want to grow, process and build with their own home-grown hemp and this is very possible and intriguing.

Small Scale Mobile Decorticators

For both of these groups there are two possibilities. The [HurdMaster](#) and the [Formation Ag Micro Decorticator 118](#).

The HurdMaster is only 575# and is mounted on an easy to move about frame. It can process 100# to 200# of hemp stalks per hour with two operators. It can process either retted or green hemp stalks up to 1 inch in diameter.

The hurd comes out as ¼ inch to just over 1 inch in length which is perfect for hempcrete as well as animal bedding without further processing. The fiber can be used as is for garden mulch.

The HurdMaster is being produced by [Peruza](#) of Lativa - a high quality process engineering and equipment manufacturing company that works worldwide.

The equipment runs on 220V electricity, has SS rollers, gear drivers and stands 32"by 79" by 49". It costs \$14,400 and fits on a shipping pallet that weighs 772#. Once a deposit of half the price is made it will ship in 6 to 8 weeks. This is a wonderful and sturdy solution. There are many others out there made by individuals or university shops for research, but this one seems to be very professionally done.

Please see the HurdMaster Brochure [here](#).

There is also an American made machine that is very similar and runs off of 110V. It is a [Formation Ag Micro Decorticator 118](#) and sells for \$21,000 and is made and shipped from Colorado. The manufacturer manufactures a full-sized system as well so hemp decortication is its primary business and they offer full tech support in processing, marketing and cultivation of hemp. See Formation Ag brochure [here](#).

Formation Ag is a wholly owned division of Global Fibers Inc. and both companies are 100% devoted to the expected roll out of an American hemp industry. Formation Ag is one of the

leading players in development and production of hemp related equipment and offers equipment for:

- Planting
- Cultivation
- Harvesting
- Processing
- Decortication

All with the potential for financing.

Medium Scale Decorticators

There are several medium scale decorticators but only one that we think is as advanced as the Hemp Train. That would be Formation Ag - made in Colorado Formation Ag [Fiber Track 660](#) can process 1.5 to 1.8 tons per hour. Unlike the Hemp Train the Formation Ag system comes in modules that can mix and match according to the end product needs. The primary advantage here is in the potential for additional processing of the bast fiber to prepare it for different markets simply by adding one or two more pieces of equipment to the line.

One potential disadvantage in Hawai'i is that even though their literature says that the equipment can handle green hemp without retting, their very truthful CEO said it works best with retted materials. By contrast the Hemp Train engineers claim that their straw does not need to be retted but this needs to be verified before purchase.

A Word of Caution to Cannabinoid Hemp Growers

It is a tightly held belief that Cannabinoid Hemp straw can be turned into high value hempcrete. However, according to the equipment experts that have been interviewed this is an unrealistic expectation because when hemp is grown at a rate of 1600-2000 plants per acre the stalk will become both excessively fat and tough. No small decorticator could handle a stock thicker than 1 inch in diameter. Formation Ag is doing experiments with growing Cannabinoid Hemp but using Industrial Hemp seeding rates with favorable results so far. However, the extremely high price of the additional high value seed (many times the cost of industrial hemp seed) will most likely make this practice financially untenable.

Stalk disposal possibilities for Cannabinoid Hemp growers. To avoid hemp stalks from going into the landfill there are a few potential uses:

1. Compost them on the farm or take to a professional composting facility
2. Chop and sell as mulch
3. Chop and sell as animal feed
4. Drop off at an anaerobic digester

Conclusion for Cannabinoid Farmers:

Small hemp decorticators are basically used for experimental purposes only. Please contact Formation Ag for their opinion on that subject. They make the Formation Ag Micro Decorticator 118 primarily for university research.

Very few people ever commit to the work of hand feeding a mobile decorticators to build an entire house. That is not to say that it could not happen but it would take real dedication and hundreds of hours. This would not make financial sense but there are craftsmen willing to go to the work for the satisfaction of saying the house was grown on their land.

We wish that a mobile decorticator would help the Cannabinoid farmers but according to the president of Formation Ag, Randy Wright, a mobile decorticator cannot be used on Cannabinoid hemp because the stalks are using 2 to 3 inches in diameter and very tough. As stated before mobile decorticators can only process up to one inch in diameter.

Mobile Decorticators vs large scale processing plants:

As stated above there is no comparison. There is no option to use a mobile decorticator for starting a hemp industry. They are only for experimental lab use per their manufacturer. If the State is serious about supporting the start-up of a hemp industry then they must support the installation of a 1.5 ton per hour decorticator so that farmers will begin to grow hemp in our state.

As stated in so many places throughout the report, there will only be one decorticator in Hawai'i in the beginning. Which island it will end up on will depend on who wins the competitive bid for the RFP.

H. Volume and Mass Requirements for Processing Per Day

For Both the Hemp Train and the Formation Ag 660 We Will Use:

- Throughput 1.5 tons/hour
- 8 hours /shift
- 12 tons/shift
- Full time is 168 hours/week
- Which is 4 shifts at 10.5 hours/shift
- We will guess at 80% efficiency to start with
- For a need of 250 tons * 80% = 200 tons per week to feed the processing plant
- 200 tons per week * 50 weeks is 10,000 tons per year
- At 5 tons / Acre that is 2000 acres rotated around for 3 crops/year
- 1.5 tons per hour – after processing by weight
 - 40% hurd
 - 40% bast fiber
 - 10% micro-hurd
 - 10% micro-fiber
 - For an annual output of
 - 4000 tons of hurd
 - 4000 tons of bast fiber
 - 1000 tons of micro-hurd
 - 1000 tons of micro-fiber
- Please note that these percentages are based on dual purpose hemp grown primarily for seed in Canada and may be less hurd per ton than when fiber hemp is processed

I. Approximate Square Footage Required Per Component

There Are Only Three Areas of the Processing Facility and They Can All Be Under the Same Roof or Spread Out a Bit.

- Storage for the straw bales needed for the next week's processing.
- Actual processing space.
- Storage for the offtake (often it comes off the processor in bags or is bagged in this area). Plus the shipping of goods.

Equipment	Total	Straw Storage	Shipping and Product Storage
Hemp Train	6,000 sq ft		
Formation Ag	15,000 sq	2000 sq ft	2000 sq ft
Cretes &	ft	5000 sq ft	5000 sq ft
Laroche	50,000 sq	10,000 sq ft	10,000 sq ft
	ft		

This must be read in context. We are still talking about the one processing plant to process hemp straw into hurd and fiber. It is still 1.5 tons per hour. It will be placed on the island that wins the RFP based on their business plan as long as the entity can prove that they have 3000 acres of land available to them as stated above and in the executive summary.

The square footage of space needed for each component is in the box above.

J. Economic Implications of the Recommended Infrastructure by Island to the Hemp Farmers, the Hemp Industry, and the State of Hawai'i

According to [Civil Beat](#) Hawai'i has 1,930,000 acres zoned for agriculture, with 39% of those being used for pasture. This leaves us with roughly 1,170,000 acres of potential agricultural land, minus the 8% (155,000) acres that are currently producing food. In the end, we have about one million acres registered as agricultural land that are lying fallow.

Bob King, co-founder of Pacific Biodiesel, informed the Hemp Task Force that his company has the infrastructure ready to process 3 million gallons of biodiesel per year specifically for Hawai'i. Based on peer-reviewed research, one hectare can produce 207 gallons of biodiesel (or 83 gallons per acre). This means Pacific Biodiesel is equipped to handle seeds from 36,000 acres of hemp, coincidentally the same number of acres of sugarcane once produced on Maui by A&B.

Hemp cultivation on 36,000 acres would yield approximately 144,000 tons of hemp straw annually. This straw could be digested in anaerobic digesters across the islands, producing biogas which can then be upgraded to Renewable Natural Gas (RNG), with captured CO₂ as a byproduct for commercial use. Europe, particularly the Netherlands, is ahead in biogas technology, with 250 digesters generating 219 MW of electricity and having upgrade capacities for both RNG and vehicle fuel.

Hawaiian startup Agripelago is working on adapting this well-established technology for local use, aiming to foster Hawai'i's independence from fossil fuels with facilities on each island.

Post biodiesel production, if the 144,000 tons of hemp straw were processed at plants on each island (6 plants with a 3-ton-per-hour capacity), Hawai'i could produce around 58,000 tons each of hurd and fiber. These materials could be used for hempcrete, hemp blocks, hempwood, insulation, fiber boards, and more.

Taking contractor Joe Smith's numbers for a 1,500 sq ft house with hempcrete walls (12,500 pounds) into account, and adding estimates for other hemp-based construction products, a house might use approximately 14.5 tons of hemp hurd and fiber. This would mean that 36,000 acres of hemp could produce 3 million gallons of biodiesel and roughly 8000 new homes from locally grown and manufactured products. Plus, this initiative could earn carbon credits and set⁹¹

an example for eco-tourism.

But wait, there's more! With Hawai'i's year-round growing season, hemp could be one of three annual crops in rotation with corn and soybeans, supporting the production of broilers, laying hens, and fish — all of which have efficient feed-to-meat conversion ratios. If hemp farmers were subsidized to grow 36,000 acres each of corn and soybeans annually, this would yield over 600,000,000 pounds of feed per year. This feed could support the production of 50 million broilers annually, meeting and exceeding Hawai'i's consumption of 30 million chickens. The excess feed could support egg production to meet local demands.

Additionally, chicken manure from this operation could enrich Hawai'i's soil, which is currently deprived of nitrogen-rich compost. This compost is essential for regenerative agriculture and productive soil for shade houses, where vegetables can be grown year-round, similar to practices in Spain and Mexico.

Hemp hurd rejects could serve as poultry bedding to absorb manure, which can then be used to produce high-quality compost and Black Soldier Fly larvae, enhancing chicken feed and compost quality. This process is already being employed by Tyson Foods with their Dutch partner ProTix.

In summary, using hemp could serve as the cornerstone for revitalizing Hawai'i's agricultural land, aiming for greater food security and reduced dependency on imports. Addressing food security should become a top priority for the state legislature, focusing on sustainable farming practices over tourism. This strategy involves identifying potential agricultural lands, educating the public, and providing subsidies for local crop production to encourage farmers.

Let's ensure food security and sustainability remain at the forefront for Hawai'i's future

K. Task Force Feedback & Findings By Sector

The first Hawai'i Hemp Task Force Meeting was May 17th, roughly 2 ½ months into our 4-month consulting assignment. After the task force members were finalized, we realized that the majority of the members were cannabinoid farmers. We were tasked with looking into the infrastructure needs of Hawai'i hemp farmers and the hemp industry with a focus on 5 sectors: Building, Fuel, General Fiber, Grain/Food, and Cannabinoids. The majority of the feedback we received when speaking to and emailing with the task force members pertained to the Cannabinoid Sector with a huge emphasis on rules and regulations. We listened to them and took note of their concerns but realized that it was taking the focus away from the larger picture of a hemp industry that could be scalable and have broader reaching effects for Hawai'i's economy.

Unfortunately, we are not able to make many recommendations pertaining to most of these concerns as there were so many differing opinions and feedback and a lack of data to back up some of it. We wanted to acknowledge the importance of the cannabinoid farmers and businesses and that is why we recommend a Hemp-Derived Cannabinoid Task Force in order to thoroughly address many of their concerns below. Due to the fact that the existing hemp industry in Hawai'i is the Cannabinoid Sector, as the Industrial Hemp industry is still in its nascent stages, we have listed as much feedback as possible below from the Cannabinoid Sector so that their voices can be heard and so that they can be documented in this report. We also give a snapshot of the other hemp sectors and who is already creating businesses in those sectors as they are the ones who need the most support now in order to grow the hemp industry in Hawai'i. We highlighted some of the top-level feedback in each sector below while adding additional feedback to the Cannabinoid Sector.

Building Sector:

- The second hempcrete home on Maui, located in Kula, was completed this spring by Hemp Home Hawai'i. The [Maui News](#) recently came out with a cover article about hempcrete and the benefits of building with it which was then picked up by [Hemp Build Mag](#). Ohana Hui Ventures, LLC has just planted its first industrial hemp seeds with the hopes of growing hemp for building materials, Dr. Li from UH Manoa along with PIHA (Pacific Industrial Hemp Alliance) is looking to conduct hemp seed research for fiber and construction materials at the Waimanalo Research Station Hemp, and Hemp Solutions Kauai is looking to grow 1000 acres of industrial hemp on Kauai to make hemp bricks to build homes. The Hemp Building Sector is the most important of the 5 hemp sectors in ⁹³

this report. There is a housing crisis across the state and the most recent wildfires on Maui have only added to that crisis. Hempcrete is still very new in Hawai'i, but housing is already a high demand product in the state and hempcrete is one of the easiest hemp products to make: hemp hurd, water, and lime. Below is some of the feedback from the task force on the Building Sector. There is some uncertainty surrounding building with hempcrete in Hawai'i. While several homes have now been built with hempcrete, investors want to make sure that if they invest in the hemp building industry in Hawai'i that homes can be built easily utilizing hemp and they will not run into roadblocks.

- Hempcrete was added to the [2024 International Residential Code \(IRC\)](#) but has not yet been adopted by the State of Hawai'i. Once it is, it should be fairly easy to include hempcrete in county building codes. This would help to give stability to the burgeoning hempcrete industry in Hawai'i and allow investment in infrastructure to support it. Having it in the county code should relieve any doubt from those looking to invest in hempcrete infrastructure in Hawai'i.
- There is potentially 1000 acres of state land on Kauai that could grow industrial hemp for hempcrete with the potential to scale up to more acreage. Hemp Solutions Kauai is currently talking to outside investors about opening a processing plant to make hemp bricks but says that since there is still some uncertainty around building with hempcrete as noted above, investors are leary of taking the risk.
- Investors want to see that industrial hemp is being grown so that they feel more secure to build a processing plant here. Investors want to be sure that the hemp can be moved from the farm to the processor and that the bricks can be moved from the warehouse to a build site or retail partner without worry.
- Hemp Home Hawai'i who just completed a hempcrete home in Kula this spring and had to import the hemp hurd from the mainland. Ideally, they would like to use locally grown hemp in their builds. They have clients that want to build with hempcrete, but there is no locally grown hemp currently for them to use.
- Hemp Solutions Kauai is looking for a \$200K grant to get 2 model hempcrete homes built on Dept of Hawaiian Homelands property on Kauai. They would partner with a local trade school. They have a build team on site. They would be used as classrooms for education about hemp and as model/spec homes for politicians, community members and other investors, so they can see what a hempcrete home looks like in person and experience what it is like to live in a home built with hempcrete. The Planning Department can do tests to confirm there are no liabilities with building with hempcrete. It is a great way to show proof of concept.

- We need to be able to build quickly. Prefab hemp panels, hemp bricks, and hemp spray are options to build more quickly and to store resources so that for example when Lahaina is ready to rebuild, there will be plenty of building materials ready to go and because you can grow up to 3 hemp crops per year, there should always be hemp building materials available on the islands.

Fuel Sector:

The biofuel sector already exists in Hawai'i. Pacific Biodiesel was the first biofuel company in the nation and has been around for almost 30 years. They have the capability now to process hemp seeds for culinary oils and are very interested in being able to process hemp for biofuel. They have access to approximately 1000+ acres of land on Kauai to grow seed crops and would need to rotate different crops, so hemp would be a natural fit in their rotation of crops. Oahu based Agripelago has invested a lot of money in R&D on developing biogas projects: specifically Renewable Natural Gas (RNG) with Renewable Natural Gas with Carbon Capture Utilization and Storage (CCUS). Both of these company's need support from the government in order for them to utilize hemp for fuel. By supporting companies like Pacific Biodiesel and Agripelago it will help move Hawai'i toward their goal of 100% clean energy by 2045. Below is some of the feedback from the task force on the Fuel Sector.

- Agripelago wants the State of Hawai'i to apply Federal law.
- Grant Overton, Founder of Agripelago said that Kamehameha schools is unable to license industrial hemp to lease because of the uncertainty.
- Some of the large landowners don't want to take the risk.
- For banking you have to sign something saying you aren't dealing with cannabis. Locally they are not familiar with the federal standards surrounding hemp.
- Moving goal posts-year over year, new regulations proposed. Rules are not given time to be implemented. That uncertainty diminishes their ability to raise money and is killing investment potential.
- Per Grant at Agripelago, equipment is needed, ideally a dual-use hemp crop would be harvested with what is known as a [dual-header hemp harvester or double-cut hemp combine](#). It harvests the entire crop in one pass, so this captures all fractions of the crop while dividing out the seed.

- Per Grant at Agripelago, the issue is that the State of Hawai'i wanted to create a definition of industrial hemp that was not inclusive of green leaves or foliage material. This would have a negative impact for two reasons: 1) it would reduce their useable biomass yield by around 40-50% (so they would be throwing out 40-50% of the biofuel yield) and 2) it would be economically unfeasible to separate the leaf material when using this type of dual-header harvester.
- Grant's top recommendation for the State of Hawai'i is to align Hawai'i's hemp regulations with US Federal law as described extensively under the Farm Bill and as regulated by the USDA.

Fiber Sector:

- There currently is not an existing hemp fiber industry in Hawai'i. Infrastructure is needed as well as land to grow industrial hemp. Hemp Alta has expressed interest in potentially opening an industrial hemp processing plant on Maui which could help kickstart the industry and entice large landowners to add industrial hemp to their crop rotations. Below is some of the feedback from the task force on the Fiber Sector. Have equipment libraries on each island where farmers can check out equipment to farm hemp including a mobile decorticator. The non-profit Friends of Waimanalo already offers something like this. Just need to make sure that the equipment is sanitized before it heads to a farm so as not to cross contaminate or bring invasive species or pests to the farmers land. They already have the capability to sanitize the farm equipment and could be a good model for other islands..
- Per Scotty Wong at Ohana Hui Ventures, LLC, the USDA was doing a hemp call every Wed, they would bring in different experts and talk about hemp regulations at the Federal level. He would like to do something similar at the state level-so that everyone knows what the rules and regulations are and they can have an open dialogue with the government agencies.
- Offer grants for farmers. Make them strictly for Hawai'i hemp farmers to kickstart the industry. It enables the farmers to figure out what equipment is needed and where to get it from.
- Per Scotty Wong, the biggest thing for fiber/hurd is that they need equipment with the proper attachments. Harvesting equipment, seed dryers, decorticators...
- Education is key. Ohana Nui Ventures, LLC is already doing education on their farm.
- Zoning requirements may need to be relaxed in order to build additional farm structures on hemp farms.

- Seed research is vitally important as we need to develop seed varieties that grow well in different climates across Hawai'i. Jari Sugano, the Oahu County Administrator for CTAHR's off campus facilities, is working with Dr. Li from UH Manoa, on the USDA application to conduct hemp research at the Waimanalo Research Station. They will need a processing area and lab to collect data. The State of Hawai'i needs to support hemp seed research in order for farmers to grow profitable hemp crops.

Seed/Grain Sector:

Like the Fiber Sector, there isn't really a seed/grain hemp industry in Hawai'i, but there is a lot of potential for food products like hemp seed hearts, hemp oil, hemp mylk, hemp protein and animal feed. Investment is needed to support this industry as there are many value-added food products that can be made from hemp seed giving rise to more Hawaiian owned hemp food related businesses. Below is some of the feedback from the task force on the Seed/Grain Sector.

- Per Grant at Agripelago, seed has the potential for high value, often +50% of the value chain derivable from a dual use hemp crop. However, much of the potential is from value-added food products, such as hemp milks, flour, and protein products. This requires market development to be realized to attain revenues beyond commodity seed pricing. With commodity seed pricing, there is still significant value, but larger scale production would be needed to compete with other North American producers.

Cannabinoids Sector:

The majority of the members on the task force are cannabinoid farmers, some of which are USDA licensed, some of which have not renewed their licenses and some of which have chosen not to renew their licenses due to the ongoing instability in regulations. Only 3 of the task force members are also DOH licensed to process hemp (there are 4 total DOH processing licenses currently in the state). This has led to a majority of the feedback coming from this sector, a lot of which had to do with rules and regulations. We were tasked to focus on infrastructure for this report, but because there were so many concerns in the Cannabinoid Sector, we felt we needed to list these in the report with the recommendation that a Hemp- Derived Cannabinoid Task Force be formed in order to address all of these issues. Below is some of the feedback from the task force on the Cannabinoid Sector.

- The Hawai'i legislature finds that although the Hawai'i hemp cannabinoid and cannabidiol market is estimated to be \$32,000,000 to \$54,000,000 annually, most of that money flows to out-of-state hemp farmers and businesses due, in part, to consumers in Hawai'i not being able to differentiate between products that are made with Hawai'i-grown hemp and Hawai'i-branded products made with imported hemp because the labeling does not provide where the hemp originated from.²³
- As of April 2024 there are 58 active USDA licensed hemp farmers in Hawai'i and only 4 of those have the DOH hemp processing license. Based on that math, it would appear that some hemp businesses are processing their hemp illegally and that a majority of the cannabinoid sales in Hawai'i are from imported manufactured hemp products. While a significant amount of cannabinoid products are being imported to Hawai'i, there are some small farms that are growing and processing hemp. The 2024 USDA National Hemp Report states that the acreage is so small that they do not even have an accurate number of acres that are being grown in the state, which may also be due to a lack of reporting on the part of the hemp farmers or it may be that there really isn't much hemp being grown in the state. The current cannabinoid hemp industry is primarily made up of small scale boutique farmers.²⁴
- Something that regularly comes up from the task force and has been reinforced by the proposed SB 651, is that although existing State law prohibits the sale of cannabinoid, or CBD -infused foods, such as chocolates or gummies, these products are sold on all islands at multiple venues, including gas stations, airport kiosks, and grocery stores. Although food products account for the most cannabinoid-infused product sales across the country, Hawai'i farmers and manufacturers are prohibited from selling these products, losing significant sales to mainland farmers and manufacturers. Per one task force member, "the two segments: cannabinoid extraction (and synthesis) and industrial hemp should have their own regulations. Hemp CBD should be regulated and synthesized cannabinoids should be banned. Hawai'i cannot compete with the synthesized cannabinoid market and we will always suffer. Local hemp farmers and producers should be allowed greater freedom instead of less freedom to operate."
- There has also been feedback regarding the lack of enforcement for those players who are non-compliant, as stated above regarding edibles being sold in gas stations and the like. They feel that they are able to sell these products illegally with no enforcement

²³ HISB 651 2024:

<https://legiscan.cHawaii'text/SB651/id/2893827#:~:text=The%20legislature%20finds%20that%20although%20the%20Hawaii%20hemp%20cannabinoid%20and,products%20that%20are%20made%20with>

²⁴ USDA National Hemp Report 2024: <https://downloads.usda.library.cornell.edu/usda-esmis/files/gf06h2430/3t947c84r/mg74s940n/hempan24.pdf>

which is affecting the local companies who are trying to be compliant with the rules and regulations surrounding manufactured hemp products.

- Many of the task force members feel that the manufactured hemp industry is over regulated. They claim that Hawai'i is one of the most regulated states in the nation, although we have not been able to get any data to back that up from any of the task force members.
- Currently in Hawai'i DOH-OMCCR is responsible for issuing hemp processor permits and regulating those permittees to ensure compliance with applicable rules. They say they can only regulate those processors that come forward and obtain a permit. DOH has no mechanism for knowing who is operating without a permit. There are currently only 4 active DOH processor licenses in Hawai'i and 58 active USDA Hemp producer licenses which highlights the fact that some farmers are most likely processing their hemp illegally.
- There are several hemp task force members from the cannabinoid sector that do not want manufactured hemp to be regulated by the same entity that regulates cannabis. Gail Byrne Baber said that economist Beau Whitney did a study that showed that in Oregon when they combined cannabinoid hemp and cannabis under the same regulatory entity it ended up having negative effects on the hemp farmers like making it so that hemp farmers were not able to access banking and were losing their insurance. We have asked for that study from Beau Whitney, but he did not send any.
- One of the biggest concerns we have heard from local cannabinoid farmers and sellers is the competition from imported products and the lack of oversight on illegal products being sold in Hawai'i. There also is a lot of uncertainty in the cannabinoid sector when it comes to rules and regulations. The goal posts keep moving every legislative session making it very hard for local hemp farmers and businesses to keep up. Some task force members do not want hemp regulated by the same entity that regulates cannabis as was proposed in HI SB 3335 that eventually died in the House.²⁵
- There are only 4 DOH licensed cannabinoid processors in the state. Many farmers on the task force do not have access to processing equipment. Some have asked for a shared processing facility while others want to process on their farms to save money. Kauai Hemp Co was set up as a vertically integrated grower/processor on Kauai who also offers toll processing, white label, and formulation/cultivation consulting, yet not many farmers have been utilizing these services. Some of the reasons that farmers have not been utilizing their processing services have been due to inter island bulk hemp transport costs and regulations.

²⁵ HI SB3335: <https://legiscan.com/HI/bill/SB3335/2024>

- Recommended: test before harvest and then final product not in between as it is too costly and THC could go above .3% but it would need to be below that for the final product anyway, so why test in between as this is affecting business.
- One task force member recommended creating a “Certified 100% Hawaiian Grown Hemp” seal that can be applied for based on proof that the hemp was grown in Hawai‘i. This can apply to all other hemp products made with Hawaiian grown hemp, not just cannabinoid products. There could be a database that lists all of these brands and the seal will enable them to charge a premium for their products. Robert Bence would like the HDOA to get rid of the movement reports and buffer zones and the HDOH to eliminate the fee to get the DOH license.
- Some of the farmers would like hubs on each island where they can have access to farm equipment. Like an equipment library. Brittany Neal noted that if there is shared equipment, they need to make sure that there are no pests or invasive seed matter on the equipment before going to a new farm. Scotty Wong from Ohana Hui Ventures, LLC said that they already do equipment rentals and are able to sanitize the equipment before it goes to a new farm, so it could be replicated on all islands that have an equipment hub.
- The farmers would like to have a shared processing facility for cannabinoids where they can process their flower to make their products.
- Many task force members have said Hawai‘i has made it very difficult to do CBD hemp business in the state.
- Many task force members have said that the testing requirements are unrealistic and expensive.
- Bill 1359 passed in July 2023 but they still don’t have the rules.²⁶ They want clarity on everything so everything is clear. They feel like hemp is the lowest priority to cannabis and agriculture. There were other cannabis things that passed and they got all the rules and the hemp industry is still waiting. They would love a better roadmap or direction.
- Grants are needed for local farmers. They would love to get some grants for infrastructure. Compliance grants to help uplift some of the smaller businesses. More grants towards STEM and Ag jobs-Shared workspaces-like making CBD soap-shared kitchen.
- Labor costs are high and it’s a small pool for labor, they would like help with bringing labor costs down

²⁶ HI HB1359: <https://legiscan.com/HI/bill/HB1359/2023>

- They wouldn't be opposed to regulation if it was followed up with enforcement. They say you can't make gummies, pre-rolls but lots of people sell them illegally.
- Labeling rule passed but HDOH hasn't set the rules and who is going to enforce it?
- They have had a lot of difficulty with competition. The state prohibits them from producing consumables-gummies-which is 40% of CBD market right now.
- It is difficult to compete at a price point with out-of-state brands, especially some bad players-using marketing tactics using Hawaiian names when they aren't actually made or grown in Hawai'i.
- There is a lack of willingness to engage in conversation from the HDOH-they are hiding their legislation till the last minute. They do not respond to their requests for information, the only time they see each other is at the hearings-but it should be beforehand.
- They want to bring stakeholders together. They suggest one call per month with HDOH and one with HDOA so everyone can discuss concerns, get educated. They need to learn from them-but the HDOH/HDOA need to learn from the farmers as well. Needs to be a two way flow of conversation-very open forum.
- They would like to bring back a hemp conference to Hawai'i to help educate the community and to bring stakeholders together
- Kyle Leong would like to legalize smokable hemp products in Hawai'i. It is a higher profit due to less processing needed. Jared Dalgamouni President of Hawaiian Choice, says that Hawai'i desperately needs a facility to remediate the extracts to broad spectrum that will allow the final product to remain cGMP certified. But with the constantly changing laws and rules, no one will invest into such a facility. remediation facility with cGMP that makes Hawaiian extracts cost effective and also cGMP certified. Distillation and isolation is needed also.
- From Brittany Neal: Local law enforcement uses a Narcotics Identification Kit ("NIK") field test to detect the presence of THC in a substance they believe may be marijuana. With the use of a NIK field test, hemp would be considered marijuana by local law enforcement. The determination that a substance in someone's possession contains any amount of THC, triggers the ability of law enforcement to seize and forfeit property without any due process for the individual in possession. The test does not quantify the amount of THC that is present. The NIK field test is not sufficient for differentiating between hemp and illicit marijuana.

- Many task force members would like to see a legislative pause for a few years where the legislation that has already been passed is allowed to play out to see what works and what doesn't, before things are changed again or not allowed to happen because of the possibility of changes occurring through new legislation like what happened with the delayed convening of this task force.

The Department of Health

One thing the HDOH (Hawaii Department of Health) has said is that they have noticed many of the USDA licensed farmers in the state do not have the proper HDOH license to process the hemp they grow. As stated above, there are only 4 active HDOH licenses presently in the state of Hawai'i, yet there are 59 USDA licenses to grow hemp; of those, it is very hard to surmise how much hemp the farmers are actually growing as there is limited data available.

The HDOH have also stated that **it is very important the applicant understand the definitions in 328G**. Specifically, what is meant by "processing", "hemp biomass" and "manufactured hemp product" as these terms work together to determine if someone needs a HDOH permit or not. For example, "**processing**", *for purposes of chapter 328G, HRS*, specifically means making a transformative change to "hemp biomass" to make crude extract or a "manufactured hemp product". Processing also includes anyone producing a manufactured hemp product from crude extract or using a manufactured hemp product as an ingredient to make another manufactured hemp product. So, there is a lot of specificity captured in the term "processing" that further requires a clear understanding of what is meant, in 328G, by "hemp biomass" and "manufactured hemp product".

"Hemp biomass" is defined in 328G as the leaf and floral parts of the plant, as these have been identified as the primary parts of the plant used by industry to extract for cannabinoids, terpenes, etc. This differs *significantly and meaningfully* from the definition of "hemp biomass" in hemp cultivation law – section 141-42(h) – which defines "hemp biomass" as applying only to the stalks of hemp plants. So, a hemp farmer needs to have clear awareness on what is meant by "hemp biomass" depending on which law they are trying to comply with. Finally, the

applicant must have a clear understanding of what is meant by “**manufactured hemp product**”, in 328G, which means any product created by “processing” that is **either consumed orally in tablet, capsule, powder, softgel, or liquid form (e.g. hemp oil) OR is in a form for topical application to skin or hair.**

The law clearly states in 328G-2(i) that “It is the responsibility of the hemp processor to make sure it has a valid permit and is legally allowed to process hemp biomass or prepare a manufactured hemp product and in compliance with any and all laws and regulations.”

Some of the Key Players Who are Paving the Way for a Hemp Industry in Hawai'i.

Based on our research and interviews, some on the task force and some not, we have found that there are several groups on our islands that are already diving head first into Industrial Hemp and Cannabinoid Hemp. We want to highlight them below as they are the visionaries for our state and are leading the way and they need support.

Building:

[Hemp Solutions Kauai](#)-located on Kauai. They are looking to partner with Ohana Nui Ventures, Inc. to farm approx 1000 acres of industrial hemp to make hempcrete bricks. They are looking to build a processing facility to process the hemp and make the hempcrete bricks.

They are also looking to build two hempcrete homes on Hawaiian Homelands land to help educate policy makers, investors and the community about the benefits of building with hemp. They are currently doing R&D on hemp batteries which could potentially replace the current batteries being used.

[Hemp Home Hawai'i](#)-located on Maui. They have built 2 tiny homes out of hemp and just completed a 1000 sq ft hempcrete house in Kula. They already have prospective clients that want to build hempcrete homes, but will need to import hemp hurd from the mainland until hemp is grown here to support their business.

Fuel:

[Agripelago](#)-located on Oahu, has invested the last 6 years of their time researching hemp for seed and fuel, but has run up against volatility in the rules which makes it hard for investors to commit. Supporting a company like this who has invested a lot of money and time is crucial for the industrial hemp industry to grow.

[Pacific Biodiesel](#)-based on Maui with operations on Big Island and Kauai, have the infrastructure on Kauai, in place to process hemp for fuel and oil. They recently planted [100 acres of sunflowers](#) on Kauai. Pacific BioDiesel is prepared to press food grade hemp seed into the raw materials needed by the Hawaiian body care industry. They have the infrastructure in place to press hemp seeds into culinary oils and biodiesel - they are just waiting for the hemp seeds

Fiber:

[Scotty Wong & Scotty Reis-Moniz](#): are business partners in Ohana Nui Ventures, Inc. and also help run [Friends of Waimanalo](#) a 501 (c) 3 organization. They run a 400 acre farm in Wahiawa and are looking to expand into growing industrial hemp as a rotation crop on the farm for fiber. They are leading the way as he is working with Alex Wu and Terry Moran of [Kanda Hemp Seeds](#) on hemp seed strains that will grow best here in Hawai'i. They are also working with Kim Philips of Plan-It Hemp. She is a farmer who grew her own hemp and built the first hempcrete home in Montana and is now living on Oahu to work with them on growing hemp for industrial use. They are also looking to partner with Hemp Solutions Kauai as noted above, to farm approx 1000 acres of industrial hemp on Kauai for hempcrete.

Grain Food:

[Agripelago](#) (see above Fuel section) has been researching utilizing the seeds for hemp protein powder, hemp mylk,...

Cannabinoids:

[Kauai Hemp Company](#), located on Kauai, is the largest cannabinoid grower and manufacturer in Hawai'i. They are vertically integrated, USDA licensed, and one of only four DOH-licensed processors in the state. They produce their own products and also offer white labeling services for other companies. However, due to pending legislation, they are currently unable to produce gummies, which are among the highest-selling cannabinoid products. Additionally, they face challenges with redundant testing requirements for distillate and logistical issues with farmers moving their flower to the processing plant.

Despite these hurdles, Kauai Hemp Company is well-equipped to process flower from other farmers, making them an excellent option while other processors are being established on different islands.

However, to make this feasible, shipping costs between islands would need to be subsidized, and there must be assurances that flower can be transported from farmers to processors without additional barriers.

Hemp Processors:

[Hemp Alta](#): based in Canada, is a hemp processing company that has expressed interest in opening a processing plant on Maui. They use the HempTrain™ Advanced Processing System developed, designed, engineered and manufactured by Canadian Greenfield Technologies Corp. The HempTrain™ system enables the processing of hemp straw bales into three streams: long, strong, intact bast fiber, clean size-specified hurd and nutrient-rich green microfiber – at the rate of around 2,000 pounds an hour. This would enable the state to process hemp and help to scale the industrial hemp industry in Hawai'i.

Research:

PIHA (Pacific Industrial hemp Alliance) is working with the University of Hawai'i on seed genetics that will help local farmers utilize the best seeds for their climate. They should be given the full support they need to do research on the best seed varieties that will work in Hawai'i. This is a key component of a successful industrial hemp industry in the state.

Farmer Support:

[Hawai'i Hemp Farmers Association \(HHFA\)](#), is a 501(c)(3) Nonprofit organization founded to further the multi-faceted hemp industry in Hawai'i and advocate for the needs of the industry, especially farmers. HHFA shares knowledge regarding farming, processing, best practices amongst membership and with community and politicians. They have built relationships with national and international relationships experts to help inform the best direction for Hawai'i industry.

Education/Outreach:

Ohana Nui Ventures, Inc./Friends of Waimanalo mentioned above in the Fiber section, also provide outreach and educational opportunities. They have a bunch of different hemp samples on the farm like hemp plastic utensils, hemp rope, hempcrete, hemp wood... Anyone who stops by can learn more about hemp and see a lot of the different possibilities of products that can be made with it. Students have stopped by to learn how to make hemp paper, politicians have stopped by to learn more about hemp.

Friends Of Waimanalo already has a Build and Trades program that could potentially support hemp education-especially building with hemp. Their educational efforts should be supported as education along with proper seed varieties for our climate, are very important to the growth of the industrial hemp industry in Hawai'i.

[Greg Smith owner of Earth Matters Hemp Hawai'i](#)-located in the Kau district on the Big Island, is interested in utilizing his farm for education and research as well. He has been growing hemp for CBD for many years. The farm is totally off grid with solar and catchment with three large greenhouses on the property. He received a \$75K grant from the state back in 2017 to do hemp seed research, so he would be a valuable educational tool for hemp farmers on the Big Island. He would need support to get this going.

[Kauai Hemp Company](#)-located on Kauai, is looking to build out an educational area on their farm and give tours. We visited their farm in July as they were just starting to put the seedlings in the ground. They grow and process the flower on their farm and do processing for other farmers and can create white label products as well. They have a small shop setup to sell their products. They are looking to expand and create a welcoming space for guests to come and tour the farm to see how the products are made and learn about the benefits of hemp.

[Hemp Solutions Kauai](#)-they are looking to build two hempcrete houses/classrooms that would be utilized for educational purposes and also to help sell hempcrete as a building material. They are looking to work with local tradespeople so they can teach them how to build with hemp.

Hemp education is very important, and the above entities are already doing it or are in the process of expanding into more education. Ideally there would be at least one educational location on each island where the community members, stakeholders, investors, local council members and state officials can come to see and experience all that hemp has to offer. The state needs to support these educational opportunities in order to destigmatize hemp because it is still very closely associated with cannabis and the stigma needs to be removed in order for an hemp industry to be successful in the state.

HDOA (Hawai'i Department of Agriculture)

Create a manual like [this one](#) on how to grow hemp, best seed varieties,... and basic rules like buffer zones, transportation reports.

HDOH (Hawaii Department of Health)

Clearly define the rules and regulations so that farmers and business owners can understand, especially since the rules keep changing and can be quite confusing. The below flow chart is a great example of the types of educational content needed to help inform hemp farmers and processors.

DISCLAIMER:
Existing hemp processor permittees are unauthorized to process hemp biomass into crude extract and/or process crude extract into a manufactured hemp product until updated interim rules have been approved.

August 2024

HAWAII DEPARTMENT OF HEALTH - HEMP PROCESSOR PERMIT
The following hemp processing operations require a permit and compliance with interim rules 11-37, HAR

<p>A</p>  <p>Anyone processing hemp biomass to make a compliant MHP.</p>  	<p>B</p>  <p>Anyone processing hemp biomass into compliant crude extract. <i>"Crude extract shall be sold only to a hemp processor with a valid permit issued by the department, or to a person with equivalent authority from a regulatory agency in another jurisdiction." Not allowed for sale to consumer.</i></p> 	<p>C</p>  <p>Anyone completing the process of producing a compliant MHP from crude extract. <i>Those that do not want to process hemp biomass can obtain compliant crude extract and complete the manufacturing process into a compliant MHP.</i></p>  	<p>D</p>  <p>Anyone using a compliant MHP as an ingredient to make another MHP. <i>Those that do not want to process hemp biomass or start with crude extract can obtain compliant MHP to use as ingredient to make another MHP. *Includes repackaging/relabeling activities.</i></p>  
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Crude Extract = initial cannabinoid containing extraction from hemp biomass that is not fit for use or consumption. Further processing required to create cannabinoid containing MHP.
Hemp Biomass = floral and leaf plant material.
Manufactured Hemp Product (MHP) = cannabinoid containing product applied topically to skin or taken orally in a form allowed in rules.

[Permit application, Law – Ch 328G, HRS and *Interim Rules – Ch 11-37, HAR](#) *tentative Aug/Sept 2024. Email: doh.hemp@doh.hawaii.gov
 Applicant requirements:
1. Complete application and return with permit fee and supporting documentation:

- Valid USDA license to grow hemp or consent to background check establishing proof of no disqualifying felony conviction.
- Indoor facility and planned processing operations (e.g., extraction methods) comply with local zoning, building and fire codes.
- Or, processing operations (e.g., extraction methods) do not include use of heat, volatile compounds or gases under pressure and operations occur in enclosed indoor facility that is:
 - Exempt from building permit and building code requirements pursuant to section [46-88, HRS](#).
 - Or, occurs in a food hub or agricultural park.

NOTE: Applicants sharing a facility, like a food hub or commercial kitchen, with a business permitted by [Food Safety Branch \(FSB\)](#) should consult with permit owner and FSB to ensure hemp processing operations can occur in same shared space.

2. Indoor processing facility criteria:

- Facility used to process hemp biomass, as described in pathway "A" or "B" above, must be at least 500 ft. from playgrounds, schools, state parks, state recreation areas, residential neighborhoods, hospitals, or daycare facilities. This requirement does NOT apply to applicants that limit their processing operations to those described in pathway "C" or "D".
- Applicant must provide description how their processing facility will comply with relevant sections of Ch. 11-37, HAR, with respect to facility design and construction (e.g., easily cleanable materials), ventilation control, source water for cleaning and sanitation operations, facility plumbing to carry water to required locations and to convey sewage and liquid waste away from facility, access to plumbed hand wash sinks and toilets with water under pressure, etc.

NOTE: Please consult DOH - [Environmental Management Division](#) and [Environmental Health Services Division](#) to ensure your planned hemp processing operations comply with the laws and rules they administer. If your process uses solvents or other hazardous materials, please contact the DOH's Hazardous Waste Program (808-586-4226) for information on waste management regulations.

Conclusion

A state-supported hemp industry in the Hawaiian Islands could revitalize the local economy by filling the gap left by the decline of the sugar, pineapple, and seed corn industries. Unlike these export crops, cultivating hemp creates raw materials for secondary industries, fostering a circular economy and producing various products that could significantly reduce imports. Key products include:

- Prefabricated housing panels
- Locally-made hemp blocks for construction
- Locally-made construction materials- insulation and wood replacements
- Biodiesel and Renewable Natural Gas (RNG) to replace imported fuels
- Locally-produced high-end health food products
- *Hawaii Made* Cannabinoid Products

Environmental and Agricultural Benefits

Hemp is a powerful phytoremediation plant, capable of detoxifying agricultural fields by removing heavy metals and working with soil microbes to metabolize residual agricultural chemicals. Notably, hemp has been shown to increase the yield of subsequent crops by 20%. Given Hawai'i's limited arable land suitable for food production, soil rejuvenation is one of the most critical benefits of developing a statewide industrial hemp industry.

Enhancing Food Security

Hemp prepares land for other beneficial rotational crops, including corn, soybeans, colored beans, adapted wheat varieties, oats, squash, potatoes, sweet potatoes, melons, silage, and other crops that could significantly contribute to Hawai'i's food security. Before the best agricultural lands are sold for luxury homes, it is imperative that Hawai'i adapts mechanized agriculture to support large scale food production. As a pioneer crop, hemp can play an instrumental role in this transition.

Recommendations for Establishing a Hemp Industry

The State of Hawai'i must build its hemp industry within the framework of food security while simultaneously developing local industries to utilize the raw materials produced by hemp. Our recommendations for establishing a hemp industry within an agricultural circular economy are based on three key reasons:

1. **Advancing Food Security:** By integrating hemp as a rotational crop, Hawaii can make significant progress toward its food security goals.
 - Hemp cleans and rejuvenates the soil while sequestering carbon.
 - It also prepares fields for modern mechanical agriculture.
2. **Local Production of Raw Materials:** Hemp, being a 3-4 month crop, can efficiently provide raw materials for various industries:

1. Construction
 2. Biofuels
 3. Value-added food
 4. Cannabinoids
 5. Carbon credits
3. **Promoting Local Economies:** Supporting locally grown raw materials can foster the development of new industries, reducing reliance on imported products. This promotes a circular economy where money generated from industrial hemp stays within Hawaii.

Economic Impact and Local Industry Development

The demand for locally grown construction materials, industry-based jobs, and locally produced food products is undeniable. The state can leverage its power to help private industry meet these needs through various means, including:

- **Grants and Loans:** Providing financial support to farmers and processors to establish a robust hemp industry.
- **Tax Incentives:** Offering tax breaks to businesses involved in the cultivation, processing, and utilization of hemp.
- **State Expertise:** Providing technical assistance and resources to ensure the success of hemp-related projects.

Immediate Actions

To effectively kickstart a hemp industry in Hawai'i, the state must support farmers, processors, and end-users of hurd and bast fiber concurrently. This can be achieved through the following steps:

- **Processing Plant Development:** Create an RFP to establish a single processing plant on one island before expanding to others. This will allow farmers to begin growing dual-purpose hemp, selling seeds, and storing hemp straw for future processing.
- **Industry Partnerships:** The State must support the development of diverse off-takers for primary products from the hemp decortication process—hurd and bast fiber. The State must further support the development of industries prepared to create value-added products from these materials.
- **Construction:** Given Hawaii's need for housing and lack of locally produced construction materials this is a natural starting point for building a hemp industry by making RFPs that would promote the development of locally manufactured building materials
- **Biofuels:** The infrastructure to create biodiesel from hemp seeds is in place and the infrastructure for RNG from hemp biomass has potential. This industry will benefit from farmer subsidies to encourage hemp production for use in all sectors.

Conclusion

Supporting the development of a hemp industry in Hawai'i within the framework of food security can provide significant environmental, economic, and agricultural benefits. By implementing strategic recommendations and leveraging state support, Hawai'i can create a sustainable and prosperous future centered around the versatile and valuable hemp plant.

L. Findings & Recommendations

Introduction to Each Section is the Same:

1. Current Status and Required Support:

The hemp industry in Hawai'i is still quite new, but there is tremendous opportunity for it to grow and scale. An exception is the Cannabinoid sector that has been the hemp champion in the islands for over 20 years. Pacific Biodiesel is prepared to grow and has the infrastructure to process 1000s of acres of industrial hemp for the purpose of making renewable biodiesel. Agripelago is in start-up mode for developing an anaerobic digester to convert hemp biomass into RNG renewable natural gas. Ohana Nui Ventures has planted 4 acres of seed trials to help move things forward. The University of Hawai'i is preparing for additional cultivation trials. Hemp Homes Hawai'i is importing hemp hurd for the purpose of developing a market for homes built from hempcrete. We are focusing on Industrial Hemp and recommending that a new Cannabinoid Task Force be set up to advance the Cannabinoid industry in the State because of its longstanding special needs.

Our recommendations are based on our interpretation of:

- extensive interviews, task force meetings, emails and in person meetings with the members of the task force
- visits to operating hemp farms
- visits to operating hemp processors in both Canada and The Netherlands
- visits and zoom conversations with hemp processing equipment manufacturers
- internet research
- communicating with manufacturers for quotes
- our background in mechanized agriculture and food security issues

2. The Purpose of this report:

Is to make recommendations based on the potential we have observed from other parts of the world that are benefiting from a hemp industry. We are attempting to tell the State of Hawai'i that they should support this industry not based on what is currently in Hawai'i but on the potential given the State's assets and its tremendous need for local industry and food security. We recognize that this is a heavy lift but one that is essential for the future of our State. This is an industry that can supply jobs and

food while being paid by carbon credits to reduce our imports.

3. For more details:

These findings and recommendations were written in a condensed format to make it easy for the Hemp Task Force to read and vote upon. More details can be found in the full report. The details in the report follow the outline we were given. The recommendation sections highlighted in yellow are our top recommendations and should be addressed first and foremost.

Findings General Fiber Sector (Straw):

1. Current status of the General Fiber sector: There are currently no general fibers being produced in Hawai'i other than a 4-acre test plot being grown by Ohana Nui Ventures on Friends of Waimanalo land on Oahu. Our recommendations are meant to kick start this industry.

2. To develop this industry, State support is necessary for:

- University of Hawai'i's selection of the best hemp varieties and cultivation practices.
- Subsidies to encourage farmers to grow hemp.
- Development of a primary processing plant.
- Use of hemp for biofuels, including both biodiesel and RNG.
- Development of hemp-based construction materials.

3. Primary Processing Plant:

The key to starting an Industrial Hemp industry is establishing a primary hemp processing plant, known as a "Decorticator." Without a buyer, farmers will not risk growing hemp. Splitting hemp straw into hurd and bast fiber is essential for the further production of the many products made from hemp.

4. Processing Equipment Placement:

The choice of which island will be the first to develop a processing plant will be defended by each applicant for the RFP to build the first processing plant. Each

applicant will need to defend their choice of island based on availability of land to lease and access to water for irrigation.

5. Infrastructure Assessment:

To assess infrastructure needs for an Industrial Hemp industry in Hawai'i, we attended Hawai'i Task Force meetings and conducted interviews with:

- Task Force members.
- Local farmers and prospective hemp growers.
- Experts in hemp construction and biofuel production.
- Potential buyers of hemp hurd and bast fiber.
- Hemp entrepreneurs and non-profits conducting hemp research.

6. Visits and Research:

Visits and interviews were conducted with:

- [Canadian Greenfield Technologies](#) and [Hemp Alta](#) in Calgary, BC.
- [Dunn Agro](#), a fully integrated company in The Netherlands.
- [Formation Ag](#), a manufacturer of decortication equipment.
- The [Hemp Museum](#) in Amsterdam.
- Various international experts in hemp equipment and product development.
- Andrew Oscar from [United Fiber](#) and internet research.
- [Kauai Hemp Company](#)
- Recently completed Kula, Maui hempcrete home

7. Products from Industrial Hemp:

- Industrial Hemp farmers have four primary products to sell: seeds, mature straw (once seeds are removed), green straw (before seed setting), and carbon credits.
- The primary hemp straw processor can sell fiber, microfiber, hurd, and micro hurd. The proportions of these products depend on the hemp variety and harvest age.

8. Local Initiatives:

- [Ohana Hui Ventures, Inc.](#) (OHV), in partnership with the non-profit [Friends of Waimanalo](#) (FOW), has a 430-acre farm in Wahiawa on Oahu with 40% of the acreage licensed to grow hemp.
- Initiatives include partnerships for seed genetics, soil remediation, R&D on innovative hemp processors, and extensive education and outreach programs.

Recommendations General Fiber Sector:

1. Processing Plant Development:

- Recommend a public competition for grants, loans, loan guarantees, tax incentives, and expertise to support building and operating a 1.5-ton-per-hour decorticator plant for processing hemp straw into hurd and bast fiber.
- Consider the first plant using the [Hemp Train](#) or the [Formation Ag Fiber Track 660](#) . They are similar in output, ease of use and cost.
- Avoid early-stage hammer mill European-style equipment.
- Estimated cost for the initial 1.5-ton/hour processing plant:

Item	Cost
Equipment	\$3,300,000
Shipping	\$40,000
Industrial setup (10,000 sq ft, partially enclosed)	\$2,500,000
Small equipment for factory and office	\$250,000
Indirect and management costs	\$500,000
Total	\$6,590,000

- Consider structuring the grant/loan for state ownership, with a potential transfer to the factory's workforce over time.
- State can set the percentage of cost they are willing to pay

2. Subsidies for Growing Hemp:

- State subsidies for selling hemp straw at \$300/ton and seeds at \$0.40/lb for at least five years to encourage hemp and food crops rotation.
- Support for farmers needing equipment purchase assistance.

3. University of Hawai'i Support:

Grant for specialty equipment for hemp research, including:

- 1st Products No-Till 96-inch Grain Drill with corn plates.
- Roller crimper.
- [Formation Ag FiberTrack 118](#) Micro mobile decorticator.
- Used hay baler, rake, and mower.
- Support for Jari Sugano and Dr. Li's USDA application for hemp research at the Waimanalo Research Station, including a processing area and lab, seed variety trials, cultivation recommendations specific to Hawaii
- The University will submit a proposal for their final needs of which a budget of \$85,000 should be included for the equipment above

Findings Building Sector:

1. **Status in the Building Sector:** Hemp Home Hawai'i is importing hemp hurd for the purpose of developing a market for hempcrete homes by building demonstration homes on Maui. Ohana Nui Ventures and Friends of Waimanalo have been holding classes and demonstrating to their students that homes can be built with this locally grown material. Kauai Hemp Solutions is a startup looking to develop a hemp block production facility on the island of Kauai as well as a hemp block construction company.
2. **Uncertainty Surrounding Hempcrete:**

Commercial contractor Joseph Smith of [Hemp Home Hawai'i](#), River Young of [Hemp Solutions Kauai](#), and Scotty Wong of Ohana Hui Ventures note uncertainty around hempcrete construction in Hawai'i. Although some hempcrete homes have been built,

investors and banks are cautious. Hemp Solutions Kauai is looking to partner with Ohana Hui Ventures to grow 1,000 acres of industrial hemp on Kauai for construction.

3. Building Code Integration:

David Sellers, Principal Architect at [Hawai'i Off-Grid Architecture and Engineering](#) highlighted that hempcrete has been added to the 2024 International Residential Code¹ (IRC), but it has not yet been adopted by Hawai'i. State adoption would streamline local code updates, providing stability to the hempcrete industry and encouraging investment. Current emergency housing proclamations also limit actions by the state building code council. Adoption at the state level would facilitate county-level adoption and provide clarity and stability for hempcrete investors.

4. State Support for Hemp Products:

To develop a hemp industry, the State must encourage demand for hemp-based products. The early adapters of large-scale uses of hemp in Hawai'i will be for biofuels and construction materials with others to follow.

5. Housing Shortage Solution:

Hemp-based products could significantly replace building materials needed for Hawai'i's housing shortage. Hemp straw processed into construction materials offers zero waste. Given the urgent housing needs, experts advocate for developing hemp-based building products, infrastructure, plans, and demo houses. The development of a statewide industrial hemp industry would significantly benefit Hawai'ian housing needs while creating desirable jobs in the sector or construction materials manufacturing.

6. Secondary Construction Products:

It is important to support the early development of building materials made from hurd and bast fiber, such as:

- Pre-made hemp building blocks
- A prefab hempcrete factory

¹ 2024 International Residential Code: <https://codes.iccsafe.org/content/IRC2024P1/appendix-bl-hemp-lime-hempcrete-construction>

- A hybrid hemp/concrete block factory using existing cement block production infrastructure
- Research by companies like [HPM Building Supply](#) into locally made hemp products such as:
 - § Hemp fiberboards
 - § Hemp insulation
 - § Hemp sub-flooring
 - § Hemp roofing materials
 - § Hemp wall boards
 - § Hemp plastics
 - § Hemp flooring and trim boards
 - § Wood replacement materials

Recommendations Building Sector:

For a thriving hemp industry, primary raw materials must be in demand even before they are produced. This requires state investment in secondary industries to transform primary hemp products into value-added items. We recommend the following steps:

1. Convene a Task Force via RFP for interested groups: Assemble architects, engineers, and builders to:

- Review and update Hawai'i's building codes for hempcrete structures.
- Design three sets of [hempcrete house plans](#) and two accessory buildings for pre-permitted state-wide construction.
- Design one 500 to 1000 sq ft agricultural building using hempcrete and locally grown, borate-treated structural bamboo from [Whispering Winds Bamboo](#) of Maui.
- Develop a system of interchangeable panels for prefab housing using locally produced hempcrete.

2. Issue an RFP for the development of a Hemp Block Company:

- Developing blocks that are at least 50% hemp is an important value-added hemp product that could be produced in Hawaii for use in Hawaii
- The RFP should cover developing interlocking hemp blocks with an internal structural system for rapid construction.
- Using hemp blocks construct a demonstration building for state approval.

- Thoroughly research licensing technology for structural hemp/concrete hybrid blocks from the [University of Nebraska](#) and Global Fibers.
- These blocks, 50% lighter than standard CMUs, would replace some cement and aggregates currently imported with locally grown hemp.

3. Support Local Construction Material Manufacturers:

Create an RFP for R and D monies to encourage local manufacturers to develop techniques for producing the following from locally grown hemp:

- Hemp fiberboards
- Hemp insulation
- Hemp sub-flooring
- Hemp roofing materials
- Hemp wall boards
- Hemp plastics
- Hemp flooring and trim boards
- Wood replacement materials

All these products are currently found in the marketplace and existing technology could be licensed by a Hawaiian production facility for local sale with a significant job creation.

4. Prefab Panel Demo Building:

- Issue an RFP for a company to develop a prefab hempcrete building factory in collaboration with the Hemp Task Force and local truss companies.
- Turn the prefab panel designs into a demo building.
- Develop a comprehensive plan for a hemp prefab panel factory, detailing the support needed from the State.

Findings Biofuel Sector:

- 1. Current status of the biofuels sector:** The State of Hawai'i is very fortunate to be the home of Pacific Biodiesel with the processing capacity to process 3 million gallons of biodiesel from hemp as soon as the hemp seeds are harvested. In addition, Archipelago is a start-up working to bring anaerobic digestion technology to the state for the purpose

of producing RNG (renewable natural gas) from hemp. Both of these companies deserve State support.

2. **Both biodiesel and renewable natural gas (RNG)** can be produced from locally grown hemp using distinct processes. Biodiesel, derived from hemp seeds, has been produced for over 100 years and was initially used to power the first [Ford cars](#). This process is commercially viable with existing infrastructure in Hawai'i, primarily due to [Pacific Biodiesel's](#) efforts. Hemp biodiesel production can yield approximately 207 gallons per hectare (83 gallons per acre).
3. **RNG, on the other hand, is produced from the straw** of the hemp plant through anaerobic digestion of cellulosic biomass. This commercially mature technology is being developed for use in Hawai'i by [Agripelago](#), which aims to leverage industrial hemp for both food products and biomass biofuel production. Research from the Estonian Environmental Investment Center has demonstrated high yields from hemp biomasses.²
4. **Agripelago also highlights that anaerobic digestion** can utilize green leaves lost during current harvesting techniques. Collecting these leaves, even with THC content below 0.3%, raises suspicions that hinder progress in biofuels and alternative animal protein production. Utilizing the green stalk of hemp to produce biofuels offers a solution for farmers with crops exceeding the 0.3% THC threshold, ensuring they do not enter the consumables market.
5. **Pacific Biodiesel** currently produces over 6,000,000 gallons of biodiesel annually for the local Hawaiian market. They began nearly 30 years ago by making biodiesel from recycled cooking oil on Maui, later expanding to using grease trap waste and animal renderings. More recently, they have demonstrated Hawai'i's potential for a locally grown circular agricultural economy by growing sunflowers and safflowers, predicting that 80% of revenues generated would stay in the state while reducing dependence on imported fossil fuels. Their efforts with hemp, however, were stymied by political and social stigma and a lack of funding from local banks, forcing founders Bob and Kelly King to create a

² An Agro-economic Analysis of Briquette Production From Fibre Hemp and Energy Sunflower: <https://www.sciencedirect.com/science/article/abs/pii/S0926669013004834>

business entity in their personal names to proceed with experimentation.

6. **If these successful leaders** in climate change technology and environmental concerns faced such barriers, one can imagine the pressures on Hawaiian cannabinoid hemp growers. This challenge underscores the banking and commercial insurance difficulties experienced and reported by task force members and highlights the need for improved banking and commercial insurance support.
7. **With the acceptance of Industrial Hemp in Hawai'i**, Pacific Biodiesel's large processing plant on the Big Island is poised to produce hemp seed culinary oils, biodiesel, and waste cake animal feeds, leveraging existing infrastructure used for processing macadamia nut waste and sunflower and safflower oil seeds. This facility, employing over 100 people, is a critical asset for the future of hemp cultivation on the islands.

Recommendations Biofuel Sector:

1. Subsidies (a repeat of General Fibers Recommendation that affects Biofuels)

The State should subsidize hemp seed production at \$0.40 per pound of seed and hemp straw at \$300 per ton produced to stimulate production. Farmers needing support for upfront equipment purchases should have the option to take an advance on their subsidies.

2. Support Business Integration

The State should mitigate the business and banking stigma associated with hemp processing to support biodiesel and RNG production as well as the entire hemp industry.

3. Financial Incentives

The State should foster RNG and biodiesel production through grants, loans, tax incentives, and other financial mechanisms.

By addressing these areas, Hawai'i can unlock the full potential of its hemp biofuels industry, contributing to economic growth, job creation, environmental sustainability, and energy independence.

Findings Grain/Food Sector:

Hemp is increasingly recognized as a valuable food source, offering a range of nutritional and economic benefits.³ This document outlines the key reasons why hemp is an excellent addition to our food systems, particularly highlighting its high protein content, health benefits, and potential as a value-added food product.

1. **Current status of the Grain/Food sector:** Hawai'i excels at health food consumption and cottage industries. Currently there are no hemp seeds being grown in Hawai'i but once organic seeds can be produced, the 'Made in Hawai'i' food and beauty products markets will be prepared to capitalize on this new resource.
2. **Nutritional Benefits of Hemp**
 - **High Protein Content** Hemp seeds are an exceptional source of protein. Unlike many other plant-based proteins, hemp protein contains all nine essential amino acids, making it a complete protein source. This makes it an excellent option for vegetarians, vegans, and those with dietary restrictions that limit traditional protein sources such as meat or dairy.⁴ According to Agripelago Industries one acre of cultivated hemp can produce 2000 gals of Hemp Mylk.⁵
 - **Omega-3 and Omega-6 Fatty Acids** Hemp seeds are rich in Omega-3 and Omega-6 fatty acids, which are essential for maintaining heart health, reducing inflammation, and supporting overall well-being. These fats are also crucial for brain function and development.
3. **Health Benefits of Hemp**
 - **Digestive Health** Hemp seeds are high in fiber, which aids in digestion and helps maintain a healthy digestive tract. This can help prevent common digestive issues such as constipation and bloating.
 - **Allergy-Friendly** As the consumption of hemp-based protein increases, it provides a viable alternative for individuals with allergies to milk, wheat, and other common allergens. Hemp protein is hypoallergenic and can be safely

³ Medical News Today: <https://www.medicalnewstoday.com/articles/323037#nutrition>

⁴ <https://j cannabisresearch.biomedcentral.com/articles/10.1186/s42238-022-00156-7>

⁵ <https://www.agripelago.com/home/hemp-based-foods>

consumed by most people with food sensitivities.

- **Skin Health** Hemp oil, derived from hemp seeds, is beneficial for skin health. It is rich in essential fatty acids and vitamins that nourish and hydrate the skin, making it a popular ingredient in body products and supporting many *Made in Hawaii* cottage industries.

4. Economic and Market Potential

- **Value-Added Food Products** Seed has the potential for high value, often +50% of the value chain derivable from a dual use hemp crop.⁶ Hemp is most beneficial when utilized in value-added food products. Products such as hemp mylk, hemp flour, and hemp protein powder not only provide nutritional benefits but also offer higher market value compared to raw hemp seeds. These products require market development to fully realize their potential and achieve revenues beyond commodity seed pricing. With commodity seed pricing, there is still significant value, but larger scale production would be needed to compete with other North American producers.
- **Local Food Security** Processing hemp seeds for human consumption can significantly contribute to local food security. By producing hemp-based products locally, we can reduce reliance on imported foods and strengthen our local food systems.
- **Made in Hawai'i Label** Locally produced hemp products can benefit from the "Made in Hawai'i" label, which is expected to enhance their appeal in the marketplace. This label can help differentiate Hawai'i-grown hemp products from those produced elsewhere, adding value, and boosting local economies.

Recommendations Grain/Food Sector:

1. Eliminate Regulatory Barriers

The state should eliminate any unnecessary laws limiting the use of hemp seeds for animal consumption.⁷ This will help facilitate the development and

⁶ Grant Overton, CEO of Agripelago

⁷ University of Oregon White Paper: Identification of Research Priorities For the use of hemp By Products as Feed Ingredients for Livestock and Animals:
https://agsci.oregonstate.edu/sites/agscid7/files/hemp/2023-hemp_feed_workshop_white_paper.pdf

commercialization of hemp and its byproducts as an animal feed ingredient.

2. **Support for Product Development** The state should support requests for proposals (RFPs) from companies interested in developing and marketing hemp seed products. This can help stimulate innovation and growth in the hemp food industry.
3. **Dual-Use Potential** Hemp seeds have the potential for high value, especially when used for both food and biofuel production. The waste products from biofuel production can be repurposed as animal feed once legal restrictions are lifted.

By leveraging the nutritional benefits and market potential of hemp, we can create a sustainable and profitable food source that supports both human and animal health while boosting local economies.

Findings Cannabinoid Sector:

1. **Current Status of the Cannabinoid Sector:** There were a total of 101 active USDA licensed hemp farmers in 2020. In 2024 there are now only 58 active USDA licensed hemp farmers, 39 expired, and 4 surrendered (see attached addendum). In 4 years the number of hemp farmers has fallen by almost half. Only 4 of those USDA licensed hemp farmers have the HDOH hemp processing license. Of those 4 HDOH licenses, 3 are on the Hemp Task Force. Based on that math, it would appear that not only are a majority of the cannabinoid sales in Hawai'i from imported manufactured hemp products, the regulations in place and cost to stay in the cannabinoid industry are pushing cannabinoid farmers to leave the industry. While a significant amount of cannabinoid products are being imported to Hawai'i, there are some small farms that are growing and processing hemp. The 2024 USDA National Hemp Report states that the acreage is so small that they do not even have an accurate number of acres that are being grown in the state, which may also be due to a lack of reporting on the part of the hemp farmers or it may be that there really isn't much hemp being grown in the state.⁸ In 2021 the USDA Farm report said there were 17 acres of hemp grown, but there is no data from

⁸ USDA National Hemp Report 2024: <https://downloads.usda.library.cornell.edu/usda-esmis/files/gf06h2430/3t947c84r/mg74s940n/hempan24.pdf>

2022 onward, so it is very hard to get any idea of the size of the local cannabinoid market.

Based on interviews and surveys with the Task Force, most of them are not farming yet or have chosen to pause farming due to the uncertainty in rules and regulations surrounding the Cannabinoid Hemp Industry. The current local Cannabinoid Hemp industry is primarily made up of small-scale boutique farmers and there is a lack of data to truly understand the current local Cannabinoid Hemp industry.

2. Hemp grown for cannabinoids is a high value crop for local farmers in Hawai'i. Most of the farmers that grow hemp for flower also grow other crops which contributes to food security in Hawai'i. They also utilize the hemp to remediate their soil, as a companion crop or as a rotation crop. It is hard to make money in farming in Hawai'i due to higher labor costs, lack of access to water, variable weather conditions like fire, high winds, excess rain or lack of rain, and competition from out of state imports that are cheaper in the marketplace. The farmers want to be able to focus on farming and not have to constantly fight battles on new rules and regulations surrounding the cannabinoid industry. Being able to grow and sell a high value crop can enable them to keep farming, make money and support food security in Hawai'i.
3. One of the biggest concerns we have heard from local cannabinoid farmers and sellers is the competition from imported products and the lack of oversight on illegal products being sold in Hawai'i. Companies from the mainland and overseas are selling illegal hemp-derived cannabinoid products in Hawai'i with virtually no oversight. They are selling gummies and other edibles; hemp flower and hemp pre-rolls yet local farmers are not able to make or sell these products. Online retailers are also able to ship CBD products that are not legal in Hawai'i, like gummies to Hawai'i but local businesses that want to be compliant cannot legally make or sell them in Hawai'i. There are also CBD companies with Hawaiian names using misleading marketing tactics to make it seem as if these products were grown and made in Hawai'i when they were imported from the mainland. Hopefully the new labeling requirements will fix this, but if there is no oversight over illegal products being sold here currently, then who will be overseeing the new labeling requirements to make sure brands are complying with them?

4. According to many of the Task Force members, there is also a lot of uncertainty in the cannabinoid sector in Hawai'i when it comes to rules and regulations. According to many of the Task Force members, the goal posts keep moving every legislative session making it very hard for local hemp farmers and businesses to keep up. They are still waiting on clarification from the HDOH on some of those rules from HB 1359⁹ that was passed by the State legislature in May 2023, creating Act 263, which was enacted July 11, 2023 without the Governor's signature. Also, over regulation of production and processing has driven hemp farmers out of business.¹⁰ There were a total of 101 active USDA licenses in 2020. In 2024 there are now only 58 active USDA licensed hemp farmers, 39 expired, and 4 surrendered (see attached addendum). This highlights the fact that there have been barriers put into place for local hemp farmers, yet the cannabinoid industry is flourishing in the state due to the influx of out of state and international cannabinoid products being imported to Hawai'i at a detriment to the local farmers.
5. Many of the task force members do not want hemp regulated by the same entity that regulates cannabis as was proposed in HI SB 3335 that eventually died in the House.¹¹ A task force member stated that when hemp and cannabis were combined in Oregon, some of the hemp farmers lost their insurance and access to banking. They said that hemp economist Beau Whitney did a study on the effects of the comingling of hemp and cannabis in Oregon, but he would not share that data with us to confirm this when asked. (See addendum)
6. There are only 4 HDOH licensed cannabinoid processors in the state as of this writing. Yet there are 58 active USDA licensed hemp farmers in the state. We have been unable to gather information on where all of these farmers are processing their hemp. Many farmers on the Task Force do not have access to processing equipment. Some have asked for a shared processing facility while others want to process on their farms to save money from outsourcing.

⁹ HI HB1359: <https://legiscan.com/HI/bill/HB1359/2023>

¹⁰ Civil Beat-Hemp Farmers Are Fed Up With Government Regulations Hampering the Industries Potential: <https://www.civilbeat.org/2022/05/hemp-farmers-are-fed-up-with-government-regulations-hampering-the-industrys-potential/>

¹¹Hawai'i SB3335: <https://legiscan.com/HI/bill/SB3335/2024>

7. Kauai Hemp Company was set up as a vertically integrated grower/processor on Kauai who also offers [toll processing, white label, and formulation/cultivation consulting](#), yet not many farmers have been utilizing these services. Some of the reasons that farmers have not been utilizing their processing services have been due to inter island bulk hemp transport costs and regulations and additional testing requirements between harvest and end product. Other farmers have said that it is too expensive for them to process their flower with Kauai Hemp Company.

Recommendations Cannabinoid Sector:

1. **This recommendation addresses findings 2-6 above, with a complete list of feedback** from the cannabinoid farmers in **Task Force Feedback in section K.** of the accompanying report. After speaking to all of the cannabinoid farmers on the Task Force, we came to realize that many of their concerns were around rules and regulations that are affecting their businesses and a lot of this is very complex and they all had different things that were affecting their individual businesses. Our task per HB 1359 Act 263¹² was to address infrastructure needs, so that is why we are recommending that a separate Hemp-derived Cannabinoid Focused Task Force be created during the next legislative session in order to directly address the well-founded concerns of the cannabinoid farmers and business owners and come up with concrete solutions to help grow the hemp-derived cannabinoid sector in Hawai'i.

We recommend that this Task Force be made up of cannabinoid farmers as well as representatives from both the HDOA, HDOH and a representative from the Attorney General's office as well as a hemp economist who can bring all the relevant data to the table for discussions. This task force can have direct dialogue with the HDOA, the AG office and HDOH to come up with tangible solutions to help support and grow the local cannabinoid industry in Hawai'i and help create an even playing field with the out of state competitors. They also need to come up with a plan for oversight and determine whose role it is to monitor and take action against illegal products being sold in the state. They

¹² HB 1359 Act 263: https://hdoa.hawaii.gov/wp-content/uploads/2024/07/Act263-SLH2023-GM1377_HB1359-Hemp.pdf

feel that their voices are not being heard and more and more Cannabinoid Hemp farmers are leaving the industry due to the ever- changing regulations. They want to be able to voice their concerns and be informed of new potential legislation in a timely manner and not when it is about to hit the floor as what happened with the proposed HI SB 3335.

2. Small CBD processors are needed on Hawaii Island (ideally 2), Maui, and Oahu. Competitive grants for nonprofits and/or small businesses should be offered to establish processors on the three main islands. The Cannabinoid Task Force can go into more detail on what types of processors are needed.
3. Lab testing grants/subsidies for both cultivation testing for USDA and product testing for DOH. DOH testing is very expensive. This can be further investigated in the Cannabinoid Hemp Task Force.
4. Toll processing already exists on the island of Kauai where Kauai Hemp Company is fully licensed and legally set-up to safely process Cannabinoid Hemp for other farmers. Yet not many farmers are using this service and from what we have learned from members of the Task Force, is that they are nervous about the laws governing transportation of Cannabinoid Hemp as well as worried about the expense and also the degradation of the flower over a several day transit time. We recommend that the state subsidize the extra transport and processing fees that can help cover refrigerated shipping costs because hemp loses terpenes and compounds quickly if not in controlled environment: temperature and humidity (this can be hashed out further in the Cannabinoid Task Force).

Findings General:

1. Nomenclature Confusion:

There is significant confusion in the nomenclature surrounding hemp. The terms “Industrial Hemp” and “Hemp” are currently used interchangeably, causing confusion about applicable rules and regulations for different plant end uses. Industrial Hemp grown for construction should not be subjected to the same regulations as hemp grown for cannabinoids. The broad current definition is hindering the development of a

conventional Industrial Hemp industry due to the plant's similarities with Cannabis as they have differing end uses.

2. Market Growth:

The global hemp market is rapidly growing, from \$7.9 billion in 2023 to a projected \$47.82 billion in 2032.¹³ The Hawai'i Hemp Task Force unanimously believes that a vertically integrated hemp industry would benefit the state economy and support sustainability goals. By this we mean that all stages of the supply chain take place in Hawai'i: cultivation, processing, manufacturing, distribution and retail. However, there is a lack of statewide economic analysis for this potential new industry in the islands.

3. Environmental Benefits:

Studies show that hemp is remarkably proficient at extracting heavy metals like lead, cadmium, and nickel from contaminated soil, accumulating them in its tissues.¹⁴

University of Hawai'i research demonstrated that Industrial Hemp can metabolize 75% of residual atrazine in Hawaiian soil within 30 days. This capability suggests that growing hemp in burned areas of Lahaina could significantly aid large-scale remediation efforts.

Recommendations General:

1. Clarify the Definition of Industrial Hemp:

The House Agricultural Committee introduced verbiage in the 2024 Farm Bill, H.R. 8467 (§10006), passed by the House and now considered by the Senate.¹⁵ This bill would establish a new statutory definition of industrial hemp, distinguish it from hemp grown for cannabinoids, and relax certain regulatory requirements. If passed, the Hawai'i Legislature should incorporate similar definitions to create clear distinctions between cannabinoid and industrial hemp for both industries to progress.

¹³ Fortune Business Insights-Industrial Hemp Market Size:
<https://www.fortunebusinessinsights.com/industrial-hemp-market-102459>

¹⁴ NRFHH-Exploring the Potential of Industrial Hemp in Phytoremediation of Heavy Metals:
<https://www.nrfhh.com/Exploring-the-Potential-of-Industrial-Hemp-in-Phytoremediation-of-Heavy-Metals,176819,0,2.html>

¹⁵ Hemp Provisions in the Farm Bill and FY2025 Agriculture Appropriations Bill:
<https://crsreports.congress.gov/product/pdf/IN/IN12381>

2. Two Full Time Hemp Coordinator Positions:

- 1.) One within HDOA to provide technical assistance and administer grants for farmers and connect farmer stakeholders
- 2.) One within HDOH to provide technical assistance to cannabinoid hemp processors and manufacturers and administer grants. The HDOH position is not an enforcement position and absolutely should separate from the Cannabis Agency.

3. Support for Education:

We recommend grant funding from the Department of Education to support hemp education statewide:

- Launch a hemp educational campaign for residents and tourists to explain the difference between hemp and cannabis, promoting the benefits of Hawai'i grown hemp products in the state.
- Create an Industrial Hemp handbook in partnership with the Department of Agriculture, based on local seed trials and research, to guide farmers on best practices in Hawai'i. Similar to [this one](#) from California.
- Partner with and fund non-profits like Friends of Waimanalo to offer workforce training for hempcrete construction, benefiting new and existing farmers, as well as the building industry.

4. Workforce Training and Education:

Encourage the creation of workforce training and educational opportunities to teach the building sector about hemp building materials, creating new jobs and training professionals like carpenters and plasterers.

5. Support from the Carbon Market

- Hemp, known for rapid carbon sequestration, generates significant carbon credits. These credits could be sold to local airlines to offset tourist transportation emissions, thus supporting both eco-tourism and the hemp industry.
- This can be a fairly difficult process to maneuver for a farmer so to support farmers getting the full value of their verified carbon credits we recommend that

the State develop a staff position to help the farmers and primary and secondary processors in these negotiations.

6. Workforce Training and Education

Encourage the creation of workforce training and educational opportunities to teach the building sector about hemp building materials, creating new jobs and training professionals like carpenters and plasterers.

M. Definitions

Hemp: Defined as “the plant *Cannabis sativa* L. and any part of that plant, including the seeds thereof and all derivatives, extracts, cannabinoids, isomers, acids, salts, and salts of isomers, whether growing or not, with a delta-9 tetrahydrocannabinol [THC] concentration of not more than 0.3 percent on a dry weight basis” (7 U.S.C. §1639o).

Cannabinoids: No specific definition of cannabinoids exists in the U.S. Code. Cannabinoids refer to the unique chemical compounds produced in the *Cannabis sativa* plant, which are known to exhibit a range of psychological and physiological effects.

Cannabinoid Hemp *Floral hemp): Hemp used for the extraction of essential oils from plant resin, such as cannabidiol (CBD), cannabigerol (CBG), cannabinol (CBN), or other phytocannabinoids. Floral hemp includes smokable hemp.

Industrial Hemp: Hemp grown for fiber or for the “whole grain, oil, cake, nut, hull, or any other non-cannabinoid compound, derivative, mixture, preparation, or manufacture of the seeds of such plant,”

HDOH: Hawai'i Department of Health

HDOA: Hawai'i Department of Agriculture

USDA: United States Department of Agriculture

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O. Addendum

ACT 263 SLH 2023 HAWAII HEMP TASK FORCE MEMBERS

MEMBER NAME	BUSINESS NAME	ISLAND MEMBER	ACTIVE USDA LICENSED	DOH PROCESSOR	SECTOR REPRESENTED				
					Building	Cannabinoid	Fuel	General Fiber	Grain/Food
Brittany Neal	Hawaiian Hempstead	Hawaii Island	X			X			
Gail Byrne Baber	Hawaii Royal Hemp	N/A			X	X	X	X	X
Gloria Ilagan	Mauna Kea Trading Company, LLC	Hawaii Island	X			X			
Grant Overton	Agripelago Corporation	Oahu	X				X		X
Greg Smith	Earth Matters	N/A			X	X			
Janine Holstein	Maui Majesty, LLC	Maui	X	X		X			
Jared Dalgamouni	Hawaiian Choice	N/A				X			
Joseph Smith	Hemp Home Hawaii LLC	N/A			X				
Judiah McRoberts	Kauai Hemp Co (Omao Labs/Lands LLC)	Kauai	X	X		X			
Kelly King	Pacific Biodiesel Technologies LLC	N/A			X		X		
Kyle Leong	Hawaii Gold Farms LLC	Oahu	X		X	X	X	X	X
Liliana Napoleon	Napoleon Gentry, LLC	Molokai	X		X	X	X	X	X
Michele Matsuda	Kulele LLC	Oahu	X		X	X		X	
Qing Li	UH Manoa - CTAHR	Oahu	X		X	X			
Robert Bence	Hawaii Sustainable Farms	Maui	X		X	X	X	X	X
Scott Wong	Ohana Hui Ventures, Inc.	Oahu	X		X		X	X	X
Ty Cheng	Hemptuary Hawaii	Oahu	X	X		X			
Rusty Tapp	Kama'aina Ventures LLC	Hawaii Island	X			X			

USDA Licensed Hemp Growers as of May 2024					
Business or License Holder Name	License Number	City	State	Zip Code	Status
Mauna Kea Trading Company, LLC	USDA_15_0043	Captain Cook	Hawaii	96704	Active
Ryan Stone	USDA_15_0072	Haiku	Hawaii	96708	Active
Island Hemp LLC	USDA_15_0067	Hilo	Hawaii	96720	Active
Kapu Kine Farms LLP	USDA_15_0058	Hilo	Hawaii	96720	Active
Ryan Marshall	USDA_15_0097	Hilo	Hawaii	96720	Active
Young Michael Tarring	USDA_15_0084	Hilo	Hawaii	96720	Active
Agripelago Corporation	USDA_15_0095	Honolulu	Hawaii	96822	Active
American Hemp Growers	USDA_15_0104	HONOLULU	Hawaii	96817	Active
American Hemp Growers	USDA_29_0030	HONOLULU	Hawaii	96817	Active
American Hemp Growers	USDA_33_0038	HONOLULU	Hawaii	96817	Active
American Hemp Growers	USDA_37_0528	HONOLULU	Hawaii	96817	Active
American Hemp Growers	USDA_49_0051	HONOLULU	Hawaii	96817	Active
American Hemp Growers	USDA_50_0018	HONOLULU	Hawaii	96817	Active
American Hemp Growers	USDA_55_0347	HONOLULU	Hawaii	96817	Active
American Hemp Growers	USDA_C56206_0011	HONOLULU	Hawaii	96817	Active
American Hemp Growers	USDA_P13203_0005	HONOLULU	Hawaii	96817	Active
Dong Chul Choi	USDA_15_0099	Honolulu	Hawaii	96813	Active
Hawaii Gold Farms, LLC	USDA_15_0071	Honolulu	Hawaii	96816	Active
Intellectual Ag LLC	USDA_15_0015	Honolulu	Hawaii	96814	Active
James E Wilson Jr	USDA_15_0101	Honolulu	Hawaii	96830	Active
Jon Windham	USDA_15_0059	Honolulu	Hawaii	96813	Active
Kulele LLC	USDA_15_0012	Honolulu	Hawaii	96707	Active
Timer Hawaii Collective	USDA_15_0091	Honolulu	Hawaii	96816	Active
Zane DeMello	USDA_15_0094	Honolulu	Hawaii	96816	Active
Cucun Lam	USDA_15_0082	Honomu	Hawaii	96728	Active
Dong Wei	USDA_15_0081	Honomu	Hawaii	96728	Active
Brittany Neal	USDA_15_0003	Kaeaa	Hawaii	96749	Active
Eric D. Freitas	USDA_15_0083	KAILUA	Hawaii	967342332	Active
Kona Coast Botanicals LLC	USDA_15_0070	Kailua Kona	Hawaii	96740	Active
Lono Holdings, LLC	USDA_15_0029	Kamuela	Hawaii	96743	Active
Hi 2 O LLC	USDA_15_0031	Kaneohe	Hawaii	96744	Active

Procana Hawaii LLC	USDA_15_0004	Kapolei	Hawaii	96707	Active
Napoleon Gentry, LLC	USDA_15_0069	Kaunakakai	Hawaii	96748	Active
David Neal Rieck	USDA_15_0087	Keaau	Hawaii	96749	Active
Hokukano Ranch, Inc.	USDA_15_0063	Kealakekua	Hawaii	96750	Active
Jason Fried	USDA_15_0107	KILAUEA	Hawaii	96754	Active
Nancie Bean	USDA_15_0061	Kilauea	Hawaii	96754	Active
Janine Holstein	USDA_15_0045	Kula	Hawaii	96790	Active
Maui Majesty LLC	USDA_15_0026	Kula	Hawaii	96790	Active
Pan Pacific Ventures, LP	USDA_15_0030	Kula	Hawaii	96790	Active
Robert Bence	USDA_15_0102	KULA	Hawaii	967908705	Active
Ronald Dickson	USDA_15_0047	Kula	Hawaii	96790	Active
Omao Labs LLC	USDA_15_0106	Lihue	Hawaii	96766	Active
Omao Lands LLC	USDA_15_0009	Lihue	Hawaii	96766	Active
Atto Assi	USDA_15_0086	Mountain View	Hawaii	96771	Active
James Haberer	USDA_15_0079	Mountain View	Hawaii	97661	Active
Kamaaina Ventures LLC	USDA_15_0068	Mountain View	Hawaii	96771	Active
Michael Ruggles	USDA_15_0066	Mountain View	Hawaii	96771	Active
Kip Riihiluoma	USDA_15_0105	Mt View	Hawaii	96771	Active
Annette Keanu	USDA_15_0108	NAALEHU	Hawaii	967721162	Active
Bobbie Beevers	USDA_15_0073	Naalehu	Hawaii	96772	Active
John Douglas Beaton	USDA_15_0080	Paaulo	Hawaii	96776	Active
Satomi Yamanaka	USDA_15_0103	Waialua	Hawaii	96791	Active
Waianae Valley Farms	USDA_15_0078	Waianae	Hawaii	96792	Active
Maui Best Inc.	USDA_15_0076	Wailuku	Hawaii	96793	Active
Solvate Services LLC	USDA_15_0053	Wailuku	Hawaii	96793	Active
Sunshine Farming Inc	USDA_15_0075	Wailuku	Hawaii	96793	Active
Ohana Hui Ventures, Inc	USDA_15_0093	Waimanalo	Hawaii	96795	Active
Proxarus Inc.	USDA_15_0064	Waimanalo	Hawaii	96795	Active
Business or License Holder Name	License Number	City	State	Zip Code	Status
Curt Hiraga	USDA_15_0019	Aiea	Hawaii	96701	Expired
Hillary Leano	USDA_15_0021	Aiea	Hawaii	96701	Expired
No Ka Oi Orangics	USDA_15_0010	Ewa Beach	Hawaii	96706	Expired
Aloha Green LLC	USDA_15_0033	Hilo	Hawaii	96721	Expired
Corey Ogles	USDA_15_0057	Hilo	Hawaii	96720	Expired

Goodbye Kitty LLC	USDA_15_0037	Hilo	Hawaii	96720	Expired
Maulua Investments LLC	USDA_15_0035	Hilo	Hawaii	96721	Expired
Ono Nut Farms, Inc.	USDA_15_0044	Hilo	Hawaii	96720	Expired
Shropshire Group LLC	USDA_15_0034	Hilo	Hawaii	96721	Expired
TROPICAL SUNSET FARMS LLC	USDA_15_0002	HOLUALOA	Hawaii	96725	Expired
AJA Nursery, LLC	USDA_15_0018	Honolulu	Hawaii	96825	Expired
HC Ventures Inc.	USDA_15_0039	Honolulu	Hawaii	96839	Expired
New Pineapple Properties Limited	USDA_15_0007	Honolulu	Hawaii	96819	Expired
Vespucci Collective Inc.	USDA_15_0008	Honolulu	Hawaii	96822	Expired
AINA Hawaiian Tropical Farms LLC	USDA_15_0040	Honomu	Hawaii	96728	Expired
Gail Byrne Baber	USDA_15_0001	KAMUELA	Hawaii	96743	Expired
Hawaii Royal Hemp	USDA_15_0025	KAMUELA	Hawaii	96743	Expired
Leif Lindsey	USDA_15_0062	Kamuela	Hawaii	96743	Expired
Lisa Cash	USDA_15_0049	Kamuela	Hawaii	96743	Expired
Lono Holdings, LLC	USDA_15_0041	KAMUELA	Hawaii	96743	Expired
Leia Gardem, LLC	USDA_15_0050	Kapolei	Hawaii	96707	Expired
Imua Energy, LLC	USDA_15_0016	Kihei	Hawaii	96753	Expired
Mina Yamagaki	USDA_15_0005	Kihei	Hawaii	96753	Expired
R-Dam LLC	USDA_15_0011	Kihei	Hawaii	96753	Expired
R-Dam LLC	USDA_15_0038	Kihei	Hawaii	96753	Expired
Aina O Ho'okupu O Kilauea	USDA_15_0046	Kilauea	Hawaii	96754	Expired
Hawaii Organic Nutraceuticals Inc.	USDA_15_0020	Kilauea	Hawaii	96754	Expired
Jaime Means	USDA_15_0048	Kilauea	Hawaii	96754	Expired
J. Hearl, LLC	USDA_15_0042	Kula	Hawaii	96790	Expired
Ahimsa Sanctuary Farms, LLP	USDA_15_0055	Makawao	Hawaii	96768	Expired
Evoke Innovative Solutions Inc.	USDA_15_0060	Makawao	Hawaii	96768	Expired
Mauna Loa Farms, LLC	USDA_15_0013	Mountain View	Hawaii	96771	Expired
Gregory Smith	USDA_15_0027	Naalehu	Hawaii	96772	Expired
Ronald Foreman	USDA_15_0024	Ninole	Hawaii	96773	Expired
Marianne Fong	USDA_15_0017	Pepeekeo	Hawaii	96783	Expired
Hawaiian Hempyre Farms LLC	USDA_15_0036	Volcano	Hawaii	96785	Expired
Martin and Associates LLC	USDA_15_0032	Volcano	Hawaii	96785	Expired
Carefree CBD LLC	USDA_15_0006	Waialua	Hawaii	96791	Expired
Bradley Bayless	USDA_15_0028	Wailuku	Hawaii	96793	Expired

The Maui Third Wave	USDA_15_0014	Wailuku	Hawaii	96793	Expired
Business or License Holder Name	License Number	City	State	Zip Code	Status
Lindsey Andrews	USDA_15_0089	Hilo	Hawaii	96720	Surrendered
Loud Goat Farms LLC	USDA_15_0054	Kapaa	Hawaii	96746	Surrendered
Maurice Munechika	USDA_15_0023	Lihue	Hawaii	96766	Surrendered
Cultivation Sector Consulting	USDA_15_0085	Makawao	Hawaii	96768	Surrendered



QUOTE

1560 Hastings Crescent SE
Calgary, Alberta, T2G 4E1
Phone 1-877-622-3354

DATE: May 3, 2024
INVOICE #

Bill To: **Ship To:** Honolulu, HI

Comments or Special Instructions:

40ft Seacan of Hurd for Hempcrete to Honolulu

P.O. NUMBER	SHIP DATE	SHIP VIA	F.O.B. POINT	TICKET NUMBER	TERMS
	TBD	TBD			50% deposit, 50% at ship

QTY (bags)	DESCRIPTION	UNIT PRICE	TOTAL
960	Hurd for Hempcrete- 65L Bags	\$ 24.90	\$ 23,904.00
	Freight (Calgary, AB to Honolulu, HI)- Estimate		7,812.00
SUBTOTAL			\$ 31,716.00
GST# 76586 6801 RT0001			
TAX			\$ -
TOTAL (USD)			\$ 31,716.00

III. CURRENT PROCESSING REGULATIONS (applies to cannabinoids only) – HI DOH

- Must apply to DOH for a processing license,
- Must pass background check or have USDA hemp license with passed FBI background check
- Requirements and restrictions for a processing license,
- Act 263 (no rules yet) - Hemp farmers may process in non-permitted agricultural buildings and Food Hubs if the farmers are using non-volatile compounds or compressed gases, e.g. extracting hemp oil using ice, water, or coconut oil. Buildings must be enclosed structures such as steel retrofitted shipping containers.
- Must comply with good manufacturing processes,
- Concentrated hemp extract may not be sold to consumers.

IV. CURRENT MANUFACTURING REGULATIONS (applies to cannabinoids only)

For using hemp cannabinoids as an ingredient in a hemp cannabinoid product:

- Only legal hemp cannabinoid products are tinctures and external products such as lotions, salves, soaps, etc.
- Manufacturing should follow good manufacturing processes,
- All final products sold to consumers must be tested to the highest requirements for any hemp CBD products of any state in the U.S.,
- Lab reports (certificate of analysis) must be posted on company websites for every batch of CBD products manufactured so the public can see for themselves the products are compliant with THC levels, accurate regarding compounds advertised, and free of pollutants (metals, mycotoxins, etc.)
- Act 263 (HB 1359): Labels must disclose where (the origin) of where the hemp was grown for all hemp products, including CBD, and must state, if the origin is not Hawaii where the hemp was grown and percentages if it is a mixture of origins.
- Manufacturing location must be on label.
- Act 263 (HB 1359) gave DOH the authority to introduce new products and set THC dose limits. For instance, gummies and flower products are not currently legal. Act 263 allows DOH to set non-intoxicating limits for THC in new products, such as gummies. New 2024 legislative session introduced HB 2449/SB3138 that clarifies that DOH can add products by rules.

Hawaii Hemp Industry Opposed to Including Hemp Cannabinoids in Rec Cannabis Bills

Pull all hemp, *including* cannabinoid hemp, out of the recreational marijuana bills, HB 2600 and SB 3335. See letter addressed to the members of the legislature for additional detail, file named, *Answers_to_Questions_Hemp_Impacts_from_Rec_Cannabis_Bills_240124_signed.pdf*

1. The USDA and FDA will be addressing the cannabinoid hemp issues this year, changing and establishing new regulations. It makes no sense to establish a new regulatory structure in Hawaii for hemp at this point, especially since the problem gummy and vape products, which are imports, are not legal and the authority for the state to enforce on these products in Hawaii has been established and confirmed by federal court, according to DOH. The problem is an enforcement issue.
2. Data from experts shows that co-mingling regulatory programs, legislation, or rules for marijuana (a federally illegal schedule 1 drug) with hemp (a federally legal crop) can result in the loss of essential business services such as banking and insurance to all hemp sectors (building, fiber, food, CBD).
3. If Hawaii hemp farmers, processors, and manufacturers lose their hemp business services such as banking, nutrition, they can't afford the services offered to marijuana businesses. Monthly banking fees for marijuana businesses average \$2,500 per month (range \$1,500 to \$5,000).
4. It is more costly for the state to include in the cannabis commission regulatory framework.
5. The American Banking Association does not want the risk of providing financial services to any hemp business because of the co-mingling of hemp and high THC cannabis policy and regulations in several states.
6. Despite what the director of the Oregon Liquor and Cannabis Commission may have stated about the hemp industry in Oregon last week, we have confirmed that hemp farmers and hemp processors and manufacturers have been impacted in Oregon by the regulatory structure has impacted business services. Ken Iverson of Iverson Farms - <https://www.iversonfamilyfarms.com> - one of Oregon's largest hemp farms and farmers has been told by his bank and insurance company that he will lose both services if he grows hemp this year. Ken does not grow for intoxicating products. The OLCC must not be aware of this situation.
7. 2023, Whitney Economics testified before the Oregon Legislature confirming that hemp farmers and processors have lost \$75 million to \$100 million due to the change in cannabis regulatory policy in Oregon that placed cannabinoids under the OLCC.
8. There are no functional regulatory gaps regarding hemp in Hawaii. There *is an enforcement gap* on illegal products such as high THC gummies and vaping, which are imports. It is

easy to identify illegal products and sweep them off the shelves. See regulatory structure on next page.

9. Hawaii is a unique agricultural state, especially given our islands and geographic spread. Often what works on the mainland for agriculture (farming methods, cultural and regulatory structures) does not work here. Hawaii's hemp industry (what is grown and made here – not imports) is different from the mainland with much smaller farm sizes, restraints for processing due to being an island state, no multi-state operations (MSOs), no legal gummy or food or beverage products, and Hawaii hemp farmers are still rebounding from onerous rules that prevented farmers from moving hemp off their farms for years, etc. The Legislature can't guarantee that Hawaii hemp farmers and businesses will not lose their banking, insurance, or other hemp business services as a result of this proposed cannabis regulatory framework. No hemp farmer, processor, or manufacturer should be put out of business because the state legalizes recreational marijuana.

SUMMARY OF EXISTING HEMP REGULATIONS IN HAWAII

Cultivation, Processing, Manufacturing

I. CURRENT CULTIVATION REGULATIONS

USDA

- Must pass FBI background check and fingerprinting for a license to cultivate,
- Every planting is entered into USDA database and the designated purpose of the planting, e.g. food, cannabinoid, hempcrete, etc.
- Every harvest requires inspection and testing by USDA approved laboratory,
- Every harvest must pass USDA inspection and lab test or crop is destroyed,
- Each hemp variety or planting area requires a separate test,
- All lab tests must be entered into USDA database,
- Law enforcement has 24/7 access to USDA database and can see where all hemp plants are in real time as well as designated use of plants after harvest

HI DOA

- Requires USDA license,
- Act 263, 2023: 300 ft buffers from public spaces such as parks and schools and 100 ft of dwellings not owned or controlled by the hemp licensee, except for farms that were part of the initial hemp pilot project,
- Law enforcement may enter at any time if there is sufficient concern marijuana is being grown illegally,

II. CURRENT TRANSPORTATION REGULATIONS

HI DOA

- Transport of harvested hemp can only be between USDA licensed farms or a licensed processor,
- All hemp transportation must be reported to the State DOA,
- All transport must include a copy of the farmers USDA license and lab test,



January 24, 2024

RE: Answer to Questions Posed During Hemp Discussion with Subject Matter Experts Regarding HB 2600 and SB 3335: Impacts to Hawaii's Hemp Industry

Aloha,

Thank you for attending the discussion on hemp and the impacts of the proposed recreational cannabis bills (HB 2600 and SB 3335) on the Hawaii hemp industry and discussion with subject matter experts, economist Beau Whitney and attorney Anne van Leynseele. Below are answers to questions that were posted in the Zoom chat and discussed but not directly answered in the chat.

The questions seek to understand why combining hemp and recreational cannabis under one bill and one regulatory structure/commission will negatively impact hemp. **Why would all hemp sectors lose the support services of banking, insurance, marketing platforms etc. because of the proposed rec cannabis bill, and why would this recreational cannabis bill impact all hemp sectors (food, fiber, fuel, etc.), not just cannabinoids?** Answer number three on page two is nuanced but very important.

The below answers are based on the outcomes and data from 17 states that combined hemp and recreational and/or medical marijuana legislation with hemp. Mr. Whitney predicted the economic impact of similar cannabis legislation in one state would result in a 0.3% increase in unemployment across the state. Post implementation data showed his prediction to be dead on at 0.3%. Both Mr. Whitney and Ms. van Leynseele have extensive experience in numerous states with respect to on-the-ground hemp and rec cannabis and medical marijuana regulations and policy. Each has and still does consult with state and federal government agencies on how to "fix" recreational cannabis, medical marijuana and hemp programs and Mr. Whitney consults internationally. We are hopeful that the Hawaii Legislature will heed these experts' advice: pull all hemp elements out of the proposed recreational cannabis bill(s) and focus on implementing HB 1359/Act 263.

The answers to the above questions center on three primary facts:

- 1.) Hemp is a legal crop at the Federal level and marijuana and recreational cannabis aren't legal at the Federal level. Under the Controlled Substances Act, marijuana is still a Schedule 1 drug along with heroin, lysergic acid diethylamide (LSD), 3,4 methylenedioxy-methamphetamine (ecstasy), methaqualone, and peyote.
- 2.) The impacts to non-cannabinoid hemp sectors (food, fiber, fuel, etc.) due to regulatory uncertainty and changes in the regulatory landscape is significant. In 2022, there was a \$20 billion loss of investment and economic impact nationally to the food and fiber hemp

sectors due to regulatory uncertainty and changing regulatory landscape according to Mr. Whitney's work. It is estimated that Oregon lost \$100,000,000 during this same time due to shifting regulatory frameworks. Most Hawaii hemp farmers can enumerate how Hawaii hemp regulations, which have been the most onerous in the U.S., have scared off investment in hemp operations in Hawaii in the last five years. The proposed recreational cannabis bill is a shockwave to the hemp regulatory landscape for Hawaii and will have consequences to all hemp sectors if hemp is not removed.

- 3.) Vital business service companies don't want the risk of co-regulation, co-mingling. Once a state declares that the hemp industry is regulated under the same legislation, rules, and/or programmatic framework such as a cannabis commission or board as the agency that regulates marijuana and rec cannabis, hemp support companies (banking, insurance, marketing, etc.) don't want to be responsible for differentiating between legal hemp and medical marijuana and recreational cannabis.

The banking industry is a good example of lost services to hemp businesses while marijuana businesses are not impacted. This vital business service refuses to risk responsibility for differentiating between marijuana and hemp sources of funds when states blur the lines through co-regulation and co-mingling of oversight, and force the marijuana standard on the legal hemp products. For example, banks and credit unions that allow business accounts for licensed marijuana have compliance teams that review all revenue that enters the account and compare it with published data on sales figures for each license. Banks and credit unions charge from \$2,500 to \$5,600 dollars per month to marijuana companies for the added work of the compliance team. Hemp companies are being denied an account in states that have co-mingles regulatory frameworks because the data for hemp sales are not tracked by states combing the regulation of marijuana and hemp. Hemp companies under the marijuana regulatory requirement cannot afford these monthly fees and in most states co-regulating, banks and credit unions have refused to open accounts since early 2021. So hemp companies have no business account or are forced to lie and open accounts under obscure names. Many have received 30-day closure notices from banks and credit unions, and cannot find another place to bank.

If regulators don't *clearly* differentiate between hemp derived cannabinoid products and marijuana products with separated programs, legislation, and rules, the hemp support companies/businesses don't want the risk of responsibility of potentially accidentally supporting a scheduled drug and having to sort through the differences once co-mingled. It is costly, complex and confusing for the hemp support business services (hence the below questions from the Zoom meeting) and as a result hemp companies, not rec cannabis companies are denied services or can no longer afford them if they are still offered.

The impact of co-mingling regulatory frameworks in other states has already impacted hemp business in Hawaii and if this proposed recreational cannabis bill moves forward with any hemp elements, the impact will be costly and devastating to all Hawaii hemp sectors.

When the hemp regulations and hemp programs are clearly separated, it provides the risk mitigation that these hemp support businesses require and they will continue to support the hemp industry, all sectors.

Why are all hemp sectors impacted by the AG recreational cannabis bill?

- 1.) The continually shifting hemp regulatory landscape has impacted all hemp sectors as outlined in number two above, creating significant losses to the food and fiber industry. The intent of the farmers that helped found the Hawaii hemp industry was to use the value added products of hemp to subsidize food production.
- 2.) The hemp support businesses do not differentiate between hemp sectors for several reasons. (1) it is impossible for support business to know whether the funds deposited are from hempcrete for housing or from hemp cannabinoid products; (2) it is impossible for support business to determine if deposited funds are from federally legal hemp cannabinoid products or not (FDA allowed list: resin may be used in oils, lotions, cleansers, bath or other pharmaceutical (tinctures) or topical products); and (3) despite the U.S. Treasury's Financial Crimes Networks (FinCEN's) 2020 policy guidance, banks and credits unions are following state's lead and lumping all hemp companies together. Please see attached FinCEN_Hemp_Guidance_508_FINAL. The proposed Hawaii recreational cannabis bill(s) jeopardize hemp support services for all hemp sectors (food, fiber, etc.) and without these services hemp sectors that include affordable housing can't function or receive investment.

Problem Summary

The 2024 proposed Hawaii recreational cannabis bill(s) does *not* provide clear separation between hemp and medical marijuana and recreational cannabis as it combines a an illegal Schedule 1 drug in one piece of legislation and under one regulatory commission (and shared rules) with a Federally approved crop, hemp. The proposed rec cannabis legislation itself, by including cannabinoid hemp, muddies the water for hemp business service companies, putting all Hawaii hemp businesses (including food and housing materials for affordable housing projects) at risk of losing vital business services and investment.

Solution

Keep hemp separated from medical marijuana and recreational cannabis. *Don't* combine them in legislation, regulations, rules, or programmatic frameworks. Implement Act 263, which provides DOH with the authority to 1.) authorize new hemp products if DOH so chooses (if it wants to make gummies legal) and 2.) set limits on THC for new hemp products (gummies).

As attorney Anne van Leynseele (specializing in hemp and cannabis law for 11 years) shared

yesterday, enforcing on gummies now is easy because all gummy and vape products are illegal in Hawaii, so there is no requirement to differentiate between intoxicating and non-intoxicating gummies (less than 5 mg THC per serving). If DOH decides it wants to legalize non-intoxicating gummies, it has the authority to do so. If funding restricts field enforcement for non-compliant hemp products, a DOH hotline can help target administrative enforcement. But the key is to keep hemp and medical marijuana and recreational cannabis distinct in the state with respect to legislation, rules, and programmatic framework.

Unintended Consequences

1. According to subject matter expert, Anne van Leynseele (hemp and cannabis law for 11 years), based on her experience, sweeping in cannabinoid hemp into the regulatory framework of rec cannabis will make rulemaking and changing or updating regulations very difficult as multiple sectors have to agree to the proposed changes. The proposed Hawaii rec cannabis bill with hemp is exactly the type of bill that is too big and slows down rulemaking and makes functional, efficient changes (as is required with any emerging industry) very difficult and costly to businesses and the State.
2. The costs to set up a recreational program that includes hemp cannabinoids will increase the costs to the State, local hemp farmers, and local processors and manufacturers.
3. This bill would further force Hawaii consumers to purchase unreliable internet hemp cannabinoid products *imported* from overseas and the U.S. mainland and, potentially unwittingly, break federal and Hawaii laws by importing gummies and other infused food and beverages and vapes.

Online Sales

Forty percent (40%) of CBD sales are online. Hawaii gummies and vape products are mostly imports, even those products with Hawaii branding are manufactured on the mainland or import cannabinoids from China or the mainland because it is so much less expensive than using Hawaii produced cannabinoid oil. It is not feasible for a Hawaii farmer to sell cannabinoid oil to someone else to make value-added products because a Hawaii farmer has to charge much more than a mainland or overseas supplier because our farming costs are so high. Hawaii farmers typically get 20% less than mainland farmers. The only place a Hawaii hemp farmer makes money (and many food farmers) is by selling a value-added product directly to the consumer.

Answers to Specific Questions from the Zoom Chat

Q 1. How would having a cannabis agency regulate both cannabis and hemp be different from having the office of medical cannabis regulate both cannabis and hemp?

The Department of Health is *not* a cannabis agency. Even though hemp was unilaterally moved under the Office of Medical Cannabis Control and Regulation of the Department of Health, our

legislation (Act 263 and previous Acts) and our rules remain separate from medical marijuana and rec cannabis acts and rules and there is no Cannabis Board of Commission now which lumps hemp with rec cannabis or medical marijuana. *Functionally, legislatively, programmatically, and with respect to rulemaking and regulations, the Hawaii hemp industry is currently clearly separated from medical marijuana and recreational cannabis.* The proposed recreational cannabis bill erases these divisions, setting the stage for wiping out the hemp industry through loss of business support services and investment per above and adding additional business requirements that farmers and the industry can't afford. Mr. Whitney confirmed that the economic burden of the proposed Hawaii rec cannabis bills is a business killer for the Hawaii hemp industry.

Without consulting the hemp industry, the hemp rulemaking for processing and product manufacturing per Act 263 and previous acts was moved under the DOH Office of Medical Cannabis Control and Regulation program. We understand the dispensaries opposed this move and no one in the hemp industry was consulted. The timing of the move, July of 2023, is aligned with the Attorney General's timeline for beginning the work on a rec cannabis bill. The Hawaii hemp industry found out about the move after the fact. If DOH prefers hemp remains under the Office of Medical Cannabis, so be it, but do not blur the lines anymore between recreational cannabis, medical marijuana, and hemp or, as has been shown in other states, the hemp industry will be severely impacted, likely decimated.

Q.2. Have you seen any banking impacts currently because hemp is regulated by the office of medical cannabis?

There are already impacts from the co-mingling of regulatory frameworks in other states to Hawaii hemp farmers with regard to insurance. One of our member's farm insurance was cancelled without notice 18 months ago by Lloyds of London. When our farmer pursued an answer to why their insurance was canceled the reason given was because the farm grows hemp. The farmer didn't give it too much thought and moved on to securing insurance but has been unsuccessful to-date. Today, we learned from the expert cannabis attorney that joined us on the Zoom meeting, Anne van Leynseele, that Lloyd's of London quit insuring hemp businesses, like our Hawaii hemp farmer's farm, because of the co-mingling of regulatory frameworks at the U.S. state level - combining hemp and marijuana under a regulatory framework. Given the experience of 17 other states, the proposed rec cannabis bill would only multiply this problem across Hawaii in a short amount of time. There are a number of national hemp organizations that monitor hemp legislation across the U.S. and hemp business support services will quickly become aware of the proposed co-mingling of hemp and medical marijuana and rec cannabis under one legislative act and regulatory framework of a cannabis commission or board.

Q.3. How does regulating the intoxicating cannabinoids under Act 263 differ from regulating the intoxicating cannabinoids under the Adult Use bill?

Act 263 is only about hemp; no rec cannabis or medical marijuana is mentioned or part of Act 263. There is a very clear line of separation. The rec cannabis bill/adult use bill co-mingles hemp and rec cannabis and medical marijuana legislatively, creates a combined regulatory framework with related rulemaking and programmatic functions (hemp regulated under a future Cannabis Board

that also oversees medical marijuana and recreational cannabis).

Further, hemp products that are the issue (intoxicating gummies and vaping) are not legal under Act 263. There are no current legal products (tinctures, salves, lotions, etc.) that are the issue. Act 263 does give DOH the authority to legalize these currently illegal products (gummies) and set limits to ensure any new hemp cannabinoid product is *not* intoxicating (less than 5 mg THC per serving of edibles or whatever DOH decides). It is not difficult to enforce on gummies – no label or testing is required because they are just not legal currently.

Regulating any hemp cannabinoid under the Adult Use bill/proposed recreational cannabis bill will jeopardize all hemp sectors as outlined in previous sections (loss of support services, additional economic burdens and loss of investment).

Q.4. And how does regulating intoxicating hemp cannabinoids under Act 263 not affect the farmers creating non intoxicating hemp products (hempcrete, ropes, fibers...) but the regulating of intoxicating hemp cannabinoids will affect the farmers growing non intoxicating hemp?

Regulating cannabinoid hemp products under Act 263 will not impact the rest of the hemp sectors because of the clear division of legislation, rules, and programmatic framework. The *imported* gummies and vaping which are not legal under Act 263 and not made here are the problem. Act 263 provides the pathway for DOH to ensure that the *ONLY* hemp cannabinoid products sold in Hawaii are non-intoxicating and if DOH adds gummies to the list of allowed products in Hawaii, DOH has the authority to set non-intoxicating limits for gummies. Functionally, a great deal of the cannabinoids used in the imported gummies and vape products is grown on yeast in China. That is why Mr. Whitney and Ms. van Lynseele made a joke about the need to regulate yeast during the Zoom call. Per the above sections, if hemp is kept under Act 263, then there is no co-mingling of hemp with medical marijuana and recreational cannabis, and the hemp support businesses (banking, insurance, marketing, etc.) have the confidence to continue to provide services to all hemp sectors, including hempcrete, fiber, food, etc.

Thank you for your interest in hemp and we are happy to answer or ask Mr. Whitney or Ms. van Lynseele to answer your questions.

Respectfully,

<i>Gail Byrne Baber</i>	<i>Grant Overton</i>	<i>Brittany Neal</i>
Gail Byrne Baber	Grant Overton	Brittany Neal
President	Vice President	Vice President

Overview of the CEMS-50 Ethanol CBD Extraction System

Sourced in China this is turnkey ethanol extraction equipment for making full spectrum CBD crude oil. This system can process 10 kilograms (22 lbs) of dried and shredded hemp flowers per hour. The basic system costs \$155,000, \$13,000 for installation and education and \$5600 for shipping. It will also require a 400 sq ft processing room and a separate room for drying and shredding. From this process can be expected .9 kilograms of crude oil per hour. Delivery time is about 120 days and about two weeks to install and train staff at a rate of \$200/day plus travel and per diam.

This turnkey set up comes with all required cooling, heating and vacuum.

The main processes of this system are:

- dehydration unit
- shredding unit
- chilling section for taking cane ethanol down to 40°C for cold extraction
- extraction section for biomass extraction
- filtration section
- evaporation section for recovering ethanol
- concentration section for making full spectrum OK oil

With an add on Molecular Distillation System that will cost an additional \$29,500 the system will produce .675 kilograms of distillate per hour.

With an additional add on of a Crystallizing System costing \$17,000 isolates can be produced at a volume .4kg per hour from the same 10Kg/hr of dried and shredded flowers.

MODULAR DESIGN WITH SCALABILITY FOR ALL POSSIBILITIES



Installation

MODULAR



Winterization

-60 °C



Automation

OPTIONAL



Processing

~80 LBS /CENTRIFUGE



Ethanol Recovery

~97%



Capacity

CUSTOMIZABLE



Product

CRUDE

C E M S



* Actual layout and structure may vary for different needs.



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🌐 www.pureyindustry.com

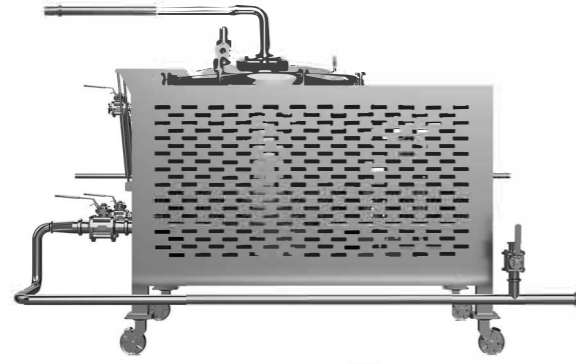
📍 808, Haitong Rd.,
Wenzhou, ZJ, 325025
China

CENTRIFUGE EXTRACTION MODULAR SYSTEM



PRE-CHILLING

- MOC SUS304
- Dimple jacketed
- Fully insulated
- -60°C / -76F working temperature
- From 52 gal to 260 gal
- Level control system (optional)
- Flow rate control (optional)
- Movable skid with brakes



CENTRIFUGE

- MOC SUS316L
- Jacketed and insulated
- Scalable for massive processing
- From 25 LBS to 80 LBS each
- Biomass to ethanol ratio 1 LBS to 1 gal
- Level control system (optional)
- Siemens control PLC (optional)
- Unique design
- Movable skid with brakes



FILTRATION

- MOC SUS304
- Filter model optional:
bad filter 50 micron; micro filter;
titanium rod filter
- Holding tank integrated
- Transfer pump integrated
- Level control system (optional)
- Movable skid with brakes



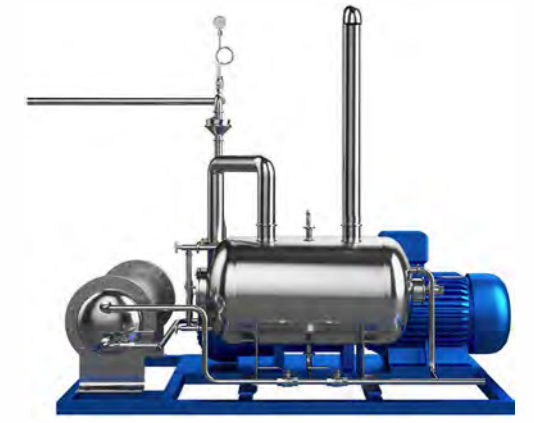
FALLING FILM

- MOC SUS316L & SUS304
- Evaporation cap.: 200L/h to 1000L/h
- Oil heating circulator (optional)
- High efficiency for ethanol recovery
- Movable skid with brakes



DECARB REACTOR

- MOC SUS316L & SUS304
- Capacity: from 26 gal to 132 gal
- Oil heating circulator 150°C / 302F (optional)
- Insulated and jacketed
- Movable skid with brakes



VACCUM STATION

- Sliding-vane rotary vacuum pump
- Vacuum buffer tank
- Explosion-proof
- Movable skid with brakes

UTILITIES

For whom is building from scratch, utilities circualtors are available for optional:

- Chilling circulator
- Cooling circulator
- Oil heating circualtor

INSTALLATION

Modular designed sections, sitting on movable skids, easily fit for different sizes of workshop, with full potential for further expanding.

Simply connect each section with the sanitary hoses comes with the system. Plug it, add biomass and ethanol, it's all good to go.

ELECTRICAL

All pumps and motors are explosion-proof, pre-checked before shipping.

UL rated motors available.
Runs @ 460V 60Hz 3 Phase or as per your requirements.

SERVICE

On-site training and guidance of installation services available.

MOC certificate, explosion-proof certificate, QC, UL and CE.

1 year parts and service warranty.

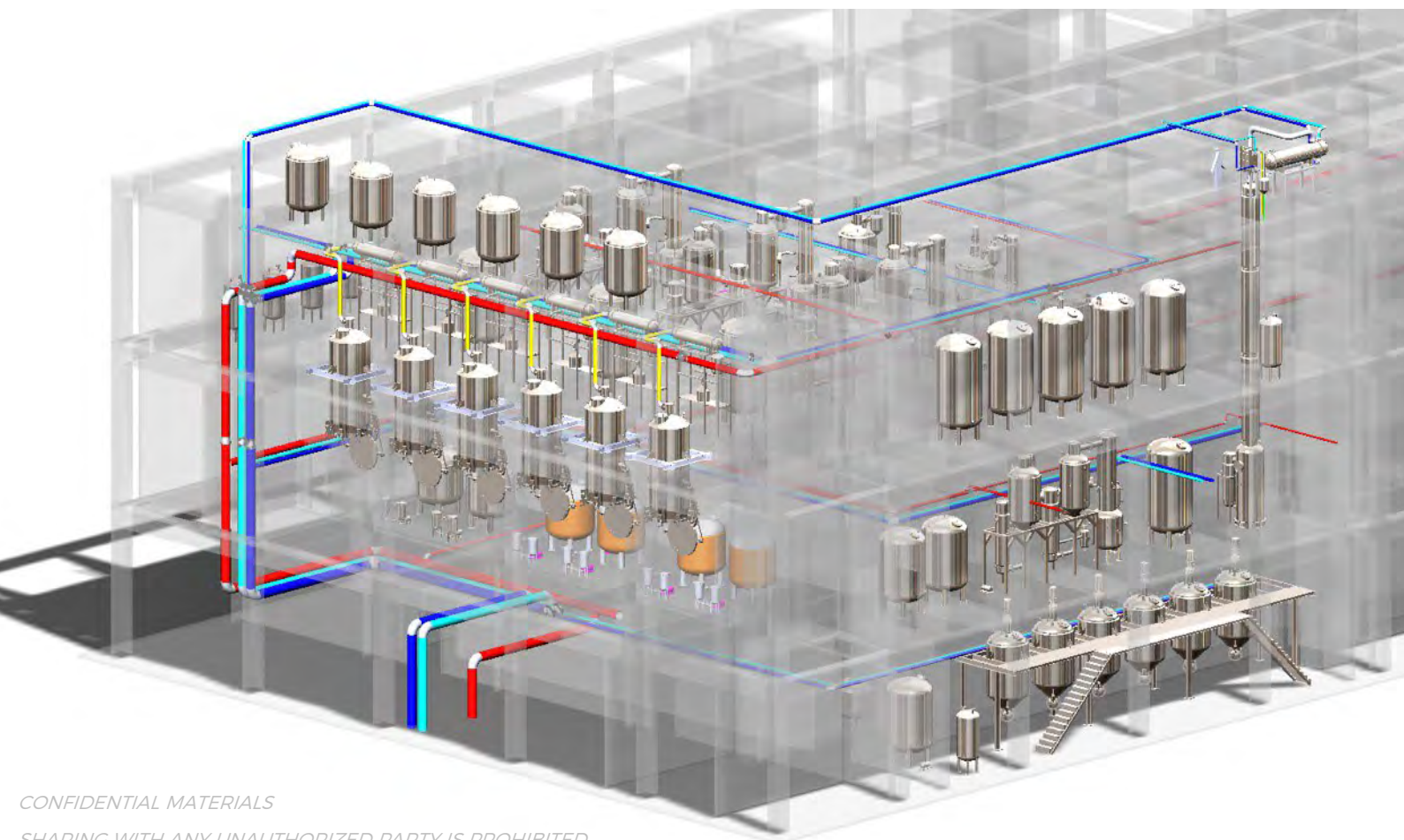
PROJECT PROPOSAL

CLIENT: CHARLOTTE

PROJECT: CEMS-50

PROPOSAL NO.: PM-CLT-240701

Rev.01
Date: July 1, 2024



CONFIDENTIAL MATERIALS

SHARING WITH ANY UNAUTHORIZED PARTY IS PROHIBITED

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1.0 COMPONENTS

1.1 Brief



3D Rendering of the system. The final layout, system may vary for different needs

System mentioned herewith include **Pre chilling section, Centrifuge Extraction section, Filtration Section, Evaporation section and Concentration/decarb section.**

All sections are modularized and can be installed on Skids with wheels which allows our client to easily put those them into different rooms or adjust orientation in using.

Pre chilling section, Centrifuge Extraction section, Filtration Section, Evaporation Section and Concentrator/Decarb section are the sections that will have potential ethanol volatiles in the air, thus it is crucial to have all electricals of the room where those sections be installed in a non-hazardous area on proof.

PureyMech works hand in hand with our clients and our engineers to design **competitively priced** ethanol extraction systems based on our clients desired processing capacity.

Whether you need a complete turnkey hemp extraction system designed or are just looking to fill in any gaps in your existing ethanol extraction system, PureyMech's modular system is always your first choice.

1.2 Features

ADVANTAGES OF ETHANOL EXTRACTION

The cannabis extraction process that manufacturers use can make a big difference in production efficiency and final product quality. Compared to other methods, ethanol extraction is a highly advantageous process due to the following:

- **Affordable equipment and replacement components.**

Ethanol extraction systems are often less expensive than their CO2 counterparts with similar capacities because they operate at lower pressures. Maintenance is also simpler because it is easy to find affordable replacement components should a part fail.

- **Reduced energy consumption**

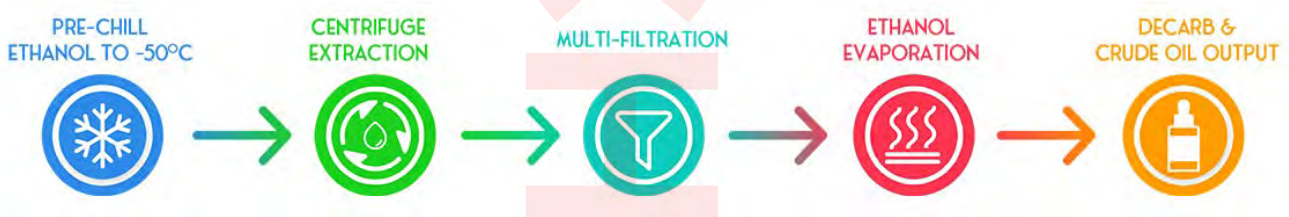
Ethanol extraction systems are less power intensive, extracting a larger amount of product in less time than other solvent extraction processes for significant power savings.

- **Rapid extractions.**

Ethanol efficiently draws unwanted materials directly out of the biomass, which is a benefit over CO2 and other solvents. Therefore, when extraction requires winterization, the use of ethanol facilitates the process. This makes ethanol extraction ideal for distillate products.

- **Scalability.**

Ethanol extraction systems are easy to scale for increasing the desired production volume. However, because ethanol is a flammable substance, be aware of national stipulations that limit the amount of flammable liquid materials allowed in any one facility. While the cannabis industry doesn't currently have many commonly accepted standards, there are some local and national regulations based on a facility and its operating procedures, including fire code flammable liquid restrictions, and food grade processing standards.



Dehydration Machine:

- temperature range: 30~75° ,
- Power 3.96Kw,
- Heating power 6.82Kw,
- Maximum power 10.1Kw
- Airflow 11000m³/h.
- tray x 60pcs, each tray ds about 3 6kgs
- S304 made with insulation covers.



Picture does NOT present the actual product, system may vary for different needs

 Shredding machine:

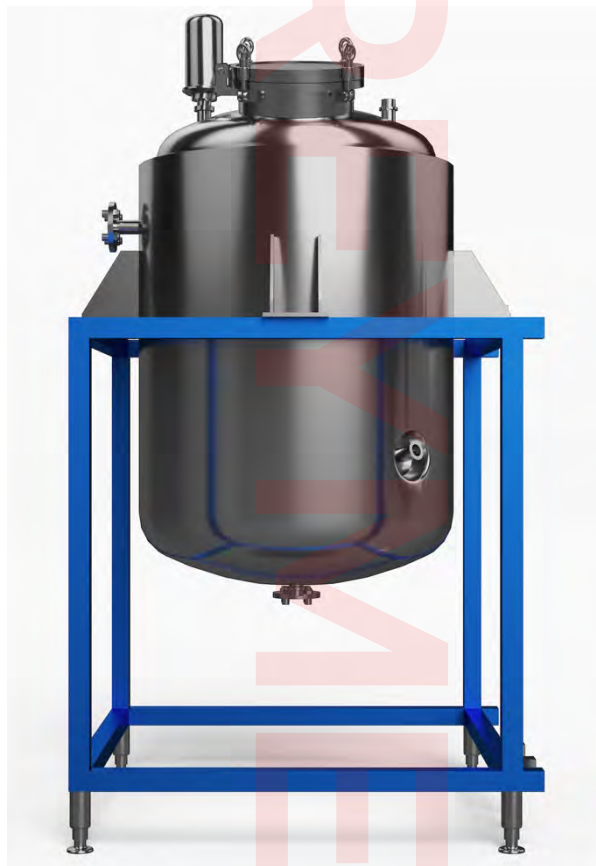
- Processing capacity: 80 15 g/h
- Weight: 140kg,
- Power 2.2kw,
- Speed: 720rpm,
- Mesh 6mm
- MOC: 304



Picture does NOT represent the actual product; system may vary for different needs

❄️ Pre chilling:

- Using 1 number of 100L chilling tank.
- S304 made. Fully insulated and jacketed
- With air filter on top
- Centrifugal pump, 1m³/ Explosion proof
- With -80C cryo chiller, LSZ 50/80 EX
- Compliant with the latest GMP standards, directives, and requirements.
- Complete modular design delivery; no need for on site installation.

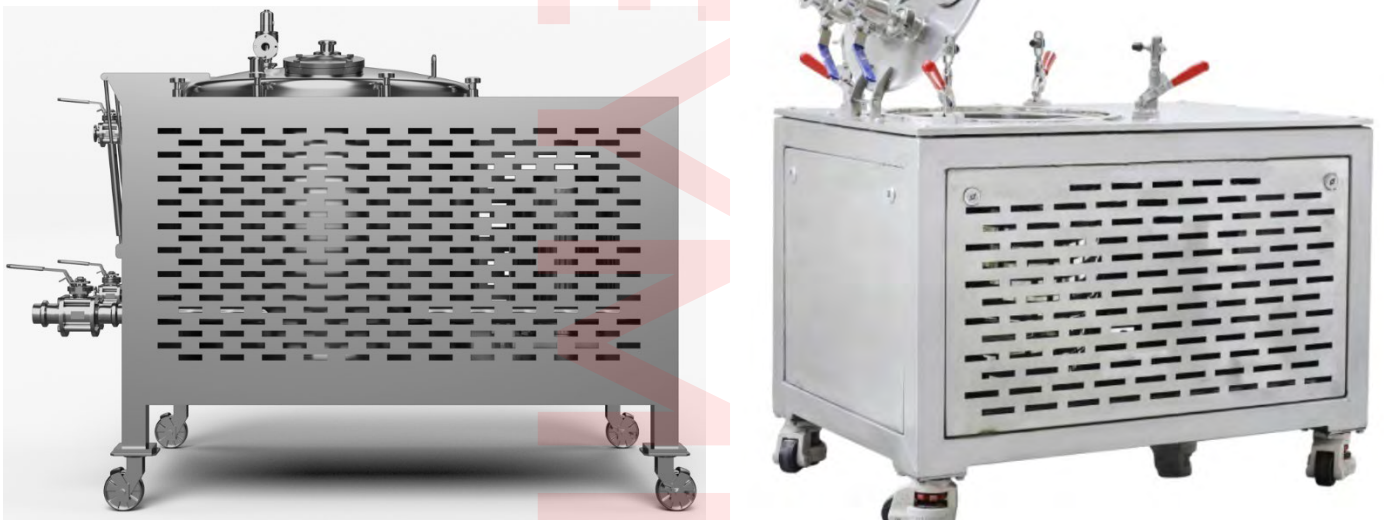


3D Rendering does NOT represent the actual product, system may vary for different



Centrifuge:

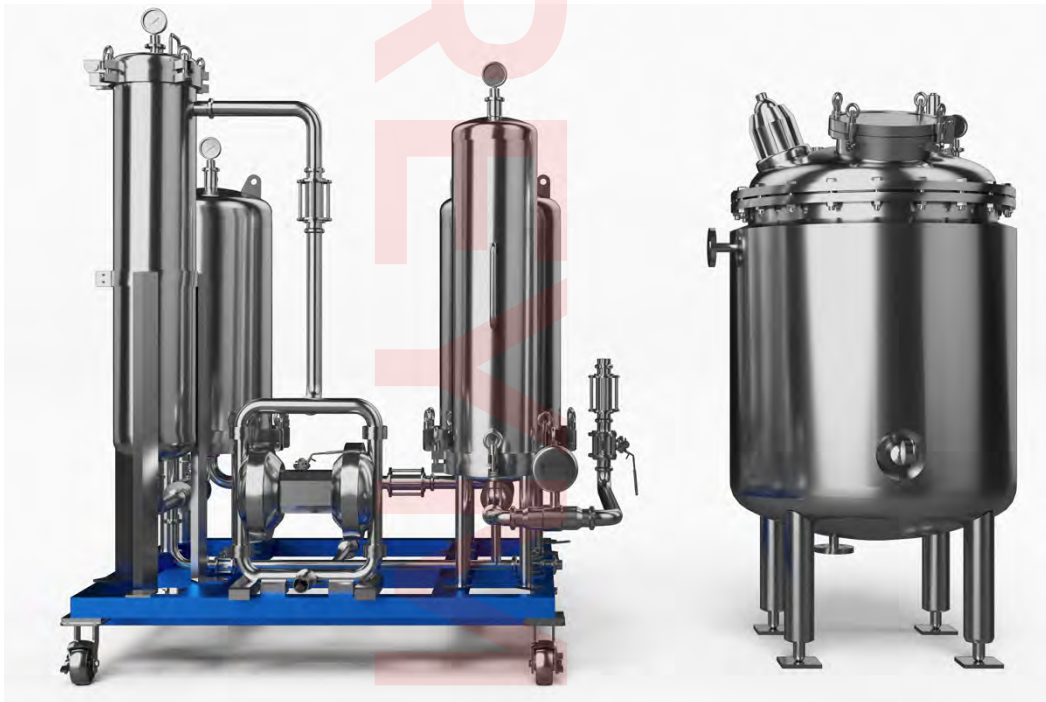
- 1 set of PM centrifuge, unique design for CBD industry
- **50L, maximum: biomass 5~6kg/run.**
- A spin dry cycle removing **reducing 95-97% of the ethanol**
- Insulated for maintaining extraction temperature.
- Compliant with the latest GMP standards, directives, and requirements.
- Complete modular design delivery; no need for on site installation.
- Motor and transmission parts are enclosed to ensure safe operation.
- All electricals to be explosion proof
- Button control, temperature readout.



3D Rendering does NOT represent the actual product, system may vary for different

 Filtration:

- Formed by
 - 1 set of #2 bucket filter
 - 1 set of millipore filter
- ⑩ Diaphragm pump, 1 m³
- 100L pre heating buffer tank, S304
- Compliant with the late GMP standards, directives, and requirements.
- Complete modular design delivery; no need for on site installation.



3D Rendering does NOT represent the actual product, system may vary for different

Evaporation:

Falling film evaporator

- Evaporation capacity: 100L/ (wat base)
- With plate heat exchanger as condenser
- Negative pressure pump recovering ethanol
- With vacuum pump and vacuum balance tank
- MOC 304
- Compliant with the latest GMP standards, directives, and requirements.
- Complete modular design and delivery no need for on site installation.



3D Rendering does NOT present the actual product system may vary for different

 Concentrator:

Rotary Evaporator

- HBG made reactor
- Volume 20L
- Jacketed, P FE valves
- Explosion proof motor
- With cooling circulator for condenser cooling
- Compliant with the latest standards, directives, and requirements.
- Complete modular design delivery no need for on site installation.
- Integrated with thermal circulator and cooler.

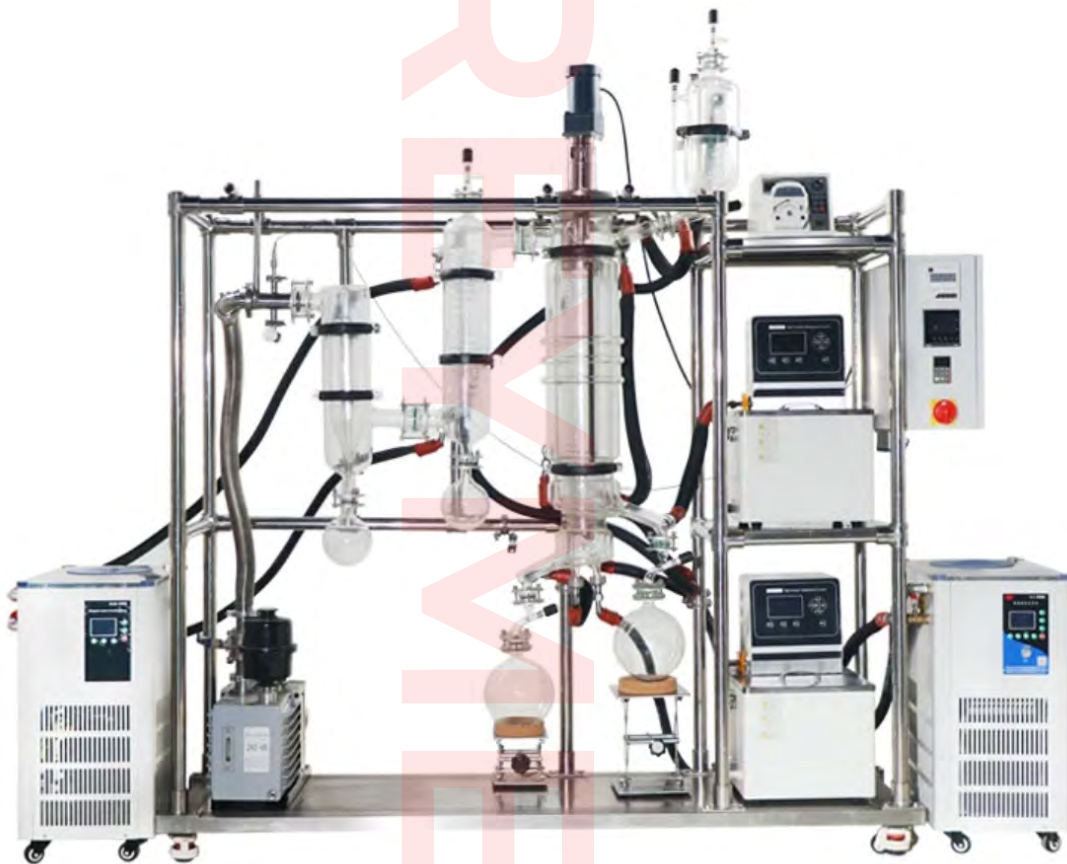


Picture does not represent actual product, system may vary for different needs



Molecular Distillation:

- One stage distillation
- 0.1 m² heating area
- Continuously feeding and outputting
- Integrated heating and chilling circulator
- Fully pre installed and pipelined
- All cooling and heating circulators controlled by central HMI
- Compliant with the latest GMP standards, directives, and requirements.
- Complete modular design delivery; no need for on site installation.



Picture does NOT represent the actual product, system may vary for different needs



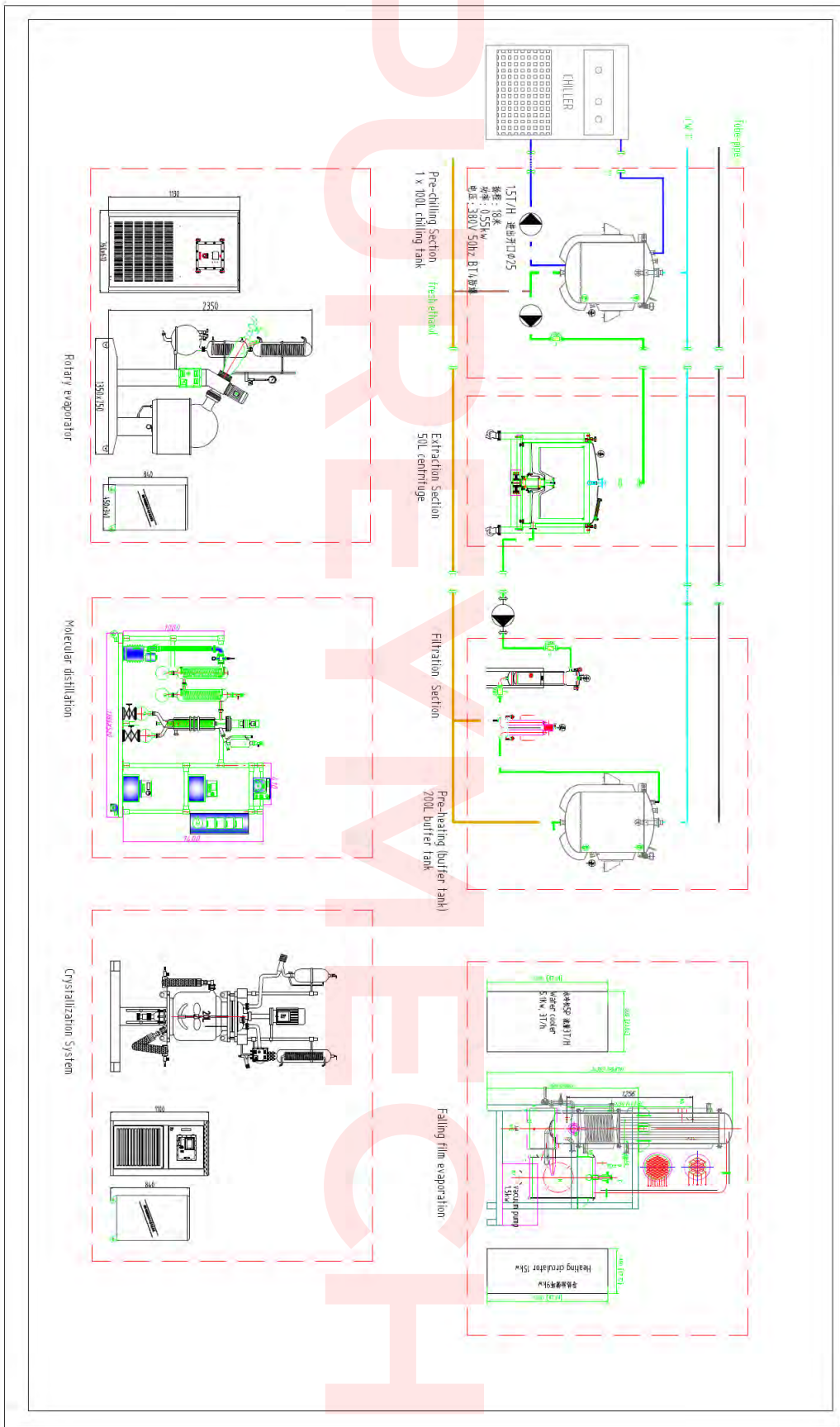
Isolation Reactor:

- HBG made reactor
- Volume 10L
- Jacketed, with insulation layer P E valves
- Explosion proof motor
- Including heating & cooling circulator and vacuum pump
- Compliant with the latest GMP standards, directives, and requirements.
- Complete modular design delivery; no need for on site installation.



Picture does NOT represent the actual product, system may vary for different needs

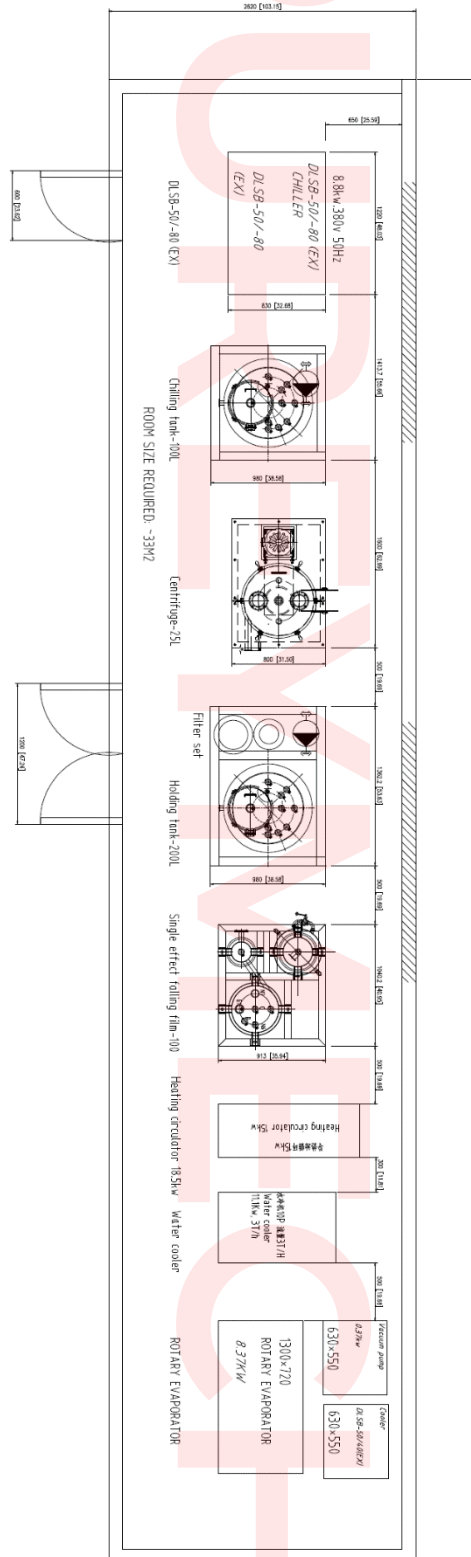
1.3 Drawings

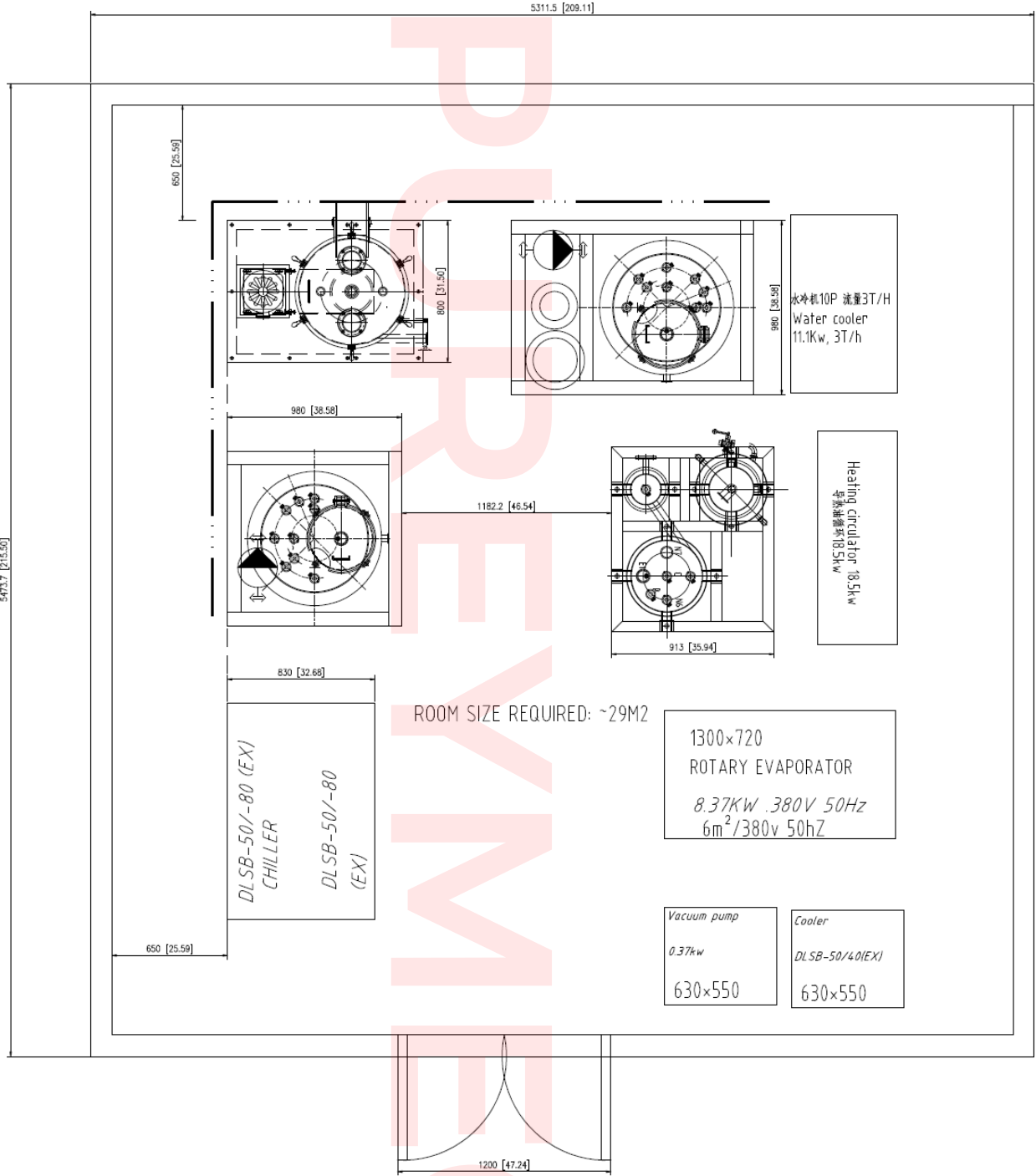


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1.4 Layout Design

We have two different layout designs for your reference. One is Straight Line layout, one is square layout.





Initial layout design is for reference only, actual layout shall be redesigned based on client's room.

1.5 Automation

1. Pre chilling Skid
 - Temperature control on Chill
 - Pump control onsite
2. Centrifuge Skid
 - Button controlling box
 - Control of speed, rotation direction, on off, emergency stop
 - Temperature readout
3. Filtration Skid
 - Pressure readout onsite
 - Pump control onsite
4. Falling Film Evaporator
 - Temperature, pressure on site read out
 - Pump control onsite
 - Vacuum pump control onsite
5. Rotary evaporator
 - Temperature control onsite
 - Pressure control onsite
 - Rotating control
6. Molecular distillation system
 - Temperature control onsite
 - Pressure control onsite
 - Rotating control
7. Isolation reactor
 - Temperature control onsite
 - Pressure control onsite



Control box on Extraction Skid

Picture does NOT represent the actual product, system may vary for different needs

1.6 Breakdown List

 PUREYMECH <small>INTEGRATED & DELICATE</small>	Project	PM-CLT-240624	Date	June.24.2024
	PID		Draft	Charles Shen

No	Item	Specs	MOC	QTY	UNIT	NOTE
A Pre-Chilling Section						
1	Cryo Chiller	DLSZ-50/80 EX. cooling power 7.4kw, total power 7.8/14.1kw	304	1	set	
2	Pre-Chilling Tank	100L, jacketed, insulated, as per drawing	304	1	set	
3	Centrifugal pump	F=1m ³ /h.	304	1	set	
4	Manual Valve	1.0" TC, -50-50°C	304	4	pc	
5	Hose	1.5" TC, -50-50°C L=1000mm	304/PTFE	2	pc	
6	Pipe glass	1.0" TC, -50-50°C		1	pc	
7	Maghetic Level Indicator	1.5", on-site readout, L=550mm	304	1	pc	
8	Bi-matel temperature gauge	-60-50°C, L=100mm	304	1	pc	
B Centriuge Section						
1	Centrifuge extractor	50L volume	304	1	set	
2	Manual Ball Valve	1.0" TC, -50-50°C	304	2	pc	
3	Diaphragm pressure gauge	-1-5bar	304	1	pc	
4	Hose	1.5" TC, -50-50°C L=1000mm	304/PTFE	2	pc	
C Filtration Section						
1	Bucket filter	2#	304 HOUSING	1	pc	
2	Millipore filter		304 HOUSING	1	pc	
3	Centrifugal pump	F=1m ³ /h	304	1	set	
4	Manual Ball Valve	1.0" TC, -50-50°C	304	3	pc	
5	Pipe glass	1" TC, -50-50°C	304	2	pc	
6	Diaphragm pressure gauge	-1-5bar	304	2	pc	
7	Hose	1.5" TC, -50-50°C L=1000mm	304/PTFE	1	pc	
8	Buffer tank	100L insulated	304	1	set	
9	Bi-matel temperature gauge	-60-50°C, L=100mm	304	1	pc	
10	Maghetic Level Indicator	1.5", on-site readout, L=550mm	304	1	pc	
11	Manual Ball Valve	1.0" TC	304	2	pc	
D Falling Film Evaporator						
1	Falling film evaporator	100L/h evaporation capacity (water-base)	304	1	set	
2	Negative pressure pump	0.55kw explosion-proof	304	1	set	
3	Lobe pump	1m ³ /h, explosion-proof	304	1	set	
4	Bi-matel temperature gauge	Range -20-150°C L=100mm	304	1	pc	
5	Manual Ball Valve	1.5" TC	304	1	set	
6	Manual butterfly valve	1.5" TC	304	9	set	
7	Check valve	1.5" TC	304	1	pc	
8	Flange ball valve	DN32 PN16	304	1	set	
9	Metal hose	DN32 PN16 L=1000mm	304	1	set	
10	Metal hose	1.5" L=1000mm	304	2	pc	
11	Vacuum pump	2BV 2.2KW+50L balance tank		1	set	
12	Thermal Oil Heating Circulator	TCO07-20BF-24, total power 25.5Kw, RT-300°C, pump 6.5m ³ /h		1	set	
13	Cooling circulator	CH01-10A, total power 9.9Kw, outputing 7°C, pump 15m ³ /h, compressor 3.75kW*2		1	set	
E Rotary Evaporator						
1	Rotary Evaporator	YRE-2050Z(EX), heating power 8000W, motor 370W, evaporation capacity - 8L/h	Class	1	set	
2	Cooling circulator	DLSB-50/40(EX), cooling capacity 8644-1200(W), unit power 2.7Kw		1	set	
3	Vacuum Pump	SHZ-95B (EX), power 370W/550W, suction 80L/min, -0.098mpa		1	set	
F Biomass Treatment						
1	Biomass dehydration machine	Temprature range: 30-75oC, power 3.96Kw, heating power 6.82Kw, maximum power 10.1Kw, airflow 11000m ³ /h, Tray x 60pcs, each tray loads about 3-6kgs.		1	set	
2	Shredder	80-150kg/h, weight: 140kg, power 2.2kw, 720rpm, mesh 6mm		1	set	
TOTAL COST			US\$155,000.00	FOB NINGBO, CHINA		

* On the premise of not changing function of such system, final configurations may vary.

CONFIDENTIAL MATERIALS; UNAUTHORIZED SHARING IS PROHIBITED

C Molecular Distillation						
1	Feed valve	Material: high borosilicate glass, expansion coefficient 3.3 Model: 0-8mm high vacuum valve Ball mill mouth: RS30		1	set	
2	Feeding tank	Material: high borosilicate glass, expansion coefficient 3.3 Form : Jacket , with 2 vacuum valves Capacity: 1 L (with scale and constant pressure) Constant pressure valve: 0- 6 mm Discharge valve: 0- 12 mm Discharge port: Glass bowl plug RS30 Export matching O-ring R40 (material FEP+fluorine)Design temperature:RAT-300°Coperating temperature: RAT-200°C IPUMP-2L		1	set	
3	Feed pump	Speed: 0.1-200 (digital display) Resolution: 0.1RPM Flow range: 0.0002~880 ml/min		1	set	
4	Motor (gear motor)	Power supply: 220V/50HZ Power: 120W Speed: 1440r, reduction ratio 3:1 Displayed speed: 0-300rpm		1	set	
5	Magnetic coupling system	Driving source: customized high temperature resistant large diameter multi-level strong magnetic Fixed block material: PTFE, PEEK Bearing material: imported German wear-resistant, high-temperature-resistant and corrosion-resistant bearings (brand SKF) Jacket material: 316L		1	set	
6	Scraper rotor	Frame material: 316L Scraper material: PTFE + graphite composite material, high temperature resistance 300°C Scraper type: Bevel gear, close to the inner wall of the main evaporator Spring material: 316L, quantity 9 Number of scrapers: 3		1	set	
7	Main evaporator	Material: high borosilicate glass, expansion coefficient 3.3 Form: The outer layer is a jacket, through which the heat transfer oil flows, the inner layer is a coil + ball tube composite condensation Effective evaporation area: 0.1m ² Built-in condensation area: 0.15m ² Design temperature: 350°C Operating temperature: -300°C Design pressure: 0.001Pa Stirring port: flange with groove, matching O-ring (FEP+fluorine) Upper right feed port: Glass bowl RS30 Steam outlet on the left side of the upper end: glass bowl RS40 Lower right outlet: Glass bowl stopper RS30 Lower left outlet: Glass bowl stopper RS30 Heat transfer oil inlet and outlet: DN15 Condensate inlet and outlet: DN15		1	set	
8	Main evaporator receiving bottle	Material: high borosilicate glass, expansion coefficient 3.3 Form: Spherical flask with RS mouth Feeding port: Glass bowl RS30 Capacity: 2.0L		1	set	
9	External condensation	Material: high borosilicate glass, expansion coefficient 3.3 Form: Inner coil Condensation area: 0.25m ² Steam inlet on the upper right side: Glass bowl plug RS40 Steam outlet on the left side of the lower end: glass bowl RS40 Lower outlet: Glass bowl RS30 Condensate inlet and outlet: DN15		1	set	
10	Condensation receiving bottle	Material: high borosilicate glass, expansion coefficient 3.3 Form: Spherical flask with RS mouth Feeding port: Glass bowl RS30 Capacity: 1.0L		1	set	

11	Glass cold trap	Material: high borosilicate glass, expansion coefficient 3.3 Form: Double jacket cold hydrazine Capacity: 3L Upper left vacuum outlet: flat flange DN26 Steam inlet at the lower right: Glass bowl plug R540 Lower outlet: Glass bowl RS30 Comes with a dust cover REQUIRED EXTRA COOLING MEDIUM: dry ice or liquid nitrogen or other medium, customer-prepared		1	set	
12	Cold trap receiving bottle	Material: high borosilicate glass, expansion coefficient 3.3 Form: Spherical flask with RS mouth Feeding port: Glass bowl RS30 Capacity : 1.0L		1	set	
13	Supporting Structure	Buffer device: 140mm cork support Lifting device: 304 surface experimental lifting table		2	set	
14	Heating system	Form: High temperature circulator Model: GX-3010 Tank capacity: 10L Power supply: 220V/50HZ Power: 2KW Lift: 6m Temperature range: room temperature - 250 degrees Circulation pump flow: 15L/min Supporting: 6 stainless steel hoses, wrapped with heat insulation sleeve		2	set	
15	Low temperature circulation system	Form: Low temperature coolant circulation pump, achieving continuous cooling from 0 to -20 degrees Model: DLSB-5/20 Capacity: 5.0L Power supply: 220V/50HZ Circulation pump capacity: 35L/min Lift: 6m Supporting: 2 stainless steel hoses, wrapped with insulation sleeve		1	set	
16	Built-in constant temperature system	Form: High temperature cooling cycle thermostat, achieving continuous heating and cooling from -20 degrees to 100 degrees Model:DFY-5/20 Capacity: 5.0L Power supply: 220V/50HZ Design temperature: -20°C~105°C Operating temperature: -20°C~100°C power : 1.2kw Cooling power: 0.6KW Circulation pump flow: 20L/min Equipped with 2 stainless steel hoses, wrapped with insulation sleeves Heat transfer medium: Prepared by the customer, water or other constant temperature medium is recommended		1	set	
17	Vacuum fine-tuning valve	Interface:KF16 Minimum adjustable amount (Pa·L/S): $1.3 \cdot 10^{-1}$ Maximum adjustable amount (Pa·L/S): 26700 Applicable range (Pa): $\leq 10^{-5} - 1.3 \cdot 10^{-5}$ Valve leakage rate (Pa·L/S): $\leq 1.3 \cdot 10^{-6}$ Medium temperature (°C): -25 - 150		1	set	
18	Two-stage rotary vane vacuum pump	Power supply: 220/50HZ Power: 0.75KW Air outlet: KF25 Drain port: KF25 Pumping speed: 6L/S Ultimate pressure: 0.067Pa Speed: 1400rpm Oil consumption: 1.5L Other Accessories: One SUS304 stainless steel bellows, interface KF25 SUS304 oil return high vacuum valve KF25 one One oil separator		1	set	

19	Gasket	Material: Stainless steel 304 + fluoro rubber O-ring Function: Used for sealing between glass cold trap and 304 stainless steel tee		1	set	
20	Metal pipe fittings	Material: SUS304 Form: Four-way Interface at both ends: KF25 Middle upper interface: KF16 sensor interface Middle lower interface: KF16 vacuum fine-tuning valve		1	set	
21	Control cabinet	Material: SUS304 Type: Aviation plug vacuum system control buttons		1	set	
22	Removable frame	Material: SUS304 Form: The base is welded with square tubes, the bracket is constructed with round tubes, and the joints are connected with sus304 pipe fittings The roller is CD-60F Fomar wheel, which can be adjusted horizontally		1	set	
23	RS mouth fixture	Material: Aluminum Alloy Form: Horseshoe clamp Surface plating Screws are SUS304, nuts are electroplated		1	set	
24	KF mouth fixture	Material: aluminum alloy + sus304 Type: Quick-open Bracket material: sus304		1	set	
TOTAL COST				US\$29,500.00		FOB NINGBO, CHINA

* On the premise of not changing function of such system, final configurations may vary.

H Crystallization						
1	Crystallization Reactor	10L reaction tank, bottom filtration, with two receiving kettle, gas condenser.		1	set	
2	Heating & cooling circulator	-10°C to 200°C		1	set	
3	Vacuum pump	SHZ-95B (EX), power 370W/550W, suction 80L/min. -0.098mpa		1	set	
TOTAL COST				US\$17,000.00		FOB NINGBO, CHINA

* On the premise of not changing function of such system, final configurations may vary.

1.7 Power Consumption & Yield Volume

Power consumption

Total power consumption is around 85kw

Required power supply: 380V, 5 phase

(Customize voltage available)

Yield Volume

Say if worker only take two runs per hour
that's $5 \times 2 = 10$ kg of biomass processing per hour.

Almost always through our data, system will yield about 90% of the CBD dry biomass potency in oil weight calculation being the following 10% CBD biomass so $90\% = 9\%$. And that will raise to 60-67% CBD potency.

The volume of distillate yield by weight is usually about 70-80% by weight of the crude.

The isolation system will yield somewhere in the range of 50-80% isolate depending on how potent your distillate is as per above, how good you are at the chemistry SOP and that your equipment is very efficient in terms of temperature controls.


So generally speaking:

10kg of biomass per hour @ 10% CBD

Crude yield = $10 \times 0.09 = 0.9$ kg/h

Distillate yield = $0.9 \times 0.75 = 0.675$ kg (short path distillation system required)

Isolate yield = $0.675 \times 0.6 = 0.405$ kg/h (crystallization system required)



THE SOLUTION
OF
LARGE QUANTITY PROCESS

2.0 GENERAL INFO

2.1 Material

Stainless Steel

Stainless Steel Vendor: Shanghai Bao Steel Group Corporation or equivalent supplier



In order to keep the raw material and make sure proper material will be used, we insist asking the material vendor to provide original material test report.

Also, we will do incoming tests to ensure the material is qualified:

- Metal spectrum analyzer
- Thickness gauge
- Roughness detector

All designing, manufacturing and inspection processes are performed according to GB150 1998. ISO9001 Quality Management System Standard will also be applied throughout the entire manufacturing process.

2.2 Welding



During the welding process, plasma cutting machine imported from Germany will be used for tank longitude and girth welding and fillet welding to make sure the welding seam smooth and even.

Also, GMAW welding technology will be applied, inert gas concentration is 99.999%. Different welding wire ER316L or ER308 will be applied for different material of SS plate.

For particular circumstances, electric arc welding will be applied. Welding material used for:

S304 S304: A102; S316L S316L: A022 Different SS: A302.

Welding seam between jacket and vessel shall be NDT inspected according to JB4730 94 to ensure the integrity and long service life.



2.3 Polishing



After welding process, the internal surface shall be polished 3 times by 180#, 320# and 400# polishing. Non woven paper shall be proceeded after to get internal surface roughness $Ra \leq 0.4\mu m$.

For particular cases, electrolytic polishing shall be applied in order to get extreme smoothness, $Ra = 0.2\mu m$.

The polishing result comes from above processes will be complied with GMP requirements.

2.4 Packing & Shipping

Equipment will be thoroughly washed before packing. Water used for washing should not have chloridion content more than 25mg/L to avoid damage of stainless steel surface. Water stains must be cleaned once washing is finished.

Plastic wrap film should be applied around the entire equipment.

Electrical parts should be disassembled and packed in crates if possible, otherwise it should be fully protected from every kind of potential damage in shipping.

Tank will be put down and sitting on a C frame support, steel wire will be used for fasten tank to support. Rubber should be applied to where steel wire is touching the equipment.

When fixing the equipment in container, multiple fixing belts and/or steel wires should be used to make sure no movement of equipment

Tank dia. LESS than 2.2meters
stuffed in 40"HC with belts and steel wires fixed.



Tank dia. MORE than 2.2meters,
stuffed at Flat Rack with belt and steel wire fixed, tarpaulin covered.



Modular systems or small tanks/goods
Crates packed, pallets available if required.



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2.5 In accordance with GMP & FDA

- All vessel shall be airtight, avoiding dead leg, easy to clean, maximum reduce environment contamination and residue of last batch. Mechanical seal shall be applied for agitator. Lid shall be applied for the equipment which will be assembled/dismounted frequently to avoid operate exposed.
- Pipes connection shall be considered for CIP washing. Clamps/flanges shall be as near as possible to the vessel body DN of the connections shall not be too small.
- Vessel head with manhole preferred to weld with vessel cylinder, sealing elements of manhole shall be easy to clean. If the diameter of vessel is too small for manhole, flange connection between head and cylinder shall be considered, but the sealing element of flanges shall be even with vessel internal surface.
- Baffles, shaft support and coupling inside the vessel is not preferred as first choice. Eccentric agitation systems shall be applied for better blending result.
- Dry or water lubricating mechanical seal for upper agitator is preferred. Food grade oil shall be applied for gearbox if in applicable.
- All material contacts surface shall be mirror polished, $Ra \leq 0.4\mu m$, external surface shall be matte finishing with $Ra \leq 0.8\mu m$ also mirror polishing is available for particular circumstance.
- All seal elements contact with products shall be food grade. Including but not limited to flanges seal for hand holder, manhole/handhole seal, pipeline flanges/clamps seal and valves disks.
- Pressure equipment must be qualified by national standards and/or international standard (PED direct 97/23/EC or ASME) certain welding license shall be carried by welders.
- All manufacture process shall have complete documentation on process records, material purchasing records, warehousing /O records.
- Liquid level while mixing shall not be over head flange to avoid fouling. Multi liquid level mixing situation shall be considered.

2.6 Procedures of Orders



Inquiry & Proposal

- ✦ Proposal against URS (URS requirements) will be provided in 17 days, depends on specs and variety of goods.



Proforma Invoice

- ✦ Proforma invoice will be provided once proposal is confirmed.



Down Payment

- ✦ Down payment should be paid before production started as PI instructed.



DQ (Design Qualification)

- ✦ Design qualification paperwork will be provided by PureyMech for Buyer's approval.



Manufacture Release

- ✦ Once DQs confirmed by Buyer, a letter of Manufacture Release should be sent from Buyer to PureyMech to start manufacturing.



Manufacturing

- ✦ PureyMech start manufacturing goods as per DQ and Manufacture Release.



FAT (Factory Acceptance Test)

- ✦ Protocols of FAT will be provided by PureyMech for Buyer's approval. FAT shall be conducted in the presence of both parties.



Balance Payment

- ✦ Balance payment be paid before container stuffing once goods is accepted by Buyer after Good Inspection or be paid as per PI/Contract instructed.



Shipping

- ✦ By air, by sea or by courier as per Buyer's requests. Nearest sea port is Ningbo China, or Shanghai China.

3.0 SCOPE OF WORK

3.1 Inclusions

Supplier will be responsible for

- Design as per User's requirements;
- Manufacturing and purchasing of the equipment mentioned herewith;
- Pre-tuned before shipping
- On-line tech support

3.2 Exclusions

The following items are excluded from our scope of supply and are in the scope of work of Buyer:

- R22 refrigerant, thermal oil and/ or any kind of chilling/heating medium.
- Power cable to our control box.
- Seaway freight and insurance during transportation.
- Installation/commissioning onsite provided against charges.
- Any items not mentioned in this proposal.

3.3 Documentation

The offer is based on the internal standards of Supplier for CAD, mechanical and electrical engineering, Control systems and all lists corresponding to the contents of the documentation.

For electronic documents: On documents in the following formats are to be considered as binding electronic documents in .tif or .pdf format.

Design will be drafted on GMP standard and relevant standards and regulations.

Documents required for GMP qualification will be provided as follows:

- DQ, FA, IQ, OQ, PQ
- MOC certificate
- QC reports
- User's manual

4.0 COMMERCIAL CONDITIONS

4.1 Price List

The cost of this offer listed as below:

No	Description	QTY	Unit	Total	Remarks
1	CEMS 50 System	1	US\$155,000.00	US\$155,000.00	
2	Molecular Distillation System	1	US\$29,500.00	US\$29,500.00	
3	Crystallization System	1	US\$17,000.00	US\$17,000.00	
	Total	1		US\$201,500.00	FOB Ningbo
SAY US DOLLARS TWO HUNDRED ONE THOUSAND FIVE HUNDRED ONLY					

The travel expenses and daily allowance of the Supplier staffs for project location are not included in the quoted price and will be invoiced as follows:

- Daily AllowanceUS\$200 /day/ person
- Hotel Provided by Buyer
- Train / flight (Economy) / car rental..... Provided by Buyer

4.2 Payment Terms

- Trade term to be understood as [FOB Ningbo, China, Incoterm 2010](#)
- 60% of the contract price as a down payment pay by / in advance.
- 40% of the contract price pay by before container stuffing after FA .
- All prices stated include value added tax.
- If User is in arrears with a payment or part of a payment, Supplier has the right to suspend its works until such time as the due amount is received by the account. Supplier shall not be held responsible for any delay caused by this.

4.3 Delivery Terms

- Delivery time: within [100~120 working days](#) upon receiving [Manufacture Release](#) from User.
- Delivery terminal: FOB Ningbo
- Risk & Responsibility:
 - Supplier will be responsible for the transportation cost, insurance and damage of the goods if any during the transportation from factory to the port mentioned in trade term.

User shall be responsible for the rest of transportation cost, insurance and damage of the goods if any.

4.4 Warranty

Within 12 months after the completion of commissioning of the device, or within 18 months after the shipment date whichever comes first.

Parts subject to wear and corrosive media are excluded from the Warranties.

4.5 Applicable Laws

The laws of the China shall apply if any conflict of law statutes.

The exclusive venue shall be the Wenzhou, China.

4.6 Validity of Offer

This Offer remains valid until [July 15, 2024](#).

5.0 ANNEXES

Dear Charlotte,

We sincerely thank you for your trust and support!

Hope the proposal we provided above will be appropriate and reasonable to fulfill your needs.

If any further assistance needed, please contact us freely.

PUREYMECH will always be at your disposal!

Best Regards,

PUREYMECH



Project	PM-CLT-240624	Date	June.24.2024
PID		Draft	Charles Shen

No	Item	Specs	MOC	QTY	UNIT	NOTE
A Pre Chilling Section						
1	Cryo Chiller	DLSZ 50/80 EX cooling power 74kw total power 78/141kw	304	1	set	
2	Pre Chilling Tank	100L jacketed insulated as pe	304	1	set	
3	Centrifugal pump	F=1m ³ /h	304	1	set	
4	Manual Valve	1 0" TC 50-50°C	304	4	pc	
5	Hose	1 5" TC 50-50°C L=1000mm	304/PTFE	2	pc	
6	Pipe glass	1 0" TC 50-50°C		1	pc	
7	Maghetic Level Indicator	1 5" on site readout L=550mm	304	1	pc	
8	Bi matel temperature gauge	60-50°C L=100mm	304	1	pc	
B Centriuge Section						
1	Centrifuge extractor	50L volume	304	1	set	
2	Manual Ball Valve	1 0" TC 50-50°C	304	2	pc	
3	Diaphragm pressure gauge	1-5bar	304	1	pc	
4	Hose	1 5" TC 50-50°C L=1000mm	304/PTFE	2	pc	
C Filtration Section						
1	Bucket filter	2#	304 HOUSING	1	pc	
2	Millipore filter		304 HOUSING	1	pc	
3	Centrifugal pump	F=1m ³ /h	304	1	set	
4	Manual Ball Valve	1 0" TC 50-50°C	304	3	pc	
5	Pipe glass	1" TC 50-50°C	304	2	pc	
6	Diaphragm pressure gauge	1-5bar	304	2	pc	
7	Hose	1 5" TC 50-50°C L=1000mm	304/PTFE	1	pc	
8	Buffer tank	100L insulated	304	1	set	
9	Bi matel temperature gauge	60-50°C L=100mm	304	1	pc	
10	Maghetic Level Indicator	1 5" on site readout L=550mm	304	1	pc	
11	Manual Ball Valve	1 0" TC	304	2	pc	
D Falling Film Evaporator						
1	Falling film evaporator	100L/h evaporation capacity (water base)	304	1	set	
2	Negative pressure pump	0.55kw explosion proof	304	1	set	
3	Lobe pump	1m ³ /h explosion proof	304	1	set	
4	Bi matel temperature gauge	Range 20-150°C L=100mm	304	1	pc	
5	Manual Ball Valve	1 5" TC	304	1	set	
6	Manual butterfly valve	1 5" TC	304	9	set	
7	Check valve	1 5" TC	304	1	pc	
8	Flange ball valve	DN32 PN16	304	1	set	
9	Metal hose	DN32 PN16 L=1000mm	304	1	set	
10	Metal hose	1 5" L=1000mm	304	2	pc	
11	Vacuum pump	2BV 2.2KW+50L balance tank		1	set	
12	Thermal Oil Heating Circulator	TCO07 20BF 24 total power 25.5Kw RT 3 ump 6.5m ³ /h		1	set	
13	Cooling circulator	CH01 10A total power 9.9Kw 15m ³ /h compressor 3.75kW*2		1	set	
E Rotary Evaporator						
1	Rotary Evaporator	YRE 2050Z(EX) heating power evaporation capacity ~ 8L/h	Glass	1	set	
2	Cooling circulator	DLSB 50/40(EX) cooling capac 8644 0(W) power 2.7Kw		1	set	
3	Vacuum Pump	SHZ 95B (EX) power 370W/5 W suct 80L/m 0.098mpa		1	set	
F Biomass Treatment						
1	Biomass dehydration machine	Temperature range 30-75°C power 3.96Kw heating power 6.82Kw maximum power 10.1Kw airflow Tray x 60pcs each tray loads ab 3.6kgs		1	set	
2	Shredder	80 150kg/h weight 140kg po 2.2kw 720rpm mesh 6mm		1	set	
TOTAL COST			US\$155,000.00	FOB NINGBO, CHINA		

* On the premise of not changing function of such system, final configurations may vary

G Molecular Distillation					
1	Feed valve	Material high borosilicate glass expansion coefficient 3.3 Model 0.8mm high vacuum valve Ball mill mouth RS30		1	set
2	Feeding tank	Material high borosilicate glass expansion coefficient 3.3 Form Jacket with 2 vacuum valves Capacity 1 L (with scale and cover) Constant pressure valve 0.6 mm Discharge valve 0.12 mm Discharge port Glass bowl plug RS30 Export matching O ring R40 (material FEP) Design temperature RAT-300°C Operating temperature RAT-200°C		1	set
3	Feed pump	IPUMP 2L Speed 0.1-200 (digital display) Resolution 0.1 RPM Flow range 0.0002~880 ml/m		1	set
4	Motor (gear motor)	Power supply 220V/50HZ Power 120W Speed 1440r reduction ratio 3:1 Displayed speed 0-300rpm		1	set
5	Magnetic coupling system	Driving source customized high temperature resistant large diameter multi level strong magnetic Fixed block material PTFE PEEK Bearing material imported German high temperature resistant and corrosion resistant bearings (brand SKF) Jacket material 316L		1	set
6	Scraper rotor	Frame material 316L Scraper material PTFE + graphite composite material high temperature resistance 300°C Scraper type Bevel gear close the inner wall of the main evaporator Spring material 316L quantity 9 Number of scrapers 3		1	set
7	Main evaporator	Material high borosilicate glass expansion coefficient 3.3 Form The outer layer is a jacket through which the heat transfer oil flows the inner layer is a coil + ball tube for condensation Effective evaporation area 0.1m ² Built in condensation area 0.15m ² Design temperature 350°C Operating temperature ~300°C Design pressure 0.001Pa Stirring port flange with groove matching O ring (FEP+fluorine) Upper right feed port Glass bowl R Steam outlet on the left side of the upper glass bowl RS40 Lower right outlet Glass bowl Lower left outlet Glass bowl stopper RS30 Heat transfer oil inlet and outlet DN15 Condensate inlet and outlet DN15		1	set
8	Main evaporator receiving bottle	Material high borosilicate glass expansion coefficient 3.3 Form Spherical flask with RS mouth Feeding port Glass bowl RS30 Capacity 2.0L		1	set
9	External condensation	Material high borosilicate glass expansion coefficient 3.3 Form Inner coil Condensation area 0.25m ² Steam inlet on the upper right Glass bowl plug RS40 Steam outlet on the left side of the lower end glass bowl RS40 Lower outlet Glass bowl RS30 Condensate inlet and outlet DN15		1	set
10	Condensation receiving bottle	Material high borosilicate glass expansion coefficient 3.3 Form Spherical flask with RS mouth Feeding port Glass bowl RS30 Capacity 1.0L		1	set

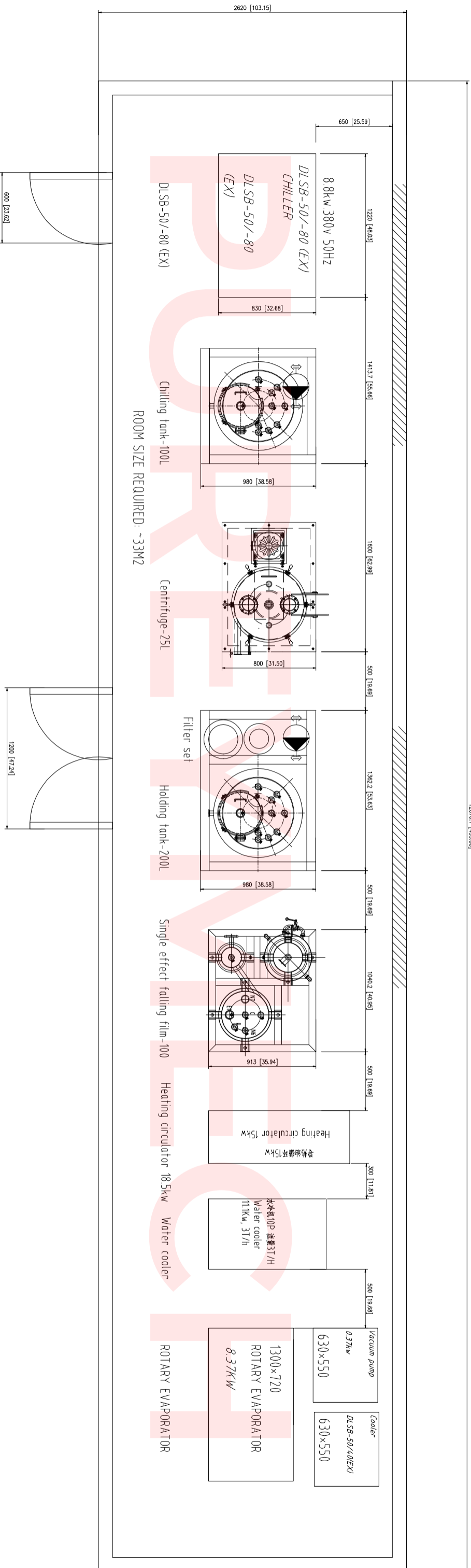
11	Glass cold trap	Material high borosilicate glass expansion coefficient 3.3 Form Double jacket cold hydrazine Capacity 3L Upper left vacuum outlet flat flange DN26 Steam inlet at the lower right Glass bowl plug RS40 Lower outlet Glass bowl RS30 Comes with a dust cover REQUIRED EXTRA COOLING MEDIUM dry ice or liquid nitrogen or other medium customer prepared		1	set	
12	Cold trap receiving bottle	Material high borosilicate glass expansion coefficient 3.3 Form Spherical flask with RS mouth Feeding port Glass bowl RS30 Capacity 1.0L		1	set	
13	Supporting Structure	Buffer device 140mm cork support Lifting device 304 surface experimental lifting table		2	set	
14	Heating system	Form High temperature circulation Model GX 3010 Tank capacity 10L Power supply 220V/50HZ Power 2KW Lift 6m Temperature range room temperature ~ 250 degrees Circulation pump flow 15L/min Supporting 6 stainless steel hoses wrapped with heat insulation sleeve		2	set	
15	Low temperature circulation system	Form Low temperature coolant circulation pump achieving continuous cooling from 0 to -20 degrees Model DLSB 5/20 Capacity 5.0L Power supply 220V/50HZ Circulation pump capacity 35 L/min Lift 6m Supporting 2 stainless steel hoses wrapped with insulation sleeve		1	set	
16	Built in constant temperature system	Form High temperature cooling cycle therm achieving continuous heating and cooling from -20 to 100 degrees Model DFY 5/20 Capacity 5.0L Power supply 220V/50HZ Design temperature 20°C~105°C Operating temperature 20°C~100°C power 1.2kw Cooling power 0.6KW Circulation pump flow 20L/min Equipped with 2 stainless steel hoses wrapped with insulation sleeves Heat transfer medium Prepare water or other constant temperature medium is recommended		1	set	
17	Vacuum fine tuning valve	Interface KF16 Minimum adjustable amount Maximum adjustable amount L/S) 2.00 Applicable range (Pa) <= 10 ⁻⁵ ~ 3*10 ⁻⁶ Valve leakage rate (Pa L/S) <= 10 ⁻⁶ Medium temperature (°C) 25 ~ 150		1	set	
18	Two stage rotary vane vacuum pump	Power supply 220/50HZ Power 0.75KW Air outlet KF25 Drain port KF25 Pumping speed 6L/S Ultimate pressure 0.067Pa Speed 1400rpm Oil consumption 1.5L Other Accessories One SUS304 stainless steel bellows interface KF25 SUS304 oil return high vacuum valve KF one One oil separator		1	set	

19	Gasket	Material Stainless steel 304 + fluoro rubber O ring Function Used for sealing between glass cold trap and 304 stainless steel tee		1	set	
20	Metal pipe fittings	Material SUS304 Form Four way Interface at both ends KF25 Middle upper interface KF16 s Middle lower interface KF16 vacuum e tuning ve		1	set	
21	Control cabinet	Material SUS304 Type Aviation plug vacuum system control buttons		1	set	
22	Removable frame	Material SUS304 Form The base is welded with squ cket is constructed with round tubes and the joints are nected with sus304 pipe fittings The roller is GD 60F Fomar wh which can be adjusted horizontally		1	set	
23	RS mouth fixture	Material Aluminum Alloy Form Horseshoe clamp Surface plating Screws are SUS304 nuts are electroplated		1	set	
24	KF mouth fixture	Material aluminum alloy + sus Type Quick open Bracket material sus304		1	set	
TOTAL COST			US\$29,500.00	FOB NINGBO, CHINA		

* On the premise of not changing function of such system, final configurations may vary

H Crystallization						
1	Crystallization Reactor	10L reaction tank bottom filtr n with o rece ng kettle gas condenser		1	set	
2	Heating & cooling circulator	10°C to 200°C		1	set	
3	Vacuum pump	SHZ 95B (EX) power 370W/5 W suction 80L/m 0 098mpa		1	set	
TOTAL COST			US\$17,000.00	FOB NINGBO, CHINA		

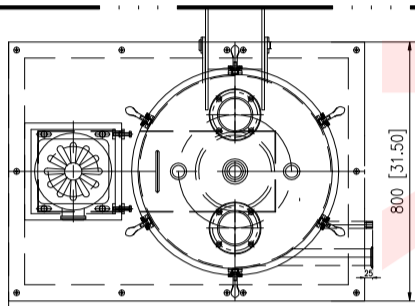
* On the premise of not changing function of such system, final configurations may vary



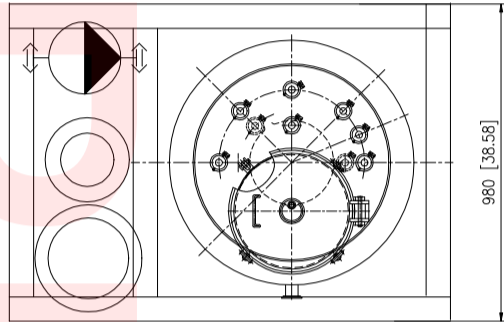
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5311.5 [209.11]

650 [25.59]



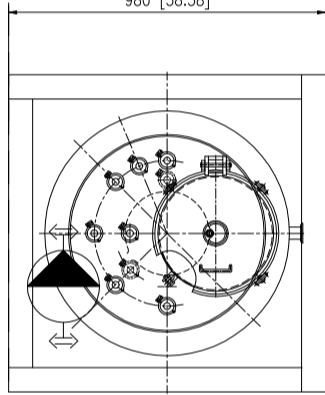
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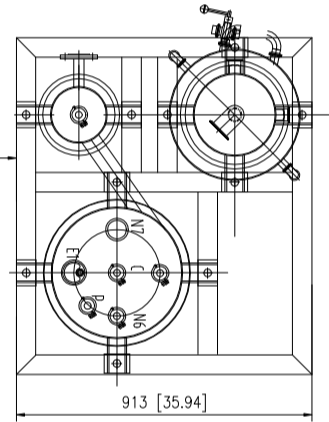
980 [36.58]

水冷机10P 流量3T/H
Water cooler
11.1Kw, 3T/h

980 [38.58]



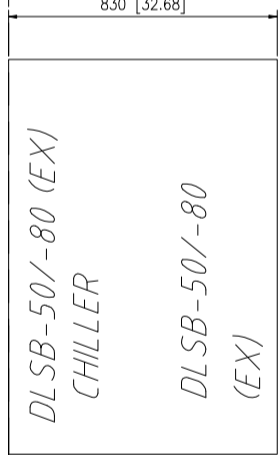
1182.2 [46.54]



913 [35.94]

Heating circulator 18.5kw
导热油循环18.5kw

830 [32.68]



DLSB-50/-80 (EX)
CHILLER
DLSB-50/-80
(EX)

ROOM SIZE REQUIRED: ~29M²

1300x720
ROTARY EVAPORATOR
8.37KW .380V 50Hz
6m²/380v 50hZ

650 [25.59]

Vacuum pump

0.37kw

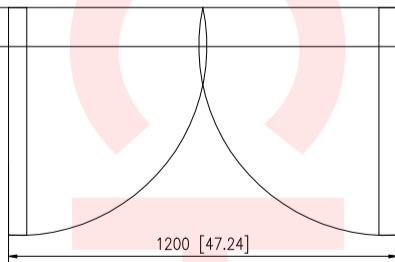
630x550

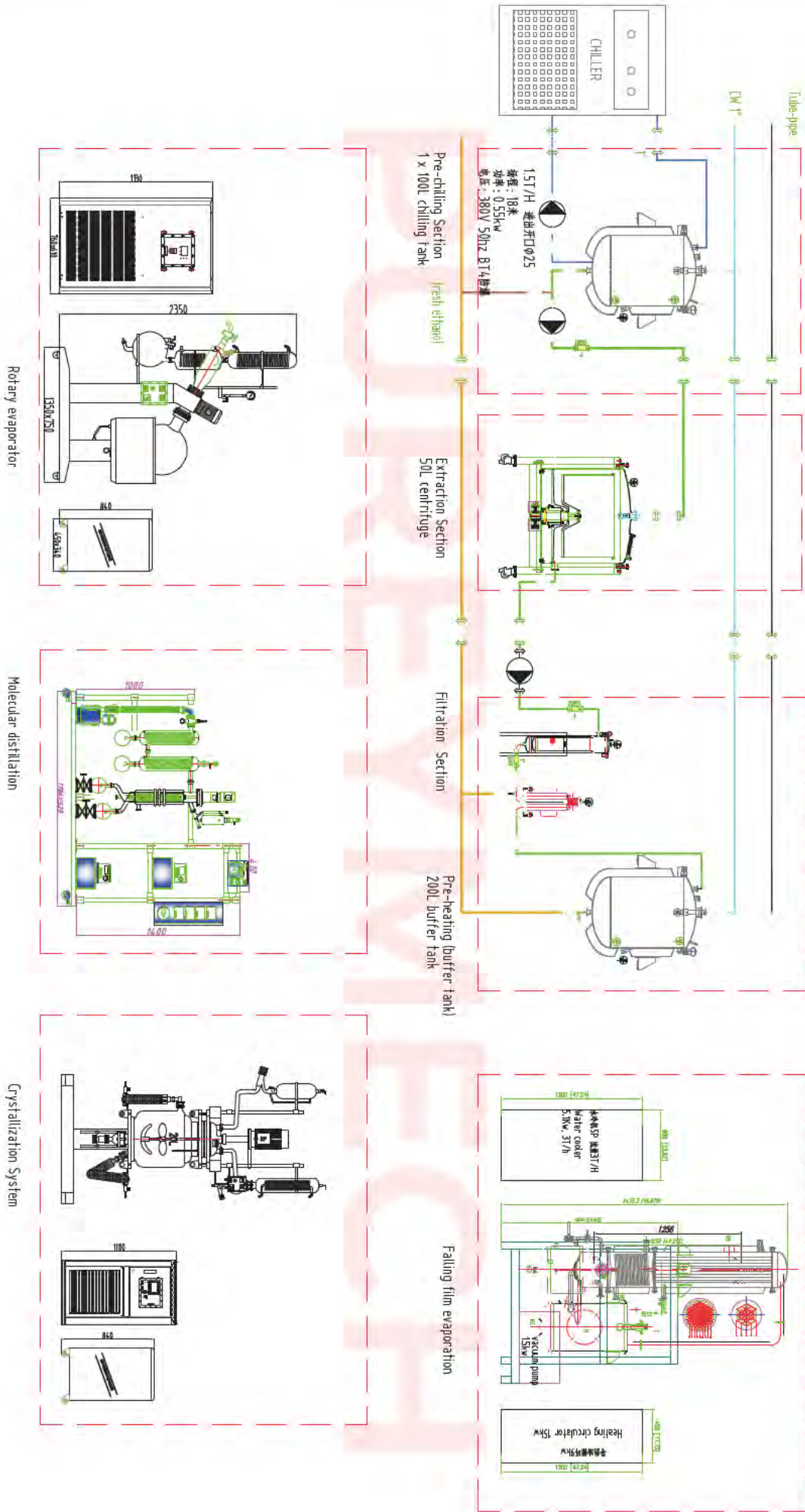
Cooler

DLSB-50/40(EX)

630x550

1200 [47.24]





上海医药工程技术有限公司
 SHANGHAI PHARMACEUTICAL ENGINEERING TECHNOLOGY CO., LTD.

Commercial proposal

Date: 29/3/2024
Contact: Alex Teodorescu
Offer Ref: O24-0047
Version: A
Your Ref:

To the attention of
Char O'Brien and Megan Villa

Hemp Fiber Processing line 4 t/h

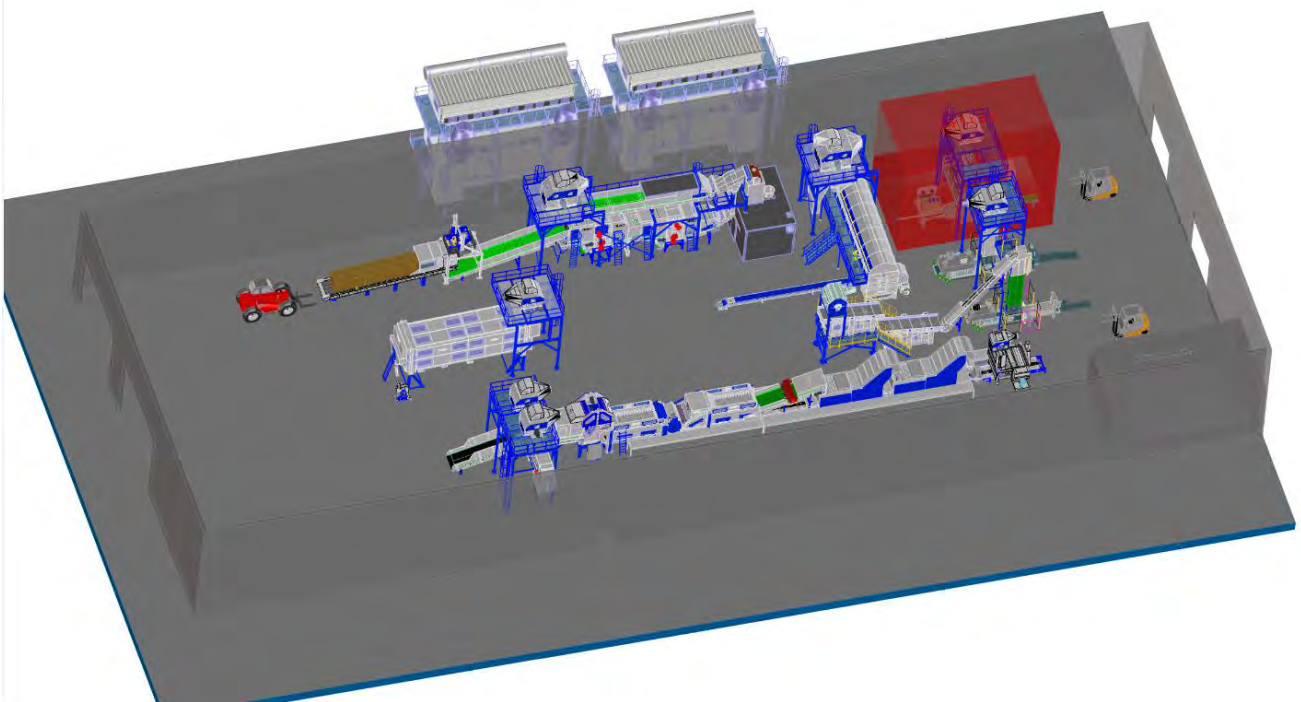
We are pleased to submit this commercial proposal, free of engagement, according to our general terms of sale.

1. Basic data

1.1. Processing capabilities:

- Hemp processing :
 - Input capacity: 4000 kg/h.
 - Output: Technical fibers containing <2% of hurd material, baled in bales.
 - Output: Cleaned hurd in bulk. Optional baled in 20kg bales.
 - Output: Short fibers with up to 35% of hurd in them (related to the weight of the short fibers) in bulk.
 - Output: Dust in bulk.

Example of 4tph processing line (*this is just an example - the line in the scope of the proposal can differ from the one in this image*):



1.2. Given:

- Round bales with max. dimensions $\varnothing 1800 \times 1500$ mm.
- Bulk material can also be fed in the line.
- Bale density: around 155 kg/m^3 (between 140 kg/m^3 and 165 kg/m^3)
 - Max bale size $\varnothing 1800 \times 1500$ weighs between 500 and 620 kg.
 - Min bale size $\varnothing 1600 \times 1200$ weighs between 330 and 400 kg.
- Moisture content: between 13% and 18% (everywhere in the bale – no wet spots).
- Yellow color, dry or retted to a light grey color; if the input material is green (green flexible stalks), the result will be worse. If the straw is over-retted the quantity of dust will be much higher and the capacity will drop.
- If the humidity of the material is higher than 20%, you will risk blocking of the line, reducing the capacity (sometimes to less than half of the max.) and possibly damaging the equipment.
- Operation: 24h/day – 5days/week.

1.3. REMARKS:

- Cleanliness: when we talk about 2% of hurd in the fiber, this means that of the total amount of technical fiber there is 2% of hurd in there. So 100 kg of technical fiber contains max. 2 kg of hurd. So it is never related to the total amount of hurd in the plant.
- Stones, rocks, metals and other foreign parts can reduce the capacity and/or damage the equipment. It is recommended to educate farmers to keep the amount low so that the chance of getting them out after the straw opening is high. If the amount is too high, not all will be taken out and some will continue through the equipment making sparks, fire or damaging the equipment.
- The following equipment is being used by Hempflax, La Chanvrière de l'Aube, Cavac, AITF, Natural Fibers, ...
- The modular composition of the line allows easy modification if and when it is needed.
- Our equipment has proven its reliability and its performance on many levels during the past decades. We have built in the highest possible flexibility in terms of output material.
- The equipment is very efficient in decortication and in energy use because of the fact that all main motors are on frequency drive in order to avoid losses at partial load.
- Due to the fact that everything works in suction, there the dust level in the production room is very low, even if ductwork would have a puncture due to the wear. The fans are high efficiency fans which are running under optimal conditions and because they are placed in the clean air side there is no wear on the fans.
- The operation is visualized so that almost anyone can operate the system after a short training.
- The set-up is compact and maintenance is quite easy.

2. Feeding and decortication.

2.1. Process:

2.1.1. Input: round and rectangular bales of hemp straw

2.1.2. Output:

- Fiber containing approx. 20% of hurd – in bulk (option of baling is indicated)
- Uncleaned hurd in bulk
- Dust in bulk

2.2. Feeding and decortication

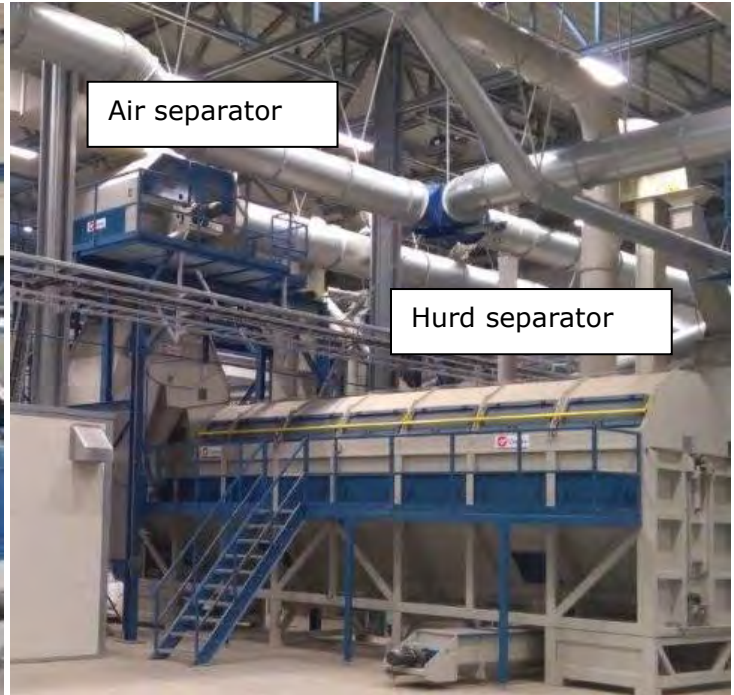
- Storage conveyor, 10 m long, 1.5 m wide – straps from the bales to be taken off manually.
- Bale and straw cutter:
 - The cutter has to be operated by one person.
 - The bale will be positioned, with the center under the knife, by the operator.
 - The bale retainer is closed to prevent the bale from falling onto the next step.
 - The first cut through the center of the bale creates two half bale parts.
 - The conveyor has to move backwards until the front of the first half is at the position of the knife.
 - The operator can set the length after which a button is pushed and the full bale is cut to the set length. During this operation the bale retainer is in the upward position.
 - The cut straw drops onto the transfer conveyor that feeds the straw opener.
- Transfer conveyor, inclined, length 7.5 m – brings the slices to the straw opener.
- Twin straw opener composed of the first part for coarse opening of the straw, followed by the second part for final opening and feeding to the line.
- Decorticator, type CRD1301-IDS.
- Spark detection to be placed in the ductwork between the decorticator and the air-separator + valve to shut off the suction and valve to discharge the material to the floor instead of in the hurd separator.
- Air separator: type RK1815 – discharges the decorticated material into the hurd separator. The dust loaded air is separated and goes to the filtration units.
- Supporting structure, platform, access ladder for this air separator.
- Hurd separator type DIII-10M to remove as much hurd as possible from the fiber.
- Conveyor at the outfeed side of the hurd separator, that can turn to the left or to the right. When turning to the left, the fiber is being moved to the buffer conveyor before passing a second time through the decorticator. When turning right, the fiber is being move to the fiber cleaning part.
- Air separator: type RK1810 – discharges the fiber after the first pass onto the buffer conveyor. The dust loaded air is separated and goes to the filtration units.
- Supporting structure, platform, access ladder for this air separator.
- Buffer conveyor, 12 m long, placed above the twin straw opener. Once this conveyor is full, the infeed of straw automatically stops and a valve switches, after which the fiber runs through the decorticator a second time.
- Air separator RK1410, connected to the hurd exit of the hurd separator, to bring the hurd to the next step.
- Air separator RK1410, positioned above the buffer conveyor of cleaning line, connected to the exit of the right side of the conveyor at the fiber exit of the hurd separator, to bring the fiber to the cleaning line.
- Supporting structure, platform, access ladder for the air separator.
- Coupling parts.
- Lay-out and engineering.
- Installed power in this part: 387 kW – 50Hz – 3phase 400V.



Bale cutter



Twin straw opener



3. Fiber cleaning.

3.1. Process:

3.1.1. Input: bulk decorticated fiber containing approx. 20% of hurd.

3.1.2. Output:

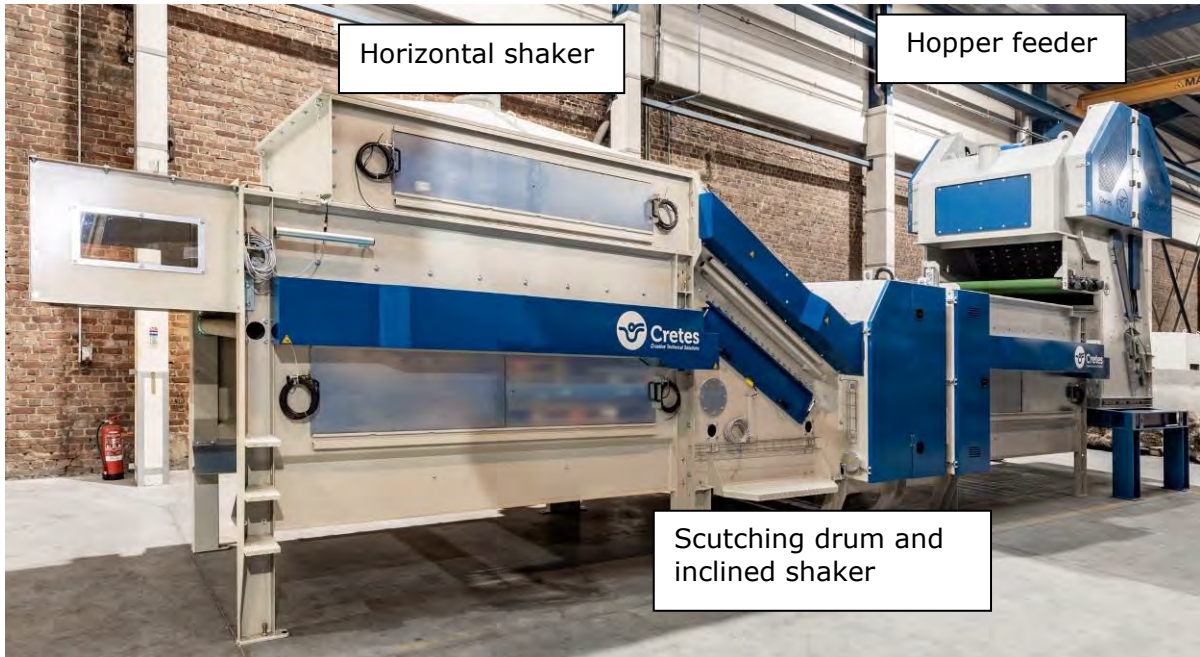
- Fiber containing generally <2% of hurd – in bulk (cleaning degree depends on the retting degree and quality of raw material).
- Uncleaned hurd in bulk
- Dust in bulk

3.2. Fiber opening and cleaning :

- The hopper feeder feeds the decorticated fiber in a regular way to the cleaning line. In several steps, the hurd is taken out and the fiber is being cleaned. The fiber contains in general less than 2% of hurd after this step. The fiber is then being transported to a baling press.

The line is composed of the following items:

- Buffer conveyor.
- Hopper feeder: CH1500 with entry and exit conveyor.
- Horizontal shaker to clean.
- Scutching drum to loosen the remaining hurd.
- Inclined shaker to separate the hurd.
- Horizontal shaker
- Inclined conveyor with magnetic top drum to eliminate as much magnetic metal as possible.
- Inclined conveyor with metal detection (reverses when the detection is activated to get the fiber with metal parts out).
- 2x combined fine opener with step cleaner.
- Support under the cleaning line and the hopper feeder to place them higher to put the hurd conveyor underneath.
- Hurd conveyor.
- Air separator RK1410 + supporting structure, platform, access ladder (transporting the fiber to a baling press).
- Air separator RK1410, with supporting structure, platform, access ladder (collecting fibers that might be aspirated in the dust extraction).
- Coupling parts.
- Lay-out and engineering.
- Installed power in this part: 124 kW – 50Hz – 3phase 400V.



4. Fiber baling.

4.1. Process:

4.1.1. Input: fiber coming from the fiber cleaning section

4.1.2. Output: bales of fiber – dimensions see below.

- Weight of the bales depends on the degree of hurd in the fiber and is between 200 and 250 kg.

4.2. Technical fiber baling

- Automatic baling press C40S1000M-45: bales 735x765 – length is adjustable but generally around 1100 mm. Metal wire strapping.
- Filling shaft for the baling press.
- Coupling parts.
- This machine has its own electrical cabinet, with detections on the machine and safety devices.
- Installed power in this part: 49 kW – 50Hz – 3phase 400V.



Automatic fiber baler fed by an air separator

5. Hurd (shives) cleaning.

5.1. Process:

5.1.1. Input:

- Flow 1 : hurd coming from the decortication.
- Flow 2 : hurd coming from the refining.

5.1.2. Output:

- Cleaned hurd (dust extracted and low fiber content)
- Short fibers containing 35% of hurd (amount is below 10% in case of good raw material)
- Dust in bulk

5.2. Hurd cleaning for hurd from the decortication part:



Hurd cleaner

- Hurd cleaner, 8 m long with interchangeable sieves.
- Suction of cleaned hurd, connected to an air separator RK1410 that is placed at the next step. We transport by suction to do a final dust extraction before the hurd moves to the final step.
- Supporting structure, platform, access ladder for the air separator.
- Collecting conveyor for fibers and oversize hurd.
- Blower Z603 to blow the fibers and oversize hurd back to the infeed of the second decorticator.

5.3. Hurd cleaning for hurd from the fiber cleaning part:

- Under the cleaning line there is a collecting conveyor for hurd and short fibers. This conveyor feeds a simple shaker table.
- The goal is to retrieve as much hurd as possible and feed that hurd to the hurd cleaning under 5.2.
- The remaining hurd and short fibres will be transported with an inclined conveyor to the short fiber baler.

5.4. Other:

- Coupling parts.
- Installed power in this part: 27 kW – 50Hz – 3phase 400V.



Shaker table

6. Second cleaning step for hurd

- Elevator to take the hurd under the cleaning drum and transport it to the oscillating shaker.
- Oscillating shaker to do a second cleaning step.
- Conveyor to transport the short fiber and oversize hurd to the fan under 5.2.
- The cleaned hurd will be collected by the suction system and air separator RK1108 that is quoted under 5.2.
- Coupling parts.
- Addition to the electrical cabinet.
- Lay-out and engineering.
- Installed power in this part: 13 kW – 50Hz – 3phase 400V.



7. Automatic hurd baling

7.1. Process:

- 7.1.1. Input: cleaned hurd.
- 7.1.2. Output : 20 kg bags of hurd (or 15 kg).

7.2. Hurd baling :

- Air separator : RK908 + supporting structure.
- Receiving buffer with augurs – 0,8 m³.
- Weighing bunker with pneumatic valves and augurs – 0,25 m³.
- Vertical compression unit.
- Horizontal compression unit with hydraulic slide.
- Bags made from rolls of PE foil:
 - The foil is put over a formation shoulder and pulled over a rectangular tube.
 - A longitudinal seal bar seals at the top.
 - A transversal bar seals at the bottom.
- The compressed hurd is pushed in the formed bag and the transversal bar seals also the top.
- The baler produces up to 200 bags per hour of 20 kg (or 15 kg).
- A roller conveyor brings the bales to the exit of the machines.
- Coupling parts.
- The baler has its own electrical cabinet, with detections on the machines, safety devices. The basic connections to interact with the rest of the process are included.

- Installed power in this part: 95 kW – 50Hz – 3phase 400V.



8. Short fiber baling.

8.1. Process:

- 8.1.1. Input: short fiber loaded with hurd, coming from the second hurd cleaning.
- 8.1.2. Output: bales of fiber – dimensions see below.

- Weight of the bales depends on the degree of hurd in the fiber.

8.2. Short fiber baling

- Automatic baling press C40S1000S-22: bales 535x565 – length is adjustable but generally around 1100 mm. Metal wire strapping.
- Filling shaft for the baling press.
- Coupling parts.
- This machine has its own electrical cabinet, with detections on the machine and safety devices.
- Installed power in this part: 26 kW – 50Hz – 3phase 400V.



Picture showing 2 baling presses next to each other

9. Suction and filtration

- All suction points have to be connected with ducts to the filtration system.
- Dust filtration: 2 automatic bag filters, each type APF200, each with a capacity of 75000 m³/h and with platform and ladder.
- Total capacity = 150000 m³/h.
- Rotating air lock at the bottom of each filter.
- Inclined dust augur to bring dust to a bin (bin not included).
- To be installed outside the building – under a roof.
- Total height is 9800 mm.
- Each filter has a suction fan, capable of generating 75000 m³/h suction at a negative pressure of 4000 Pa.
- Dust control sensor at the outlet of each filter: detects when too much dust comes out the clean side (this may happen when a bag is punctured or loose).
- Installed power in this part: 273 kW – 50Hz – 3phase 400V.



10. Electrical system

- Central electrical cabinet with main switch.
- Only the baling press has its own electrical cabinet.
- Motor starters for motors with fixed speed.
- Frequency drives for motors with variable speed and for motors over 15 kW (except on the balers).
- Safety circuits.
- Motor protection systems.
- Sensors pre-wired on the machines that are transported in one piece: optical sensors, inductive sensors, ...
- Door switches pre-wired on the machines that are transported in one piece.
- Emergency stop circuits.
- Push buttons and action buttons on certain machines.
- PLC Siemens.
- Visual interface on a screen to operate the system.
- Necessary components to make everything work.
- Programming – control software.

11. Auxiliary, delivery and installation

11.1. Ductwork

- Ductwork can be determined when the exact lay-out is finished.
- Cretes will supply drawings of the ductwork that has to be made and installed by a local company.

11.2. Cables and cable trays

- Cretes provides the drawing where the cable trays have to be put and also the cable list. This work needs to be done by a local contractor.

11.3. Transport, installation and start-up

- Transport: 45 containers 40ft (OT-HC) on land with train/truck: price to be determined when shipping is arranged.
- We have included the price for packing the equipment and loading the containers (FCA Gullegem, Belgium).
- Mechanical installation by local crew, with guidance of 2 Cretes technicians (6 local mechanics during ± 72 working days on site – effective working hours = 10 hours per day, 6 days per week). Rates for Cretes technicians (Max. 24 consecutive workdays on site): 6910 euro/week, traveling at cost, hotel + breakfast at cost, rental car at cost.
- Ductwork : to be installed by the ductwork manufacturer. We estimate that he will need +/- 50 working days with 4 persons to install the ductwork. Part can happen during mechanical installation.
- Electrical installation: A local electrical contractor has to put the cable trays and all cables (control and power wiring). A Cretes electrician supports the local contractor during this process as long as it is required. Rates for electrical technician (Max. 24 consecutive workdays on site): 6910 euro/week, traveling at cost, hotel + breakfast at cost, rental car at cost.
- Start-up, commissioning and training of staff:
 - 3 weeks – 2 software engineers check the I/O's and rotation directions and test the program.
 - 3 weeks – 2 engineers for balancing the air-flows.
 - 2 weeks – 2 engineers for starting up, running with material and training of staff.
 - 2 weeks – 1 engineers for follow up after running a few weeks.Rates for Cretes engineers (Max. 24 consecutive workdays on site): 8110 euro/week, traveling at cost, hotel + breakfast at cost, rental car at cost.
- The above are estimates that can vary depending on circumstances, motivation and skills of local people. These cannot be controlled by Cretes and fall outside of our responsibility.
- Installation and start-up has to happen under acceptable atmospheric conditions to preserve the safety and health of everyone on site. Onsite work will be suspended when temperatures are below 5°C or higher than 32°C, during rain, hail or snowfall when working outside, or other conditions that prevent the people from delivering quality work. This may result in additional (traveling) costs for supervisors.
- Daily rates for additional work: 1210 euro/day/person, traveling at cost, hotel + breakfast at cost, rental car at cost.

12. Price overview:

Description	Price in euro (€)
2. Feeding and decortication	€ 1 555 000,-
3. Fiber cleaning	€ 1 099 000,-
4. Fiber baling	€ 215 000,-
5. Hurd cleaning	€ 290 000,-
6. Second step for hurd cleaning	€230 000,-
7. Automatic hurd baling	€ 490 000,-
8. Short fiber baling	€ 170 000,-
9. Suction and filtration	€ 432 000,-
10. Electrical system	€952 000,-
11.3 – second dot: packing and loading (FCA Gullegem-Belgium)	€ 161 000,-
Price FCA Gullegem of items described above:	€ 5 594 000,-

13. General specifications:

13.1. Manuals and maintenance instructions:

- Are delivered by CRETES, written in English, after final commissioning and in digital format (PDF)
- On request, we can provide the manuals in other languages, but extra translating costs will be invoiced.
- Unfinished equipment as described in the European Directive 2006/42/EG are delivered with a Declaration by the Manufacturer of the type Annex II.1.B from this Directive. The person completing this equipment or implementing it in the installation for which it is intended, is responsible for the CE-marking and this only after evaluation of the remaining risks and the reduction of these risks to an acceptable level.
- Completed equipment/installations as described in the European Directive 2006/42/EG are delivered with a EC Declaration of Conformity of the type Annex II.1.A from this Directive.

13.2. Finishing:

- Standard CRETES finishing and colors:
- Machines and parts: RAL 7044 (silk grey) and RAL 5009 (blue azure)
- Safety items: RAL 1023 (traffic yellow)

13.3. Electric:

- Required power supply: 3 phase 400V – 50Hz.
- Standard European components (mainly Siemens).
- Total installed power (without options) : 994 kW – power consumption at full capacity : approx. 610 kW per hour.

13.4. Space and operators:

- Operators: 4 persons: 1 man feeding bales and taking off the straps, 1 operator for the bale and straw cutter, 1 line supervisor and 1 man taking away finished products.
- Required space: Building 90 m long and 30 m wide with clear height of 10 m.
 - Ware housing for raw material is not included in this: make sure to have at least storage for 1 week on site.
 - Ware housing for finished products is not included in this: to be determined according to your sales conditions.

13.5. Compressed air:

Compressed air quality should be in accordance with standard DIN ISO 8573-1:

- Max particle size: 0.1micron – class 1
- Dew point (pressure): -20°C – class 3 min.
- Oil content: max. 0.01mg/m³d – class 1
- Min. required working pressure: 8bar
- For the full processing line you will need approx. 240 Nm³/h.

Warranty	<p>Duration: 1 year in 2-shift system after commissioning</p> <ul style="list-style-type: none">• On parts and on-site work (max 18 months after availability in our workshops)• The warranty does not apply to parts subject to wear and tear and to parts that have been improperly used, neglected, improperly maintained or damaged due to an external cause. <p>Travel, accommodation and transport costs are not included in the warranty.</p>
Mounting & start-up	<p>The complete site must be cleaned and set free to enable the mounting and assembly in a practical and safe way.</p>

We hope we have made you a suitable offer. We wish to thank you for your inquiry and we remain at your service for any further information.

For Cretes nv
Alex Teodorescu

CRETES NV

Bissegemstraat 169

8560 Gullegem – Belgium

Tel +32(0)56 411 094 – Fax +32 (0)56 419 956

www.cretes.be – info@cretes.be

BTW BE0412 423 610 – RPR Kortrijk



GENERAL TERMS AND CONDITIONS OF SALE – CRETES NV

- 1. ORDERING** By simply placing an order, the buyer accepts the terms and conditions specified below. Even when the general terms and conditions of the customer contain provisions that should be different from Cretes NV's terms and conditions, the seller's terms and conditions shall always prevail.
- 2. PRICES** The prices and remittances are established based on the current economic situation. Except for a contrary provision, they shall apply for 30 days as from the date of the offer. Prices are net ex-factory and without packaging unless specified otherwise. All taxes, input duties and stamps of whatever nature that encumber the contract shall be borne by the buyer.
- 3. DELIVERY TERM** The delivery term shall start as from the payment of the contractually foreseen advance payment. The determined delivery terms are only indicative and, therefore, non-binding. A delay in the delivery shall not entitle the buyer to compensation or interest payment unless this was stipulated formally. The delivery term shall be deferred by operation of law and the buyer may not claim losses in case of force majeure (including strikes, interruption or delay when supplying raw materials).
- 4. INSTALLATION** The installation, foundations, positioning, electrical connection, personnel training and after sales services are not included in the obligations of the seller. They will always be a part of an additional contract at the expense of the buyer and for the price that shall be determined when the performance is made but always while applying the present general terms and conditions. The costs for using forklift trucks required for loading and positioning the sold items shall be at the expense of the buyer. If the installation is included in the sales price, the buyer shall commit to having the installation take place without delay and the buyer must pay compensation should the buyer not comply with his/her obligations.
- 5. DELIVERY** The delivery shall take place at the agreed location. If a location for delivery was not agreed, it shall take place ex-factory. It is assumed that items are accepted before departure from the storerooms of the seller. Any guarantee for construction errors shall apply for a year to start as from the delivery date or from the date on which delivery should have taken place. In any case, a complaint shall be inadmissible in whatsoever form either from the 8th day after receipt of the items or from the 3rd day after receiving the invoice. The seller shall not accept the return of items without the seller's prior permission. When a return is accepted, this shall take place carriage paid at the address of the seller. Should the complaint concerning the quality of the items be admissible and with foundation, the obligations of the seller shall only entail the free replacement of the item that is faulty without the seller being asked to pay additional compensation in any other way. The repair or replacement of parts during the guarantee period shall not, in any case, extend the guarantee. The return and complaints shall suspend, in any case, the demandability of the sums due and payable. The guarantee shall no longer apply should the buyer decide to make repairs or changes or have a third party make repairs or changes without prior approval from the seller.
- 6. INTELLECTUAL PROPERTY** After delivery, the seller shall transfer to the buyer all required plans and documents to assure the operation of the delivered devices and equipment. Plans that are transferred to the buyer by the seller may never be given to third parties and shall always continue to be the material and intellectual property of the seller. The implementation plans, however, shall remain with the seller without the buyer being entitled to examine them.
- 7. TRANSPORT** The items shall travel at the risk of the buyer even when the sale takes place carriage paid including all the costs or by using the seller's own ordering service unless specified otherwise. If the seller contracts with the shipper, the seller shall only do this as a mandatory of the buyer. In case of loss, damage, etc., the buyer can only turn to the shipper or the third party responsible without intervention from the seller.
- 8. RETENTION OF TITLE** The seller shall retain the title of the delivered items until all claims on the buyer, whichever these may be, are fully paid. The buyer commits to inform the seller immediately should items be encumbered at the buyer's expense or in the buyer's hands. Every partial or total disposal of items by the buyer contrary to the seller's property rights shall be deemed to be a breach of trust as referred to in the provisions of Article 491 of the Belgian Penal Code.
- 9. EXPRESS AVOIDANCE CLAUSE** The seller shall be entitled to consider the contract terminated without a notice of default or any intervention by the court being required in the following cases: when the advance is not paid, upon bankruptcy of the seller, when an application for a composition has been filed regarding the seller, upon the liquidation of the seller, when the sold items are the object of a buyer's attachment, when the buyer does not comply with the buyer's obligations and liabilities on the expiry date and when everything points to the buyer not intending to comply with the buyer's obligations and liabilities. Should the seller invoke the express avoidance clause in relation to the buyer, the seller must do this through a registered letter or bailiff's notification. In this case, compensation shall be due and payable of at least 40% of the order amount to be increased by all losses linked to the items as well as the termination of the contract.
- 10. PAYMENT** Invoices must be paid in cash where all costs shall be at the expense of the buyer at the registered office of the seller unless agreed otherwise expressly and in writing. Issuing bills of exchange and receipts shall not entail substitution of one debt for another. When an invoice is not paid on the expiry date, the invoice amount shall be increased by an interest of 1% per month and a fixed compensation of 15% of the amount of the order where a minimum of € 124 shall apply by operation of law and without notice of default being required.
- 11. CANCELLATION** Should the contract be cancelled by the buyer, the already invoiced and/or not yet paid advance payments shall continue to be deemed acquired definitely by the seller. Should, however, the suffered losses as a result of the cancellation (loss of profits and suffered losses) be higher than the already invoiced advance payments, the seller shall be entitled to claim the integrally suffered losses.
- 12. COMPETENT COURT** Belgian law shall apply to all offers and contracts of the seller. Should there be a dispute, only the court of the registered office of the seller shall be deemed competent. The seller, however, shall continue to be entitled, as the claimant, to summon to appear in front of the Court of the residential town or city of the respondent.
- 13. REGULAR PAYMENTS** The buyer recognises the right of the seller to stop the further execution of the contract when an invoice is not paid on the expiry date with regard to contracts where successive services must be delivered that are invoiced regularly. The seller also retains the right to refuse the execution of running orders when the previous deliveries to the same buyer or an associated company were not yet paid.
- 14. SAFETY** In case of installation and commissioning by the seller's staff, the buyer must provide all required information regarding safety regulations at the relevant site. The regulations must have been provided before the contract is entered into. The instructions must have also been provided and explained to the seller's staff expressly before the activities commence. The buyer must take all required measures to assure safety. If the safety regulations should not be observed by the seller's staff, the buyer must inform the seller immediately so that the seller can take the required measures. Delays due to this shall never be borne by the seller. If the safety regulations are not or are notified too late, all additional costs for taking the required measures shall be borne by the seller.

RECIPROCAL LIABILITY RESTRICTION

The parties declare to be professional equal trading partners unreservedly. They declare that they have arrived at the entered into contract based on their free will and with reciprocal respect. Based on the above, they have decided to restrict the reciprocal liability with regard to and because of the opportunity of executing this contract. The parties shall never be liable to each other for whatever damage or loss whatsoever that should exceed the sole limit of € 5 million agreed here even when different provisions should have been made elsewhere in the contract.

This amount also includes any claims or amounts owed from their appointed individuals, contractors, subcontractors or other trading partners to whom they may appeal or whom they may control or be responsible for. The parties shall indemnify each other to the extent that they may exceed the specified limit. They shall ensure that the involved parties waive their rights.

The parties shall make the following exceptions:

When a party should be to blame for a proven, intentional or important error or omission that may be deemed intentional. In this case, this party cannot appeal to the restriction specified above and this party's liability shall be without restriction.

The immaterial damage that is not the result of material damage. The parties declare that they shall restrict this reciprocal liability to € 1 million for this purely financial and immaterial damage.

Definitions:

Damage (and loss) is deemed to mean the following:

- Both based on contractual and non-contractual liability.
- Both direct and indirect damage.

Physical injury is deemed to mean the following: injury of the physical integrity (that may or may not lead to death) and the financial and moral consequences thereof.

Material damage is deemed to mean the following: damage, destruction or loss of items including animals.

Immaterial damage is deemed to mean the following: other damage than the one described above that may arise from loss of use of an item or a right such as loss of enjoyment, being unemployed, production standstill, loss of profits and any other financial disadvantage. The parties make a distinction between the following within this context:

- The immaterial damage that is not consequential damage (or the purely immaterial damage): the immaterial damage that is not the result of physical damage or material damage.
- The immaterial damage that is consequential damage (or the immaterial consequential damage): the immaterial damage that is the result of physical or material damage.

LIMITATION OF LIABILITY WITH REGARD TO STUDY CONTRACTS:

The sole purpose of the offered (or ordered) study contract is to better investigate the terms of reference as described in this document with the goal of producing a quotation for an installation that offers a solution for the requested terms of reference. The results thereof cannot continue as an executable design or plan and may not be used as such. Should the customer use the results of the study contract for other objectives than described above, we can never be held liable for possible errors, shortcomings or omissions. Any liability regarding this is emphatically rejected under these conditions. By having the study contract executed (i.e. ordered), the customer waives any recourse and the customer commits to indemnify us with regard to all claims due to damages or losses that may have occurred under these conditions.