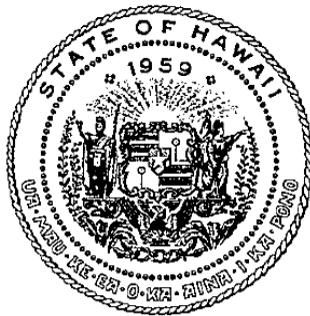


**REPORT TO THE TWENTY-NINTH LEGISLATURE
2017 REGULAR SESSION
STATE OF HAWAII**

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

ACT 159, SESSION LAWS OF HAWAII 2007



Prepared by:

**THE STATE OF HAWAII
DEPARTMENT OF AGRICULTURE**

DECEMBER 2016

ENERGY FEEDSTOCK PROGRAM

Annual Report to the Legislature for Calendar Year 2016

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, 2016-December 31, 2016.

The level of activity and interest in production of Hawaii grown energy feedstock crops increased significantly in 2016. Jatropha, sunflower and algae appear to be the leading crop/feedstock being explored at this time.

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 2016.

Act 27. Repeals chapter 201N, HRS, relating to the REFSP. Deposits proceeds in the renewable energy facility sitting special fund into the general fund. (HB2416).

Act 98. Clarifies that a publicly owned energy cooperative may be considered an energy project and project party for purposes of receiving financing through special purpose revenue bonds. (HB2231 SD1 CD1).

Act 116 Authorizes the issuance of special purpose revenue bonds to SunStrong LLC, a renewable energy developer, for the provision of electric energy and installation of renewable energy projects in Hawaii. (HB801 HD1 SD2 CD1).

Act 117. Authorizes the issuance of special purpose revenue bonds in the amount of \$30,000,000 to assist Hawaii Renewable Resources, LLC, with the development of facilities for food crop, animal feed, and renewable non-fossil fuel production on O’ahu. (HB2593 HD1 SD1).

Act 121. Exempts the operations of the Natural Energy Laboratory of Hawaii Authority from bidding requirements for concessions or space on public property. (HB1684 HD2 SD1 CD1).

Act 173. Permits hydroelectric facilities that are considered small hydropower facilities by the United States Department of Energy on agricultural district lands. (HB2077 HD2 SD2 CD1).

Act 176. Requires the Department of Education to establish a goal of becoming net-zero with respect to energy use by January 1, 2035. Requires the Department of Education to expedite the cooling of all public school classrooms. (HB2569 HD2 SD1 CD1).

Act 202. Establishes a 5-year renewable fuels production tax credit applicable to taxable years beginning after 12/31/2016. Repeals the ethanol facility tax credit. (SB2652 SD2 HD2 CD1).

Act 221. Establishes within the Livestock Revitalization Program a grant program for Qualified Feed Developers. Appropriates funds for the Feed Developer Grant Program and reimbursements to Qualified Producers for feed costs. (HB1999 HD1 SD2 CD1).

Act 248 Prohibits the discharge of treated or raw sewage into state waters after 12/31/2026 except when used to create clean energy. (HB2030 HD1 SD2 CD1).

Act 259 Extends the authorization of the issuance of special purpose revenue bonds to BioEnergy Hawaii, LLC, for the purpose of establishing a cogeneration facility and related energy production facilities, for an additional five years. (HB1853 HD2 SD1).

2. Related Research.

Hawaii Department of Agriculture

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 \$3 million appropriation during the 2014 Legislative Session 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 into a Memorandum of Understanding with Pacific Biodiesel Technologies ("PBT") to establish a temporary demonstration facility on PBT's Big Island Biodiesel site and help acquire and customize the specialized equipment which takes months to

modify and assemble. To date, \$2.3 million was expended to purchase specialized equipment, which is currently being modified at PBT and land in the W.H. Shipman Business Park to house the facility.

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 850 acres of invasive Albizia trees on land managed by the Agribusiness Development Corporation in Kalepa, Kauai and planted 900 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 Resource (CTAHR) is currently conducting a feedstock supply system project. Field trials across the state are continuing in order to determine the optimal lignocellulosic substrate for ethanol production in Hawaii. Napier grass crosses with pearl millet were found to have both drought resistance and high biomass yield. Work continued to develop one of these crosses as nutritious animal forage, supporting synergy of biofuel and forage production in Hawaii.

Research also focuses on conversion technology. A series of experiments were conducted to investigate methane yield using lignocellulosic biomass under mesophilic conditions via anaerobic digestion (AD). Napier grass, purple banagrass and energy cane were used as substrates, and cattle manure as inoculum; and microbial community analyses were also conducted. A mixture of rumen content and cow manure with Napier grass exhibited the highest archaea/bacteria diversity, and could enhance biodegradation through the synergetic action of the mixed microbial population, although the startup period should be closely monitored and a co-substrate with high buffering capacity incorporated.

An additional sustainable energy project in CTAHR is the development of a photovoltaic solar dryer as an economical tool for drying and processing of taro, breadfruit and sweet potato. As a demonstration project, a 20-foot freight container was outfitted with five photovoltaic panels at a capacity of 1.5 kw, and was able to dry 150 lbs. of sweet potato, after the tubers were reduced with a food chopper to grits of ½ inch in diameter. As a matter of food safety, it was also found it was necessary to decrease moisture content to 5% in sweet potato and breadfruit to lower water activity to the microbial safe threshold of 0.40 for these starchy materials. Public demonstrations are being performed and filmed to show the feasibility of drying then pulverizing the grits into a shelf-stable flour for baking.

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 hybrid PMB grasses has proven effective and will expand to demonstrate near-commercial scale seed production in 2017. This will allow 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 resemble Banagrass/Napiergrass in terms of yield, management and composition but are seed sterile with much less risk of invasiveness associated with Napier grasses. 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. They are a dual purpose crop as they may also be harvested at shorter intervals and used as animal feed.

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 2016, 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.

OI successfully obtained design permits for the building and sought bids to construct the feed mill in mid-2015. Unfortunately, all of the bids were significantly above OI's preliminary estimates, and OI reduced the costs of the feed mill and sought additional funding. In 2016, OI was awarded a grant in aid by the State Legislature for \$350,000, and was also awarded an additional \$300,000 grant from HDOA to finish the construction of the feed mill. OI is in the construction phase and is set to complete construction in 2017.

Pacific Biodiesel

Pacific Biodiesel Technologies was one of twelve 2014 Global Agriculture Innovation Challenge winners from across the country at last year's Asia Pacific Resilience Innovation Summit and Expo. The Company presented findings from its innovative application of a biodiesel co-product for paddy crop soil health, and control of invasive golden apple snails. Trademarked Aina Mo' (short for 'āina momona, Hawaiian for "fertile land"), the soil amendment was developed from fuel production by-products for wetland taro and potential rice farming. Combined with snail egg management, this product has also proven effective in controlling the invasive snail, *Pomacea Canaliculata*. Field trials funded by a SBIR grant produced excellent yields and no detectable levels of adverse effect in water, soil or plant tissue.

Pacific Biodiesel has completed Phase II of the project involving field trials to validate product effectiveness and environmental safety. The Company is now in the commercialization phase and has begun to offer Aina Mo' to taro farmers throughout Hawaii. A recent (late 2015) outbreak of apple snails in the farming community of Keanae, Maui HI, is now being addressed holistically with the Aina Mo' product in an attempt to eradicate the snails from the region or at least greatly reduce the snail population. Formerly known as the Asia Pacific Clean Energy Summit, the 2014 Asia Pacific Resilience Innovation Summits and Expo combined the energy summit with showcases for challenge winners in defense energy technology, agriculture innovation and island sustainability solutions.

Pacific Biodiesel was an instigator and sponsor of the "Hemp is Hope Workshop" held August 9, 2014 at the Cameron Center on Maui to educate and inspire the community for a more self-sufficient Hawaiian future. The event included guest speakers Mike Bowman of the Sustainable Biodiesel Alliance, Hemp Bound author Doug Fine, hemp house architect Tim Callahan, and Matthew Mead of Hempitecture.

Pacific Biodiesel's Hawaii Military Biofuel Crop (HMBC) project, originally started on the north shore of Oahu in 2011, was moved to the Big Island in 2015 and is scheduled for completion in March 2016. This second phase of HMBC is designed to test plots around the island with the intent of selecting the optimum areas with large acreage for growing sunflowers. The project has been successful in terms of identifying the best areas geographically, determining effective inputs and the highest performing varieties and developing best practices for planting, growing and harvesting. In addition, PBT has been collaborating with local farmers, ranchers and macadamia nut processors for other inputs to and off-takes from the crushing mill. The model for commercialization that seems the most likely is multiple 100+ acre plots totaling at least 10,000 acres per year farmed. With the current waste oil feedstock collected within the State of Hawaii, this would fulfill capacity at Big Island Biodiesel and create the optimum sustainable production with 100% locally sourced feedstock.

PBT has also been collaborating with SG Biofuels on the *Jatropha* plantation, with funding from Ulupono. Three acres were planted with 37 varieties of SGB hybrids and have seen increased yield and

faster plant development than in the previous Jatropha fields. This new experimental planting is in addition to the existing acreage originally planted by Christian Twigg-Smith and brought into the HMBC project in 2013.

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.