

Summary of
*Economic Impact Assessment for
Ethanol Production and Use in Hawaii*
draft report

by BBI International Consulting Division
Mark Yancey, Brian Duff

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

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EXECUTIVE SUMMARY

- Feedstocks are available for commercial-scale ethanol production.
- The potential in-state market potential for ethanol is approximately 41 million gallons per year (MMGY), projected to increase at an annual rate of 1.05% per year.
- A feasible scenario is 40 MMGY statewide, from three ethanol production facilities:
 - Oahu: 15 MMGY from municipal solid waste
 - Maui: 15 MMGY from molasses and sugar
 - Kauai: 10 MMGY from molasses and sugar
- Economic impact during construction is estimated to be \$253 million, with an increase in personal income of \$82 million.
- Annual economic activity following construction is \$112 million.

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Feedstock Availability

(p. 1)

- Oahu has enough organic waste to support a 40 million gallon per year (MMGY) ethanol plant.
- Maui and Kauai produce enough sugar and molasses to support commercial ethanol production of up to 25 and 15 MMGY, respectively.
- Each of the main islands has sufficient acreage to support ethanol production from energy crops, but this would require rejuvenating acreage that has been retired from production.
- This study assumes that in the near term, ethanol will be produced from locally available sugar and/or molasses. These are the only starch- or sugar-based feedstocks locally available in sufficient quantities to support a commercial scale ethanol production capability.

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Summary of Feedstocks

(p. 32)

Feedstock Resource	Supply (tons - dry basis)	Ethanol Yield (gal/ton)	Ethanol Potential (MMGY)
Starch-based crops			
Raw sugar	300,000	150	45
Molasses	100,000	72	7
Food Waste	40,500	62	2.5
Organics in MSW	620,000	60	37
Lignocellulosics			
Pineapple Residues	181,000	60-105	11-19
2001 Sugarcane Residues	535,000	75	40
2001 Whole plant	867,000	98	85
70,000 harvested acres	2,918,000	98	285
80,000 harvested acres	3,470,000	98	340

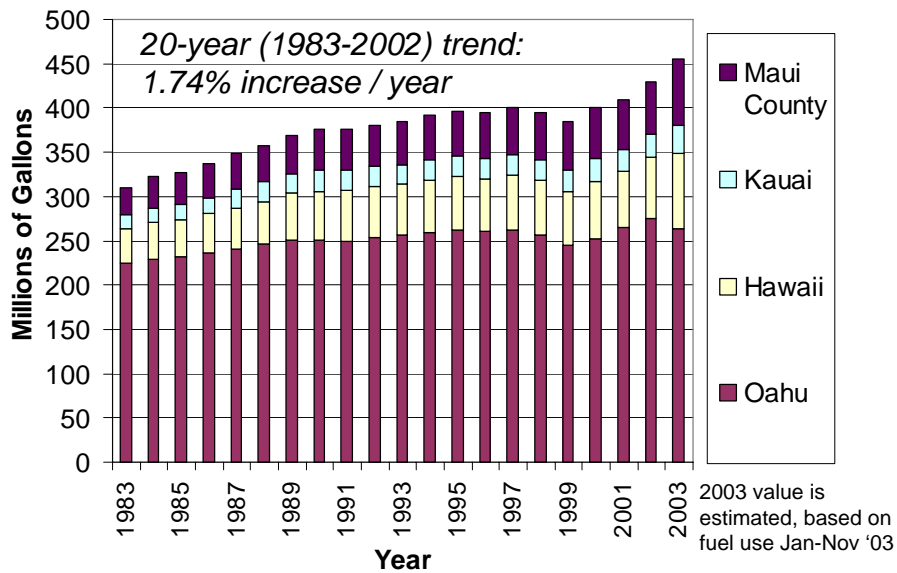
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*Projected Gasoline Demand** (p. 35)

Year	Revised estimate of gasoline demand, based on 1.05% annual growth rate (MMGY)	Original (erroneous) estimate, MMGY	Projected Ethanol Market, MMGY
2001	410	410	41
2002	414		41
2003	419		42
2004	423		42
2005	427	498	43
2006	432		43
2007	437		44
2008	441		44
2009	446		45
2010	450	635	45
2011	455		46
2012	460		46
2013	465		46
2014	470	772	47

* Corrected

Historical Gasoline Demand (Tax records)



Ethanol Scenarios

(pp. 36-39)

- Several scenarios considered, but not selected:
 - Single 40 MMGY plant on Oahu, using MSW
 - Single 40 MMGY plant, on Maui, Kauai, or Oahu. Sugar and molasses would be shipped to the ethanol facility from the island(s) of production
 - Two plants, 25 MMGY on Maui and 15 MMGY on Kauai, using locally available sugar/molasses feedstocks
 - Single 40 MMGY plant using sugarcane bagasse & leaves, or dedicated energy cane, via lignocellulosic technology
- Final 40 MMGY scenario selected for analysis:
 - Oahu: 15 MMGY from municipal solid waste
 - Maui: 15 MMGY from molasses and sugar
 - Kauai: 10 MMGY from molasses and sugar

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Table 20 - Construction Costs (p. 42)

Cost Item	Oahu 15 MMGY waste- to-ethanol	Maui 15 MMGY molasses- to-ethanol	Kauai 10 MMGY molasses- to-ethanol
Ethanol Plant Engineering and Construction Costs	\$39,980,941	\$29,142,857	\$21,714,286
<i>Construction Cost per denatured gallon of ethanol production capacity</i>	\$2.66	\$1.94	\$2.17
Owner's Costs	\$5,034,000	\$4,720,000	\$3,598,000
Total Project Cost	\$45,014,941	\$33,862,857	\$25,312,286

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Table 21 - Operating Costs (p. 43)

Cost Item	Oahu 15 MMGY waste- to-ethanol	Maui 15 MMGY molasses- to-ethanol	Kauai 10 MMGY molasses- to-ethanol
Annual Production Costs	\$14,518,708	\$15,471,333	\$10,364,296
Administrative & Operating Expenses	\$2,686,822	\$2,296,779	\$1,836,061
Principal and Interest	\$4,044,693	\$3,010,683	\$2,259,829
Annual Operating Costs	\$21,250,223	\$20,778,795	\$14,460,187
Cost/gallon	\$1.42	\$1.39	\$1.44

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Table 24 - Economic Impact (p. 48)

Impacts	Oahu 15 MMGY waste- to-ethanol	Maui 15 MMGY molasses- to-ethanol	Kauai 10 MMGY molasses- to-ethanol
Construction Demand Impact (\$millions)	\$109.2	\$82.2	\$61.4
Construction Employment Impact (jobs)	1,108 direct & indirect	833 direct & indirect	623 direct & indirect
Operations Phase Demand Impact (\$millions)	\$42	\$41.1	\$28.6
Operations Employment Impact (jobs)	257 direct & indirect	252 direct & indirect	176 direct & indirect

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Blending Location

(p. 50)

- “Since all the gasoline supply is funneled through the one site at Barbers Point, the simplest system would blend ethanol into gasoline at this site”
NOTE: The above statement has been evaluated further and has since been withdrawn by the author of this section.
- **CORRECTED STATEMENT:**
The preferred (and less costly) approach is to ship the ethanol to the various islands and blend it at each of the loading racks.

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Cases for Blending Ethanol

(p. 52)

- Case 1. Existing Blend
Vol: 400 MMGY; octane: 88.2; 124,518 Btu/gal
- Case 2. Add ethanol, waive RVP limit
NOTE: This is not a valid option.
- Case 3. Add ethanol, keep RVP limit
Vol: 434 MMGY; octane: 90.7; 120,485 Btu/gal
- Case 4. Replace lights with ethanol, keep RVP
Vol: 409 MMGY; octane: 91.6; 121,799 Btu/gal

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Table 26 - One-Time Costs (p. 54)

Cost Item	Case 3 (add ethanol, keep RVP)	Case 4 (replace lights with ethanol)
Ethanol tankage	\$ 1,000,000	\$ 900,000
Blending Facilities	\$ 500,000	\$ 500,000
Butane Tankage	\$ 1,300,000	\$ 2,800,000
Ethanol Revamp	\$ 1,300,000	\$ 2,800,000
Tankage Revamp	\$ 200,000	\$ 200,000
Total	\$ 4,300,000	\$ 5,700,000

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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
- BBI International Consulting (corrections)

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Comments Received from Tesoro

- Tesoro disagrees with the report's economic evaluation of ethanol blending because of the questionable assumptions used for the evaluation. More specifically, Tesoro believes that it is unlikely that ethanol will be blended into gasoline at a central location at Barbers Point.
- Tesoro has prepared initial capital estimates for terminal modifications that require more than one million dollars per site.

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Comments Received from Tesoro

- Tesoro disagrees with the increased gasoline consumption projections. Tesoro believes that gasoline sales will remain static and the Tesoro refinery will produce a lower volume of gasoline blendstock once ethanol blending is required.
- Tesoro anticipates reduced utilization of its manufacturing assets in Hawaii and an on-going economic cost to produce a low RVP ethanol BOB.

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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 economic benefits would accrue to Hawaii from ethanol production and the blending of fuel ethanol in Hawaii.
- The ethanol companies agree that ethanol blending in Hawaii at the 40 million gallons per annum level will be easily absorbed without necessitating reductions in refinery output and product dislocation at the State's two refineries.
- The ethanol companies disagree with the level of gasoline reformulation for volatility assumed in the report. Test results on Hawaii's gasoline indicate that such reformulation may not be necessary, or, if necessary, at a much reduced scale and cost than that described in the report.

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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 assumption of centralized blending on Oahu. The transportation of E-10 blends via pipelines and ocean barge, while possible, is generally not the industry standard.
- However, the ethanol companies agree in general with the capital cost projections, since in many instances the tanks currently exist; in other instances the large tanks required will be constructed at the ethanol plant locations; and relatively small tanks will be required for blending at outer island terminals.

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