Planning for Sustainable Tourism

Part III: Economic & Environmental Modeling Study

Volume I: Executive Summary

Prepared for

DBEDT
THE DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
STATE OF HAWAII

P.O. Box 2359 - Honolulu Hawaii 96804
Street Address: 250 South Hotel Street, 4th Floor

by:
R.M. Towill, Inc.
October 2005

PLANNING FOR SUSTAINABLE TOURISM IN HAWAII
Economic and Environmental Assessment Modeling Study

EXECUTIVE SUMMARY

Prepared for:

The Department of Business, Economic Development, and Tourism
Research and Economic Analysis Division
State of Hawaii

Prepared by:

R. M. Towill Corporation
Progressive Analytics, Inc.
Department of Urban and Regional Planning
University of Hawaii Economic Research Organization

October 20, 2005

This report has been cataloged as follows:

Hawaii. Dept. of Business, Economic Development and Tourism.
Planning for sustainable tourism. Honolulu: 2005.

Multiple volume report by various authors.

1. Tourism-Planning-Hawaii. 2. Tourism-Government policy-Hawaii. 3. Sustainable development-Hawaii.
G155.H3.H32.2005

TABLE OF CONTENTS

Tourism, Growth, and the Quality of Life in Hawaii

Tourism is one of the most important economic activities in Hawaii. Visitors are drawn to the beauty and uniqueness of Hawaii's natural and cultural environment. Yet, excessive tourism growth may threaten the very environmental and cultural assets that visitors seek. Visitors contribute to congestion on beaches, trails, and roadways. They consume water and energy and generate pollution, sewage, and solid waste. They create a demand for expansion and development of hotels and other transient accommodations. Conservation of Hawaii's environment is critical not only to preserving the quality of life of residents but it is also important to maintaining the quality of the visitor experience. Thus, a balance is sought between economic prosperity for residents, environmental preservation, and social well-being. Although the visitor industry has been an economic engine for the State, its growth must be carefully assessed and managed so as to mitigate negative impacts of growth. This study focused on three concerns: economic, social, and environmental – the so-called "triple-bottom line" of sustainable development.

Baseline data were collected on Hawaii's present economic, demographic, geographic, and environmental conditions. The data have been assembled into a set of linked models that have been refined and calibrated to successfully reproduce existing social and economic conditions in Hawaii. Several tools were developed as part of this project. First, a Computable General Equilibrium (CGE) model capable of simulating the response of the Hawaii economy to changes in tourism and environmental policy over time was created. Second, a Spatial Allocation Model (SAM) which maps Hawaii's population, tourism, and sector-level production was developed. Finally, a dynamic land use model that links the estimates for economic and residential growth from the CGE to the SAM to estimate economic and environmental impacts resulting from alternative growth scenarios is developed. These models estimate the human impact on Hawaii's ecosystems and provide indicators on elements such as air pollution, water, solid waste, and energy use.

The key contribution of this study is the development of planning tools to simulate alternative growth scenarios and the implications for Hawaii's economy, standard of living, environment, and land use. By integrating economic and infrastructure data, the models provide insights on bottlenecks and constraints to economic growth, the implications and desirability of growth, and other information that will assist statewide and county planning.

The key findings detailed in the technical report and appendices include the following:

- Tourism plays an important role in Hawaii's economy. Nearly one in every four jobs depend on visitor spending in diverse sectors such as accommodations, restaurants, retail, entertainment, amusement, and recreational services.

- For every dollar spent in Hawaii by visitors, 30 cents is on hotels, 14 cents on air travel, 11 cents is on trade, and another 10 cents is for restaurant meals.

- Using input-output analysis, on a per capita, per day basis, visitors spend more and generate more environmental impacts than residents, but in the aggregate, the spending by residents and the pollution they generate far exceeds that of visitors.

- Using a CGE model to simulate the effects of an additional million dollars of visitor spending it was found that total output increases by approximately $2.1 million. While visitor oriented businesses see growth in wages and salaries, a boost in visitor spending leads to declines in agriculture and manufacturing.

- The models simulate the impacts of changing the mix of visitors on the economy and the environment. While, for example, Japanese visitors spend more per day than other visitor groups, they also have much higher levels of retail spending generating fewer economic benefits to Hawaii. While Canadian and other visitor groups spend less per day, a comparable increase in spending by these group would necessitate more visitors and more visitor stay days, generating greater environmental impacts than, say, visitors from Japan.

- Using the latest projections of visitor spending and population growth, economic conditions and infrastructure demand was simulated for the next 30 years using low, baseline, and high growth scenarios. While high visitor growth will stimulate more in-migration and population growth, low visitor growth will dampen both economic conditions and employment growth.

- While household income and spending is projected to expand significantly over the next 30 years, economic quality of life conditions appear to be best when growth is low for two reasons. First, in-migration of new workers, necessitated under high growth scenarios, places downward pressure on salaries and wages. Second high growth scenarios appear to be inflationary in terms of the prices that both residents and visitors must pay.

- High growth scenarios place the highest demands on infrastructure systems, especially on energy and petroleum use.

- Another constraint to growth is the impending shortage of hotel room, most notably in Honolulu and Kauai, followed by Maui and the Big Island.

- While there are adequate water resources statewide and islandwide (total sustainable yields exceed demand through 2030), there are significant issues regarding the distribution and delivery of water resources related to changes in the agricultural sector and the growth of municipal water demand.

- While in general, an expansion of visitor spending generates more income for Hawaii's households leading to increased purchases of goods and services (such as health care, education, and recreation) which contribute to an improved quality of life, at the same time, those in declining industries and those on fixed incomes may not see improvements in social welfare.

- An increase in visitor spending may lead to a diminution of export production as more resources and workers are deployed in visitor related industries. The boost in household income may help in terms of Hawaii's overall ability to import goods rather than to rely on local production. This in turn may curb infrastructure demand and reduce pollution as export production continues to fall.

- It is evident that there are significant tradeoffs between various economic, environmental, and social dimensions associated with the changes in the level, nature, and location of tourism activities in Hawaii.

The Centrality of Tourism to Hawaii's Economy

The latest comprehensive data on all economic sectors in Hawaii comes from the 1997 input-output tables. Total output (including imports and inter-industry demand) amounts to $58.7 billion. In terms of final demand, household expenditures comprise approximately $19.9 billion, while the state's leading economic activity, tourism, results in annual visitor expenditures of $9.5 billion. Sectors of the economy which contribute significantly to total output include real estate ($9.0 billion), state, local, and federal government ($8.6 billion), finance and business services ($6.6 billion), retail trade ($4.2 billion), health services ($3.9 billion), construction ($3.5 billion), hotels ($3.5 billion), and restaurants ($2.3 billion). It was also determined that the total output for transportation activities (including ground, water, and air) amounted to approximately $3.6 billion, or roughly, 6% of the state's total output.

The major spending categories for households include real estate ($5.2 billion), health services ($3.6 billion), retail trade ($2.3 billion), finance and business services ($2.0 billion), restaurants ($1.0 billion), and wholesale trade ($686.6 million). Visitor spending is concentrated in areas such as hotels ($3.2 billion), air transport ($1.6 billion), retail trade ($1.1 billion), restaurants ($1.1 billion), automobile rental ($314.8 million), sightseeing transport ($285.5 million), and real estate ($239.7 million). The combined spending by visitors on performing arts, amusement, recreation, museums and golf amounts to 4.5% of their total spending. These percentage distributions are both a function of the state's industrial structure as well as the differences between visitors and residents. Visitors spend proportionately more on hotels, restaurants, and certain transport services (air and rental car) than residents. Residents, on the other hand, spend proportionately more on health care and financial and business services than tourists.

The Environmental Impact of the Visitor Industry

Understanding infrastructure demand by industries is important for two different reasons. First, industries need infrastructure services in order to produce their various goods and services. Second, the demand for infrastructure gives a measure of the stress on the environment. There is a limited amount of fresh water and a limited capacity for wastewater treatment, solid waste disposal, electricity generation and other crucial infrastructure services.

A contribution of this study was to determine economy-wide visitor demand for infrastructure services. This is complicated as visitors demand very few infrastructure services through direct purchases. Rather than purchase water or electricity from utility providers, they purchase hotel services or restaurant services through which water or electricity purchases are made. This analysis uses methods of microeconomic analysis to provide an accounting of infrastructure use by residents and by visitors. The effort involved several steps. An extensive dataset was compiled that details natural resource and infrastructure demand, along with intermediate and factor demand, for 131 sectors in Hawaii's economy. Input-output analysis is used to attribute total infrastructure demand (by industry and by final consumers) to residents, visitors, and other consumers of Hawaii output.

Key findings of the infrastructure analysis are given in Table 1. Residents are clearly the primary users of most infrastructure elements in the economy. Residents demand 61.4 billion gallons (84 percent) of water, 5,253 GWh (73 percent) of electricity, 1,287,940 mmBtu (46 percent) of utility gas, and 353.7 million gallons (87 percent) of highway gasoline and diesel fuel. They create 85 percent of the solid waste tonnage in Hawaii. Thus, residential demand and growth is the primary driver of most infrastructure elements. However, key visitor industries are intensive users of infrastructure. Hotels, restaurants, and retail services are each heavy users of water/sewer and electricity. Restaurants generate 21 percent of industrial solid waste. When considering infrastructure use on a per person, per day basis, the visitor impacts are significantly higher than that of the typical resident.

Table 1: Summary of Infrastructure Demand, Residents and Visitors

	Water	Sewer	Electric	Utility Gas	Solid Waste	Hwy Gas & Diesel
Total Demand	(m gal)	(m gal)	(GWh)	(mmBtu)	(m lbs)	(m gal)
Residents	61,429	33,587	5,253	1,287,940	2,423.2	353.7
Visitors	11,856	8,022	1,944	1,521,257	421.3	52.1
Daily Per Capita Demand	(gal)	(gal)	(KWh)	mmBtu	(Lbs)	(gal)
Residents	138.9	75.9	11.9	0.003	5.5	0.8
Visitors	206.7	139.8	33.9	0.027	7.3	0.91

The Impact of Visitor Growth in Hawaii: A Million Dollar Analysis

An applied CGE model of Hawaii's economy and environment was developed as a planning tool. Alternative projections for visitor spending are inputs into this model, which allows for the estimation of changes in macroeconomic indicators, sector-level output and employment, social welfare measures, and environmental impacts. To illustrate the usefulness of this tool, the consequences of a $1 million increase in visitor spending is examined. This amount is large enough to trace through the effects on Hawaii, but not so large so as to create major structural changes in the local economy. Notably, the economic effects associated with visitor spending are not simply linear but instead are complex and depend on constraints such as resource and labor force base. The $1 million experiment provides a measure of how, given the current structure of the economy and present supply and demand relationships, visitor spending impacts the state's economy. Other scenarios will focus on larger changes in visitor spending to show how structural changes might come about with larger levels of visitor spending.

An increase of a million dollars in visitor spending increases total output by approximately $2.1 million with an increase in total value added of over $1.4 million. As shown in Table 2, of the $1 million, approximately $860,647 is from direct visitor spending on Hawaii products, with the remainder going to imports. The largest direct spending categories for tourists are hotels ($297,087), air transportation ($142,279), trade ($116,913), restaurants ($103,026). Not surprisingly, these visitor oriented sectors also experience growth in wages and salaries. Because of the new equilibrium, output and wages and salaries fall in two sectors: agriculture and manufacturing. This reflects a shift in economic activity towards those sectors which benefit most from tourism.

Table 2: The Impact of a $1 Million Increase in Visitor Spending

	Visitor Spending	Household Spending	Export	Output	Labor Compensation	Value Added
Agriculture	$1,005	$694	$(65,179)	$(81,738)	$(24,441)	$(38,590)
Manufacturing	$23,824	$12,760	$(163,248)	$(109,127)	$(29,942)	$(41,013)
Air Transportation	$142,279	$17,890	$(1,515)	$162,894	$48,229	$86,202
Other Transportation	$49,066	$21,508	$(10,989)	$74,746	$20,144	$34,163
Entertainment	$52,090	$10,973	$(2,910)	$63,000	$25,110	$35,665
Golf	$12,924	$4,688	$ -	$17,611	$7,613	$9,789
Hotel	$297,087	$8,998	$ -	$307,627	$119,186	$169,806
Real Estate Rental	$21,925	$275,890	$(29,387)	$424,234	$19,265	$303,926
Restaurants	$103,026	$53,843	-(686)	$161,019	$61,973	$83,746
Trade	$116,913	$158,728	$(12,320)	$321,890	$137,138	$190,258
Services	$36,337	$281,189	$(187,675)	$319,704	$178,518	$217,544
Utilities	$ -	$31,517	0	$74,505	$19,348	$46,110
Government	$4,170	$14,025	$(8,655)	$352,727	$299,401	$344,985
Imports	$139,353	$428,790	$ -	$ -		
TOTAL	$1,000,000	$1,321,493	$(482,565)	$2,089,092	$881,540	$1,442,591

Because of the multiplier effect and visitor dollars circulating through the local economy, a million dollar increase in visitor spending also serves to boost household spending by $1,321,493. The increased income translates into households spending significantly more on services (health, education, financial, etc.), real estate, and trade. A million dollar increase in visitor spending yields a $281,189 increase on service spending, $275,890 on real estate spending, and $158,728 on retail and wholesale trade spending.

Declining Japanese visitor demand as well as growth in demand from the US and other markets has spurred discussion about the optimal mix of visitors. Table 3 contains a comparison of spending by US-West, US-East, Japanese, and Canadian visitors. Several observations can be made from the data. First, the general patterns of spending by U.S. and other visitors are similar, while those of Japanese visitors are quite different. Japanese visitors spend proportionately less on air transport, less on accommodations, but more on retail and wholesale trade. Their purchase of imported goods is also much higher. U.S. and other visitors spend proportionately more on rental cars than the visitors from Japan. Japanese spend almost double the volume in imports, mainly retail purchases, than other (non-U.S.) visitors.

Table 3: Comparison of Spending by Visitor Markets

	US West	US East	Japan	Canada	Other Int'l	Average Visitor
Agriculture	$2,128	$1,385	$1,521	$2,195	$1,536	$1,716
Manufacturing	$10,064	$7,662	$12,324	$9,758	$9,190	$9,694
Air Transportation	$138,733	$197,053	$70,792	$132,503	$161,193	$144,822
Other Transportation	$54,927	$45,152	$35,707	$49,037	$76,262	$49,943
Entertainment	$47,044	$44,920	$56,798	$45,068	$93,713	$53,021
Golf	$16,141	$15,044	$6,592	$14,554	$9,729	$13,155
Hotel	$324,571	$295,681	$256,351	$441,017	$304,186	$302,398
Real Estate	$24,083	$21,992	$19,089	$30,738	$21,543	$22,317
Restaurants	$117,948	$109,191	$94,567	$74,425	$72,981	$104,868
Trade	$111,120	$115,154	$160,984	$62,906	$86,526	$119,003
Other Services	$46,953	$43,523	$30,342	$36,842	$34,223	$40,952
Utilities	$0	$0	$0	$0	$0	$0
Government	$4,826	$4,505	$3,951	$2,437	$2,392	$4,245
Imports	$101,462	$98,738	$250,983	$98,520	$126,526	$133,867
Total	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000

Estimates based on spending data provided by DBEDT – READ Division.

A $1 million increase in spending by various visitor groups is simulated and the results given in Table 4. Japanese visitors spend more ($248) on a given day than any other visitor type. The $1 million increase is associated with approximately 4,027 new Japanese visitor days. Canadians tend to spend less per day ($117). Thus a $1 million increase in spending requires 8,552 more visitor days.

Interestingly, while a million dollars in additional Japanese spending results in fewer people than does other visitor types it also contributes notably less to the gross state product ($1,373,783), household expenditures ($1,146,014), and consumer price inflation

(0.26%) than do other visitor types. $1 million from Canadians contribute the most to the economy, although not by a significant margin. The gap between Japanese economic contributions and those of other visitor types is due to the significantly higher levels of direct and indirect import of non-Hawaiian goods and services associated with Japanese spending.

While Japanese visitors spend more per day and contribute less per dollar to the local economy, they also tend on average to have a lower environmental impact. Per million dollars spent, the Japanese visitor generates less water, petroleum, and electricity demand than most visitors. Other international visitors generate a relatively low impact in terms of water and electricity. Visitors differ greatly in terms of their impact on the generation of solid waste.

TABLE 4: Impact of $ Million Increase in Visitor Spending, by Visitor Type

	US-West	US-East	Japan	Canada	Other Int'l	Average
Visitors						
Increase # visitor days	5,910	5,313	4,027	8,552	6,250	5,342
Spending per visitor day	$169	$188	$248	$117	$160	$187
Economic Impact ($ increase)						
Gross State Product	$1,654,450	$1,638,198	$1,373,783	$1,670,052	$1,577,861	$1,583,409
Household Expenditures	$1,381,039	$1,367,441	$1,146,014	$1,394,984	$1,316,087	$1,321,493
Consumer Price Inflation	0.0031%	0.031%	0.0026%	0.0032%	0.0030%	0.0030%
Total Environmental Impact (unit increase)						
Water (gal)	(1,440,910)	(1,558,726)	(1,302,054)	(1,413,727)	(1,565,705)	(1,460,057)
Non-ag water (gal)	1,220,282	1,147,846	932,150	1,294,676	1,058,823	1,123,389
Electricity (W)	140,232,192	132,418,050	125,133,724	148,393,701	120,314,447	132,875,998
Utility gas (mmBtu)	117,060,607	105,474,452	91,107,421	139,837,552	96,755,589	106,596,247
Solid Waste (lbs)	5,088	3,685	5,118	(473)	1,617	4,181
Petroleum (gal)	38,026	49,094	34,880	37,806	47,705	41,730

Hawaii 2030: Alternative Future Scenarios for Tourism and Growth

An important step in planning for visitor industry growth is an examination of how economic and environmental impacts accumulate over time. This study provides a CGE model, capable of simulating the response of the Hawai`i economy to alternative tourism scenarios out to 2030.

This model, based on a 1997 Hawaii Input-Output Table, is updated using macroeconomic data for Hawaii. The model then uses key variables in the long-range forecasting model maintained by the University of Hawaii Economic Research

Organization (UHERO). Using a time-series of data on key Hawaii, national, and international economic indicators, the UHERO model predicts inflation, employment, and output for the State and Counties. In addition to projections of county-level visitor expenditures the UHERO model forecasts growth in Federal government expenditures, both military and civilian.

Three alternative levels of growth are considered: Low, Base, and High. UHERO baseline projections for population growth involve a 33.6% increase in the number of people employed in the 2030 labor force over 1997 levels. A significant finding is that high visitor growth would provide sufficient stimulation to the economy to attract 44.4% more workers (and hence population) to Hawaii, shown in Table 6. In contrast, low visitor growth dampens economic conditions as well as employment, with growth of only 16.4%. The low visitor expenditure growth scenario might be considered as supporting the existing residential population with a natural level of growth over the 30 year time horizon. Baseline and high levels of visitor growth would require that workers migrate to the State from other locations.

Table 5. Visitor Expenditure Projections to 2030

	Low Projection		Base Projection		High Projection	
	$ million	Cumulative % change from 1997		Cumulative % change from 1997	$ million	Cumulative % change from 1997
1997*	$ 10,931		$ 10,931		$ 10,931	
2003	11,362		11,362		11,362	
2010	13,773	26.0%	14,501	32.7%	15,243	39.4%
2020	17,948	64.2%	20,138	84.2%	22,541	106.2%
2030	23,891	118.6%	28,457	160.3%	33,860	209.8%

Source: UHERO Projections; *actual.

Table 6. Employment Projections to 2030

	Low Projection		Base Projection		High Projection	
	Jobs	%change	Jobs	%change	Jobs	%change
1997*	564,137		564,137		564,137	
2003*	591,800		591,800		591,800	
2010	609,043	8.0%	637,941	13.1%	651,503	15.5%
2020	634,727	12.5%	702,642	24.6%	737,397	30.7%
2030	656,669	16.4%	753,448	33.6%	814,709	44.4%

Source: UHERO Projections; *actual

Other key findings are presented in Table 7. Under all scenarios, household spending far out-paces that of visitor spending. The highest level of visitor spending in 2030 is projected to be approximately $33.9 billion. Household expenditures range between a low of $79.8 billion to a high of $99.7 billion.

The 30 year growth in household expenditures depends on both the level of visitor activity and the inflow of new workers. Total household expenditures is projected to expand from $25.0 billion in 1997 to low visitor growth levels of $79.8 billion ($55.0

billion real) and high visitor growth levels of $99.7 billion ($66.0 billion real). On an individual household basis, however, economic quality of life conditions appear to be better with lower visitor growth. Several indicators support this observation. First, real average compensation of employees expand from $35.1 thousand in 1997 to 2030 projections of $53.8 thousand (53.1%) under low growth, $49.8 thousand (41.7%) under base growth, and $48.3 thousand (37.4%) under high growth scenarios. This is due two factors. First, the migration of new workers to Hawaii places downward pressure on wages and salaries to workers. This is evident in the relatively lower average returns to labor observed under the high growth scenario ($48.3 thousand) relative to the low growth scenario ($53.8 thousand). Second, the greater is local demand, the higher are consumer prices. Over thirty years, low visitor growth generates a consumer price index of 154 versus 162 for high visitor growth. Note that the benefits of lower growth also appear to be realized by proprietors, and similar average discrepancies between low and high visitor growth scenarios are observed.

Growth in visitor expenditure has a multiplier effect on total economic output, and the value added of Hawaii producers and this impact accumulates over the thirty year planning horizon. Gross State Product (GSP) is estimated to increase, at minimum by 163.7% (or 71.0% in real terms) to $101.8 billion ($66 billion real). High projections for growth involve GSP growth of upwards of $123.7 billion ($76.3 billion real). This growth involves an increase in output in key economic sectors, as well as an increasing strain on Hawaii's environmental assets.

Table 7: Hawaii 2030: Low, Baseline, and High Visitor Growth Scenarios

	1997	2030 low	2030 base	2030 high
Labor Force (thousands)*	594.7	692.2	794.3	858.8
Visitor Expenditures ($m)*	10,931.0	23,890.8	28,457.0	33,859.8
Real Visitor Expenditures ($1997 m)	10,931.0	14,517.4	17,282.7	19,844.8
Consumer Price Index (1997 = 100)	100.0	154.2	156.0	162.1
Visitor Price Index (1997 = 100)	100.0	164.6	164.6	170.6
Household Expenditures ($million)	24,962.0	79,848.2	89,049.6	99,668.3
Real Household Expenditures ($1997 m)	24,962.0	55,004.2	60,657.2	65,981.1
Real Avg Household Expenditures ($1997 th)	42.0	79.5	76.4	76.8
Compensation of Employees ($ m)	21,626.2	59,436.8	63,846.8	69,558.2
Real Compensation of Employees ($1997 m)	21,626.2	38,547.0	40,920.5	42,903.5
Real Avg Comp of Employees ($1997 th)	35.1	53.8	49.8	48.3
Proprietor's Income ($ m)	2,088.0	5,115.6	5,618.3	6,213.1
Real Proprietors' Income ($1997 m)	2,088.0	3,317.7	3,600.8	3,832.2
Real Average Proprietors' Income ($1997 th)	16.5	22.5	21.3	20.9
Total Output ($ m)	58,732.5	139,411.9	154,914.6	170,912.1
Real Total Output ($1997 m)	58,732.5	90,413.6	98,826.1	105,418.6
Gross State Product ($ m)	38,615.7	101,815.5	111,778.5	123,712.0
Real Gross State Product ($1997 m)	38,615.7	66,031.0	71,640.9	76,305.5

Table 7: Hawaii 2030: Low, Baseline, and High Visitor Growth Scenarios- Continued

Macroeconomic Indicators, cumulative percent change	1997-2030 low	1997-2030 base	1997-2030 high
Labor Force*	16.4	33.6	44.4
Visitor Expenditures*	118.6	160.3	209.8
Real Visitor Expenditures	33.8	58.1	81.5
Hawaii CPI	54.2	56.0	62.1
Hawaii VPI	64.6	64.6	70.6
Household Expenditures	219.9	256.7	299.3
Real Household Expenditures	120.4	143.0	164.3
Real Avg Hsehold Expenditures ($1997 million)	89.3	81.9	83.0
Real Compensation of Employees	78.2	89.2	98.4
Real Average Compensation of Employees	53.1	41.7	37.4
Proprietor's Income	145.0	169.1	197.6
Real Proprietor's Income	58.9	72.5	83.5
Real Average Proprietor's Income	36.5	29.1	27.1
Total Output ($ million)	137.4	162.5	191.0
Real Total Output ($1997 million)	53.9	68.3	79.5
Gross State Product ($ million)	163.7	189.5	220.4
Real Gross State Product ($1997 million)	71.0	85.5	97.6

Unless otherwise noted, projections are generated by the CGE model simulations.
* indicates exogenous shocks derived from the UHERO long-range growth forecasts.

In all cases, the higher visitor expenditures are, the higher the demand is for the infrastructure services as shown in Table 8. In comparing low and high growth scenarios, the impact on infrastructure appears to be most dramatic in terms of energy demand, with high growth increasing petroleum use to 4,357.0 million gallons and electricity use to 18,507.7 GWh compared to low growth demand increases of 3,545.7 million gallons and 15,922.0 GWh respectively.

Table 8: Projected Infrastructure Demand for Alternative Growth Scenarios

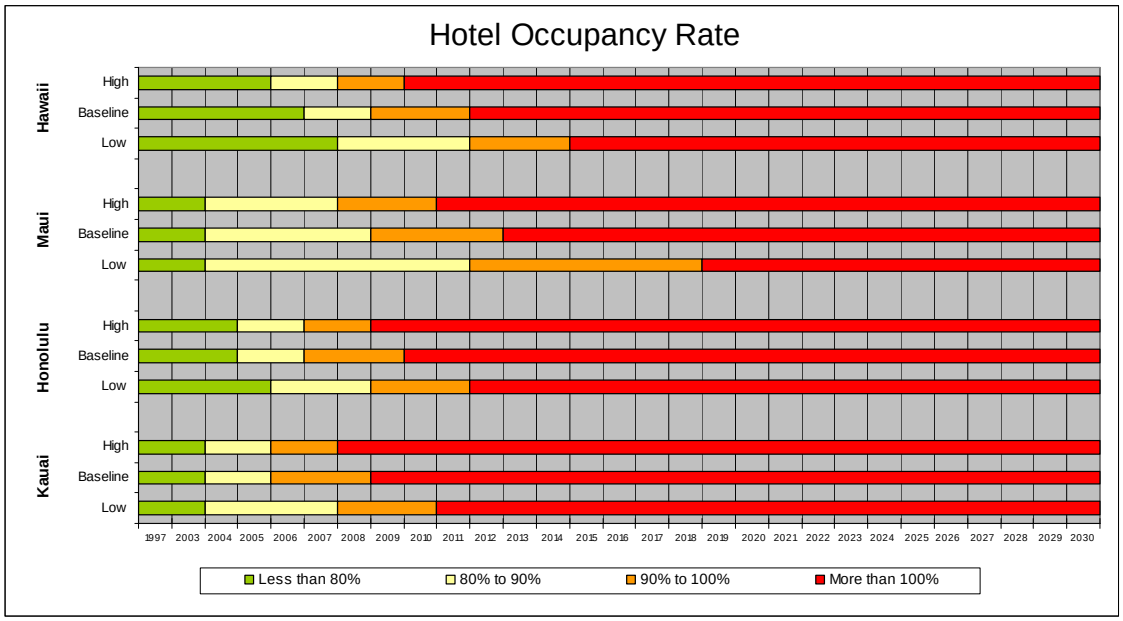
Low Visitor Growth	1997	2010	2020	2030
Water, gallons million	100,368.6	114,566.5	130,664.4	146,962.0
Non-ag Water, gallons million	86,156.2	106,307.8	124,096.6	141,934.6
Solid Waste, pounds million	3,198.2	3,438.6	3,655.8	3,846.1
Electricity, GWh	10,009.0	11,995.4	13,906.2	15,922.0
Utility gas, mmBtu	3,706,734.7	4,272,453.9	4,784,473.9	5,266,846.3
Petroleum, gallons million	2,030.9	2,449.4	2,948.1	3,545.7

Base Visitor Growth	1997	2010	2020	2030
Water, gallons million	100,368.6	118,074.4	139,198.6	159,616.5
Non-ag Water, gallons million	86,156.2	109,469.6	131,998.8	153,972.2
Solid Waste, pounds million	3,198.2	3,589.6	4,017.4	4,374.9
Electricity, GWh	10,009.0	12,387.8	14,891.3	17,445.9
Utility gas, mmBtu	3,706,734.7	4,452,278.1	5,242,408.7	5,985,536.8
Petroleum, gallons million	2,030.9	2,542.6	3,195.5	3,971.7

High Visitor Growth	1997	2010	2020	2030
Water, gallons million	100,368.6	119,665.6	143,448.1	167,272.6
Non-ag Water, gallons million	86,156.2	111,095.5	136,248.2	161,591.2
Solid Waste, pounds million	3,198.2	3,665.2	4,214.6	4,726.3
Electricity, GWh	10,009.0	12,606.5	15,476.8	18,507.7
Utility gas, mmBtu	3,706,734.7	4,562,786.6	5,536,680.4	6,518,953.6
Petroleum, gallons million	2,030.9	2,611.2	3,392.8	4,357.0

To better understand the capacity of the state to absorb more tourism, an analysis of the state's hotel room capacity is also conducted, using the low, base, and high projections of visitor demand for hotel rooms, see Figure 1. Based on this analysis, it is determined that Kauai and Honolulu already face an impending shortage of hotel rooms, followed next by Maui and then the Big Island. As occupancy rates reach more critical levels, visitors will increasingly seek alternatives to hotels including time-shares, condominiums, and other accommodations.

Figure 1: Projected Occupancy Rates with Fixed Hotel Room Inventory



In terms of the analysis of environmental capacity, it is apparent that there are adequate water resources to accommodate new growth provided that island wide resources can be effectively distributed to areas experiencing growth and demand, Table 9. For each island, the total annual sustainable yield remains far above water demand through 2030. The analysis of developed regions of each County yields a different assessment as the transportation of water from wetter undeveloped regions to arid high growth regions which is a policy issue facing the Counties, as is the extension of water infrastructure and wastewater treatment facilities. With solid waste, the needs are more critical, especially on Kauai and Oahu, as shown in Figure 2. Table 10 shows visitor demand at the County Level for various good and services. These sectors have demands for infrastructure which are used to compute the demands provided in Table 9 and Figure 2.

Table 9: Projected County Water Demand and Sustainable Yields

	60% Sustainable Yield (million gallons)	1997	2010		2020		2030	
		Million gals/year	Million gals/year	Cumulative % from 1997 to 2010	Million gals/year	Cumulative % from 1997 to 2020	Million gals/year	Cumulative % from 1997 to 2030
Kauai	84,972							
High		11,140.13	9,886.21	(11%)	10,849.46	(3%)	11,773.94	6%
Base		11,140.13	9,790.10	(12%)	10,556.85	(5%)	11,240.17	1 %
Low		11,140.13	9,442.99	(15%)	9,798.32	(12%)	10,233.57	(8)%
Oahu	97,674							
High		54,532.35	66,148.95	21 %	81,824.42	50 %	97,819.98	79 %
Base		54,532.35	64,993.31	19 %	78,751.65	44 %	92,330.11	69 %
Low		54,532.35	62,866.33	15 %	73,540.45	35 %	84,415.39	55 %
Maui	123,297							
High		10,670.79	12,881.01	21 %	15,921.98	49 %	19,000.11	78 %
Base		10,670.79	12,659.48	19 %	15,335.62	44 %	17,958.57	68 %
Low		10,670.79	12,247.56	15 %	14,331.04	34 %	16,441.71	54 %
Hawaii	532,389							
High		7,199.58	8,902.15	24 %	11,096.39	54 %	13,323.75	85 %
Base		7,199.58	8,741.15	21 %	10,672.16	48 %	12,570.60	75 %
Low		7,199.58	8,455.70	17 %	9,969.17	38 %	11,497.66	60 %

Figure 2: Projected Regional Trigger Points for Solid Waste Disposal

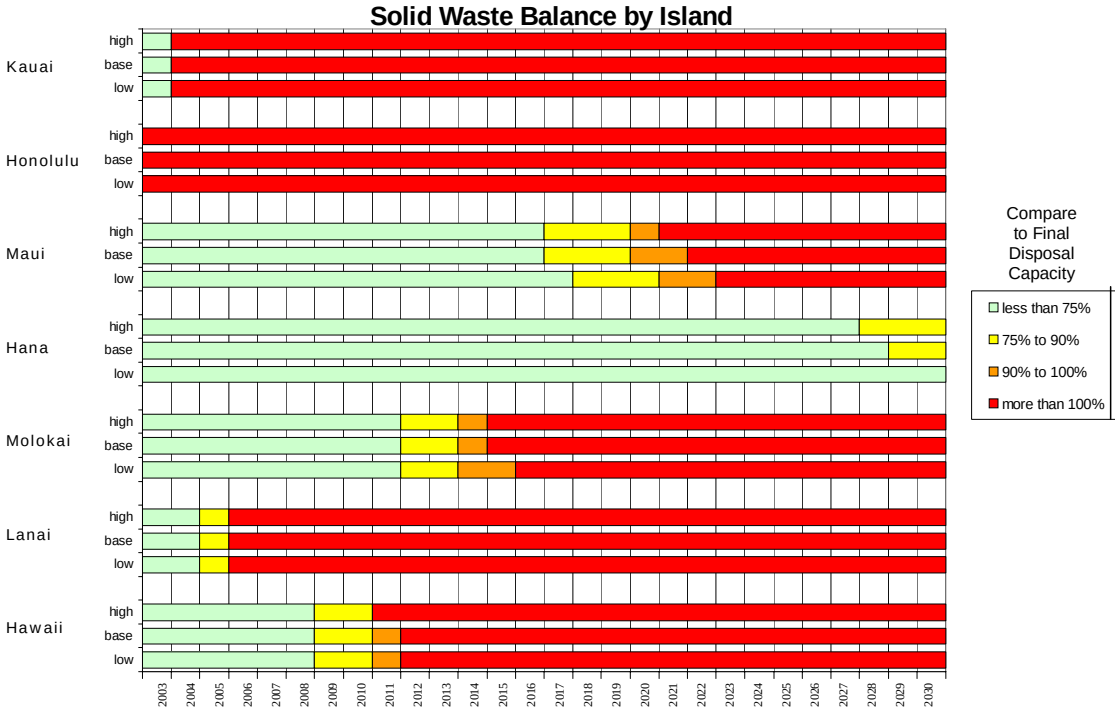


Table 10: County-Level Real Visitor Demand Projections

Oahu	**1997**	**2010**		**2020**		**2030**	
	($m)	($m)	cum. % change from 1997	($m)	cum. % change from 1997	($m)	cum. % change from 1997
Ground transportation	34.15	35.11	2.8	41.31	21.0	46.62	36.5
Automobile rental	141.09	143.72	1.9	170.67	21.0	194.85	38.1
Performing arts	16.81	16.81	-0.0	19.09	13.5	20.84	24.0
Amusement	69.96	73.81	5.5	88.23	26.1	101.41	45.0
Recreation	45.79	46.86	2.3	54.44	18.9	60.62	32.4
Museums historical	20.85	21.31	2.2	24.69	18.4	27.41	31.4
Sightseeing transport	127.95	129.73	1.4	152.06	18.8	170.85	33.5
Golf courses	76.34	77.88	2.0	90.63	18.7	101.06	32.4
Hotels	1606.85	1618.37	0.7	1878.08	16.9	2090.28	30.1
Real estate	107.41	109.27	1.7	131.17	22.1	150.65	40.3
Restaurants	758.53	795.59	4.9	930.37	22.6	1045.41	37.8
Retail trade	565.13	571.07	1.0	659.03	16.6	728.18	28.8

Big Island	**1997**	**2010**		**2020**		**2030**	
	($m)	**($m)**	cum. % change from 1997	**($m)**	cum. % change from 1997	**($m)**	cum. % change from 1997
Ground transportation	11.02	12.64	14.7	15.32	39.0	17.90	62.4
Automobile rental	45.54	51.74	13.6	63.30	39.0	74.83	64.3
Performing arts	3.47	3.85	11.0	4.51	30.1	5.11	47.4
Amusement	14.43	16.89	17.1	20.85	44.6	24.87	72.4
Recreation	9.44	10.73	13.6	12.87	36.3	14.87	57.4
Museums historical	4.30	4.88	13.4	5.83	35.7	6.72	56.3
Sightseeing transport	41.30	46.71	13.1	56.40	36.6	65.61	58.9
Golf courses	15.74	17.82	13.2	21.42	36.1	24.78	57.4
Hotels	437.96	490.68	12.0	587.43	34.1	677.73	54.8
Real estate	34.67	39.34	13.5	48.65	40.3	57.85	66.9
Restaurants	82.81	95.71	15.6	115.92	40.0	135.52	63.7
Retail trade	153.65	172.49	12.3	205.49	33.7	235.51	53.3

Maui	**1997**	**2010**		**2020**		**2030**	
	($m)	($m)	cum. % change from 1997	($m)	cum. % change from 1997	($m)	cum. % change from 1997
Ground transportation	21.50	25.44	18.3	29.03	35.0	33.07	53.8
Automobile rental	88.81	104.12	17.2	119.95	35.1	138.21	55.6
Performing arts	8.32	9.41	13.1	10.40	25.1	11.47	37.9
Amusement	34.60	41.31	19.4	48.08	38.9	55.82	61.3
Recreation	22.65	26.23	15.8	29.67	31.0	33.37	47.3
Museums historical	10.31	11.92	15.6	13.45	30.4	15.09	46.3
Sightseeing transport	80.54	93.99	16.7	106.87	32.7	121.18	50.5
Golf courses	37.76	43.58	15.4	49.39	30.8	55.62	47.3
Hotels	948.30	1088.68	14.8	1228.20	29.5	1380.08	45.5
Real estate	67.61	79.16	17.1	92.19	36.4	106.85	58.0
Restaurants	198.39	230.81	16.3	263.99	33.1	300.08	51.3
Retail trade	258.87	296.81	14.6	333.35	28.8	371.97	43.7

Table 10: County-Level Real Visitor Demand Projections – continued

Kauai	1997	2010		2020		2030	
		($m)	cum. % change from 1997	($m)	cum. % change from 1997	($m)	cum. % change from 1997
Ground transportation	9.53	11.79	23.7	14.04	47.3	16.13	69.2
Automobile rental	39.38	48.25	22.5	58.01	47.3	67.42	71.2
Performing arts	2.52	2.98	18.5	3.43	36..4	3.82	51.9
Amusement	10.47	13.09	25.0	15.87	51.6	18.60	77.6
Recreation	6.85	8.31	21.3	9.79	42.9	11.12	62.2
Museums historical	3.12	3.78	21.1	4.44	42.3	5.03	61.0
Sightseeing transport	35.71	43.55	22.0	51.68	44.7	59.11	65.5
Golf courses	11.43	13.81	20.9	16.30	42.7	18.53	62.2
Hotels	254.33	305.54	20.1	359.34	41.3	407.40	60.2
Real estate	29.98	36.68	22.4	44.59	48.7	52.12	73.9
Restaurants	86.45	105.59	22.1	125.54	45.2	144.07	66.6
Retail trade	110.00	132.06	20.0	154.54	40.5	174.01	58.2

Conclusions and Recommendations

This project has illustrated some of the challenges facing Hawaii in the future. In this section, the most important conclusions of the report are highlighted and some policy directions for addressing the challenges ahead are suggested. There are limits to the growth of tourism both because of internal constraints and because of external forces and competition from other destinations.

The visitor industry in Hawaii is a mature one. Unlike other places in which tourism is a more recent phenomenon, poised for take-off, growth and rapid expansion, Hawaii's tourism product is more advanced, stable, and unlikely to see massive expansion.

Tourism is clearly one of the most important economic activities in Hawaii. Tourism is distinguished by its size and share of the state's economy.

The state's economy is heavily oriented towards tourism and services. Key sectors include real estate, services (health, education, financial, etc.), government, and those catering to tourists (hotels, transportation, restaurants, etc.). While visitors spend proportionately more on hotels, transportation, restaurant meals, and sightseeing, household spending on many of these services (retail, restaurant meals, entertainment, etc.) is also quite significant. Local spending on health, education, finance and other services far surpasses the level that tourists spend on these goods and services.

In this study, the environmental impacts of tourism were examined, by estimating the direct and indirect demand for various infrastructure services by visitors and households.

The greatest industrial demand for infrastructure services (water, electricity, sewer, solid waste etc.) comes from hotels, real estate, restaurants, and other businesses. It is important to note that residential demand for these services exceeds that of not only tourists, but also industrial demand. While residents consume more of these

environmental services, in the aggregate, on an average, per day basis, the demand for these services by tourists is greater.

Using the CGE model, the impact of visitor expenditures was also simulated The visitor oriented sectors such as hotels, transport, trade, and restaurants experience gains, but also, notably, the boost in household expenditures resulting from increasing visitor spending also stimulates spending on other services (health, education, financial, etc.). More income to households means more spending on real estate as well as retail trade.

Not all sectors are equally affected by a boost in visitor spending. The sectors that will experience the greatest growth in job creation include retail, health services, restaurants, hotels, and air transport. Increased visitor spending also generates impacts on the environment. In particular, there is a growth in demand for municipal services

The simulations also reveal significant differences between various visitor groups and their spending patterns and their resulting environmental impacts. Because Japanese visitors spend more on a per day basis than for example Canadian visitors, to earn the same amount of income will require more Canadian visitor days (8,552) than Japanese visitor days (4,027). Yet because Japanese visitors are making greater purchases of goods and services not from Hawaii, the additional million dollars in Japanese visitor spending contributes less to the economy than does the additional million dollars from Canadian visitors. While Japanese Visitors spend more per day and contribute less per dollar to the local economy, they also tend on average to have a lower environmental impact.

Given our present industrial structure, that the incomes of Hawaii's residents are closely tied to the visitor industry. A growth in visitor spending without an increase in the labor force simply transfers more income to Hawaii workers, increasing household welfare and real household expenditures. An expansion in the labor force without an increase in visitor spending tends to harm Hawaii households as real incomes fall. Labor force expansion without a growth in either tourism or another economic sector will lead to a decrease in the standard of living for Hawaii's residents. On the other hand, an increase in the labor force without growth in visitor spending will mean an improvement in welfare for visitors because they will be getting more service for their spending.

The quality of the visitor experience is dependent on the responsiveness of the labor force to tourism growth. Moreover, the more visitors spend, the higher prices are for both visitors and residents. Increases in visitor spending create more inflation when the labor markets are inelastic than when there is in-migration. However, residents are better off when visitor spending is not accompanied by an increase in the labor force. This transfers more income to households. But there is a limit to the growth of tourism without expansion of the labor market.

The results reveal that while the greatest increase in gross state product in 2030 occur with the highest levels of visitor spending and population growth. The high growth scenarios produce the greatest levels of inflation for both residents and visitors. The high growth scenarios also increase strain on Hawaii's environmental resources. At the same

time, the addition of more residents fuels the economy and promotes higher levels of production and output.

The hotel room capacity of the state was also analyzed. Based on this analysis, it was determined that Kauai and Honolulu already face an impending shortage of hotel rooms, followed next by Maui and then the Big Island. As occupancy rates reach higher levels, visitors will seek alternatives including time-shares, condominiums, and other accommodations.

There is adequate state or county land and water resources to accommodate new growth. However, if water is to remain in certain regions and not be transported to the dryer, growing parts of the state, then there are definitely resource constraints. Moreover, there are questions regarding the development of infrastructure services and the allocation of costs for both water and wastewater facilities. With solid waste, the needs are more critical, especially on Kauai and Oahu.

There are concerns regarding solid waste disposal, especially on Oahu and Kauai, and in the long-term on all islands.

Summary of Major Issues Identified

A few issues for future research have emerged.

First, if tourism is to grow, even modestly, there is need to re-examine our policies with regard to the development of hotels and visitor accommodations.

A second issue that has emerged in relates to the differential impact of various types of visitors coming to Hawaii. On the one hand, high spending tourists from generate the most economic activity, yet much of that economic activity (retail purchases, etc.) leaks out of the state of Hawaii. Lower spending tourists typically spend proportionately more of their trip budget on restaurant meals, hotel rooms, rental cars, gasoline, and stay longer than the typical high spending visitor. Because it takes more lower spending visitors to achieve the same levels of output and production, the impact in terms of water use, wastewater, electricity, and other infrastructure services (with the exception of solid waste generation) is proportionately greater. Additional research needs to be done in terms of identifying the optimal mix of visitors from key markets in terms of economic, environmental, and social benefits and costs.

A third concern relates to the question of how much additional population growth and in-migration is desirable for our state. This issue has emerged not only in terms of the increasing demand for labor in the visitor industry and in other businesses in Hawaii, but also, more fundamentally because it is the resident population that creates the greatest strain on our environment.

Finally, while tourism is an essential component of Hawaii's economy and while this study focused on the issues related to its "sustainability" defined in terms of economic, environmental and social consideration, it is clear that there are larger issues related to

Hawaii's industrial structure, its population dynamics, and its patterns of growth and development over the long-term.

Recommendations and Policy Options

The study team recommends a number of ways in which the state and counties may address the impacts of future tourism growth.

In addition to considering the differences between east and west bound tourists, changing the mix of business, honeymoon, convention, and other categories of tourists might be considered. Potential new mixes could include "eco-tourists," "edu-tourists," "health tourists" and other types of visitors to Hawaii.

There may be reason to do a better job of managing the externalities associated with tourism. Externalities are the unintended by-products of a production process, such as pollution, noise, or disruption of wildlife habitat. There are three basic approaches to managing externalities: tax policy, land use policy and infrastructure pricing.

In addition to managing externalities, the study has identified additional information needs, and, perhaps, the development of further extensions of the databases, methods, and tools created as part of this project.

While measures of economic success abound, there is need to go further in terms of capturing measuring environmental quality and social vibrancy. Future work should go towards the development of appropriate measures of sustainable development that cut across different economic, environmental, and social domains.

In this project, a great amount of data has been collected from many different sources. A plan to ensure the ongoing collection and updating of vital information related to the economy, environment, and society in Hawaii should be developed.

In addition to the CGE model, the use of input-output methods, Geographic Information Systems (GIS), and other techniques of regional analysis have been demonstrated. There is a need to expand the present state-of-knowledge with regard to modeling techniques and methods of assessing the impacts of sustainable development.

Statewide economic data were used to build the initial model and then allocated down to the county and sub-county levels. Another approach would be to begin with a county level input-output table and use a more "bottom-up" approach to investigating the relationships between tourism, the economy, the environment and community.

Another strategy may involve using the data and methods created in this project as a basis for re-engineering the production of tourism in Hawaii. As noted in this study, because tourists spend more, they tend to consume more water and other infrastructure services. Perhaps more emphasis could be directed towards water savings devices, smart buildings, energy-efficiency, and other new technologies that could reduce the environmental impacts of tourism in order to create a more economically, environmentally, and socially sustainable product.

Department of Business, Economic Development & Tourism
P.O. Box 2359
Honolulu, Hawaii 96804
Street Address: 250 South Hotel Street

www.hawaii.gov/dbedt