

# Hawaii Economic Issues

Periodic research and data reports on issues of current interest  
State of Hawaii - Department of Business, Economic Development & Tourism  
Research & Economic Analysis Division



## Economic Report 2011

# The Size of Hawaii's Energy Sector

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## Introduction

The energy sector<sup>1</sup> is one of the critical components of the Hawaii economy. Energy is used by all the industries. Therefore, the cost, usage, and efficiency of energy all impact the price of goods and services produced by all the industries. Energy is also critical to end users such as government, private households, and visitors. It impacts the daily operation of virtually our entire society and is a critical key to the quality of life of our residents and visitors.

Despite this, there is no standard definition of what constitutes the “energy sector.”

The North American Industry Classification System (NAICS), which is used by the United States in collecting and reporting government statistics, does not have a definition for the energy sector or industry.

Therefore, this study attempts to define the Hawaii's energy sector by aggregating the industries classified by NAICS but doing businesses or research in the field of energy. This includes businesses related to traditional energy such as petroleum and electricity and renewable energy such as electricity generation by hydro, wind, biomass and photovoltaic, as well as businesses producing or conducting research on bio-fuel.

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<sup>1</sup> A sector is one of a few general segments in the economy within which a large group of companies can be categorized. An economy can be broken down into about a dozen sectors, which can describe nearly all of the business activity in that economy. An industry, on the other hand, describes a much more specific grouping of companies with highly similar business activities. Essentially, industries are created by further breaking down sectors into more defined groupings. Each of the dozen or so sectors will have a varying number of industries, but it can be in the hundreds. For example, the financial sector can be broken down into industries such as asset management, life insurance and regional banks. The regional bank industry, which is part of the financial sector, will only contain companies that operate banks in the state.

As measures of the “size” of the energy sector, employment and gross domestic product (GDP) are estimated. In this report, energy sector jobs and GDP estimates include only the direct impacts and exclude the indirect and induced impacts.

Beyond the employment and GDP measures, energy expenditures is another size measure of energy sector. Hawaii residents spent about \$7 billion in 2008 on energy, which accounted for about 5.0% of all the consumption in the state for that year. However, \$4.1 billion was spent on imported oil in that year.

When estimating the size of a sector, this calculation deducts the value of imports and purchases from other sectors.

We believe the GDP measure is the most comprehensive measure of a sector since it is the net value produced by the sector without the value of imports and purchases from other sectors.

## **Definition of the Energy Sector**

The energy sector defined in this study includes the following six major categories:

1. Fossil fuel resource exploration
2. Fossil fuel production, conversion, and distribution
3. Electricity/steam production, transmission and distribution
4. Energy related structure/facility construction/installation
5. Energy products wholesalers, retailers, and fuel dealers
6. Renewable energy project construction and R&D

Each category is also part of several industries based on the NAICS code. We found total of 14 industries comprise the energy sector in Hawaii.

## **Energy Sector Employment**

Total jobs in the energy sector were drawn primarily from a database maintained by the Economic Modeling Specialists Inc. (EMSI)<sup>2</sup>. Data at EMSI come from nearly 90 federal, state, and private sources, including Bureau of Economic Analysis, U.S. Department of Commerce, U.S. Department of Labor, and U.S. Census Bureau. For some industries, data provided by EMSI were allocated to energy and non-energy industries by DBEDT.

Some NAICS industries include both energy industries and non-energy industries, and the jobs in these industries cannot be separated between energy industries and non-energy industries. For example, the total jobs of the Plumbing, Heating, and Air-Conditioning Contractors Industry cannot be separated between plumbing (non-energy) and heating (energy) in the original data source. In such case, the total jobs are allocated between energy and non-energy based on a DBEDT estimation.

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<sup>2</sup> For a detailed description of the EMSI data, please go to: <http://www.economicmodeling.com/data/>.

As shown in Table 1, jobs in Hawaii's energy sector totaled about 14,000 in 2010 and accounted for 1.7% of all the jobs in the state, including both wage and salary jobs and self employed jobs.

From 2002 to 2007, the share of energy sector jobs in total jobs remained about the same at about 1.5%; from 2007 to 2010, the share of energy sector jobs increased from 1.5% to 1.7%.

Table 2 presents the growth of the energy sector jobs comparing with the growth of the total jobs in the state. Hawaii's energy sector experienced an annual average growth of 3.0% in jobs between 2002 and 2010, a much higher percentage than the overall job growth at 1.3% during the same period.

According to DBEDT estimates, jobs growth in the renewable energy infrastructure construction and research industry grew at an annual growth of 19.5% during the same period. On the other hand, gasoline stations experienced job loss at 1.9% per year due to the consolidation of the industry. According to the economic census data from the U.S. Census Bureau, number of gasoline stations in Hawaii dropped from 324 in 2002 to 295 in 2007.

Table 3 shows the distribution of jobs in the energy sector. The largest employer in the energy sector is the Electrical and Other Wiring Installation Contractors, which filled 28.3% of the total energy positions in 2010. Electricity companies supported 19.5% of the energy sector jobs, followed by gasoline stations where 18.1% of the total energy jobs located.

Table 1. Hawaii Energy Sector Employment (number of job counts)

NAICS	Industry	2002	2003	2004	2005	2006	2007	2008	2009	2010
211-213	Oil and Gas Extraction	178	211	274	252	366	399	531	777	756
2211	Electric Power Generation, Transmission and Distribution	2,227	2,225	2,281	2,400	2,471	2,565	2,627	2,728	2,739
2212	Natural Gas Distribution	292	290	293	274	296	269	307	304	304
22133	Steam and Air-Conditioning Supply	15	20	-	-	-	-	1	7	6
23712	Oil and Gas Pipeline and Related Structures Construction	101	60	42	78	80	95	92	99	97
Part of 23713	Power Line and Related Structures Construction	372	489	451	457	474	470	452	427	439
23821	Electrical Contractors and Other Wiring Installation Contractors	3,306	3,714	3,828	4,083	4,320	4,517	4,701	4,167	3,975
Part of 23822	Heating, and Air-Conditioning Contractors	540	597	662	775	821	845	854	776	746
32411	Petroleum Refineries	384	418	439	430	445	488	489	492	485
4247	Petroleum and Petroleum Products Merchant Wholesalers	378	397	399	419	451	509	651	677	648
447	Gasoline Stations	2,963	2,899	2,869	2,785	2,699	2,638	2,610	2,509	2,533
45431	Fuel Dealers	44	75	63	51	44	69	75	71	71
Part of 23	Renewable Energy Construction	125	130	134	137	185	191	284	315	522
Part of 54171	Renewable Energy R&D	170	175	181	185	251	258	385	426	706
	Total Energy Sector	11,095	11,700	11,915	12,325	12,903	13,313	14,058	13,775	14,027
	Total statewide Jobs	753,287	769,295	792,071	818,616	840,102	863,536	859,977	835,730	832,788
	Energy Sector as % of State total	1.5	1.5	1.5	1.5	1.5	1.5	1.6	1.6	1.7

Source: DBEDT Estimate based on data from Economic Modeling Specialists Inc. (EMSI).

Table 2. Growth of Energy Sector Employment

Industry	Average Annual Growth (%)
Oil and Gas Extraction	19.8
Electric Power Generation, Transmission and Distribution	2.6
Natural Gas Distribution	0.5
Steam and Air-Conditioning Supply	-10.8
Oil and Gas Pipeline and Related Structures Construction	-0.5
Power Line and Related Structures Construction	2.1
Electrical Contractors and Other Wiring Installation Contractors	2.3
Heating, and Air-Conditioning Contractors	4.1
Petroleum Refineries	3.0
Petroleum and Petroleum Products Merchant Wholesalers	7.0
Gasoline Stations	-1.9
Fuel Dealers	6.2
Renewable energy construction	19.5
Renewable energy R&D	19.5
Total Energy Sector	3.0
Total statewide jobs	1.3

Source: DBEDT Calculation from data in Table 1.

Table 3. Industry Share of the Energy Sector Employment (%)

Industry	2002	2004	2006	2008	2010
Oil and Gas Extraction	1.6	2.3	2.8	3.8	5.4
Electric Power Generation, Transmission and Distribution	20.1	19.1	19.2	18.7	19.5
Natural Gas Distribution	2.6	2.5	2.3	2.2	2.2
Steam and Air-Conditioning Supply	0.1	0.0	0.0	0.0	0.0
Oil and Gas Pipeline and Related Structures Construction	0.9	0.4	0.6	0.7	0.7
Power Line and Related Structures Construction	3.4	3.8	3.7	3.2	3.1
Electrical Contractors and Other Wiring Installation Contractors	29.8	32.1	33.5	33.4	28.3
Heating, and Air-Conditioning Contractors	4.9	5.6	6.4	6.1	5.3
Petroleum Refineries	3.5	3.7	3.4	3.5	3.5
Petroleum and Petroleum Products Merchant Wholesalers	3.4	3.3	3.5	4.6	4.6
Gasoline Stations	26.7	24.1	20.9	18.6	18.1
Fuel Dealers	0.4	0.5	0.3	0.5	0.5
Renewable energy construction	1.1	1.1	1.4	2.0	3.7
Renewable energy R&D	1.5	1.5	1.9	2.7	5.0
Total Energy Sector	100.0	100.0	100.0	100.0	100.0

Source: DBEDT Calculation from data in Table 1.

## Energy Sector Jobs and the Green Jobs

The energy sector jobs are different from the “green” jobs. According to the definition of the U.S. Bureau of Labor Statistics (BLS), “green jobs are either: (1) jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources, or (2) jobs in which workers’ duties involve making their establishment’s production processes more environmentally friendly or use fewer natural resources.” According to the definition adopted by the Hawaii’s Green Workforce: A Baseline Assessment Study conducted by the Hawaii Department of Labor and Industrial Relations (DLIR)<sup>3</sup>, a green job is one that engages in economic activity that makes a positive impact on the environment or energy sustainability, either on a full- or part-time basis.

The DLIR study defined five core areas as green: (1) generate clean, renewable, sustainable energy, (2) reduce pollution and waste; conserve natural resources; recycle, (3) energy efficiency, (4) educational, training and support of a green workforce, and (5) natural, environmental-friendly production. Some of the core areas are not included in the energy sector. For example, the energy sector does not include industries in reducing pollution and waste. There are green jobs in all NAICS industries, but only some of the jobs in each industry are considered green jobs. For example, only about 200 jobs in the utilities industry are green jobs. On the other hand, all jobs in the selected energy industries (about 2,700 jobs) are considered energy sector jobs. All jobs in the electric utility industry are considered energy sector jobs. In another words, the DLIR green jobs are function or occupation based while the energy job estimate in this report is industry based. Furthermore, the DLIR green job estimate includes only wage and salary employees while the energy job estimate in this study includes not only wage and salary employees but also self employed individuals.

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<sup>3</sup> [http://hawaii.gov/labor/rs/whats-new/Green\\_Jobs\\_Report.pdf](http://hawaii.gov/labor/rs/whats-new/Green_Jobs_Report.pdf)

## Energy Sector GDP

To estimate the monetary value of the production of the energy sector, this study uses the GDP measure. GDP is the most comprehensive measure of the value of production by a sector. It is the total sales of the sector subtracting all the purchases from other sectors. This measure is also referred to as the value added.

Three steps are used to estimate the GDP for the energy sector: 1. GDP by industry data for Hawaii are obtained from the U.S. Bureau of Economic Analysis (BEA); 2. Employment data by industry are also obtained from BEA; 3. GDP per job ratio is calculated using the BEA data; 4. Multiplying the energy job in Table 1 by the GDP per job ratio arrive the GDP for the selected energy industries. 5. Summing the GDP of all the energy industries is the GDP of the energy sector. The following formula shows the estimation procedure mathematically:

$$GDP_E = \sum_{i=1}^{14} \frac{GDP_i}{Job_i} \times Ejob_i$$

Where

- $GDP_E$  = Energy sector GDP
- $GDP_i$  = Total GDP in the  $i$ th industry
- $Jobs_i$  = Total jobs in the  $i$ th industry
- $Ejobs_i$  = Energy jobs in the  $i$ th industry

For industries with only a part of the jobs working on energy projects such as construction, this estimation procedure implies that the GDP generated by the energy-related jobs in an industry is the same as that generated by other jobs.

The estimation results are shown in Table 4. In 2010, the energy sector generated about \$3 billion of GDP, accounted for 4.5% of the total state GDP for that year. The value of GDP was nearly double between 2002 and 2010.

As indicated in Table 5, the energy sector experienced an annual GDP growth of 8.8%, higher than the 5.2% annual growth for all the sectors in the economy, both in nominal terms. The fastest growth industries are the renewable energy industries with an annual growth rate of more than 20 percent. The electricity industry grew faster (9.5% annual growth) than the petroleum industries as a whole, including petroleum refinery, wholesale, gasoline stations, and fuel dealers (7.1% annual growth).

In terms of industry distribution, electricity industry accounted for more than half (53.4%) of the energy sector GDP. Petroleum refineries contributed 15.9% of the energy sector GDP, and electrical contractors contributed 12.8% of the sector GDP in 2010.



Table 4. Hawaii Energy Sector Gross Domestic Product (GDP, \$mil.)

NAICS	Industry	2002	2003	2004	2005	2006	2007	2008	2009	2010
211-213	Oil and Gas Extraction	1	1	1	1	1	1	1	1	1
2211	Electric Power Generation, Transmission and Distribution	776	866	981	991	1,179	1,223	1,403	1,567	1,600
2212	Natural Gas Distribution	50	55	63	63	75	78	90	100	102
22133	Steam and Air-Conditioning Supply	5	8	-	-	-	-	1	4	4
23712	Oil and Gas Pipeline and Related Structures Construction	7	4	3	6	6	8	8	9	9
Part of 23713	Power Line and Related Structures Construction	25	34	33	36	38	40	40	40	42
23821	Electrical Contractors and Other Wiring Installation Contractors	221	262	277	318	349	384	419	393	383
Part of 23822	Heating, and Air-Conditioning Contractors	36	42	48	60	66	72	76	73	72
32411	Petroleum Refineries	239	352	407	351	313	358	486	466	476
4247	Petroleum and Petroleum Products Merchant Wholesalers	29	32	34	36	39	46	59	64	62
447	Gasoline Stations	123	129	133	134	136	136	135	135	139
45431	Fuel Dealers	2	3	3	2	2	4	4	4	4
Part of 23	Renewable energy construction	8	9	10	11	15	16	25	30	50
Part of 54171	Renewable energy R&D	9	10	11	12	17	17	26	30	51
	Total Energy Sector	1,531	1,808	2,002	2,020	2,236	2,384	2,774	2,916	2,996
	Total statewide GDP	44,716	47,908	52,185	56,869	61,194	64,339	66,038	65,680	67,079
	Energy sector as % of state total	3.4	3.8	3.8	3.6	3.7	3.7	4.2	4.4	4.5

Source: DBEDT Estimate based on data from Economic Modeling Specialists Inc. (EMSI) and data from the U.S. Bureau of Economic analysis.

Table 5. Growth of Energy Sector GDP

Industry	Average Annual Growth (%)
Oil and Gas Extraction	0.0
Electric Power Generation, Transmission and Distribution	9.5
Natural Gas Distribution	9.5
Steam and Air-Conditioning Supply	-4.9
Oil and Gas Pipeline and Related Structures Construction	4.2
Power Line and Related Structures Construction	6.9
Electrical Contractors and Other Wiring Installation Contractors	7.1
Heating, and Air-Conditioning Contractors	9.0
Petroleum Refineries	9.0
Petroleum and Petroleum Products Merchant Wholesalers	9.8
Gasoline Stations	1.5
Fuel Dealers	9.9
Renewable energy construction	25.1
Renewable energy R&D	23.9
Total Energy Sector	8.8
Total statewide GDP	5.2

Source: DBEDT Calculation from data in Table 4.

Table 6. Industry Share of the Energy Sector GDP (%)

Industry	2002	2004	2006	2008	2010
Oil and Gas Extraction	0.1	0.0	0.0	0.0	0.0
Electric Power Generation, Transmission and Distribution	50.7	49.0	52.7	50.6	53.4
Natural Gas Distribution	3.2	3.1	3.4	3.2	3.4
Steam and Air-Conditioning Supply	0.3	0.0	0.0	0.0	0.1
Oil and Gas Pipeline and Related Structures Construction	0.4	0.2	0.3	0.3	0.3
Power Line and Related Structures Construction	1.6	1.6	1.7	1.5	1.4
Electrical Contractors and Other Wiring Installation Contractors	14.4	13.8	15.6	15.1	12.8
Heating, and Air-Conditioning Contractors	2.4	2.4	3.0	2.7	2.4
Petroleum Refineries	15.6	20.3	14.0	17.5	15.9
Petroleum and Petroleum Products Merchant Wholesalers	1.9	1.7	1.7	2.1	2.1
Gasoline Stations	8.0	6.6	6.1	4.9	4.6
Fuel Dealers	0.1	0.1	0.1	0.1	0.1
Renewable energy construction	0.5	0.5	0.7	0.9	1.7
Renewable energy R&D	0.6	0.5	0.7	0.9	1.7
<b>Total Energy Sector</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

Source: DBEDT Calculation from data in Table 4.

## Conclusion

In 2010, the energy sector in Hawaii provided about 14,000 jobs, accounted for about 1.7% of total jobs in the state. Due to the fact that most of the renewable energy projects in Hawaii are still in the planning or R&D stages and many of the projects are carried out by non-utility industries.

In recent years, jobs in the energy sector increased faster than overall job growth. From 2002 to 2010, energy sector jobs increased 3.0% per year on average, higher than the 1.3% growth rate of total jobs.

The largest category in energy sector jobs is energy related construction and contractor jobs. In 2010, jobs in this category accounted for 37.4% of total energy sector jobs. Most of the jobs in this category are electrical contractors, which accounted for about 28.3% of total energy sector jobs. From 2002 to 2010, jobs included in this category increased 2.2% per year on average.

The second largest category is energy products wholesalers, retailers, and fuel dealers. In 2010, jobs in this category accounted for 23.2% of total energy sector jobs. Most of the jobs in this category are included in gasoline stations, which accounted for about 18.1% of total energy

sector jobs. From 2002 to 2010, jobs included in this category decreased from 3,385 jobs to 3,252 jobs, or 0.4% per year on average.

Jobs in electricity/steam production, transmission and distribution rank the third in energy sector jobs. In 2010, jobs in this category accounted for about 19.5% of total energy sector jobs.

In recent years; however, jobs in renewable energy installation and research increased faster than other energy-related industries. From 2002 to 2010, jobs in renewable energy construction and research increased 19.5% per year.

In terms of GDP, the energy sector produced \$3 billion of GDP in 2010, accounted for 4.5% of the state total of \$67 billion. More than half of the energy sector GDP was attributed to the electricity utility in 2010. The petroleum industries, including refinery, wholesalers and gasoline stations, accounted for 22.6% of the total GDP generated in the Energy sector.

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