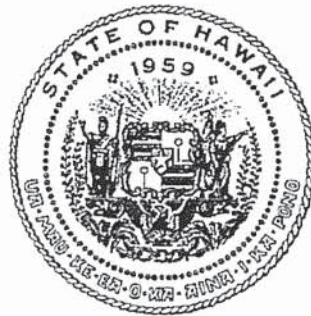


**REPORT TO THE TWENTY-EIGHTH LEGISLATURE
2016 REGULAR SESSION
STATE OF HAWAII**

**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**

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ENERGY FEEDSTOCK PROGRAM

Annual Report to the Legislature for Calendar Year 2015

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, 2015-December 31, 2015.

The level of activity and interest in production of Hawaii grown energy feedstock crops increased significantly in 2015. 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 all of the 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 program in the 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 2015.

Act 38. Amends the State's objectives and policies relating to energy facility systems, including a policy of ensuring that liquefied natural gas be used only as a cost-effective transitional, limited-term replacement of petroleum for electricity generation and not impede the development and use of other cost-effective renewable energy sources. (HB1286 HD2 SD2).

Act 72. Authorizes the issuance of special purpose revenue bonds to assist Anaergia Inc., with the development of facilities for renewable non-fossil fuel production on Maui. (HB139 HD1 SD2).

Act 97. Increases renewable portfolio standards to 30 percent by December 31, 2020, 70 percent by December 31, 2040, and 100 percent by December 31, 2045. Requires the Public Utilities Commission to include the impact of renewable portfolio standards, if any, on the energy prices offered by renewable energy developers and the cost of fossil fuel volatility in its renewable portfolio standards study and report to the Legislature. (HB623 HD2 SD2 CD1).

Act 100. Requires electric utilities to file proposed community-based renewable energy tariffs with the public utilities commission by October 1, 2015. Authorizes ratepayer participation in eligible community-based renewable energy projects. (SB1050 SD2 HD3 CD1).

Act 159. Authorizes the High Technology Development Corporation to provide 50 per cent matching grants to Hawaii awardees of alternative energy research grants from the Office of Naval Research. Makes appropriations. (HB1513 HD1 SD2 CD1).

Act 207. Authorizes the issuance of special purpose revenue bonds up to \$45,000,000 to Waimea Nui Community Development Corporation, a private not-for-profit corporation, for the planning, acquisition, and construction of agriculture, renewable energy, and educational facilities. (SB521 SD1 HD1 CD1).

Act 228. Includes hydroelectric facilities that generate up to 500 kilowatts of electricity as a permissible use on agricultural lands if the hydroelectric facilities are accessory to agricultural activities for agricultural use only and if certain other conditions are met. (HB1273 HD2 SD2 CD1).

2. Related Research.

Hawaii Department of Agriculture

The Hawaii Department of Agriculture (HDOA) has partnered with the Ulupono foundation to develop a food metrics system. A working food metrics system will provide the foundation for making data-driven policy decisions. Metrics will help HDOA identify areas of need to ensure Hawaii's limited resources are used with maximum return. The food metrics system will include energy feedstock cultivation as a part of their metrics. Currently, HDOA has contracted with Sustain Hawaii to do research, data gathering, and database development for this initiative.

HDOA has also partnered with the UH-Hilo for an agricultural baseline study. This study will look at recent aerial photographs and determine acreage of land of crops currently being farmed on Hawaii. Crops that are included in the study are those used for biomass and feedstock production. The results of this study will hopefully provide a better picture of what is currently being grown in Hawaii for biofuel/feedstock. The report is being finalized and will be available by December 2015.

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.

ADC received a \$3 million appropriation during the 2014 Legislative Session for the zero waste conversion project in Keaau, Hawaii. The funding was appropriated to develop a demonstration facility where researchers will use a 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.

If successful, the zero waste conversion project 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.

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 may take months to modify and assemble. To date, \$1.55 million was expended to purchase specialized equipment and the land to house the demonstration facility. The remaining funds will be used to complete the equipment purchase, and design and construct the facility.

On Kauai, the Green Energy Team (GET) is developing renewable “green” energy to help reduce the island’s dependence on imported fossil-fuel. GET utilizes over 1,000 acres of land managed by the Agribusiness Development Corporation in Kalepa, Kauai for cultivating and harvesting trees and using the woody biomass as a feedstock for a biomass-fueled electric generating facility that can generate 4.2 megawatts (MW) to 7.5 MW of electricity – enough to power over 3,500 homes. Pursuant to a power purchase agreement between GET and the Kauai Island Utility Cooperative (KIUC), KIUC purchases Firm, Dispatchable Capacity and energy from GET.

College of Tropical Agriculture and Human Resource

The College of Tropical Agriculture and Human Resource (CTAHR) is currently conducting a feedstock supply system project and ratoon harvesting practices project.

A feedstock supply system, consisting of purpose-grown tropical grasses and harvesting logistics systems, is being developed by CTAHR and collaborators in parallel with a biochemical conversion route for the production of drop-in hydrocarbon blending components for jet and diesel fuels. Expected outputs include growth data and comparative economic analyses for high yielding tropical energy crops (sugarcane, energycane, Napier grass, and sweet sorghum) grown under different microenvironments in Hawaii but using standardized agronomic practices; agronomic models to predict energy crop yields grown under different microenvironments; and an improved energy crop harvesting system for underutilized non-agricultural lands.

The beneficial impacts of ratoon (zero-tillage) harvesting practices for biofuel and bioenergy feedstocks within a diversified agricultural landscape are also being evaluated by CTAHR. These practices result in sustained increases in soil organic carbon that provide a greenhouse warming potential (in CO₂ equivalence) credit to the production system, help build soil health and support a diverse soil microbial community. Annual assessment of total soil organic carbon stock under continued ratoon harvests of high-yield varieties of C4 perennial grasses has occurred at benchmark locations on Maui for three years, and the final data will be collected in FY16 with the intent of up-scaling the resulting model to a plantation-size area.

Hawaii Agricultural Research Center

The Hawaii Agriculture Research Center (HARC) began working with various biofuel feedstocks in 2006 in order to advance biofuels for power and transportation as well as aid the State of Hawaii in its goal of meeting the renewable energy standards through the Hawaii Clean Energy Initiative. From 2006 to

2014 HARC and its subcontractors University of Hawaii-Manoa (UHM) and University of Hawaii-Hilo (UHH), with funding from HECO and the Electric Power Research Institute, conducted research focusing primarily on oilseed crops such as Jatropha, Pongamia, Oil Palm, Moringa, and various small oilseed crops. During that time, this work provided information on various biofuel crops to land owners, farmers, energy developers and researchers about tools to properly select crops that are most likely to suit the technical and economic needs of a biofuels industry. Research trials included various agronomic and genetic studies as well as seed-to fuel demonstrations in collaboration with Brigham Young University. Currently HARC is maintaining a germplasm collection of several hundred Jatropha selections from around the world, as well as maintaining other oilseed tree crops for future research.

Current research trials at HARC are focused on various high biomass grasses for biofuel feedstock including sugarcane, energycane, Banagrass, and sterile hybrid grasses which resemble Banagrass. HARC began breeding energycane in 2010 and has several excellent selections in field trials in 2015. Many of the energycanes are also involved in genetic studies in collaboration with the University of Illinois. Most recently HARC has been breeding high biomass grasses that resemble Banagrass but are seed-sterile and non-invasive. This will continue to be a priority through 2016 as new selections are evaluated for biomass/biofuel use, as well as use for animal feed.

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 2015, 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, Oregon and Texas. 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

GIFTPAC

In 2015, HDOA has been a participant in the Green Initiative for Fuels Transition Pacific (GIFTPAC). GIFTPAC is a Department of Defense program, with the objectives to:

1. Displace 25% of military fuel used in Hawaii by 2018. This would account for 32 million gallons of biofuel per year. The requirements for biofuel to be sold to the military under this program are: the fuel must be domestically produced, non-fossil, meet military specifications, be cost-competitive, and reduce price volatility.
2. Create an enterprise model inclusive of the local energy market that incorporates the agricultural, energy, environmental, government, industrial, and commercial sustainability objectives.

3. End state with sustainable ongoing competition among multiple commercial entities at many levels.

HDOA has been working with DBEDT and GIFTAC representatives to assess the viability of Hawaii produced biofuel to sell to the military to meet 2018 GIFTAC objectives.

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 is currently working to reduce the costs of the feed mill and also seek additional funding.

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 proven effective in controlling the invasive snail, *Pomacea Canaliculata*. Field trials 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 will begin 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 a 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 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 offtakes from the crushing mill. The model for commercialization that seems the most likely is multiple 100-acre plots totaling 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. We currently have 3 acres 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.

Grant Writing

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