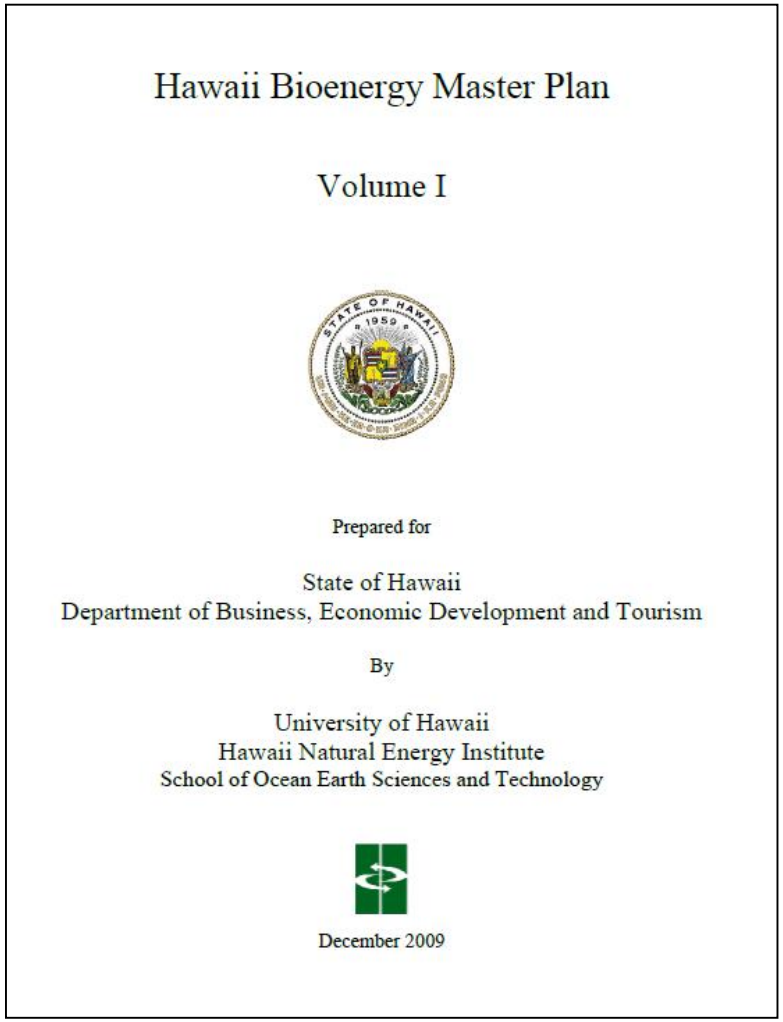
Bioenergy Master Plan

APEC Capacity Building Workshop
Honolulu, Hawaii

Scott Turn
Hawaii Natural Energy Institute
University of Hawaii
March 20, 2018

Hawaii Bioenergy Master Plan

- **Funded by State of Hawaii and US Dept. of Energy**
- **Stakeholder driven process/document**
- **Target scenarios for supplying 20% of electricity and 20% of transportation fuels from biomass**
- **Recommendations & concerns provided direction for policy support and research**



Hawaii Bioenergy Master Plan

Volume I

Prepared for

State of Hawaii
Department of Business, Economic Development and Tourism

By

University of Hawaii
Hawaii Natural Energy Institute
School of Ocean Earth Sciences and Technology

December 2009

Stakeholder Driven Process

Feedstock Production	Feedstock Logistics	Conversion	Distribution	End Use





Agriculture ---- Industry ---- Investors ---- Government ---- Community

- **Land**
- **Water**
- **Infrastructure**
- **Labor**
- **Technology**
- **Permitting**
- **Financial Incentives**
- **Business Partnering**
- **Environment**
- **Policy**

Produced ~70 recommendations

Recommendation/concern categories

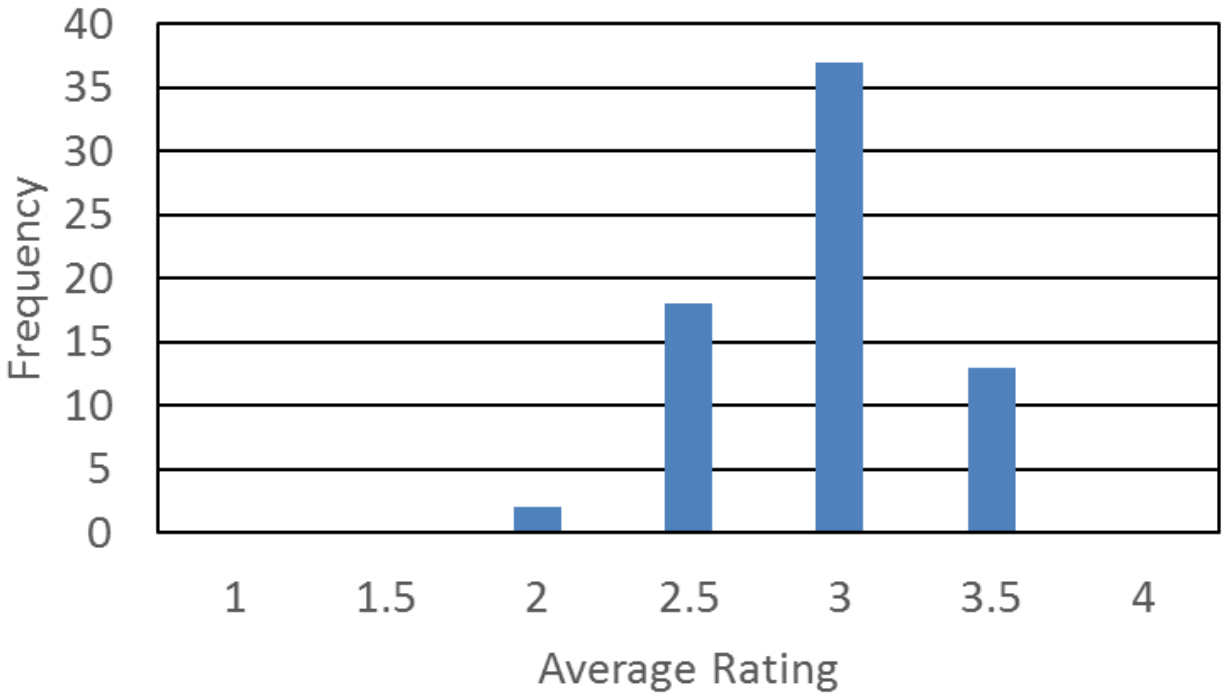
- **Availability and use of resources**
- **Value chain interdependencies**
- **Industry impacts**
- **Program level coordination**

Studies Conducted in Response to Recommendations

- State land lease procedures
- Assessing invasiveness of candidate bioenergy feedstock crops
- Assessing common elements of sustainability certification
- Algae production potential assessment

2016 Questionnaire on Current Relevance of Masterplan Recommendations

- **Stakeholders asked to rank current relevance of ~70 recommendations from 2009 Masterplan**
- **Scale**
  - **1 Not Relevant**
  - **2 Mildly Relevant**
  - **3 Relevant**
  - **4 Highly Relevant**
  - **N No Opinion**
- **22 Respondents**



Standard Deviations Range 0.6 – 1.3

Masterplan Recommendation Rankings

1. Utilization of new groundwater resources for biofuel production will necessitate assessing its influence on aquifer recharge and on estimated aquifer sustainable yields. (Ave.=3.4±0.6) (Availability and use of resources)
2. The State should continue a bioenergy technology assessment activity that can provide updated information on the status of bioenergy conversion pathways and estimates of energy return on investment (EROI) for bioenergy value chain components. (Ave.=3.3±0.9) (Value chain interdependencies)

Masterplan Recommendation Rankings

3. Further studies on various topics that closely relate to the current Bioenergy Master Plan. Description of the suggested studies is briefed below. (Ave.=3.3±0.8) (Availability and use of resources)
   - Ground Water Resources, Locations, and Potential Yields
   - Surface Water Sources, Locations, and Potential Yields
   - Surface Water Diversions and Locations
   - In-Depth Study of Biofuels; energy yield, natural resource use, economics
   - Potential Use of Reclaimed Water
   - Review of state and county policies for important ag land designation and criteria related to water.

4. Further understand Hawaii's water and land resources availability and constraints for bioenergy crops. (Ave.=3.2±0.7) (Availability and use of resources)

Masterplan Recommendation Rankings

5. Remap ALISH to incorporate latest land use changes, availability of new lands (lava and non-ALISH lands), and proven potential of Hawaiian lands for diversified cropping. (Ave.=3.2±0.8) (Availability and use of resources)

6. Conduct a systematic study for costs/benefit analysis of potential reuse of treated water for bioenergy crops, including resources needed for expansion and upgrading of treatment facilities, construction of water delivery infrastructure to the agricultural lands, and scale of bioenergy crop production. (Ave.=3.2±0.7) (Availability and use of resources)

7. Support demonstration project development along the bioenergy value chain including energy crop production, transportation and logistics, and processing and conversion technologies. (Ave.=3.2±0.9) (Value chain interdependencies)

Resulting Analysis

http://www.hnei.hawaii.edu/publications/technical-reports

Alternative Fuel Assessments

- Variable Power Icemaker (Chapter 4.6
- **Biomass-Derived Energy Products and Co-Products Market and Off-Take Study**, Stillwater Associates, June 2013
- **Liquefied Natural Gas for Hawaii: Policy, Economic, and Technical Questions**, FACTS, Inc., June 2013
- **Hawaii Geothermal Assessment and Roadmap**, PICHTR, January 2013
- **Bioenergy Production Pathways and Value-Chain Components**, December 2012
- **Geographic Information System Resources to Support Biomass/Bioenergy/Biofuel Decision Making**, December 2012
- **Biofuel Feedstock Inter-Island Transportation**, October 2012
- **State Agency Land Leases**, UH William S. Richardson School of Law, October 2012
- **Observational Field Assessment of Invasiveness for Candidate Biofuels in Hawaii**, September 2012
- **Roundtable on Sustainable Biofuels Certification Readiness Study: Hawaii Biofuel Projects**, September 2012
- **Statewide and Electricity-Sector Models for Economic Assessments of Hawaii Clean Energy Policies**, August 2012
- **Analysis of Land Suitable for Algae Production in Hawaii**, August 2011
- **Hawaii Bioenergy Master Plan**, December 2009
- **Biomass and Bioenergy Resource Assessment**, December 2002

Biomass and Fuels Processing

- **Biofuel Characterization Planning** (Chapter 2.1, HEET 09), May 2016
- **Plasma Arc Processing** (Chapter 2.2, HEET 09), May 2016
- **Biocontamination of Fuels** (Chapter 2.6, HEET 09), May 2016
- **Biofuel Corrosion** (Chapter 2.7, HEET 09), May 2016
- **Analysis of Integrated Tropical Bio-Refineries**, December 2012
- **Algal Production Studies**, Hawaii BioEnergy, July 2012
- **Potential for Ethanol Production in Hawaii**, by HNEI & UHM CTAHR, December 2006
- **Physicochemical Analysis of Selected Biomass Materials in Hawaii**, August 2005
- **Analysis of Hawaii Biomass Energy Resources for Distributed Energy Applications**, December 2002

Conclusions

- **Bioenergy Master Plan produced 70 recommendations that have received varying degrees of action/response**
- **Indications are that many of the recommendations remain relevant in 2016**

Feedstock Production | Feedstock Logistics | Conversion | Distribution | End Use





Agriculture ---- Industry ---- Investors ---- Government ---- Community

Questions?