

Summary of

HAWAII ETHANOL ALTERNATIVES

draft report

by Stillwater Associates

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Prepared for the State of Hawaii, Department of
Business, Economic Development & Tourism, Strategic
Industries Division

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EXECUTIVE SUMMARY

- The overall conclusion is that Hawaii has significant potential to economically produce ethanol from sugarcane. Large scale ethanol production could add as much as \$300 million to the local economy in direct and indirect value.
- However, in the near to midterm future, it will be more beneficial for consumers, producers, the existing petroleum industry and the State of Hawaii's public finances if locally produced ethanol is not used in Hawaii but exported to California.

(Assumes gasoline at \$0.98 / gallon; oil at \$25 / barrel)

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Hawaii's Ethanol Potential (p. viii)

- Ethanol could be produced in Hawaii at a large scale (up to 90 million gallons per year) at a competitive cost (\$1.25 - \$1.30 per gallon).
- Although ethanol could be produced from waste, it is likely to be more economical to use waste biomass for electricity production.
- With the federal excise tax credit, a blender of ethanol is projected to enjoy a cost advantage over base gasoline blendstock.

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Considerations for Local Use (p. ix)

- For each gallon of ethanol, local refiners will lose market share and be required to modify operations and construct facilities.
- Such cost increases are offset... the price per gallon at the rack will not increase.
- Hawaii consumers' fuel expenditures would increase by 3%, due to 3% lower energy content of E10, if gasoline is \$0.98 per gallon (assumes oil at \$25 per barrel).
- Blending Hawaii-produced ethanol into most or all of Hawaii's gasoline will reduce State and County tax revenues. *(Note: this statement does not match data in Table 7.1.)*

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Exporting Ethanol to California (p. ix)

- Hawaii's ethanol production can be exported to California, and to do so has significant benefits over local consumption.
- California's large ethanol fuel demand (>700 million gallons per year) allows ethanol production in Hawaii at a scale not possible for the local market alone.
- Hawaii would have all the economic benefits of ethanol production without the burden to the State of losses in local excise taxes* or higher gasoline expenditures.
- Hawaii's high-cost gasoline infrastructure would be spared additional investments.

** Note: This statement does not match the data in table 7.1.*

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Stillwater Recommendations (p. x)

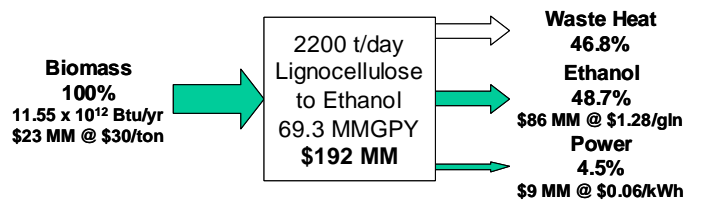
- Promote the production of ethanol from sugarcane and the use of energy crops for power generation.
- Do not mandate local use.
- Export ethanol to California.
- Evaluate ethanol production in the context of an integrated energy policy.
- Evaluate the production of Ethyl Tertiary Butyl Ether (ETBE) using locally produced ethanol and isobutylene from the local refineries.

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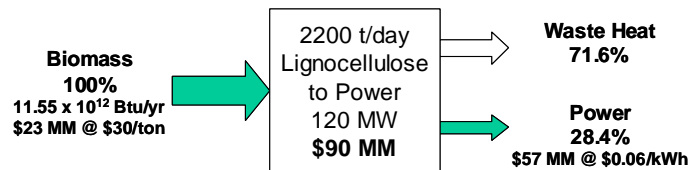
Table 1.3 - Ethanol Potential by Island (p. 9)

Energy Crops		Hawaii	Maui	Oahu	Kauai	Total
Available Land	acres	27,000	26,000	25,500	7,000	85,500
Sugarcane	t/year	486,000	468,000	459,000	126,000	1,539,000
	MMGPY	55.9	53.8	52.8	14.5	177.0
Irrigated grass	t/year	594,000	572,100	561,000	153,900	1,881,000
	MMGPY	41.6	40.0	39.3	10.8	131.7
Unirrigated grass	t/year	486,000	468,000	459,000	126,000	1,539,000
	MMGPY	34.0	32.8	32.1	8.8	107.7
Trees	t/year	270,000	260,100	255,000	69,900	855,000
	MMGPY	20.3	19.5	19.1	5.2	64.1
Organic Waste						
Newspaper	t/year	40,200	69,900	283,600	14,300	408,000
	MMGPY	4.4	7.7	31.2	1.6	44.9
Other MSW	t/year	50,000	111,900	444,900	29,800	636,600
	MMGPY	3.0	6.7	26.7	1.9	38.2
Max Ethanol	MMGPY	63.6	68.2	110.7	18.0	260.1

Fig. 1.2 - Biomass to Ethanol... or Electricity? (p. 13)



Gross Margin \$72 MM – \$22 MM Fixed & Variable Operating = \$50 MM
 EBITDA/Capital = 0.26



Gross Margin \$34 MM – \$6 MM Fixed & Variable Operating = \$28 MM
 EBITDA/Capital = 0.31

EBITDA = Earnings Before Income Tax, Depreciation and Amortization

Tbl. 2.1 - Gasoline & Ethanol Demand by County (p. 14)

		Oahu	Big Island	Maui	Kauai	Total HI
Gasoline	BPD	16,430	4,350	3,770	1,690	26,240
	MM Gln/Year	252	67	58	26	402
Potential ethanol demand for blending						
	MM Gln/Year	25.2	6.7	5.8	2.6	40.2

*BPD = Barrels Per Day
1 barrel = 42 gallons
MM = million*

Figure 2.1 - US Ethanol Demand (p. 15)

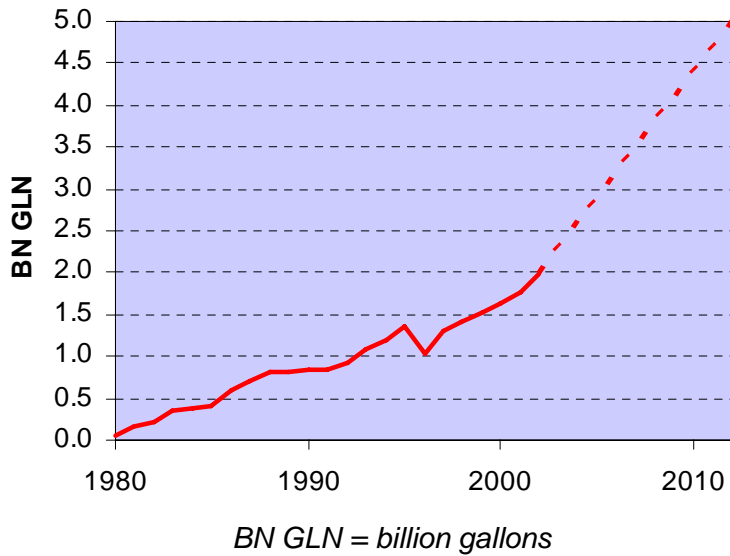


Table 2.3 - Cost of Ethanol to California* (p. 19)

	Midwest Rail	Brazil CBERA	Brazil Direct	Hawaii
Production Cost	1.25 – 1.30	1.12	0.90	1.27
Transportation & Storage	0.12 – 0.15	0.22	0.20	0.10 – 0.12
Ex-Tank CA	1.37 – 1.45	1.34	1.10	1.37 – 1.39
Import Duty			0.53	
Excise duty waiver	0.52	0.52	0.52	0.52
Net cost	0.85 – 0.93	0.82	1.11	0.85 – 0.87
Octane Blending Value	0.02	0.02	0.02	0.02
Req. Gasoline Price	0.83 – 0.91	0.80	1.09	0.87 – 0.89
	Corrected 0.87 – 0.95	0.84	1.13	

* Corrected

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Table 5.1 - Infrastructure Requirements (p. 28)

	Prod MMGPY	Usage MMGPY	Tanks Req. # x bbl	Terminal \$MM	Blending \$MM	Distribution cpg
Maui	40	5.3	2 x 20,000	-	0.5	-
Oahu		25.2	2 x 20,000	2.0	5.0	10
Hawaii		6.7	2 x 5,000	0.5	1.0	10
Kauai		1.7	1 x 5,000	0.1	0.2	10
Lanai		0.3	1 x 150	0.1	0.2	11
Molokai		0.1	1 x 150	0.1	0.2	11
Total	40	40	155,300	2.8	7.1	10

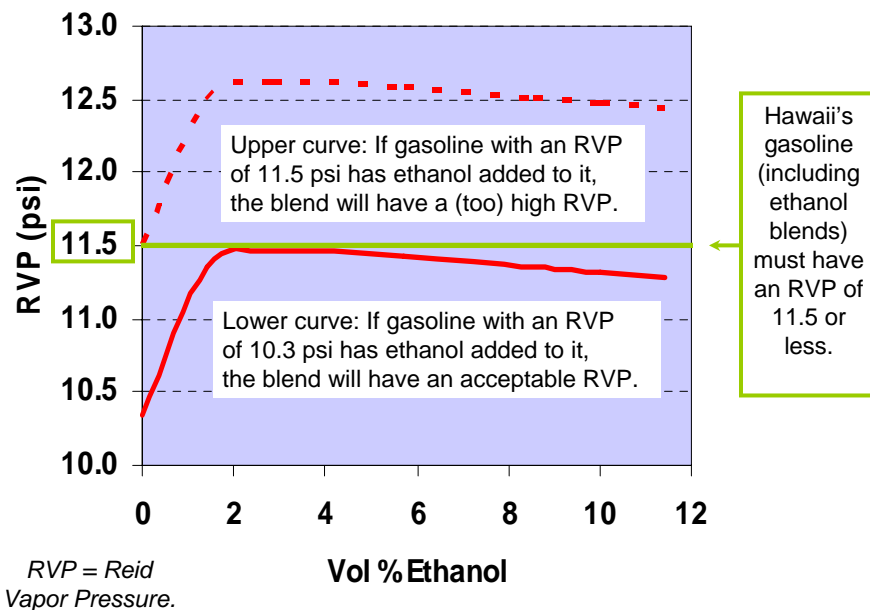
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Table 6.1 - Hawaii Refinery Products (p. 33)

	Chevron	Tesoro	Supply	Demand	Exports
	bpd	bpd	bpd	bpd	bpd
Propane	1,500	1,500	3,000	3,000	-
Gasoline	14,000	14,000	28,000	28,000	-
Naphtha	6,000	7,000	13,000	7,000	6,000
Jet Fuel	13,000	26,000	39,000	45,000	-6,000
Diesel	5,000	14,000	19,000	19,000	-
Fuel Oil*	14,000	23,000	37,000	37,000	-
Asphalt	500	500	>1,000	>1,000	-
	54,000	86,000	140,000	140,000	-

While short on jet fuel, which is imported on a regular basis, the refineries produce more material in the gasoline boiling range than the State of Hawaii consumes. Excess gasoline type material, generally naphtha, is exported by tankers to other markets, mostly to Japan as feedstock for the petrochemical industry.

Figure 6.1 - Vapor Pressure (p. 35)



6.1.3 - Partial Ethanol Blending (p. 37)

- If ethanol blending were started on only one island, i.e., Maui, it is likely that only one of the refineries would produce the low RVP material.
- Estimated cost of separate production and segregation, if allocated to the barrels sold in Maui only, would amount to 4 to 5 cpg.

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6.2.3 - Summary of Price Changes

(p. 39)

	Gasoline	E10
	cpg	cpg
Base gasoline price, rack price at \$25/bbl crude	98.0	
Volume loss effect, net of effect reduced mileage	1.7	
RVP effect	1.0	
Lower octane requirement	-1.5	
Base gasoline price for use in ethanol blending	99.2	
Gasoline component of E10 @90% blending rate		89.3
Ethanol price ex plant	127.0	
Average delivery cost to rack	10.2	
Excise tax credit	- 52.0	
	85.2	
Ethanol component of E10 @10% blending rate		8.5
Rack price for E10 gasohol blend		97.8

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Table 7.1 - Costs & Benefits

(p. 41)

		Do Nothing 0 MM GPY	Maui Only 6 MM GPY	Maui Exports 6 MM GPY	All of HI 40 MM GPY	CA Exports 40 MM GPY	
VOLUMES	HI Gasoline	MM GPY	400	397	400	372	400
	HI Ethanol Production	MM GPY	-	5	5	40	40
	HI E10 Blend Consumption	MM GPY	-	50	-	412	-
	Naphtha Exports	MM GPY	92	95	92	120	92
PRICES	HI Gasoline Rack	\$/gln	0.98	0.98	0.98	0.99	0.98
	HI Gasoline Retail Ex-Tax	\$/gln	1.23	1.23	1.23	-	1.23
	HI Gasoline Retail	\$/gln	1.72	1.72	1.72	-	1.72
	Ethanol, Rack	\$/gln	-	1.47	1.47	1.37	1.32
	E10 Blend, Retail	\$/gln	-	1.72	-	1.72	-
	Naphtha Exports	\$/gln	0.67	0.67	0.67	0.67	0.67
REVENUES	Sugarcane	MM \$/yr	-	6.0	6.0	52.8	52.8
	Ethanol + Power	MM \$/yr	-	7.3	7.3	60.1	58.2
	Ref. & Distributors	MM \$/yr	453.6	452.7	453.6	449.4	453.6
	Total	MM \$	453.6	466.0	467.0	562.4	564.6
	Gain (Loss)	MM \$	-	12.4	13.3	108.7	111.0
	Total Dir. & Indirect	MM \$	-	37.2	40.0	326.1	333.0

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Table 7.1 (cont'd) - Costs & Benefits

(p. 41)

		Do Nothing 0 MM GPY	Maui Only 6 MM GPY	Maui Exports 6 MM GPY	All of HI 40 MM GPY	CA Exports 40 MM GPY
Consumer						
Gasoline Purchases	MM \$/yr	688.0	691.3	688.0	708.6	688.0
Gain (Loss) vs. current	MM \$/yr	-	(3.3)	-	(20.6)	-
State & County						
Excise Taxes	MM \$/yr	-	0.6	-	3.6	-
St. Corp. Inc. Tax	MM \$/yr	-	0.2	0.3	2.1	2.1
St. Pers. Inc. Tax	MM \$/yr	-	0.3	0.3	1.1	1.1
St. Producer Inc.	MM \$/yr	-	(1.5)	(1.5)	(9.0)	(9.0)
Net vs. current	MM \$/yr	-	(0.4)	(1.0)	(2.2)	(5.8)
Employment						
Construction Phase	#	-	206	154	1,076	896
Sugarcane Operations	#	-	-	-	62	62
Ethanol Plant(s)	#	-	22	22	31	31
Indirect Permanent Labor	#	-	44	44	186	186

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Comments Received from:

- Tesoro
- Akana Petroleum
- ED & F Man Alcohol Inc., Maui Ethanol LLC, the Oahu Ethanol Corporation, and the Worldwide Energy Group
- Stillwater Associates (corrections)

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Comments Received from Tesoro

- Tesoro agrees ... that Hawaii's ethanol production can be exported to California at a significant benefit over local consumption.
- Tesoro agrees ... that the impact of an ethanol mandate ... is likely to be more severe than elsewhere in the US. Tesoro's gasoline production capability is already under-utilized ... Tesoro will be adversely affected by both the cost to produce a low RVP ethanol BOB, and the displaced light naphtha component.

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Comments Received from Tesoro

- Tesoro disagrees that lost margin could be recovered through increased rack prices. This would imply that all of Tesoro's gasoline sales are sold through the rack and that the rack price can be adjusted accordingly. Tesoro has large volume, long-term commitments ... that are tied to independent markets. Tesoro may face a loss of margin ... without the opportunity for an offsetting benefit from the Federal excise tax credit, since the Tesoro sale occurs prior to the addition of ethanol.
- There is also the pending Hawaii price control legislation that may prevent the recovery of these lost margins through increased prices at the rack.

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Comments Received from Tesoro

Tesoro indicates that several issues were not adequately addressed:

- Unique challenges posed by distribution of ethanol.
- Lack of sufficient ethanol production in Hawaii to meet requirements of the 10 percent ethanol mandate in the first phases of the gradual rollout.
- Costs to operate a dual gasoline system. In other jurisdictions that have introduced an ethanol mandate, there is sufficient ethanol supply to enact the mandate without the need for dual distribution systems. If the mandate is phased in gradually, refiners will be required to produce four blends of gasoline, which will entail additional capital expenditures at the refinery and at each terminal; preliminary estimates for terminal installations exceeds one million dollars per installation.

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Comments Received from Tesoro

- Tesoro disagrees with the proposal to produce ethanol for local consumption at the point of production only. For example, ethanol production in Maui would be consumed on Maui only.
- Any differentiation in the type of gasoline sold within the State of Hawaii will result in the production of multiple blends of gasoline at the Tesoro Refinery. Therefore, Tesoro believes that the ethanol mandate should be applied uniformly across the State. Tesoro would also be opposed to granting any exemptions to specific parties that would create a permanent need for multiple blends at the Tesoro Refinery.

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Comments Received from Tesoro

Tesoro indicates that projected reliability of the ethanol supply within Hawaii was not adequately addressed.

- In other areas of the country that have introduced ethanol blending, the gasoline distributors have access to many alternate sources of ethanol available by truck or rail.
- Hawaii will be unique in enacting an ethanol mandate that will be reliant upon local manufacturing capabilities without recourse to readily available alternate ethanol supplies.
- The potential for disruption to the gasoline supply chain in Hawaii can be mitigated by mandating that the ethanol producers maintain large reserves of finished ethanol product at the point of production.

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Comments Received from ED & F Man Alcohol Inc., Maui Ethanol LLC, the Oahu Ethanol Corporation, and the Worldwide Energy Group

- The ethanol companies disagree with the conclusion that *“in the near to midterm future, it will be more beneficial ... if locally produced ethanol is not used in Hawaii but exported to California.”*
- The ethanol companies commented on the assumptions that:
 - each gallon of ethanol used locally will result in 2/3 gallon of additional exports of naphtha at lower value
 - \$10 million in infrastructure investments will be required for blending
 - consumers will incur additional fuel costs
 - blending Hawaii produced ethanol into Hawaii gasoline reduces State and County tax revenues
 - ethanol has greater value in California than Hawaii

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Comments Received from ED & F Man Alcohol Inc., Maui Ethanol LLC, the Oahu Ethanol Corporation, and the Worldwide Energy Group

The ethanol companies disagree with the projected growth rate of 1% /year and the resulting conclusion that it would be at least 7 years before the use of ethanol would not require additional exports of petroleum products.

- Historical growth (1960-2001) averaged 2.5% per year.
- Since 1999, Hawaii’s gasoline consumption has increased by more than 45 million gallons, a volume greater than the contemplated ethanol production (34 million gal. by 2006).
- If recent trends in gasoline consumption continue the ethanol production would be fully absorbed by 2005.
- If historical averages are used this expected production would be absorbed by 2006, i.e., as it comes on line.

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Comments Received from ED & F Man Alcohol Inc., Maui Ethanol LLC, the Oahu Ethanol Corporation, and the Worldwide Energy Group

- The ethanol companies disagree with the assertion that exports of naphtha would increase, thus causing negative impact on refinery economics
 - The Maui project will use at least 1/3 gal. of naphtha per gallon of ethanol produced, and could purchase up to 1 gal. of naphtha per gallon of ethanol produced, for use in ethanol production and electricity cogeneration.
 - In addition, naphtha or gasoline may be used as a denaturant or in other production facilities.
 - This could improve refinery economics.
- The ethanol companies agree that the price of ethanol relative to gasoline, and tax incentives for ethanol blending, compensate the refiner for all costs associated with product displacement and reformulation.

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Comments Received from ED & F Man Alcohol Inc., Maui Ethanol LLC, the Oahu Ethanol Corporation, and the Worldwide Energy Group

- The ethanol companies disagree with the estimate of capital costs for ethanol blending at “up to \$10 million...”
 - A study prepared for the US Department of Energy by Downstream Alternatives (*Infrastructure Requirements for an Expanded Fuel Ethanol Industry*, January 2002) estimated the same costs at \$3.5 million.
- ... but they do not believe the difference in cost estimates is critical, as they agree that these one time capital costs can be recovered by the industry, via the increased margins created by the price of ethanol relative to gasoline and tax incentives for ethanol blending, without an increase in gasoline prices to consumers.

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Comments Received from ED & F Man Alcohol Inc., Maui Ethanol LLC, the Oahu Ethanol Corporation, and the Worldwide Energy Group

- The ethanol companies disagree that costs to consumers will increase.
 - The assumption that a 3% increase in fuel consumption will necessarily result in increased consumer costs is based on the premise that none of the additional margin that will accrue from tax incentives and the lower net cost of ethanol versus gasoline will be passed on to consumers. The means is readily available to pass on some of the savings to consumers.
- The ethanol companies indicate that ethanol's positive benefits, such as those listed below, were not adequately addressed:
 - greater economic activity
 - improved Hawaiian agricultural economy
 - dilution of toxic and carcinogenic chemicals in Hawaii's gasoline (e.g., benzene, toluene).

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Comments Received from ED & F Man Alcohol Inc., Maui Ethanol LLC, the Oahu Ethanol Corporation, and the Worldwide Energy Group

The ethanol companies disagree with the statement that *“the net effect of blending Hawaii-produced ethanol into most or all of Hawaii's gasoline is a reduction in combined State and County tax revenues of about \$2 million per year.”*

- According to Table 7.1, blending ethanol in most or all of Hawaii's gasoline will **increase** State and County tax revenues by \$3.2 million per annum.
- If Hawaii produces ethanol only for export this will result in a **reduction** of the State and County fiscal benefits.

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Comments Received from ED & F Man Alcohol Inc., Maui Ethanol LLC, the Oahu Ethanol Corporation, and the Worldwide Energy Group

The ethanol companies disagree with the recommendation that exporting ethanol to California is preferable to using it locally.

- The recommendation assumes that local ethanol facilities will be large (20-40 mgpy). However, the facilities actually being developed are considerably smaller (7-15 mgpy).
- The assumption that ethanol will have greater value in California does not adequately consider:
 - Probable elimination of the oxygen standard in California
 - Higher base gasoline price in Hawaii than California
 - Negative economics of shipping relatively small quantities of ethanol to California
 - Growth in the Hawaii gasoline market and likely complete absorption of expected ethanol production with zero displacement of any current gasoline production

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Comments Received from ED & F Man Alcohol Inc., Maui Ethanol LLC, the Oahu Ethanol Corporation, and the Worldwide Energy Group

- The ethanol companies agree that Hawaii has significant potential to economically produce ethanol.
- The ethanol companies disagree with the likelihood of an integrated sugarcane to energy operation as the short term most likely approach.
- The ethanol companies believe Hawaii's ethanol production potential can be realized by utilizing currently available feedstocks, e.g., molasses, and, in the future, sugarcane, sugar industry products such as bagasse and other waste or biomass products.
- The ethanol companies agree that the potential economic benefit is significant.

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Comments Received from ED & F Man Alcohol Inc., Maui Ethanol LLC, the Oahu Ethanol Corporation, and the Worldwide Energy Group

The ethanol companies also provided numerous additional comments and in-depth discussions on specific details in the report, including: assumptions with regard to the sugar industry; the calculation of indifference prices; assumptions used for lignocellulosic ethanol production costs; the use of calendar year 2000 data rather than calendar year 2002 data; octane values; ethanol blending; projected terminal and storage facilities; options for distributors to reduce costs; corrections to tariff rates used; etc.