REPORT TO THE TWENTY-NINTH LEGISLATURE
2018 REGULAR SESSION
STATE OF HAWAII

REPORT ON THE STATE'S PROGRESS TOWARD MEETING THE MILESTONES AND OBJECTIVES OF THE ENERGY FEEDSTOCK PROGRAM

ACT 159, SESSION LAWS OF HAWAII 2007

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THE STATE OF HAWAII
DEPARTMENT OF AGRICULTURE

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ENERGY FEEDSTOCK PROGRAM

Annual Report to the Legislature for Calendar Year 2017

Legislative Background

Section 141-9, Hawaii Revised Statutes, enacted pursuant to Act 159, Session Laws of Hawaii 2007, provides in full as follows:

[§141-9] Energy feedstock program. (a) There is established within the department of agriculture an energy feedstock program that shall:

(1) Maintain cognizance of actions taken by industry and by federal, state, county, and private agencies in activities relating to the production of energy feedstock, and promote and support worthwhile energy feedstock production activities in the State;
(2) Serve as an information clearinghouse for energy feedstock production activities;
(3) Coordinate development projects to investigate and solve biological and technical problems involved in raising selected species with commercial energy generating potential;
(4) Actively seek federal funding for energy feedstock production activities;
(5) Undertake activities required to develop and expand the energy feedstock production industry; and
(6) Perform other functions and activities as may be assigned by law, including monitoring the compliance provisions under section 205-4.5(a) (15).

(b) The chairperson of the board of agriculture shall consult and coordinate with the energy resources coordinator under chapter 196 to establish milestones and objectives for the production of energy feedstock that is grown in the State. The chairperson and the coordinator shall report the State's progress toward meeting such milestones and objectives annually to the legislature.

(c) The chairperson of the board of agriculture shall also consult and coordinate with research programs and activities at the University of Hawaii that will assist in the further growth and promotion of the energy feedstock production industry in Hawaii.

(d) The chairperson of the board of agriculture may employ temporary staff exempt from chapters 76 and 89. The board may adopt rules pursuant to chapter 91 to effectuate the purposes of this section. [L 2007, c 159, §5]

Energy Feedstock Program Milestones and Objectives: Reportable Activities for the period of January 1, 2017-December 31, 2017.

While we currently import approximately 90% of our fuel, we also import approximately the same percentage of food. Renewable energy development in the form of energy feedstock production is essential to Hawaii's energy security, but it should be promoted in a manner that protects the prime agricultural land that is fundamental to agricultural production and food security. Farmers in general will benefit when a locally produced fuel source is available so that they are less subject to fluctuation of world oil prices and the impact it has on petroleum based inputs.

It is also important to note that special use permits for solar energy facilities on land designated as "agriculture" have been increasing over the past several years. While not considered "energy feedstock" solar energy facilities serve a similar purpose; however, solar energy facilities cannot easily be converted to food production. For the purposes of this report, solar energy legislation will also be included as a part of the discussion.

It is critical that all of agriculture work together. We have common interests in seeing agricultural lands protected and particularly lands designated as Important Agricultural Lands; in the fair and equitable use of water and to have this fairness reflected in the water code; in increasing the number and productivity of farmers by strengthening the agricultural education programs in public and private schools, and in addressing the challenging issue of farm labor.

This report is in five sections. Part 1 of the report discusses relevant legislative measures related to energy feedstock production. Part 2 discusses related research in the field of energy feedstock production. Part 3 discusses the dissemination of energy feedstock production to potential producers. Part 4 discusses actions taken by the government and industry that affects energy feedstock production. Part 5 discusses program limitations.

1. Related Legislative Measures Enacted in 2017.

Act 15. Deletes "every fifth year reporting" requirement by the greenhouse gas emissions reduction task force to the Legislature and changes who is authorized to appoint the panel to conduct the evaluation of the energy systems development special fund projects. (HB1041).

Act 186. Establishes the University of Hawaii (UH) Green Special Fund to support energy efficiency, renewable energy, and sustainability projects and services, and planning, design, and implementation of sustainability projects for UH's benefit. Requires UH to submit an annual report to the Legislature. (HB794 HD1 SD2 CD1).

Act 199. Amends the Industrial Hemp Pilot Program by restricting cultivation of industrial hemp under the pilot project to agricultural lands and requires counties to recognize it as an agricultural product, use, or activity. Allows license application year-round. Repeals certain physical facility requirements. Repeals the requirement for a movement permit to transport industrial hemp grain or plant material. (SB773 SD2 HD1 CD1).

2. Related Research.

<u>Hawaii Department of Agriculture</u>

HDOA's Aquaculture and Livestock Support Services branch is working with the Agribusiness Development Corporation (ADC) to identify waste streams that have feed or fertilizer potential. They are working in collaboration with the United States Department of Agriculture. Currently HDOA is working on a contract to hire an aquatic feedstock specialist to further this initiative.

The ADC received a total of $4.5 million from the Legislature for the zero-waste conversion project in Keaau, Hawaii to develop a demonstration facility where researchers will use heterotrophic algae/fungi to convert papaya waste into oil and feed products. It is estimated that the Hawaii papaya industry produces approximately 15 million pounds of papaya annually that cannot be sold as fresh produce because of blemishes and other deformities and insect infestations.

Upon completion, this facility will provide farmers with the opportunity to earn additional income from the waste portions of their crops in the form of feedstock, which can be converted into oil for fuel and high protein feed for livestock. More importantly, the research on the zero-waste concept will be able to continue and could potentially be applied to other fruit and vegetable crops across the state.

To expedite the development and research, ADC entered in a Memorandum of Understanding with Pacific Biodiesel Technologies ("PBT") to establish a temporary demonstration facility at PBT's Big Island Biodiesel site where the specialized equipment is currently being modified and assembled. To date, $2.3 million was expended to purchase the equipment and land in the W.H. Shipman Business Park where the Zero Waste Facility will be located. The ADC anticipates the Zero Waste Facility will be completed in December 2018.

On Kauai, Green Energy Team (GET) declared substantial completion of its 7.5MWe biomass to energy facility in January. GET has been successfully operating the plant since then and has harvested over 1250 acres of invasive Albizia trees on land managed by the Agribusiness Development Corporation in Kalepa, Kauai and planted 1400 acres of non-invasive hardwoods on the Kalepa Lands to insure its long-term fuel supply. GET leases 1,123 acres on Kalepa. GET has a 20 + 10-year power sales agreement with the Kauai Island Utility Cooperative (KIUC), KIUC purchases Firm, Dispatchable Capacity and energy from GET to cover 12% of the Kauai's base load.

College of Tropical Agriculture and Human Resource

The College of Tropical Agriculture and Human Resources is continuing a feedstock supply system project with field trials across the state for lignocellulosic biomass cultivation for ethanol production, and more limited trials on oil crop cultivation for biodiesel. Current research is focused on identification of marginal agricultural lands in Hawaii appropriate for cultivation of Jatropha curcas, a small tree that produces oil bearing seed and a candidate crop for oil feedstock production, using an EcoCrop model. The goal of this approach is to achieve oil feedstock production without competing with cultivation of food crops.

With respect to conversion of lignocellulosic biomass (grasses) to energy, research continued to optimize anaerobic digestion (AD) conditions for biogas production from Energycane and Napier grass using hydrothermal treatment. The digestate from the conversion process, which is rich in lignin and cellulose, could also be used as an ideal substrate for generating additional bioenergy and bio-based

products via thermochemical conversion, such as pyrolysis, hydrothermal liquefaction and hydrothermal carbonization.

Bio-conversion of food waste into biodiesel and animal feed is also being investigated, using black soldier fly (BSF) larvae grown on food wastes to produce fat and protein rich BSF prepupae. The lipid content in BSF prepuae was characterized, and BSF-derived oil was found to have a high concentration of medium chain saturated fatty acids (67% of total fatty acids) and a low concentration of polyunsaturated fatty acids (13% of total fatty acids. This oil is potentially an excellent substrate for producing high quality biodiesel.

An additional energy project has focused on development of a sugar-air alkaline batter (SAAB) system. Low cost electric power generation using raw juice from culled papaya or fruit waste as feedstock was achieved in a prototype SAAB system. Fruit waste, juice-based electrochemical energy may represent a sustainable distributed energy resource for remote regions needing low-cost electricity without complicated infrastructure.

Hawaii Agricultural Research Center

Current trials at the Hawaii Agriculture Research Center (HARC) are focused on various high biomass grasses for biofuel feedstock including sugarcane, energycane, Banagrass, and sterile hybrid grasses which resemble Banagrass/Napiergrass (PMB).

HARC's most advanced energycanes have been tested in multiple trials over several years and have shown to have high biomass, disease resistance, and suitability for mechanical harvest. Several of the clones also have a high sugar content, therefore increasing the processing efficiency for biofuel production as compared to fiber alone.

A seed production system for the high yielding energy "PMB" grasses has proven effective and was expanded this year using improved parent materials on a larger scale. This system allows farmers to plant these grasses by true seed rather than by billets, as is used in sugarcane production, using existing farm equipment such as grain drills. PMB hybrids can resemble Banagrass/Napiergrass in terms of yield, management and composition but are seed sterile with much less risk of invasiveness associated with Napier grasses. New hybrids with a specific focus on forage quality for animal feed are being focused on in 2017/2018 crossing season. They can be managed as a no-till crop due to their ability to be ratooned many times, thereby reducing carbon emissions associated with tillage and annual cropping systems. The seeds are planted as a genetic family, rather than clones, thereby increasing their tolerance to potential disease and pest pressure. New material is providing genetic diversity without a large difference in yield diversity, which is critical to this crops success.

HARC is also maintaining a germplasm collection of several hundred Jatropha selections from around the world, as well as maintaining other oilseed tree crops for future research.

3. Dissemination of Energy Feedstock Information to Potential Producers

HDOA and its attached agency, the Agribusiness Development Corporation, continues to meet with individuals and companies seeking information about state or privately owned agricultural-zoned lands, water, and agricultural labor. During 2017, HDOA has met with several companies and individuals interested in producing feedstock.

HDOA remains in contact with Pacific Biodiesel. Pacific Biodiesel manages biodiesel plants in Hawaii and Oregon. Pacific Biodiesel provides engineering, equipment, contracting, and laboratory services needed for profitable community-based production of quality biodiesel from various feedstocks.

4. Maintain Cognizance of Actions Taken by Government and Industry

Hawaii Clean Energy Initiative

HDOA is a member of the Hawaii Clean Energy Initiative (HCEI), which is a partnership between the Department of Energy and the State of Hawaii, and is part of the Fuels working group. In addition to the Fuels group, there are three other working groups addressing End-Use Efficiency, Electricity, and Transportation. These groups have met separately and together throughout the year. Collectively, these four groups are tasked with:

- Benchmarking the current state of clean energy in Hawai‘i
- Identifying information gaps
- Identifying structural and technical barriers to reaching the 70% clean energy goal
- Developing strategies for overcoming the barriers.

Oceanic Institute Feed Mill

On February 1, 2013, HDOA entered into a contract with Oceanic Institute (OI) to construct a pilot production scale research feed mill. Guided by Act 122, Session Laws of Hawaii 2013, HDOA set aside $450,000 in special funds and general revenues for OI to plan, design, and construct a feed mill laboratory. The feed mill laboratory will house a Wenger X-20 extruder, an Insta Pro model 2500 dry extruder, and a CPM model 1100 pellet mill.

The objectives behind the pilot research feed mill are to:

- Construct a pilot production scale research feed mill to support allied research and development programs at OI and other U.S. aquaculture and terrestrial entities.
- Develop research feeds in cooperation with allied research and development programs at the Institute that effectively and efficiently meet all animal nutritional requirements and research objectives.

- Offer large-scale defined test feeds for genetic and nutritional improvement research programs, pharmaceutical testing for commercial viability and efficacy, equipment testing, and efficiency of different manufacturing processes.
- Provide research feed products and technical assistance to support large-scale research farm grow-out trials with shrimp and finfish that simulate commercial production conditions.
- Demonstrate, promote, and display U.S. feed milling technology, goods, and services—such as those developed by members of the American Feed Industry Association—to the countries of the Pacific Basin.
- Assist in market development and increasing the demand for American feed commodities, manufacturing equipment, computer software, and other products that support aquatic feeds production.
- Initiate an international training program that offers short courses in aquaculture feed processing technology by working in cooperation with universities, private research organizations, and commercial companies. A Memorandum of Understanding is already in place with University of Hawai`i at Hilo for educational activities with terrestrial animals. OI would like to develop a similar partnership with Hawai`i Pacific University for aquatic animals.
- Transfer feed mill processing technologies to the commercial sector once they are proven effective and commercially viable.

As of October 1, 2017, OI has reported that it has successfully completed the construction of the feed mill. The schedule of work for the remainder of 2017 is to test the feed mill's control system with ingredients. If every test is satisfactorily completed, OI will continue to support the above listed objectives.

Pacific Biodiesel

With the end of HC&S operations, Pacific Biodiesel Technologies (PBT) moved agriculture operations from Hawaii Island to Maui at the beginning of 2017 where they are farming oilseed crops on two plots of land near Waikapu totaling 266 acres. The first plantings included black oil sunflower with early, promising results from the agronomy aspect and from the public excitement over these crops.

Plantings for the 2018 harvest season began in December with both irrigated and non-irrigated trials. No herbicides or pesticides have been used on any of the crops and beekeepers were brought in to set up their "hives" near the sunflowers. The seeds were harvested on Maui then shipped to the PBT crushing mill in Keaau, Hawaii Island. There, the seeds were carefully pressed to maintain high quality, without chemical refining, and are now being sold as cosmetic oil in the Hawaii market. Other crops planned for the 2018 season are safflower, chickpeas, cover crop trials, and industrial hemp (subject to HDOA licensing). Hemp can be planted most efficiently in the first quarter while the rain is still prevalent and is a preferred crop for its flexibility as fuel, food, fiber and other high-end co-products.

5. Program Limitations

Monitoring

Expertise in biofuel processing facilities and appurtenances is not currently available within the department. Without funds to hire staff or to contract for services, HDOA will be unable to monitor the compliance provisions under Section 205-4.5(a) (16).

Staffing

While the Energy Feedstock Program was authorized to employ temporary staff, the Legislature did not provide any funding for the positions in FY 08 or subsequent years. As a result, HDOA has focused its efforts on maintaining an awareness of actions taken by government and industry and supporting the efforts and activities of DBEDT, working with the U.S. Navy and U.S.D.A. as they implement their memorandum of understanding to jointly develop biofuels, and actively participating in discussions and conferences held in 2014 to advance biofuel production in Hawaii. The Chairperson continues to meet with various companies interested in using state agricultural lands and water resources for biofuel production. HDOA is especially interested in developments in by-products from biofuel production that can be used to replace imported animal and fish feed and fertilizer. Pacific Biodiesel has been extremely helpful and collaborative in this area.

Grant Writing

No federal grants were sought during the reporting period due to lack of funding for staff.