Alaska Energy Statistics 1960-2011 Final Report

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Prepared for

Alaska Energy Authority

December 2013

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Acknowledgments

We appreciate the time and effort of numerous electric utilities, Alaska Energy Authority program managers and staff, and many other colleagues who shared information, reviewed this report, and provided valuable feedback.

Suggested citation

Fay, Ginny, Alejandra Villalobos Meléndez and Corinna West, 2013, *Alaska Energy Statistics 1960-2011*, Institute of Social and Economic Research, University of Alaska Anchorage, prepared for Alaska Energy Authority, December 2013, 72 pages.

Note

Before 1985, the federal Alaska Power Administration published the *Alaska Electric Power Statistics*. In 1985, the Alaska Energy Authority (formerly the Alaska Power Authority) began gathering statistical data and publishing this annual report. In 1988, the *Alaska Electric Power Statistics* report became a combined effort of the Alaska Systems Coordinating Council and the Alaska Energy Authority (AEA). Beginning in 1993, the report became a joint effort of the Alaska Systems Coordinating Council and the Alaska Department of Community and Regional Affairs, Division of Energy. After the 1995 report, no further reports were published until 2003, when the Institute of Social and Economic Research (ISER), University of Alaska Anchorage (UAA) prepared a report with funding provided by the AEA, the Regulatory Commission of Alaska (RCA), and the Denali Commission. Since 2008, ISER has prepared *Alaska Electric Energy Statistics* updates with funding from AEA.

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SUMMARY AND HIGHLIGHTS

This report features information that may be of general interest on electricity produced by certified utilities in Alaska in 2011. The report is not intended to provide detailed analysis of energy production and consumption, or make suggestions about how Alaska should manage its energy portfolio. The detailed data sets of the information summarized here are available on the ISER website (http://www.iser.uaa.alaska.edu/publications.php).[1]

Energy Production

- In 2011, installed capacity in Alaska was 2,197 megawatts. There was no significant change in installed capacity between 2010 and 2011.
- Approximately 6.6 million megawatt-hours (MWh) of electricity were generated in Alaska in 2011, about a 1% increase from 2010.
- Wind generated electricity accounts for 0.3% of the statewide total. Between 2008 and 2011, the amount of electricity generated annually by wind in Alaska increased over nine fold, reaching 21,190 MWh in 2011. The largest increase happened between 2008 and 2009 when it increased fourfold. Between 2010 and 2011, the amount of electricity generated by wind increased 4%.
- There is no statewide inventory of renewable energy projects other than those at utility-scale; this makes it difficult to identify distributed (non-utility-scale) generation systems. In 2011, there were 23 non-utility-scale renewable energy projects identified and operating using technologies other than hydro or wind. Of those, the Alaska Renewable Energy Fund (REF) funded 11 projects—biomass, heat pumps, heat recovery, and solar. Total production from those REF projects in 2011 displaced an estimated equivalent of 186,000 gallons of fuel oil.

Energy Sources

- Statewide, the share of electricity generated with natural gas increased from 57% to 58% between 2010 and 2011; the share generated by hydroelectric power decreased from 22% to 20%; the share generated by oil products increased from 15% to 16%; and the share generated by coal was unchanged at 6%. The share generated by wind remained under 1%, at about 0.3% statewide. By region, shares of electricity generated by the various energy sources vary sharply.
- In 2011, in the Railbelt region the main energy source for electricity was natural gas, which accounted for 73% of all electricity generated, followed by fuel oil (11%), hydroelectric power and coal (8% each). Some wind power was also produced in the Railbelt, accounting for 0.03% of the region total. There are also differences in the energy sources areas of the Railbelt region rely upon; the northern Railbelt relies significantly on fuel oil and coal.
- Most communities in Southeast Alaska, 69%, have at least a portion of the electricity they consumed generated from hydroelectric capacity; some small communities, 31%, rely solely on

[1] The Alaska Energy Statistics data sets can also be accessed through the Alaska Energy Data Gateway (https://akenergygateway.alaska.edu/).

fuel oil. Communities that depend on hydroelectric power also use fuel oil for back-up generation.

- Rural communities in Western and Interior Alaska rely primarily on fuel oil to generate electricity. Wind power is being added in a growing number of rural locations, financed in part with assistance from the Alaska Renewable Energy Fund program.
- The amount of electricity produced from hydroelectric resources varies from year to year depending on water levels. Over the last decade, hydropower production has not shown a significant positive or negative trend, growing at less than 0.5% per year. However, since 1963 hydropower has increased at a rate of 5% per year.

Electricity Consumption

- The Railbelt region is home to most of the state's population, 76% in 2011, and used approximately 78% of the electricity produced statewide.[2]
- Statewide, the average annual residential use per customer of electricity in 2011 was about 7,770 kilowatt-hours—community averages ranged from around 1,500 kilowatt-hours per customer where electricity was most expensive to more than 14,900 kilowatt-hours per customer where electricity was least expensive. By comparison, the national average use per customer in 2011 was about 11,280 kilowatt-hours.[3]
- Consumption of electricity in rural communities varies widely; due mostly to differences in prices of electricity and seasonal temperature variations. But in general, facing higher prices, most rural Alaskans consume far less electricity than urban residents. Additionally, in the Southeast region, where some communities have relatively low prices, some residential customers have opted for using electricity for space heating resulting in growing levels of electricity consumption.
- In 2011, the Southeast region had the highest levels of consumption, with residential customers consuming an average of 860 kilowatt-hours per month. In the Railbelt region, residential customers consumed an average of 640 kilowatt-hours per month. In contrast, residential customers in the Yukon-Koyukuk/Upper Tanana region consumed the least, an average of 320 kilowatt-hours per month—about half the consumption in the Railbelt region and a third of the average in the Southeast region.

Prices

- Residents in Southeast Alaska communities that rely primarily on hydroelectric power to generate electricity had the lowest residential rates in 2011 (as little as about 9 cents per

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[2] The population estimate includes population from the following census areas: Municipality of Anchorage, Matanuska-Susitna Borough, Kenai Peninsula Borough, Denali Borough, Fairbanks North Star Borough, Southeast Fairbanks Census Area.

[3] In the Lower 48, Louisiana (a state with generally warm weather and high use of air conditioning) had the highest annual consumption, at about 16,176 kWh, and Maine (one of the states with generally colder weather) had the lowest, at 6,252 kWh. (http://www.eia.gov/tools/faqs/faq.cfm?id=97&t=3)

kilowatt-hour).[4] But among Southeast communities that rely only on fuel oil, residential rates in 2011 were as high as 75 cents per kilowatt-hour.

- In Anchorage and other places in Southcentral Alaska, residential rates ranged from 13 to 22 cents per kilowatt-hour, depending on location. Residents paid lower rates in the Anchorage area, where natural gas is available. Residents paid higher rates in the Fairbanks area, where fuel oil and coal are the primary fuels used to generate electricity as they are currently more affordable than other alternatives.[5]
- Alaskans in small remote rural places that rely on fuel oil had the most expensive electricity—with prices from roughly 30 cents to more than $1 per kilowatt-hour in 2011. The only exceptions are rural communities on the North Slope, where rates are significantly lower than in most other rural communities; that region has a flat rate structure among its communities, and two have access to natural gas.
- The State of Alaska helps reduce the price of electricity for residential customers and community buildings in many remote rural communities through the Power Cost Equalization (PCE) program.[6] In 2011, 191 communities participated in the program. The PCE program is designed to pay only a portion of electricity cost, so many rural customers still pay higher rates than those in urban communities.[7] For example, in 7% of communities residential customers eligible for PCE paid rates the same as in Anchorage; while in 93% of PCE communities, paid on average higher rates than residents of the Anchorage area; in 36% of communities they paid higher rates than residents of the Fairbanks area.

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[4] The construction of many of these facilities was paid for in part with public funds and tax-exempt financing, which accounts in part for the lower rates.

[5] Golden Valley Electric Association, the utility that serves the Fairbanks area, uses a variety of petroleum products to generate electricity, including distillate fuel oil, residual fuel oil, naphtha, and heavy atmospheric gas oil; the generic term “fuel oil” is meant to include all these types of fuels.

[6] The Legislature established different functions for AEA and the Regulatory Commission of Alaska (RCA) under Alaska Statutes 42.45.100-170, which govern PCE program responsibilities. The PCE program Alaska Statutes are available at: http://www.legis.state.ak.us

[7] The PCE assistance payment is determined by a formula that covers 95% of a utility’s cost between a base rate (the weighted average rate for urban centers of Anchorage, Fairbanks and Juneau) and a ceiling (that changes periodically) for the first 500 kilowatt-hours consumed by residential customers. The program also provides some assistance for community facilities.

INTRODUCTION

This twenty-sixth edition of the *Alaska Energy Statistics* reconciles energy data from public sources and makes that data more easily available to the public and stakeholders. It primarily presents 2011 data on electricity produced by certified utilities in Alaska. It includes a brief introduction, highlights, and summary data tables. The first major section describes basic statistical indicators for Alaska utilities, and the second discusses renewable energy in Alaska. After that we look more broadly at the big picture of energy in Alaska, describing production and consumption of various energy sources. A series of appendixes defines terms, lists references, and describes data sources.

This report presents data for the state and for the 11 Alaska Energy Authority energy regions. In an accompanying workbook, we also present data by U.S. census areas, Alaska Native corporation regions, and regions used in earlier *Alaska Electric Energy Statistics* reports.[8] Unlike the preliminary version of this report, issued in fall 2012, this final report includes installed capacity data tables for 2011, as well as additional chapters on renewable energy and other Alaska energy information.

The workbook containing detailed data tables is available on the ISER website at: (http://www.iser.uaa.alaska.edu/publications.php) and on the AEA website (http://www.akenergyauthority.org/). The data presented in this report are also available for viewing and downloading through the Alaska Energy Data Gateway (AEDG) (https://akenergygateway.alaska.edu/). Table 1 lists tables available in the MS Excel workbook.

Table 1. List of Data Tables in Excel Workbook

Summary Tables	Table Description (presented by AEA Energy Regions)
Table 1.a	Communities Participating in Power Cost Equalization Program, 2011
Table 1.b	Rates in PCE Communities ($/kWh), 2011
Table 1.c	Average Consumption per Residential Customer per Month in PCE communities, 2011
Table 1.d	Installed Capacity of Certified Utilities by AEA Region (kW), 2011
Table 1.e	Net Generation by Fuel Type by Certified Utilities (MWh), 2011
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Detailed Tables	
	Installed Capacity
Table 2.1a	Installed Capacity by Prime Mover by Plant by Certified Utilities (kW), 2011
Table 2.1b	Installed Capacity by Prime Mover by Plant by Certified Utilities (Percent Distribution), 2011

[8] Those regions are: Arctic Northwest, Southcentral, Southeast, Southwest, and Yukon; see map in workbook.

ELECTRIC SECTOR

Certified Electric Public Utility Summary Tables

This summary information is aggregated by the 11 AEA energy regions (see Figure 1). The tables in this chapter present basic statistical indicators for utilities certified by the Regulatory Commission of Alaska. This section also shows selected historical statewide data the U.S. Energy Information Administration makes available through its State Energy Data System.

Power Cost Equalization Participation, Prices, and Consumption

The State of Alaska helps reduce the price of electricity for residential customers and community buildings in many remote rural communities through the Power Cost Equalization (PCE) program. The PCE assistance payment is determined by a formula that covers 95% of a utility's cost between a base rate (the weighted average rate for urban centers of Anchorage, Fairbanks and Juneau) and a ceiling for the first 500 kilowatt-hours consumed by residential customers. The base rate and ceiling may be adjusted each fiscal year. During the fiscal year of 2011, the base rate was 14.39 cents per kilowatt-hour and ceiling was $1 per kilowatt-hour. The program also provides assistance for community facilities which can receive PCE credit for up to 70 kilowatt-hours per month multiplied by the number of residents in a community.

Power Cost Equalization Participation

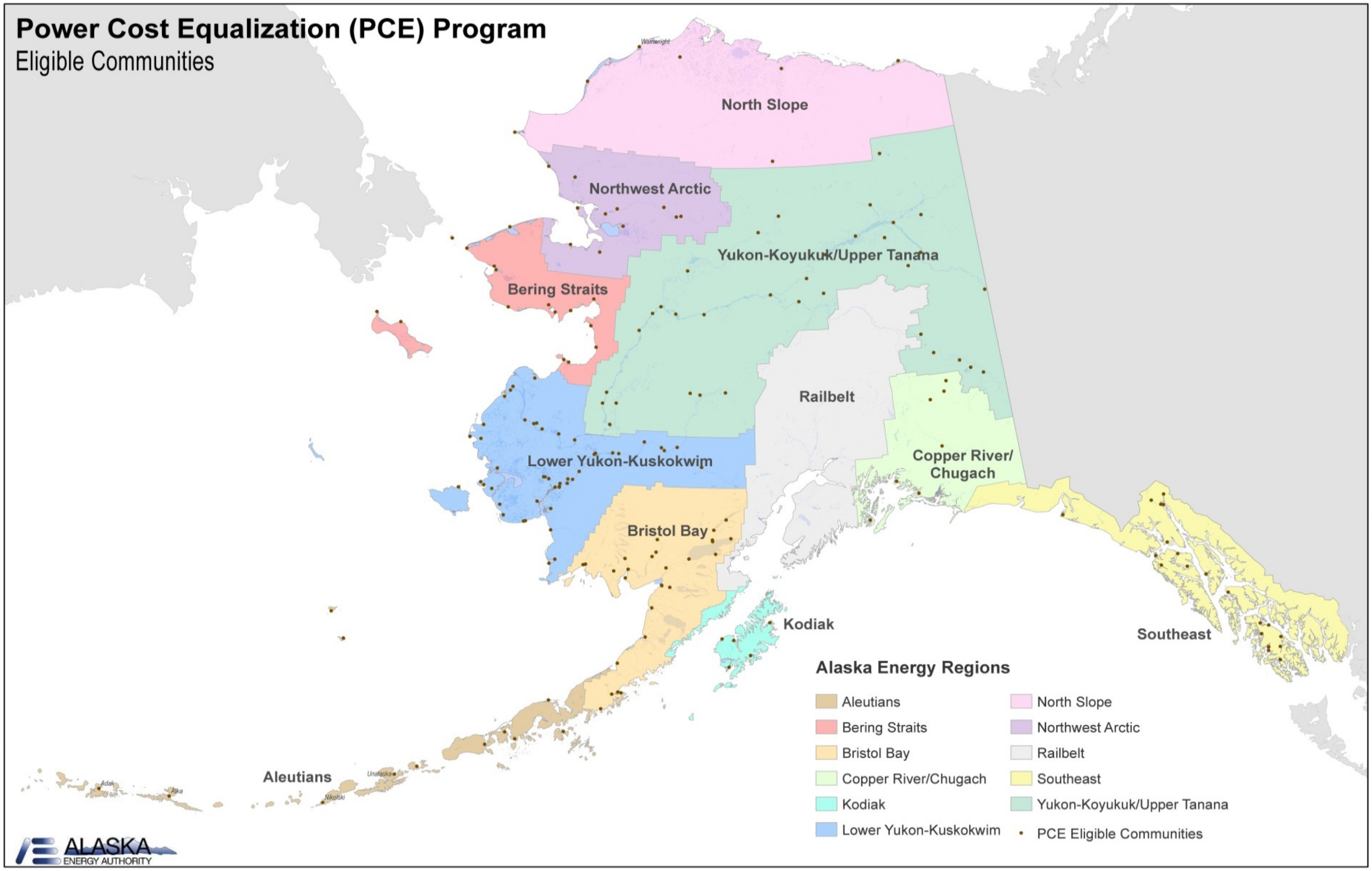
About 96% of eligible communities participated in the PCE program statewide in 2011, with regional percentages from 80% to 100% (Table 1.a). These communities are located throughout Alaska, except in the Railbelt, where no communities are eligible (Figure 1).

Table 1.a Communities Participating in Power Cost Equalization Program, 2011

AEA Energy Region	PCE Eligible Active	PCE Eligible Inactive	PCE Ineligible	Percent Active in PCE program
Aleutians	12	1	0	92%
Bering Strait	16	0	0	100%
Bristol Bay	26	1	0	96%
Copper River/Chugach	8	0	15	100%
Kodiak	4	1	5	80%
Lower Yukon-Kuskokwim	47	1	0	98%
North Slope	7	0	2	100%
Northwest Arctic	11	0	0	100%
Railbelt	0	0	95	
Southeast	22	0	9	100%
Yukon-Koyukuk/Upper Tanana	38	5	2	88%
Total	**191**	**9**	**128**	

Note: Some utilities, in both urban and rural Alaska, serve multiple communities. Compared with data presented in previous reports, we were better able to identify the communities served by these utilities. So we now present PCE program participation solely by community and not by utility; that is why the number of communities reported here is significantly higher than in previous reports. Please refer to the "Community List" table in the accompanying workbook for detailed information about communities served by each utility.

Figure 1. Alaska Energy Authority Energy Regions and Communities Eligible for Power Cost Equalization, by Region, 2011



Source: Alaska Energy Authority

Residential rates for electricity vary significantly among PCE communities for many reasons, including differences in remoteness, population, and proximity to different types and quantities of resources. The PCE program provides assistance for only a portion of the costs, as described above; it ameliorates but does not eliminate rate differences. After accounting for PCE assistance, 55% of eligible communities pay between 20 and 29 cents per kilowatt-hour, and 15% pay rates over 30 cents per kilowatt-hour (Table 1.b).

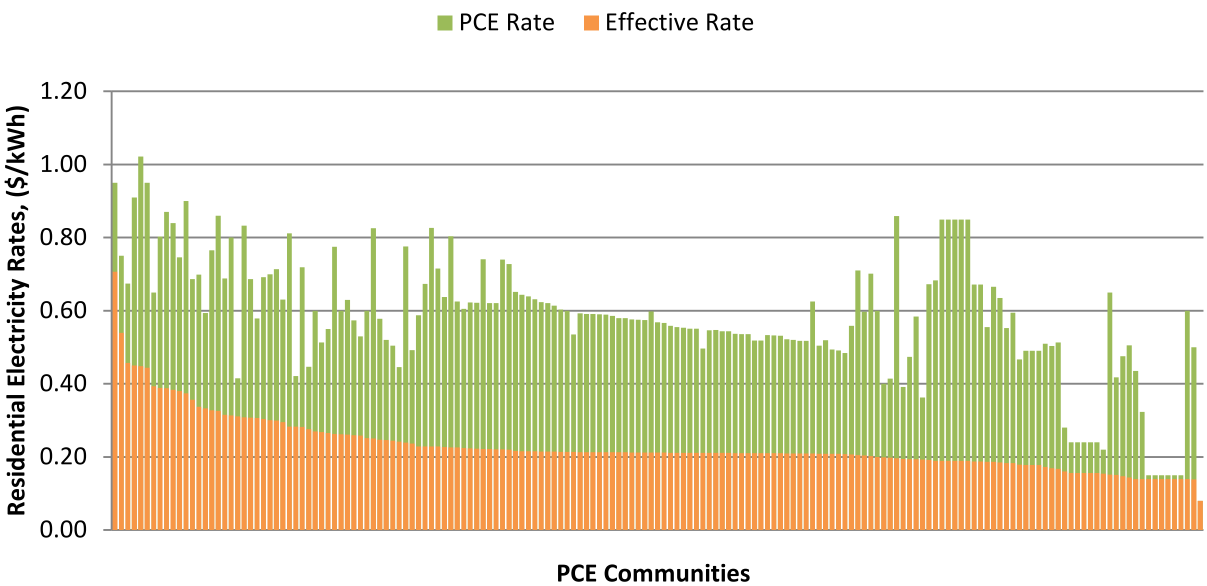
Table 1.b Rates in PCE Communities ($/kWh), 2011

Average Rate ($/kWh)			Effective Rate ($/kWh)	No. of PCE Communities
Residential	PCE	Effective		
0.37	0.20	0.16	Less than $0.19	56
0.54	0.32	0.22	$0.20 - $0.29	105
0.61	0.29	0.33	$0.30 - $0.39	23
0.70	0.27	0.43	$0.40 - $0.49	4
0.63	0.25	0.55	$0.50 - $0.59	1
1.00	0.27	0.73	More than $0.60	1
			Total No. of Communities	**190**

Note: All averages are weighted.
Total number of communities does not match the total in Table 1.a because one community participating in the PCE program did not report residential rate data. The effective rates shown in the table apply to only the first 500 kilowatt-hours consumed in a month. Additional kilowatt-hours consumed must be purchased at the full residential rate.

Figure 2 (page 14) shows the PCE rate (in green) and the effective rate with PCE (in orange) in all PCE communities in 2011. It illustrates that the PCE program is effective at equalizing prices of electricity across most PCE communities.

Figure 2. Residential Electricity Rates in Power Cost Equalization Communities, 2011

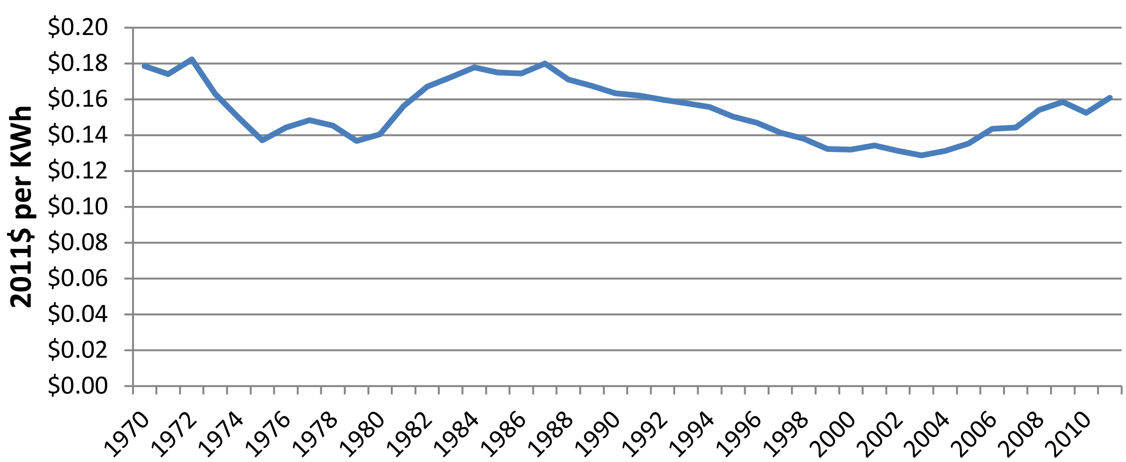


Source: Alaska Energy Authority, Power Cost Equalization program data, 2011, and authors' calculations.

Prices of Electricity

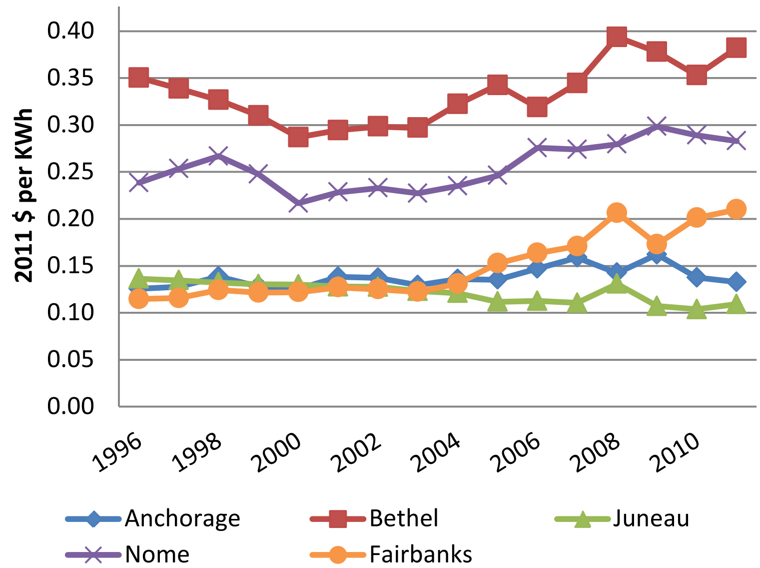
Figure 3 presents data on the real (adjusted for inflation) price of electricity statewide since 1970, and it shows that the real price of electricity has declined somewhat over time. In 2011 dollars, the 1970 average price for Alaska was 18 cents per kilowatt-hour, compared with 16 cents in 2011—a decrease of 2 cents per kilowatt-hour.

Figure 3. Average Price of Electricity for All Consumers in Alaska, 1970 – 2011 (2011$)



Source: U.S. Energy Information Administration, State Energy Data System.
Note: Prices are weighted and exclude PCE assistance.

Figure 4. Average Residential Price of Electricity, Selected Alaska Communities, 1996 – 2011



Note: Estimated average price for electricity households paid based on a 1,000 kilowatt-hours per household per month consumption level. For communities participating in the Power Cost Equalization program, the price is a weighted average. Households receive PCE assistance for only the first 500 kilowatt-hours per month they consume.
Source: University of Alaska Fairbanks, Cooperative Extension Service Alaska Food Cost Survey, and authors' calculations.

Electricity prices across Alaska vary significantly. As noted above, many rural communities face high electricity prices even after receiving PCE assistance. Figure 4 shows the major differences in prices residential customers can pay based on the University of Alaska Fairbanks, Cooperative Extension Service Alaska Food Cost Survey. For example, in the Railbelt and Southeast prices (as reflected in Anchorage and Juneau prices) are relatively low because they use natural gas and hydroelectric power to produce electricity. In Anchorage, the average residential price per kilowatt-hour in 2011 was about 13 cents, and in Juneau it was about 11 cents. In Fairbanks—where, unlike other Railbelt communities a significant amount of electricity is produced from fuel oil—residential customers paid about 21 cents per kilowatt-hour. In contrast, residents of remote communities paid much more—in Bethel, 38 cents per kilowatt-hour, and in Nome 28 cents.[9] The Cooperative Extension Services uses an index choice of 1,000 kWh to compare electricity prices across communities, which is what is shown in this graph. Note that average consumption is much lower in many rural communities because prices are so high. This is a common challenge in any kind of price comparison between communities when prices differ so much that the differences significantly affect average consumption.

Consumption of Electricity

Higher prices and variations in summer and winter light and temperatures contribute to big differences in electricity consumption in rural communities (Table 1.c). For example, communities paying an effective rate between 20 and 29 cents per kilowatt-hour consumed on average 17% more electricity during the summer than communities with effective rates between 30 and 39 cents per kilowatt-hour. During the winter, those with lower rates consumed on average 13% more. Differences in consumption

[9] These prices reflect the average residential customer's costs after PCE assistance is applied and include the non-subsidized consumption that exceeds the PCE cap of 500 kilowatt-hours per customer per month.

per customer within an effective rate category can also be quite large. For example, consumption during the summer in communities paying an effective rate between 20 and 29 cents per kilowatt-hour ranged from about 150 kilowatt-hours per customer per month to 750 kilowatt-hours.

Table 1.c Average Consumption per Residential Customer per Month in Power Cost Equalization Communities, 2011

Summer 2011 (April - September)				Percentage Residential Consumption Eligible for PCE
	kWh per Customer per Month			
Effective Rate	**Min**	**Mean**	**Max**	
Less than $0.19	136	429	955	68%
$0.20 - $0.29	49	364	843	77%
$0.30 - $0.39	125	310	591	75%
$0.40 - $0.49	101	359	535	76%
$0.50 - $0.59	269	333	540	80%
More than $0.60	96	196	246	50%
Winter 2011 (October - March)				**Percentage Residential Consumption Eligible for PCE**
	kWh per Customer per Month			
Effective Rate	**Min**	**Mean**	**Max**	
Less than $0.19	114	514	1,080	61%
$0.20 - $0.29	142	423	754	71%
$0.30 - $0.39	76	376	618	73%
$0.40 - $0.49	115	298	505	78%
$0.50 - $0.59	228	422	543	72%
More than $0.60	82	216	291	79%

Note: All averages are weighted. Percentages of residential consumption may seem lower than expected because some communities eligible to receive PCE participated in the program for only a portion of the year. If during a given month a utility did not participate and did not receive a PCE payment, then its eligible PCE consumption is 0% of sales for that month. For example, during the summer of 2011, communities with effective rates of more than $0.60/kWh had an average residential consumption eligible for PCE of 50% because some eligible communities did not participate for a number of months; had they participated the entire year the PCE eligible kWh would have been approximately 90%.

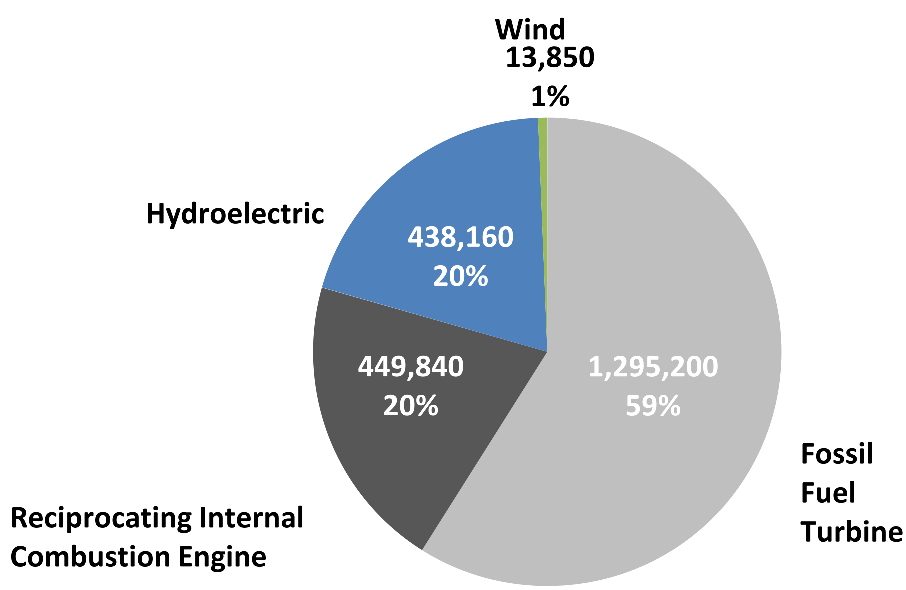
Utility Installed Capacity, Net Generation, and Fuel Use

Installed Capacity

Installed capacity is the maximum theoretical production output of a plant. Total installed capacity in the electric sector in Alaska declined slightly between 2010 and 2011, from 2,202 to about 2,197 megawatts. In 2011, 59% of the statewide installed capacity was fossil fuel turbines, 20% hydroelectric turbines, 20% reciprocating internal combustion engines, and 1% wind turbines.

Unlike total capacity, wind installed capacity did not decline: it increased 18% between 2010 and 2011, to 13,850 kilowatts. Between 2008 and 2011 wind installed capacity increased more than sevenfold. Despite this growth, wind accounted for less than 1% of the total installed capacity in Alaska in 2011 (Figure 5).

Figure 5. Installed Capacity of Certified Utilities by Prime Mover (kW), 2011



Sources: U.S. Energy Information Administration, Alaska Energy Authority's Village Assessment Preliminary Dataset, and authors' calculations. Values are rounded to the nearest 10, except for wind.

As expected, much of the installed capacity in Alaska is in the population centers in the Railbelt (64%) and Southeast (19%) (Table 1.d). The remaining 17% of installed capacity is dispersed throughout the rest of the state in small systems. Hydroelectric systems are found in the Railbelt, Southeast, Kodiak, Copper River/Chugach, Bristol Bay, and Aleutians regions. In the Railbelt, hydroelectric capacity accounts for 13% of the installed capacity. Wind turbines are found in the Railbelt, Northwest Arctic, Lower Yukon-Kuskokwim, Kodiak, Bristol Bay, Bering Strait, and Aleutians regions. Only two regions—the Yukon-Koyukuk/Upper Tanana and the North Slope—had no installed renewable energy electrical systems in 2011.

Table 1.d Installed Capacity of Certified Utilities by AEA Region (kW), 2011[10]

AEA Energy Region	Fossil Fuel Turbines	Reciprocating Internal Combustion Engine	Hydroelectric	Wind	Regional Total	Percent of Statewide Total
Aleutians	0	34,945	800	1,740	37,490	2%
Bering Strait	0	36,833	0	2,400	39,230	2%
Bristol Bay	0	27,479	824	44	28,320	1%
Copper River/Chugach	8,100	30,044	19,200	0	57,340	3%
Kodiak	0	35,232	22,875	4,500	62,610	3%
Lower Yukon-Kuskokwim	0	53,209	0	2,750	55,960	3%
North Slope	17,300	23,300	0	0	40,600	2%
Northwest Arctic	0	21,959	0	1,400	25,120	1%
Railbelt	1,198,900	26,200	184,375	1,012	1,416,780	64%
Southeast	70,900	130,922	210,085	0	414,360	19%
Yukon-Koyukuk/Upper Tanana	0	29,716	0	0	29,720	1%
Total	**1,295,200**	**449,839**	**438,159**	**13,846**	**2,197,040**	**100%**

Source: U.S. Energy Information Administration, Alaska Energy Authority's Village Assessment Preliminary Dataset, and authors' calculations.

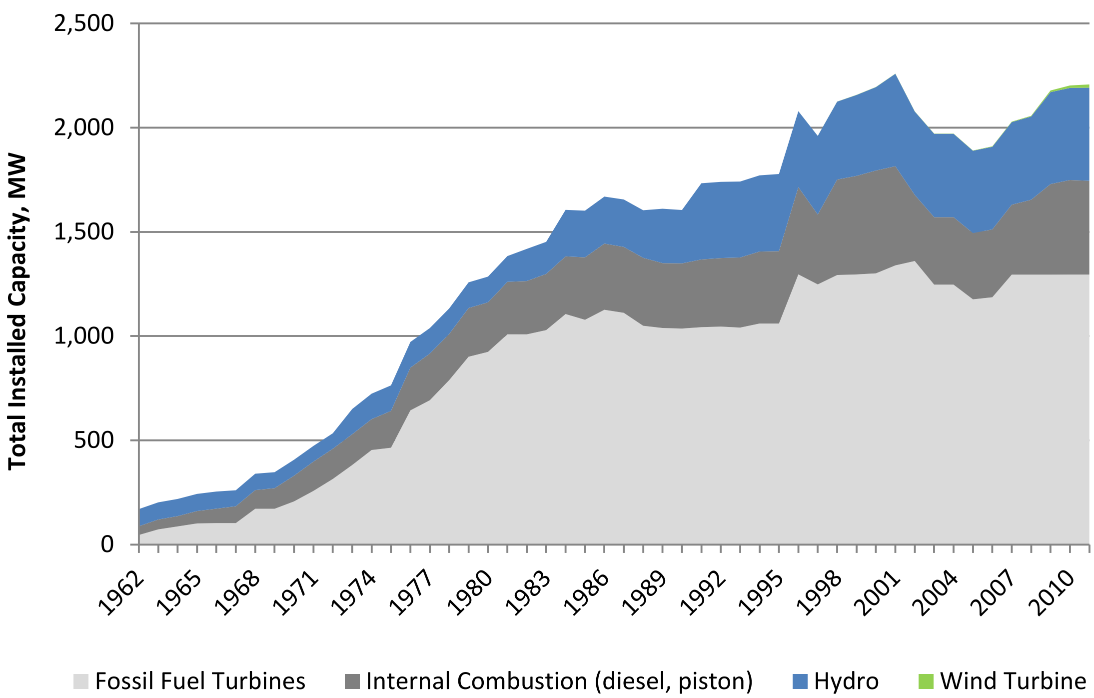
[10] This table presented 2010 data in the preliminary report. We updated this table with data provided by the Alaska Energy Authority, collected through the Village Assessment program, and final data published by the U.S. Energy Information Administration.

In Alaska, utility installed capacity for power generation increased steadily from the 1970s to the late 1990s and peaked in 2001 at 2,259 megawatts. From 2002 to 2005, there was a steady decline to about 1,890 megawatts. Since 2006, Alaska has seen installed capacity grow, and the 2011 capacity of 2,197 was near the peak 2001 level (Figure 6).

Overall since the 1960s installed capacity of fossil-fuel turbines increased the most, driven by increasing demand for Cook Inlet natural gas. Installed capacity of internal combustion prime movers increased fastest in the 1970s and early 1980s, as more rural places got electric systems, and after that growth leveled off. Capacity for producing hydroelectricity grew fastest in the 1980s and 1990s, as a number of large new hydro facilities were added.

In 2011, turbines (including gas and steam turbines and combined cycle systems) were the prime movers with the largest share of installed capacity, comprising about 59%.[11] Hydroelectric turbines and internal combustion generators had equal shares of 20% each. Finally, wind turbines were the least common prime movers in Alaska, with a share of less than 1% in 2011.

Figure 6. Installed Capacity of Certified Utilities by Prime Mover (MW), 1962-2011



Sources: U.S. Energy Information Administration, Alaska Energy Authority's Village Assessment Preliminary Dataset, and authors' calculations.

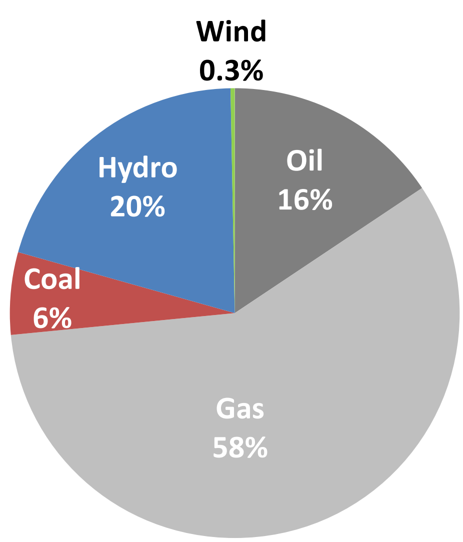
[11] Prime mover refers to the engine, turbine, water wheel, or similar machine that drives an electric generator, or for reporting purposes, a device that converts energy to electricity directly (e.g., photovoltaic solar and fuel cells). For additional details, see Appendix A.

Net Generation

Net generation is the total amount of electric energy produced by all generating units minus the energy consumed for station service or auxiliaries. In 2011, certified utilities in Alaska produced about 6.5 million megawatt-hours of electricity. There was no significant change in production between 2010 and 2011. Most of the electricity, 78%, was produced in the Railbelt region, followed by 12% in the Southeast region; electricity produced in all other regions accounted for only 10% of statewide generation.

Table 1.e and Figure 7 show net generation in 2011, by AEA region and statewide, by fuel used for generation. (Net generation excludes the electrical energy consumed at generating stations.) Gas generated 58% of electricity statewide in 2011. Natural gas is available only in the Railbelt and two North Slope communities. Hydropower generated 20% of electricity statewide, decreasing from 22% in 2010.[12] Most of the electricity in the Kodiak region is generated by hydro, and is more than half in the Copper River/Chugach region. In the Railbelt, hydropower accounted for 8% of the region total in 2011. Oil generated 16% of electricity statewide, but accounted for nearly all generation in Northern and Western Alaska. Coal accounted for 6% of the electricity generated statewide. Electricity generated by wind was about 1% of the statewide total in 2011 and continues to increase. Total net electrical generation by wind statewide increased about 4% between 2010 and 2011, from 20,348 MWh in 2010 to 21,190 MWh in 2011 (Figure 16, page 44).

Figure 7. Net Generation by Fuel Type by Certified Utilities (MWh), 2011



Source: U.S. Energy Information Administration, Power Cost Equalization program data, and authors' calculations.

[12] The amount of electricity produced from hydroelectric resources varies from year to year depending on water levels. Over the last decade, hydropower has not shown a significant positive or negative trend, growing at less than 0.5% per year. However, records are available starting in 1963, and hydropower has increased at a rate of 5% per year since then.

Table 1.e Net Generation by Fuel Type by Certified Utilities (MWh), 2011

AEA Energy Region	Oil	Gas	Coal	Hydro	Wind	Total[13]	Percent of Statewide Total
Aleutians	60,717	0	0	3,140	1	63,860	1%
Bering Strait	52,470	0	0	0	2,624	55,090	1%
Bristol Bay	50,865	0	0	3,566	88	54,520	1%
Copper River/Chugach	51,723	0	0	62,949	0	114,670	2%
Kodiak	23,381	0	0	114,528	12,364	150,270	2%
Lower Yukon-Kuskokwim	93,035	0	0	0	3,114	96,150	1%
North Slope	28,640	51,686	0	0	0	80,330	1%
Northwest Arctic	34,305	0	0	0	1,610	35,920	1%
Railbelt	559,426	3,731,561	387,160	398,747	1,394	5,078,290	78%
Southeast	32,649	0	0	757,433	0	790,080	12%
Yukon-Koyukuk/Upper Tanana	33,071	0	0	0	0	33,070	1%
Total	**1,020,280**	**3,783,250**	**387,160**	**1,340,360**	**21,190**	**6,552,250**	**100%**
Percent of Total	**16%**	**58%**	**6%**	**20%**	**0.3%**	**100%**	

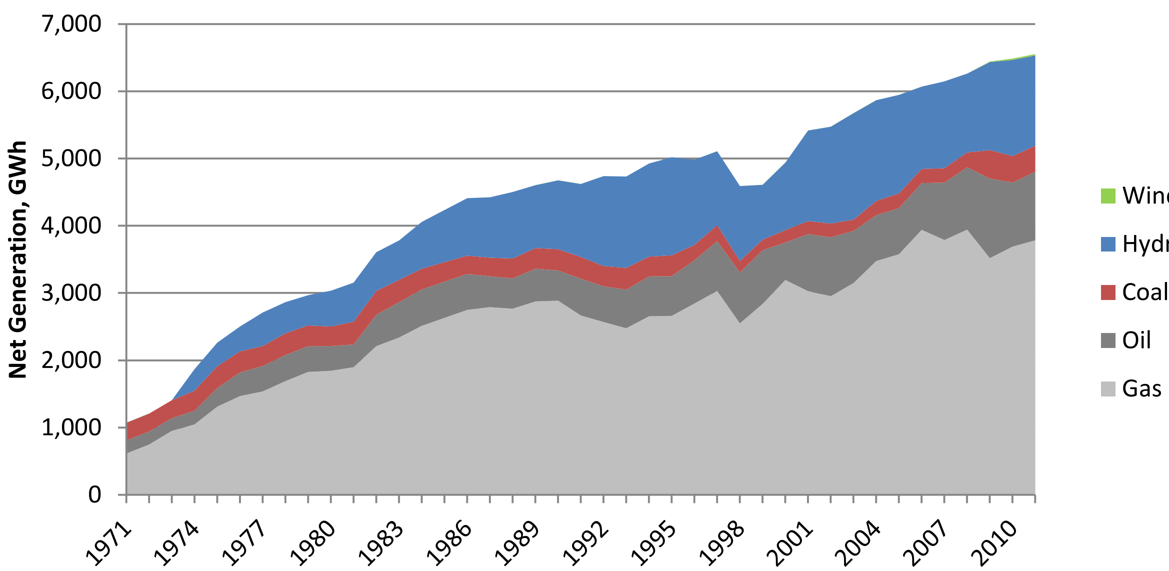
Sources: Energy Information Administration; Alaska Energy Authority Power Cost Equalization program data; authors' calculations.

[13] Total values were rounded to the nearest ten.

Natural gas is the most prevalent fuel used for power generation, and it accounts for the same share, 58% of statewide net generation, as it contributed to generation in 1975. Generation from hydroelectric power is the second most prevalent source of power; the share it contributes to statewide net generation increased from 16% in 1975 to 20% in 2011. Fuel oil was the third largest energy source for electricity in 2011; its contribution to statewide net generation increased from 12% in 1975 to 16% in 2011. Coal's contribution to total net generation decreased from 14% in 1975 to 6% in 2011. Wind was not a significant source of power generation until recently. Since 2008, the amount of electricity generated by wind has increased rapidly—but it currently makes up only about 0.3% of statewide generation (Figure 7 and 8).

Since records have been available, total net generation in Alaska steadily increased at an average rate of 5% per year, except in the 1998-1999 period, when there was a drop of about 10%.[14] Over time, net generation from all energy sources increased. Generation from natural gas, hydroelectric power, and fuel oil all increased at an average annual rate of 5% since 1971, and generation by coal increased an average of 2% per year (Figure 8).

Figure 8. Net Generation by Fuel Type by Certified Utilities (GWh), 1971-2011



Source: U.S. Energy Information Administration, Power Cost Equalization program data and authors' calculations.

[14] The decrease in production was mainly due to a significant drop in hydroelectric production in the 1998-1999 period. During that time the submarine cable that connects to Snettisham was replaced; no production was reported to EIA in that period. Also, utilities reported very large drops in production for the hydro facilities in Skagway (62%) and Terror Lake (90%); reasons for those declines are unknown.

Fuel Use

Figure 9 and Table 1.f show fuel used for generating electricity statewide and by AEA region, and Figure 10 breaks down fuel oil used by regional percentages.

Table 1.f Fuel Used for Power Generation by Certified Utilities, 2011

AEA Energy Region	Oil[15] (Gallons)	Gas (Mcf)	Coal (Short Tons)
Aleutians	4,221,440	0	0
Bering Strait	3,548,340	0	0
Bristol Bay	3,628,030	0	0
Copper River/Chugach	4,658,330	0	0
Kodiak	1,772,550	0	0
Lower Yukon-Kuskokwim	7,129,680	0	0
North Slope	2,162,790	756,310	0
Northwest Arctic	2,471,750	0	0
Railbelt	34,486,410	40,181,450	397,370
Southeast	2,687,200	0	0
Yukon-Koyukuk/Upper Tanana	2,557,160	0	0
Total (Physical Units)	**69,323,680**	**40,937,760**	**397,370**
Conversion Factor[16](MMBtu)	0.139	1.025	19.536
Total MMBtu	**9,635,990**	**41,961,200**	**7,763,020**

Source: Energy Information Administration, Alaska Energy Authority's Power Cost Equalization program data, and authors' calculations.

The fossil fuel used most for electricity generation in Alaska is natural gas, though it is available only in the Southern Railbelt and on the North Slope, in Nuiqsut and Barrow. In 2011, natural gas accounted for 71% of the fossil fuels consumed by utilities for power generation, compared to 70% in 2010. The second most used fossil fuel for power generation in 2011 was oil, at about 16% of all fossil fuel used for electricity production. Even though the Railbelt relies mostly on natural gas as a fuel, it still consumes the most oil for power generation. But except for the oil used by Golden Valley Electric Association (GVEA)—the utility that provides electricity around Fairbanks—that oil is used for stand-by generation.

[15] Utilities in Alaska use a variety of fuel oil types including distillate fuel oil, jet fuel, residual fuel oil, naphtha, and heavy atmospheric gas oil (HAGO). Each type of fuel has different characteristics and Btu content; all these fuels are included here under the label "oil." For detailed information, please refer to Table 2.3c—Generation, Fuel Use, Fuel Cost and Efficiency—in the workbook accompanying this publication.

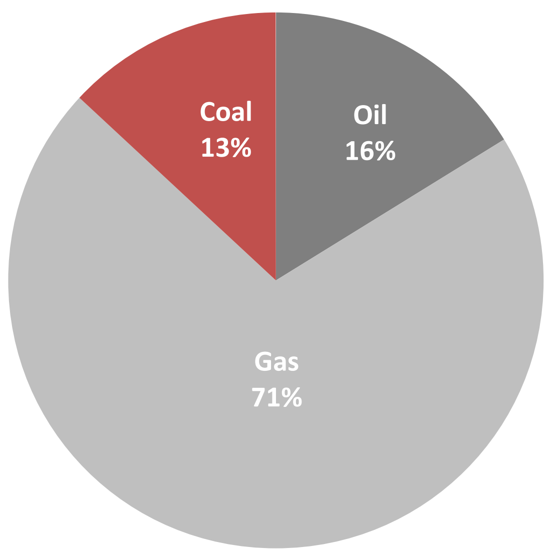
[16] Thermal conversion factors can be used to estimate the heat content in British thermal units (Btu) of a given amount of energy measured in physical units. The conversion factors shown correspond to the average Btu content in barrels of petroleum fuel (oil), Mcf of natural gas, and short tons of coal, respectively, as published by the U.S. Energy Information Administration.

GVEA depends significantly on both fuel oil and coal for power generation; over 99% of all the fuel oil used in the Railbelt is consumed by GVEA; 71% of that is naphtha, 24% heavy atmospheric gas oil (HAGO), and 5% distillate and residual fuel oil.[17]

Compared with 2010, Railbelt consumption of oil decreased about 8%, but still accounted for 50% of the oil utilities used statewide in 2011. The Lower Yukon-Kuskokwim region consumed about 10% of total statewide oil, but it reduced fuel use by 6% between 2010 and 2011. Finally, although coal generates 6% of electricity statewide, it makes up 13% of the fossil fuel used; coal consumption decreased by about 1% point between 2010 and 2011. Coal is used only in the northern Railbelt, specifically in the Fairbanks area, which has a local supply.

In 2011, burning of fossil fuels to generate power in Alaska produced about 3.5 million metric tons of carbon dioxide.[18] About 64% of utility CO_2 emissions were produced from burning natural gas, 20% from fuel oil, and 16% from coal.

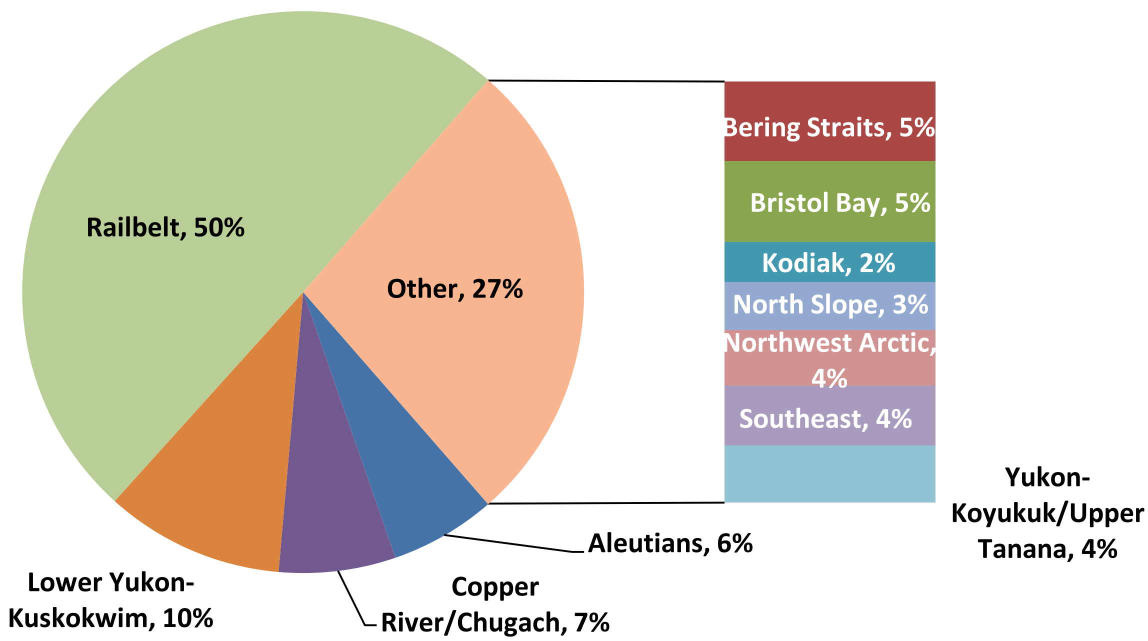
Figure 9. Distribution of Fuel Certified Utilities Used for Power Generation (MMBtu), 2011



Source: U.S. Energy Information Administration, Power Cost Equalization program data and authors' calculations.
Note: Distribution based on MMBtu. Total MMBtu=59,360,210.

[17] Golden Valley Electric Association used 99.9% of all fuel oil in the Railbelt region. Anchorage Municipal Light & Power used 0.07%, Homer Electric Association used 0.03% and the City of Seward used 0.01%.
[18] The amount of carbon dioxide emissions associated with fuel consumption by stationary sources, such as a utility, are lower for natural gas (53.06 Kg CO_2 /MMBtu, weighted national average) than for petroleum distillate fuels (73.15 Kg CO_2/MMBtu) or coal (97.17 Kg CO_2/MMBtu). To find additional information please refer to the U.S. Energy Information Administration website at http://www.eia.gov/oiaf/1605/emission_factors.html.

Figure 10. Distribution of Fuel Oil Consumed by Certified Utilities Used for Electricity Generation, by Energy Region, 2011



Source: U.S. Energy Information Administration, Power Cost Equalization program data, and authors' calculations.

Utility Sales, Revenue and Customers

Sales

Electricity sales in Alaska increased about 1% between 2010 and 2011. Several regions showed significant increases in reported sales, including the Aleutians (13%) and Bering Strait (17%). In two regions, Bristol Bay and Yukon-Koyukuk/Upper Tanana, sales decreased 2%.

Overall, residential sales accounted for 34% of electricity sales in Alaska in 2011; about 44% of electricity sales were to commercial customers (Table 1.g). The highest average use per commercial customer was on the North Slope, at 72,220 kilowatt-hours per year, followed by the Railbelt region, at 70,990 kilowatt-hours per year. By contrast, lowest average use per commercial customer was in the Yukon-Koyukuk/Upper Tanana, at about 12,890 kilowatt-hours per year, and Kodiak, at 20,360 kilowatt-hours per year. Sales to customers other than residential and commercial accounted for 22% of the statewide total.

Table 1.g Electricity Sales of Certified Utilities (MWh), 2011

AEA Energy Region	Residential	Commercial	Other	Region Total	Percent of Statewide Total
Aleutians	8,760	41,420	9,500	59,680	1%
Bering Strait	17,090	22,160	13,220	52,480	1%
Bristol Bay	14,800	24,880	11,190	50,880	1%
Copper River/Chugach	24,270	78,930	5,290	108,480	2%
Kodiak	35,080	22,240	86,910	144,230	2%
Lower Yukon-Kuskokwim	31,740	36,330	21,760	89,840	1%
North Slope	17,260	59,040	1,650	77,950	1%
Northwest Arctic	12,800	13,500	8,210	34,510	1%
Railbelt	1,640,130	2,125,760	1,050,830	4,816,720	77%
Southeast	325,050	319,380	159,200	803,630	13%
Yukon-Koyukuk/Upper Tanana	11,390	7,710	8,200	27,300	0.4%
Total	**2,138,370**	**2,751,350**	**1,375,960**	**6,265,700**	
Percent of Total	**34%**	**44%**	**22%**	**100%**	

Source: Energy Information Administration, Alaska Energy Authority's Power Cost Equalization program data, and authors' calculations.

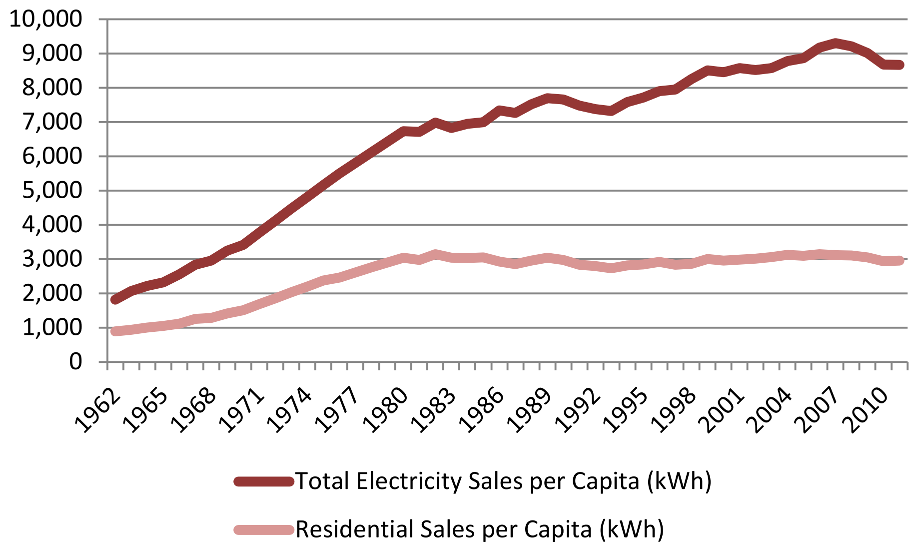
Most of the 2011 electricity sales (77%) were in the Railbelt region, where most of the customers are, followed by the Southeast region (13%). All other regions combined accounted for 10% of all electricity sales in Alaska.

The Southeast and North Slope regions had the highest annual average sales per residential customer—about 10,280 kilowatt-hours in Southeast and 7,970 on the North Slope, followed by the Railbelt region, at 7,710. The North Slope region's average sales per residential customer is relatively high compared with that in neighboring regions, likely due to the availability of natural gas in two communities and a low, flat-rate structure per kilowatt-hour across all communities. The Southeast region benefits from lower rates due to relatively high hydropower production, financed in part with public funds that have also contributed to lower rates for consumers. The price of heating oil in Southeast has continued to increase over the last few years. These higher oil prices, coupled with relatively low electric rates in the Southeast region, encouraged residents to convert to electric heating and resulted in higher electricity sales per customer.[19] The regions with the lowest annual average sales per residential customer in 2011 were Yukon-Koyukuk/Upper Tanana, at about 3,850 kilowatt-hours, and Bristol Bay, at about 4,780 kilowatt-hours.

[19] The Southeast Integrated Resource Plan (SEIRP) discusses the "Oil to Electric" conversion (page 23). The SEIRP is available at: http://www.akenergyauthority.org/PDF%20files/seirp/Section%201.pdf

Total electricity sales per capita (combined residential and other) in Alaska increased steadily until 2008, the start of the major nationwide recession and a spike in energy prices. Since 1962, statewide total and residential sales per capita increased at an annual average of 3% (Figure 11). Residential sales per capita grew rapidly until 1980, but since then residential sales have been virtually flat.

Figure 11. Electricity Sales per Capita by Certified Utilities (MWh), 1962-2011



Source: Energy Information Administration, Alaska Energy Authority Power Cost Equalization Program, Alaska Department of Labor and Workforce Development, Research and Analysis Section; and U.S. Census Bureau, and authors' calculations.
Note: Data for 1971 to 1974 and 1977 to 1979 are estimates.

Revenue

Revenue from electricity sales increased about 10% between 2010 and 2011, but distribution of revenue across energy regions did not change significantly. The Northwest Arctic region had the highest average revenue per residential customer per year, about $3,470; the Lower Yukon Kuskokwim region was next, averaging about $2,750 per residential customer account. The North Slope region had the lowest average revenue per residential customer per year—about $980. Next lowest were the Railbelt, at about $1,270 per customer, and Southeast, at about $1,310.

Statewide, 40% of the revenue from electricity sales in 2011 came from the commercial sector (Table 1.h), because it uses more electricity than other sectors—44% of sales, as shown in Table 1.g.

Table 1.h Certified Utilities Revenue ($000), 2011

AEA Energy Region	Residential	Commercial	Other	Regional Total	Percent of Statewide Total
Aleutians	4,290	19,270	4,930	28,490	3%
Bering Strait	7,490	8,790	5,910	22,190	2%
Bristol Bay	7,550	12,020	5,940	25,510	2%
Copper River/Chugach	7,950	22,540	2,360	32,850	3%
Kodiak	6,970	4,310	15,290	26,570	3%
Lower Yukon-Kuskokwim	17,600	19,440	11,910	48,950	5%
North Slope	2,140	6,700	240	9,080	1%
Northwest Arctic	6,520	6,270	4,620	17,410	2%
Railbelt	271,220	261,740	165,170	698,130	68%
Southeast	41,370	38,220	17,630	97,220	10%
Yukon-Koyukuk/Upper Tanana	6,520	4,500	4,800	15,820	2%
Total	**379,620**	**403,800**	**238,800**	**1,022,220**	
Percent of Total	**37%**	**40%**	**23%**	**100%**	

Source: Energy Information Administration, Alaska Energy Authority Power Cost Equalization program data and authors' calculations.

Customers

The regions with the most customer accounts are the Railbelt, 75% of the statewide total in 2011, and Southeast, with 12% (Table 1.i). All other regions accounted for only 13% of total electric utility customers in 2011. There were no significant changes in the number of customer accounts or regional distribution of accounts between 2010 and 2011. Residential accounts make up most of the customers in Alaska, about 84% in 2011.

Table 1.i Customers (Accounts) of Certified Utilities, 2011

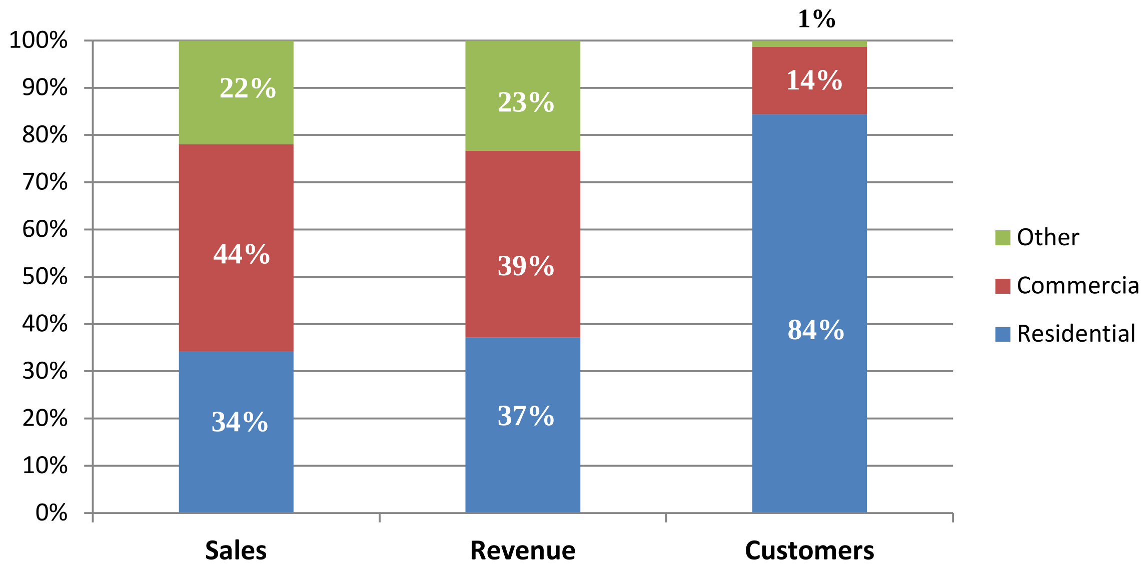
AEA Energy Region	Residential	Commercial	Other	Regional Total	Percent of Statewide Total
Aleutians	1,580	750	370	2,700	1%
Bering Strait	3,360	530	400	4,290	1%
Bristol Bay	3,100	1,000	520	4,620	1%
Copper River/Chugach	4,110	1,510	150	5,770	2%
Kodiak	4,920	1,090	140	6,150	2%
Lower Yukon-Kuskokwim	6,400	1,640	740	8,780	3%
North Slope	2,170	820	40	3,030	1%
Northwest Arctic	1,880	230	240	2,350	1%
Railbelt	212,790	29,950	640	243,380	75%
Southeast	31,620	7,870	720	40,210	12%
Yukon-Koyukuk/Upper Tanana	2,960	600	480	4,040	1%
Total	**274,890**	**45,990**	**4,440**	**325,320**	
Percent of Total	**84%**	**14%**	**1%**	**100%**	

Source: Energy Information Administration, Alaska Energy Authority's Power Cost Equalization program data, and authors' calculations.

Figure 12 shows the percentage distribution of utility sales, revenue, and customers by customer type in 2011.[20]

[20] The category "Other" includes industrial sales and electricity consumers not classified elsewhere, such as public street lighting.

Figure 12. Distribution of Sales, Revenue, and Customers of Certified Utilities, by Customer Type, 2011



Source: U.S. Energy Information Administration, Power Cost Equalization program data, and authors' calculations. Note: The category "Other" includes sales to industrial customers, public lighting service, public authority service to public authorities, railroad and railway service, and interdepartmental services.

Self-producers: Industrial and Military

Public data for industrial and military entities in Alaska that produce their own electricity are scarce. Table 2.a shows information for those that report to the Energy Information Administration. (Those with installed capacity of less than 1 megawatt are not required to report their production.) The self-generators listed, produced 388,039 megawatts-hours of electricity, equivalent to 6% of the electricity produced by certified utilities statewide.

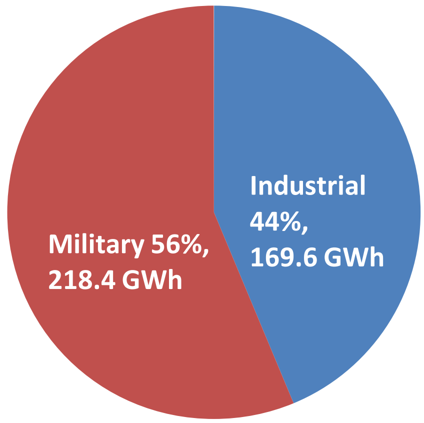
Military facilities produced and consumed 56% of the known total from self-producers and industrial facilities 44% (Figure 13). The majority of this electricity (69%) was produced by burning sub-bituminous coal. Coal was also the most consumed (85%) of all fuels for electricity generation at these facilities, followed by natural gas (8%), distillate fuel oil (7%), and some small amounts of other biomass liquids and other gases (Figure 14).

Table 2.a Installed Capacity, Fuel Used, and Net Generation by Industrial and Military Self Generators (kW, Physical Units, MWh), 2011

Self-generator Name	Type*	Prime Mover	Installed Capacity, kW	Fuel Type	Fuel Used	Fuel Used (units)*	Net Generation (MWh)
Tesoro Alaska Petroleum	I	GT	8,000	DFO	1,722	G	17
				NG	833,555	Mcf	57,111
				OG	10,900	Mcf	2,738
Unisea, Inc.	I	IC	15,500	DFO	2,425,080	G	28,064
				OBL	440,202	G	3,287
University of Alaska Fairbanks	I	IC	9,600	DFO	2,982	G	29
		ST	13,000	DFO	481,866	G	2,767
				NG	63,912	Mcf	2,838
				SUB	74,745	ST	51,304
Westward Seafoods, Inc.	I	IC	6,600	DFO	1,650,852	G	21,484
Doyon Utilities, LLC	M	ST	22,500	SUB	301,623	ST	143,878
U.S. Air Force-Eielson AFB Central Heat & Power Plant	M	IC	8,500	DFO	21,966	G	249
		ST	25,000	SUB	173,199	ST	74,114
U.S. Army-Fort Greely Power Plant	M	IC	7,400	DFO	9,534	G	160
Southern Southeast Regional Aquaculture Assn, Inc. (Burnett River Hatchery)	I	HY	80		0		
PB Energy, Inc. (Dry Spruce)	I	HY	75		0		
Armstrong Keta, Inc. (Jetty Lake)	I	HY	249		0		
Whitestone Power and Communications. (Whitestone)	I	HY	100		0		
Total			**116,604**				**388,039**

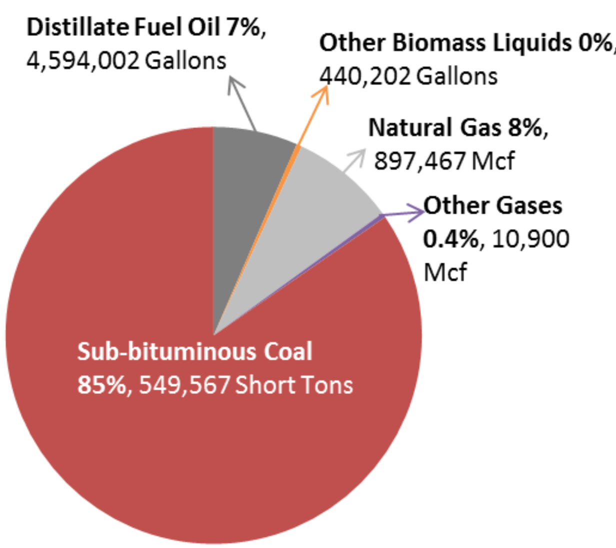
Type: (I) industrial, (M) Military
Fuel Used (units): (G) gallons, (Mcf) Thousand Cubic Feet, (ST) Short Tons
Prime Movers: Gas Turbine (GT), Reciprocating Internal Combustion Engine (IC), Steam Turbine (ST)
Fuel Types: Distillate Fuel Oil (DFO), Natural Gas (NG), Other Gases-fossil fuel derived (OG), Other Biomass Liquids (OBL), Sub-bituminous Coal (SUB)
Note: This table is NOT inclusive of all industrial and military self-generators in Alaska, but only those who report to the Energy Information Administration for which public data are available, and information provided by the Alaska Energy Authority hydroelectric program manager.
Doyon Utilities LLC owns and operates the utility infrastructure that provides service to three military facilities in Alaska; Fort Greely, JBER Richardson and Fort Wainwright. In 2007, Doyon Utilities LLC was awarded 50-year utility privatization contracts. The power-related utilities Doyon Utilities has owned and operated since fall 2008 are as follows: Fort Greely: Central Heat & Power Plant, Heat Distribution System & Utilidors; and Electrical Distribution System| JBER Richardson: Natural Gas Distribution System; and Electrical Distribution System | Fort Wainwright: Central Heat & Power Plant, Heat Distribution System & Utilidors; and Electrical Distribution System
In some cases, military facilities also purchase additional electricity from local utilities.

Figure 13. Net Generation by Self-Generator Type (Gigawatt-hours (GWh), %), 2011



Source: Energy Information Administration and authors' calculations based on limited, publically available data.

Figure 14. Fuel Used, by Fuel Type, Industrial and Military Self-Generators, by Percent MMBtu and Physical Units, 2011



Source: Energy Information Administration and authors' calculations based on limited, publically available data.
Note: Percent distribution based on fuel MMBtu; physical unit equivalence presented for readers' convenience.

RENEWABLE-SOURCED ENERGY IN ALASKA

A significant share of electricity in Alaska today—about 21%—is generated with renewable energy. Most of that (20% of the 21%) is from hydroelectric capacity in Southcentral and Southeast Alaska, and most of the other 1% is from wind turbines.[21]

But the diversity of and production from renewable energy sources is increasing. A growing number of biomass projects are producing heat energy in communities where wood is available, and geothermal, ground-source heat pumps, and solar energy systems are also currently operating in areas of Alaska. To encourage use of renewable energy, the Alaska Legislature in 2008 created the Renewable Energy Fund (REF), with the intent to appropriate $50 million annually for five years for renewable energy projects. In 2012, the enabling legislation was extended an additional 10 years.

Hydroelectric

The reporting of installed capacity of hydroelectric facilities is complicated by the ownership structure of the larger units, since ownership has changed over time, and the reporting by different entities has not always been consistent. Table 3.b lists most of the hydroelectric facilities operating in Alaska.

Between 1981 and 1985, AEA placed four hydroelectric facilities into service to provide power to communities in Southeast and Southcentral Alaska. These facilities were known as the Four Dam Pool—Swan Lake, Tyee Lake, Terror Lake, and Solomon Gulch. Swan Lake serves Ketchikan; Tyee Lake serves Wrangell and Petersburg; Terror Lake serves Kodiak; and Solomon Gulch serves Valdez and Glennallen.

In 2002, AEA sold these facilities to a joint agency composed of member utilities that purchased the hydropower output from these projects. In 2009, the Terror Lake and Solomon Gulch projects were sold or transferred to the respective operating utilities, and ownership of the Swan and Tyee Lake projects was transferred to a new agency called the Southeast Alaska Power Agency (SEAPA). Interconnection of the Swan and Tyee projects was completed in late 2009, when SEAPA built a 57-mile intertie.

The Snettisham hydroelectric facility, also in Southeast Alaska, provides power to Juneau. The federal government owned Snettisham until the Alaska Industrial Development and Export Authority (AIDEA) purchased it in 1998. Alaska Electric Light and Power operates the facility and sells the power to its ratepayers. Also in Southeast, Alaska Electric Light and Power completed construction of the Lake Dorothy hydroelectric plant in 2009. Finally, the City of Sitka operates two hydroelectric plants, at Blue Lake and Green Lake.

In Southcentral Alaska, the largest hydroelectric facility in Alaska is at Bradley Lake, which is owned by AEA, managed by AEA and the Railbelt utilities through the Bradley Lake Management Committee, and

[21] Shares are independently rounded. Hydro accounts for 20.46%, wind for 0.032%, total contribution from renewables is 20.78%.

operated by Homer Electric Association. The power from Bradley Lake is shared among the Railbelt utilities according to a formal power sales agreement (Table 3.a).

Table 3.a Utility Ownership Shares of Bradley Lake Hydroelectric Power

Utility	Share of Bradley Lake
Chugach Electric Association	30.4%
Anchorage Municipal Light & Power	25.9%
Homer Electric Association	12.0%
Matanuska Electric Utility	13.8%
Seward Electric Utility	1.0%
Golden Valley Electric Association	16.9%

Source: Alaska Energy Authority, 2010.

Also in Southcentral is the Eklutna hydroelectric facility, which the federal government owned until 1997, when it was jointly purchased by Anchorage Municipal Light and Power, which owns 53.3%; Chugach Electric Association, which owns 30%; and Matanuska Electric Association, which owns 16.7%. Another hydroelectric facility in Southcentral is Cooper Lake, which is owned and operated by Chugach Electric Association.

In addition to these larger facilities, a number of smaller hydroelectric facilities are owned and operated by other utilities and independent power producers, as shown in Table 3.b.

As mentioned earlier, hydroelectric capacity accounted for 20% of total installed capacity and net generation statewide in 2011. Four new hydroelectric facilities began operating in 2012, adding another 584 kilowatts of installed capacity. In addition, four industrial facilities account for an additional 504 kilowatts of hydroelectric installed capacity.

Table 3.b Current Operating and Proposed Hydroelectric Capacity in Alaska (kW)

Operating Hydroelectric Capacity as of CY2011

Utility/Independent Power Producer Name	Plant Name	Service Area	Installed Capacity, kW	Source
Alaska Electric Light & Power Company	Annex Creek	Juneau	4,000	EIA
Alaska Electric Light & Power Company	Gold Creek	Juneau	1,600	EIA
Alaska Electric Light & Power Company	Lake Dorothy	Juneau	14,300	EIA
Alaska Electric Light & Power	Salmon Creek	Juneau	8,500	EIA

Utility/Independent Power Producer Name	Plant Name	Service Area	Installed Capacity, kW	Source
Company				
Alaska Electric Light & Power Company	Snettisham Lake	Juneau	78,200	EIA
Alaska Power & Telephone Company	Black Bear Lake	Prince of Wales	4,500	EIA
Alaska Power & Telephone Company	Goat Lake	Upper Lynn Canal	4,000	EIA
Alaska Power & Telephone Company	Haines (Lutak)	Haines/Skagway	285	AEA Program Manager
Alaska Power & Telephone Company	Kasidaya Creek	Haines/Skagway	3,000	EIA
Alaska Power & Telephone Company	Skagway (Dewey Lakes)	Haines/Skagway	1,000	EIA
Alaska Power & Telephone Company	South Fork	Prince of Wales	2,000	EIA
Anchorage Municipal Light & Power	AWWU Conduit	Railbelt	750	AEA Program Manager
Anchorage Municipal Light & Power	Eklutna Lake	Railbelt	44,400	EIA
Chugach Electric Assn Inc	Cooper Lake	Railbelt	19,400	EIA
Copper Valley Elec Assn Inc	Solomon Gulch	Glennallen-Valdez	12,000	EIA
Cordova Electric Cooperative	Humpback Creek	Cordova	1,200	EIA
Cordova Electric Cooperative	Power Creek	Cordova	6,000	EIA
Gustavus Electric Company	Falls Creek	Gustavus	800	FERC
Alaska Energy Authority	Bradley Lake	Railbelt	119,700	EIA
I-N-N Electric Coop, Inc	Tazimina Lake	Iliamna, Newhalen, Nondalton	824	EIA
Inside Passage Electric	10 Mile	Haines/Skagway	600	AEA Program Manager
Ketchikan Public Utilities	Beaver Falls	Ketchikan	5,400	EIA
Ketchikan Public Utilities	Ketchikan Lakes	Ketchikan	4,200	EIA
Ketchikan Public Utilities	Silvis Lake	Ketchikan	2,100	EIA
King Cove, City of	King Cove (Delta Creek)	King Cove	800	EIA

Utility/Independent Power Producer Name	Plant Name	Service Area	Installed Capacity, kW	Source
Kodiak Electric Association	Terror Lake	Kodiak	22,400	EIA
Larsen Bay Utility Company	Larsen Bay	Larsen Bay	475	AEA Program Manager
Enerdyne, LLC	McRoberts Creek	Mat-Su	125	AEA Program Manager
Metlakatla Power & Light	Chester Lake	Metlakatla	1,000	EIA
Metlakatla Power & Light	Purple Lake	Metlakatla	3,900	EIA
Pelican Utility	Pelican	Pelican	700	EIA
Petersburg, City of	Blind Slough	Petersburg	2,000	EIA
Sitka, City & Borough of	Blue Lake	Sitka	7,000	EIA
Sitka, City & Borough of	Green Lake	Sitka	18,600	EIA
Southeast Alaska Power Agency	Swan Lake	Wrangell, Petersburg, Ketchikan	22,400	EIA
Southeast Alaska Power Agency	Tyee Lake	Wrangell, Petersburg, Ketchikan	20,000	FERC
Total Operating Capacity, 2011			***438,159***	

Operating Capacity after 2011

Utility/Independent Power Producer Name	Plant Name	Service Area	Installed Capacity, kW	Source
Akutan, City of	Town Creek	Akutan	100	AEA Program Manager
Atka, City of	Chuniisax Creek	Atka	284	AEA Program Manager
Chignik, City of	Indian Creek	Chignik Bay	60	FERC
Ouzinkie, City of	Mahoona Lake	Ouzinkie	140	AEA Program Manager
Total Operating Capacity after 2011			***584***	

Operating Industrial Hydroelectric Capacity

Utility/Independent Power Producer Name	Plant Name	Installed Capacity, kW	Source
Southern Southeast Regional Aquaculture Assn, Inc	Burnett River Hatchery	80	FERC
PB Energy, Inc	Dry Spruce	75	FERC
Armstrong Keta, Inc	Jetty Lake	249	FERC
Whitestone Power and Communications	Whitestone	100	FERC
Total Industrial Operating Capacity		***504***	
TOTAL Current Operating Capacity (including industrial)		**439,247**	

Source: U.S. Energy Information Administration, and Alaska Energy Authority.

Notes: Prince of Wales includes Craig, Klawock, Hollis, Hydaburg, Thorne Bay, Kasaan, Coffman Cove. The Upper Lynn Canal communities include Chilkat Valley, Klukwan, Haines, Covenant Life, and Skagway. For details about which communities are served by each utility, see the Utility List in the accompanying workbook.

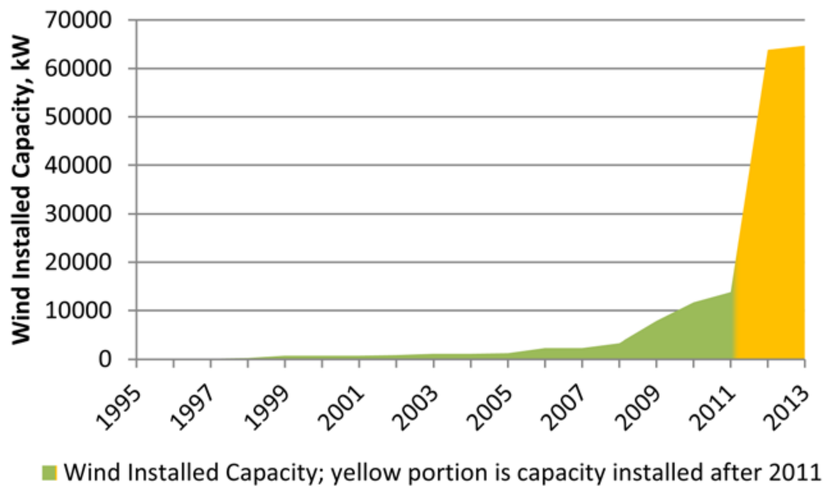
Hydrokinetic permits are for projects that generate electricity from waves or directly from the flow of water in ocean currents, tides, or inland waterways.

Since fall of 2012, the Alaska Energy Authority has collaborated with the U.S. Department of Energy, Oak Ridge National Laboratory (ORNL), on high-level screening of hydroelectric resources in Alaska. As a result, some hydroelectric installed capacity values for existing and proposed hydro-power sites will be adjusted to reflect current resource capacity. Final results will be published by ORNL after the study is completed in 2013.

Wind

Although wind makes up less than 1% of all installed capacity statewide, it has the fastest rate of growth in recent years. Figure 15 shows that after the Alaska Legislature established the Renewable Energy Fund (REF) program in 2008, installed wind turbine capacity increased dramatically.

Figure 15. Wind Capacity in Alaska, 1995-2013



Source: U.S. Energy Information Administration, Alaska Energy Authority and authors' calculations.

In 2007, before the REF program began, there were 2,355 kilowatts of wind installed capacity in Alaska. Since then, wind installed capacity has grown at an annual average rate of over 100%, with the largest growth between 2011 and 2012, when wind installed capacity increased almost five fold (from 33,846 to 63,851 kilowatts). This dramatic increase was due to a number of projects starting operations in 2012. The two largest are in the Railbelt region—Eva Creek (24.6 megawatts), which provides electricity to the Fairbanks area, and the Fire Island Wind Farm (17.6 megawatts), which serves the Anchorage area.

Table 3.c lists currently installed wind turbines in Alaska. Adding wind turbines to existing fuel oil systems is, in many cases, a challenging and complex task. Even after turbines are commissioned and become operational, technical issues can reduce the number of turbines producing electricity. The list below does not imply that all turbines listed are currently operating, or operating at full design capacity.

Table 3.c Wind Installed Capacity, kW

Utility Name	Location	Year Installed	No. of Turbines	Installed Capacity (kW)	Type of Turbines
Alaska Environmental LLC	Delta Junction	2008(100) 2010(900)	2	1,000	(1) Northwind 100 (1) EWT 900
Alaska Environmental LLC	Delta Junction	2011	5	12	Skystream 3.7
Alaska Village Electric Cooperative	Chevak	2010	4	400	Northwind 100B
Alaska Village Electric Cooperative	Emmonak	2011	4	400	Northwind 100B
Alaska Village Electric Cooperative	Gambell	2010	3	300	Northwind 100B
Alaska Village Electric Cooperative	Hooper Bay	2009	3	300	Northwind 100
Alaska Village Electric Cooperative	Kasigluk	2006	3	300	Northwind 100
Alaska Village Electric Cooperative	Mekoryuk	2011	2	200	Northwind 100B
Alaska Village Electric Cooperative	Quinhagak	2010	3	300	Northwind 100B
Alaska Village Electric Cooperative	Savoonga	2009	2	200	Northwind 100
Alaska Village Electric Cooperative	Selawik	2003	2	260	Northwind 100
Alaska Village Electric Cooperative	Toksook Bay	2006(300) 2010(100)	4	400	Northwind 100
Alaska Village Electric Cooperative	Wales	2002	2	130	Entegrity
Aleutian Wind Energy	Sand Point	2011	2	1,000	Vestas V-39
Bering Strait Native Corp. and Sitnasuak	Nome	2010	18	1,170	Entegrity
Kodiak Electric Association	Kodiak	2009	3	4,500	GE 1.5
Kotzebue Electric Association	Kotzebue	1997-2006	17	1,140	(15) Entregrity; (1) Vestas; (1) Northwind

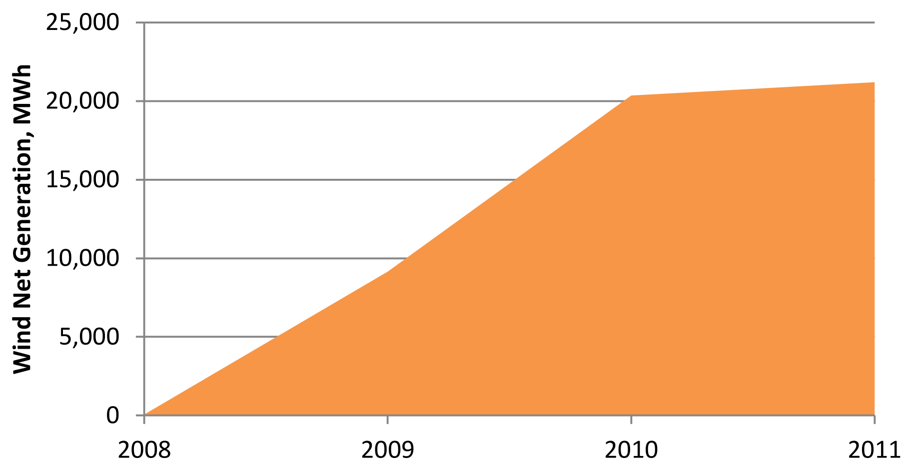
Utility Name	Location	Year Installed	No. of Turbines	Installed Capacity (kW)	Type of Turbines
Native Village of Perryville	Perryville	2008	10	24	Skystream 3.7
Puvurnaq Power Company	Kongiganak	2011	5	450	Windmatic 17S
Sustainable Energy Com. of AK Peninsula	Port Heiden Pilot Point	2004	2	20	10 kW Bergey
TDX Power	St. Paul Island	1998, 2006-2008	3	675	Vestas V-27
Umnak Power Company	Nikolski	2011	1	65	Vestas V-15
Unalakleet Valley Electric Cooperative	Unalakleet	2009	6	600	Northwind 100
Total installed as of December 2011				**13,846**	

Installed Capacity After 2011

Utility Name	Location	Year Installed	No. of Turbines	Installed Capacity (kW)	Type of Turbines
CIRI	Fire Island	2012	11	17,600	GE 1.6xle
Golden Valley Electric	Eva Creek	2012	12	24,600	RePower 2MW
Kodiak Electric Association	Kodiak	2012	3	4500	GE 1.5
Kodiak Electric Association	Kotzebue	2012	2	1,800	EWT DirectWind 900
Kokhanok Village Council	Kokhanok	2012	2	180	Vestas V-17
Alaska Village Electric Cooperative	Shaktoolik	2012	2	200	Northwind 100B
TDX Power	Tin City	2012	1	225	Vestas V-27
Tuntutuliak Community	Tuntutuliak	2012	5	450	Windmatic 17S
Kwigillingok Power Company	Kwigillingok	2012	5	450	Windmatic 17S
Banner Peak Wind Farm	Nome	2013	2	900	EWT*52
Total Wind Capacity after 2011				**50,905**	
TOTAL Current Installed Capacity				**64,751**	

Between 2008 and 2010, there was a sharp increase in net generation from wind. In 2011, wind generation increased slightly (Figure 16). Wind generation is expected to increase significantly in the years after 2011, as the substantial capacity added in 2012 begins operation, as other planned facilities are constructed and commissioned, and as existing systems are optimized and move towards generating electricity at full design capacity.

Figure 16. Wind Net Generation, 2008-2011



Source: U.S. Energy Information Administration, Alaska Energy Authority, and authors' calculations.

Other Renewable Energy Technologies

Other renewable energy technologies are also being used in Alaska. These include biomass, geothermal (direct-use and ground-source heat pumps, or GSHP), and solar. In Alaska, most of these technologies are not used in the electric utility sector, but rather are distributed systems serving a variety of residential, commercial, community, and industrial facilities. Most of these systems are used for space heating rather than producing electricity. We are not aware of any inventory of distributed energy systems operating in Alaska. Basic information about these technologies is presented below and is primarily available only for larger systems that received public funding. Most distributed systems were paid for with private funds, though many were eligible for federal tax credits if installed during eligible years.

Solar

Solar energy refers to captured solar radiation that can be converted into heat or electricity. Two solar technologies are photovoltaic devices and solar thermal systems. Photovoltaic systems transform sunlight into electricity. Solar thermal systems work by concentrating solar energy to heat a fluid (e.g., water). Both are mature technologies used extensively around the world. In northern climates their use is less common, but technological advances in these systems are resulting in solar systems becoming a potentially viable energy option in climates that receive less consistent direct solar radiation. Currently, there are at least two utility-scale solar thermal systems installed in Alaska (Table 3.d, page 48). We are not aware of any inventory of distributed solar energy systems operating in Alaska.

Geothermal

Geothermal power is a mature technology that can provide base-load power with a very high availability and capacity factor. But the current technology is very site-specific and limited to areas with an elevated geothermal gradient that is typically evidenced by hot springs, geysers, and fumaroles at or near the site. To produce electricity from geothermal resources, the heat of the earth is transferred to the surface by a fluid—generally water—where its heat is used to drive a turbine. Depending on the temperature of the resource, different power cycles are used to convert the heat into electricity. In moderate-to-high temperature resources (greater than ~400°F), the geothermal fluid is flashed to steam before being sent through a turbine to produce electricity; this is referred to as a flash plant. In lower temperature resources, the geothermal fluid is sent through a heat exchanger, which transfers the heat to a fluid with a lower boiling point than water. In this binary cycle, the secondary fluid is then flashed to a vapor, which is used to drive a turbine.

In cases where the geothermal resource is not sufficiently hot, or as a cascading use of spent geothermal fluid from a power plant, the geothermal fluid can be used directly for its heat content. The available direct uses for the geothermal fluid are temperature dependent, with higher temperature fluids being suitable for a greater array of purposes. For example, steam greater than 300 °F may be used to help process paper pulp, but since pulp processing doesn't use all the available heat, the steam may still be used for other industrial purposes, space heating, greenhouses, or mariculture.

Currently, there is only one developed geothermal resource by direct use method in Alaska. It is operated by Chena Power in Fairbanks, and has an installed capacity of 400kW (Table 3.d, page 48). The geothermal resource, aside from its traditional use for baths, is used for space heating, refrigeration, and food production.

Ground-Source Heat Pumps

Used in many other parts of the U.S. and the world, ground-source heat pumps (GSHPs) are less common in Alaska. Heat pumps operate on the same principles as refrigeration or air conditioning systems, using electricity to "pump" heat from a cold temperature source, such as the ground or a body of water, into a warmer area such as the inside of a home. Essentially, heat pumps take advantage of the moderate temperatures in the ground to boost efficiency and reduce the operational costs of heating or cooling systems. Disadvantages of heat pumps are the high capital cost of installing the systems, either as a series of wells or buried horizontal loops, and their lower efficiency in Alaska, due to the relatively cool ground temperatures. Nonetheless, several designs developed for cooler northern climates are now on the market, and combined with higher expected fuel prices, this technology may be becoming more viable for the Alaska market. Currently there are five large GSHP systems operating in Alaska, four of which were funded by the Renewable Energy Fund program (Table 3.d, page 48).

Biomass

Biomass energy, in the form of heat or power or both, is created by the combustion or gasification of carbon-based plant or animal matter. Alaska's major biomass energy resources are wood, sawmill residue, fish processing byproducts, agricultural crops and waste, and municipal waste. Biomass energy is generally considered a firm energy source, available as needed. Woody biomass is the most commonly used form of biomass fuel. It is used directly as firewood, or it can be processed into woodchips, pellets, or bricks. Processing biomass ranges from the simple (bucking logs into suitable lengths), to chipping or chunking (chippers are commonly available machinery), to the more complex (densification, which involves chipping, drying, and compressing biomass into pellets, bricks, or logs). As the levels of complexity rise, the benefits of proper handling and storage of the fuel become more pronounced. Densification, however, increases the heat per volume ratio, potentially reducing transportation and handling costs per Btu. Currently, there are at least 15 facilities with installed biomass systems in Alaska, including one wood-pellet boiler (Table 3.d, page 48).

Burning wood is a traditional form of home heating in Alaska. Conventional wood stoves can be found in homes and community buildings across the state. Researchers at the Pacific Northwest Research Station estimate there are 8,632 homes in Alaska currently using wood as the primary source of heat, with the total volume of firewood used annually as the primary source of heating at 76,203 cords. The researchers have also estimated the number of homes (31,227 units) and volume of firewood (53,502 cords) used in secondary heating. In total, they estimate that about 138,656 cords of wood are used as a primary and secondary source of heat in Alaska.[22] The researchers believe that at $3.00 per gallon for heating oil, there is an economic incentive to convert to wood/biomass heat. They estimate that the maximum likely demand for woody biomass for residential space heating in Alaska is about 815,000 cords of green wood, or about 872 tons of wood pellets, which is less than 25% of the peak timber harvest levels reported by the Alaska timber industry.[23] Another study at the research station found that the most significant barriers to converting to wood/biomass heat in individual homes are the cost of conversion and the additional work of heating with wood.[24]

Recent technological advances have resulted in a new generation of efficient wood-fired heating systems for larger installations such as schools and commercial buildings. These hydronic (hot water) systems work by producing heat through combustion directly, or by creating transportable heat by capturing the heat from burning wood in a heat-storage medium such as water. This type of system can be used to heat multiple adjacent buildings by piping heated water through an interconnected or

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[22] Brackley, Allen M.; Barber, Valerie A.; Pinkel, Cassie. 2010. Developing estimates of potential demand for renewable wood energy products in Alaska. Gen. Tech. Rep. PNW-GTR-827. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 31 p.
[23] Brackley, A.M.; Haynes, R.W.; Alexander, S.J. 2009a. Timber harvests in Alaska: 1910–2006. Res. Note PNW-RN-560. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 24 p.
[24] Nicholls, David L.; Brackley, Allen M.; Barber, Valerie. 2010. Wood energy for residential heating in Alaska: current conditions, attitudes, and expected use. Gen. Tech. Rep. PNW-GTR-826. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 30 p.

"district" loop. This system can reduce the amount of heating oil needed in each building, or even eliminate the need for oil.

Only limited data are available about other renewable energy systems discussed above. Table 3.d lists systems and available data. It is not a comprehensive list, so the production and fuel displacement values do not represent statewide totals, but only summary figures from the available data.

Table 3.d Other Renewable Energy Systems in Alaska (Excluding Hydropower and Wind)

Technology Type	Project Name/Location	Operation Start Date	Electrical Installed Capacity	Thermal Installed Capacity (MMBtu/hr)	2011 Thermal Production (MMBtu)	2011 Fuel Oil Displaced (gallons)
Solar	Kotzebue Solar Thermal					
	McKinley Village Solar Thermal[1]	June 2010		0.016	134	1,800
Geothermal	Chena Hot Springs	2006	400 kW			
GSHP	Auke Bay School[4]					
	AEL&P Lemon Creek Operations Center	1996	0	1,000		
	Juneau Aquatic Center[2]	2010 - 2011	0	1,240	5,400	45,000
	Juneau Airport Ground Source Heat Pump (HP)	July 2010	0	Air HP 0.708 Water to Water HP .885 DOAS 0.317	5,117	37,100
	Seward Sealife Center[3]	December 2012		2,160	2,502	20,000
Biomass	Dot Lake Village	1998	0	0.950		
	Logging and Milling Associates	2004	0	1.200		
	City of Tanana	2007	0	0.850		
	Regal Enterprise	2007	0	1.500		
	City of Craig	2008	0	4.000		
	Village of Ionia	2008	0	1.000		
	Barrow Mechanical	2008	0	0.425		
	Tok School Wood Heating	October 2010	0	4.000	3,217	24,400
	Gulkana Central Wood Heating	October 2010	0	2.000	780	5,900
	Delta Junction Wood Chip Heating	September 2011	0	5.000	0	0

Technology Type	Project Name/Location	Operation Start Date	Electrical Installed Capacity	Thermal Installed Capacity (MMBtu/hr)	2011 Thermal Production (MMBtu)	2011 Fuel Oil Displaced (gallons)
	Cordova Wood Processing Plant	December 2011	0	20.000	1,500	11,400
	Thorne Bay School Wood Fired Boiler Project[4]				0	0
	Lake and Peninsula Wood Boilers[4]			(Kokhanok) 0.250 (Igiugig) 0.209	0	0
	Haines (Chilkoot) Central Wood Heating System[4]			0.40	0	0
	Sealaska Wood Pellet Boiler[5]	2011		0.75	2,679	30,500
			400	**4,444**	**21,329**	**176,100**

Sources: Alaska Renewable Energy Fund Status Report, Alaska Energy Authority (January 2013), Alaska Energy Authority program managers, and Alaska Center for Energy and Power.

Note: DOAS means Dedicated Outdoor Air System.

1) Performance capacity of these solar water heating panels is a function of the difference between ambient and the inlet temperature, and the solar radiation incident on the panel. The manufacturer provides a wide capacity rating, the reported value is the relevant capacity given the climatic conditions in central Alaska. Estimates provided by the Alaska Energy Authority.

2) Production and displacement values are estimates.

3) Production and displacement values are estimates. The system began preliminary operations in July 2011, hence data reflects only a partial year. The system is estimated to displace an average of 50,000 gallons per year. Production values (MMBtu) are based on fuel displacement with an assumption of 90% efficiency.

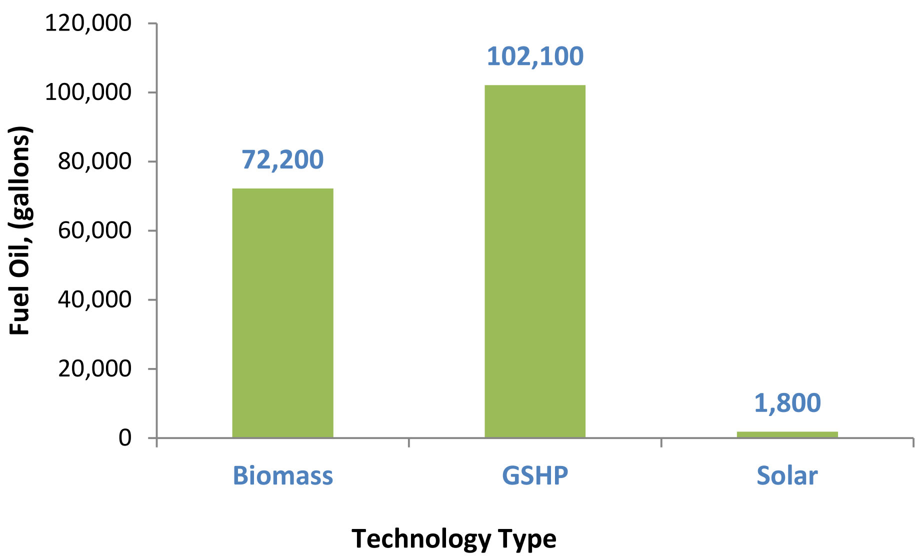
4) System installed or began operation after 2011.

5) The wood pellet boiler replaced a fuel boiler system. It is used for space heating and is combined with an emergency electric boiler back-up system. Fuel displaced reflects the average fuel usage from 2005 to 2009. Thermal production reflects metered production during the first year of operation, and it is expected to increase due to operational improvements and improved building controls.

Besides wind and hydroelectric systems, a total of 23 currently installed renewable energy systems were identified: two solar, one geothermal, five GSHP, and fifteen biomass. Except for the geothermal system in Chena Hot Springs, all are used to produce heat. The Chena Hot Springs system is designed for both heat and power.

Production data were only available for eight of these renewable energy systems. Those produced a total of 21,329 MMBtu, which is equivalent to displacing 176,100 gallons of fuel oil. GSHP production displaced the most fuel, an equivalent of 102,100 gallons, followed by biomass and solar (Figure 17). In addition, heat recovery systems displaced about 10,000 gallons of fuel oil.[25] In total all of these systems displaced about 186,000 gallons of fuel oil that would otherwise have been used. Several of these systems were in early production stages or began operations at various times in 2011, so data reported reflect partial years. Performance and reporting of these systems is expected to improve significantly over the next few years.

Figure 17. Fuel Displacement by Other Operating Renewable Energy Systems in Alaska, 2011



Source: Alaska Energy Authority, Renewable Energy Fund program data; retrieved from the Alaska Energy Data Gateway (https://akenergygateway.alaska.edu/); University of Alaska Fairbanks, Alaska Center for Energy and Power; and authors' calculations based on data on larger systems that received grant funding.

[25] Heat recovery provides a contribution to fuel displaced; however it is not a renewable energy technology. The technology recovers waste heat from a diesel or natural gas fired generator that is then used to generate more electricity; effectively increasing the fossil fuel generator efficiency.

ENERGY IN ALASKA

The Big Picture

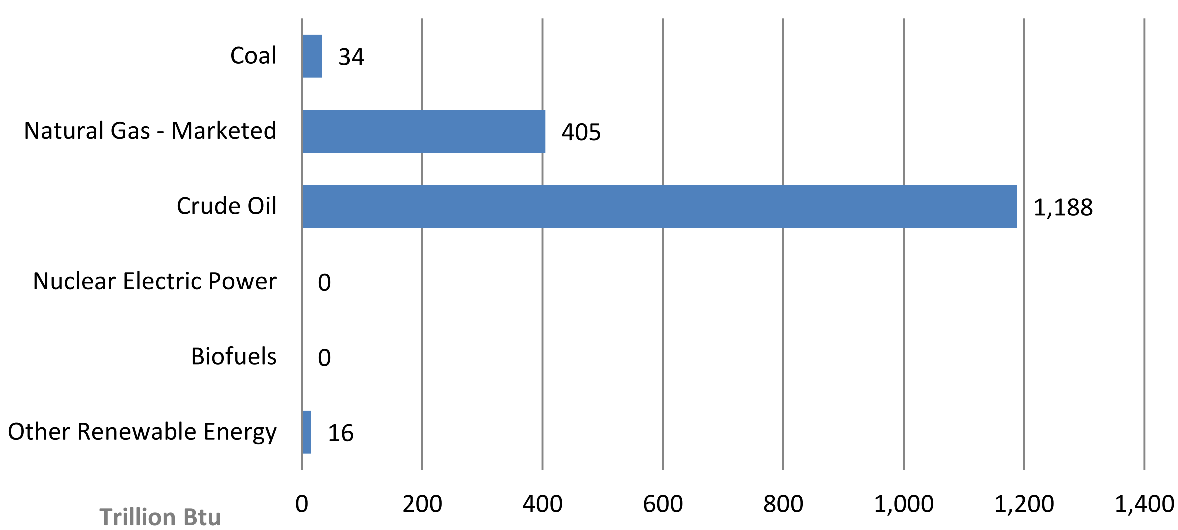
So far this report has focused just on electricity, but to help put energy use in Alaska in a broader context, this section describes the bigger picture: production and consumption of major energy sources and fuel prices in Alaska.

The U.S. Energy Information Administration makes available annual estimates of all energy produced and consumed by state, including Alaska, through the State Energy Data System (SEDS). Some historical data is also available in the SEDS.

Production and Consumption

Most of the energy produced in Alaska is crude oil, and most of that is exported (Fay et. al, 2011). In 2011, Alaska produced almost 1,200 trillion Btu, or 207 million barrels, of crude oil. Natural gas was the second largest type of energy produced in Alaska, at 405 trillion Btu, or 394 million Mcf. Also, 34 trillion Btu, or 1.7 million short tons, of coal were produced. And 16 trillion Btu were produced from all renewable energy technologies for all uses. This renewable energy production is equivalent to what 115 million gallons of fuel oil could produce. The Energy Information Administration reported no biofuels or nuclear electric power produced in Alaska in 2011 (Figure 18).

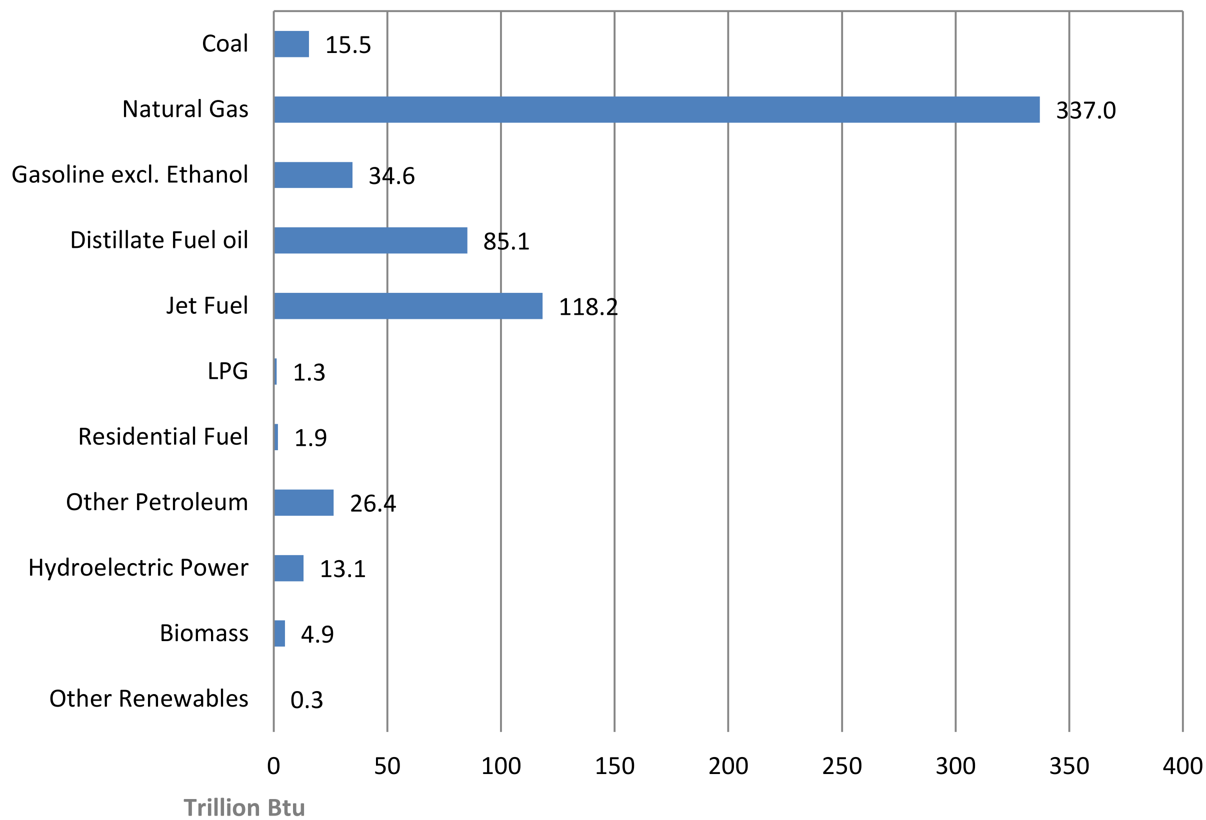
Figure 18. Alaska Energy Production Estimates by Fuel Type (in trillion Btu), 2011



Source: Reproduced image from U.S. Energy Information Administration, State Energy Data System

Crude oil is the energy source with the largest production in Alaska (Figure 18), but most of the oil is exported. Natural gas is the energy source most consumed in Alaska, accounting for about 53% of all energy consumed (Figure 19). About 3% of all energy consumed in Alaska is from renewable sources (Figure 19).

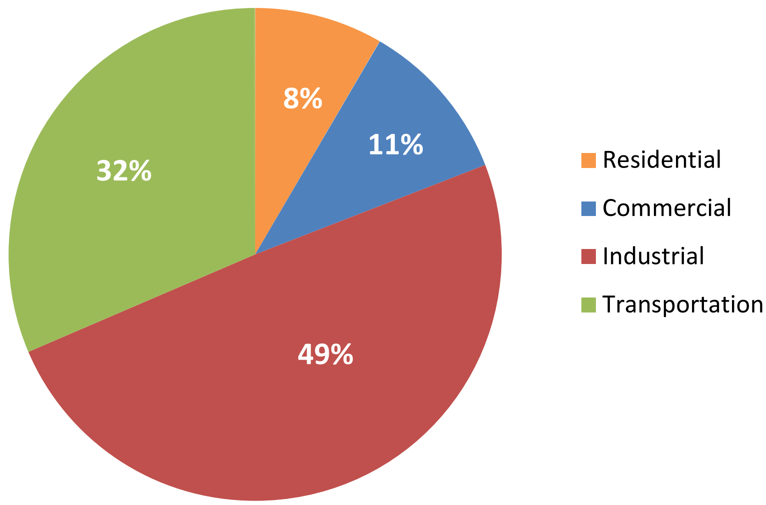
Figure 19. Alaska Energy Consumption Estimates, 2011



Source: Reproduced image from U.S. Energy Information Administration, State Energy Data System.
Note: Other petroleum products include kerosene, aviation gasoline, lubricants, asphalt and road oil.

Looking at consumption by sector, the industrial sector consumes almost half— 49%—of all energy consumed in Alaska. The transportation sector consumes 32%, the commercial sector 11%, and the residential sector 8% (Figure 20).

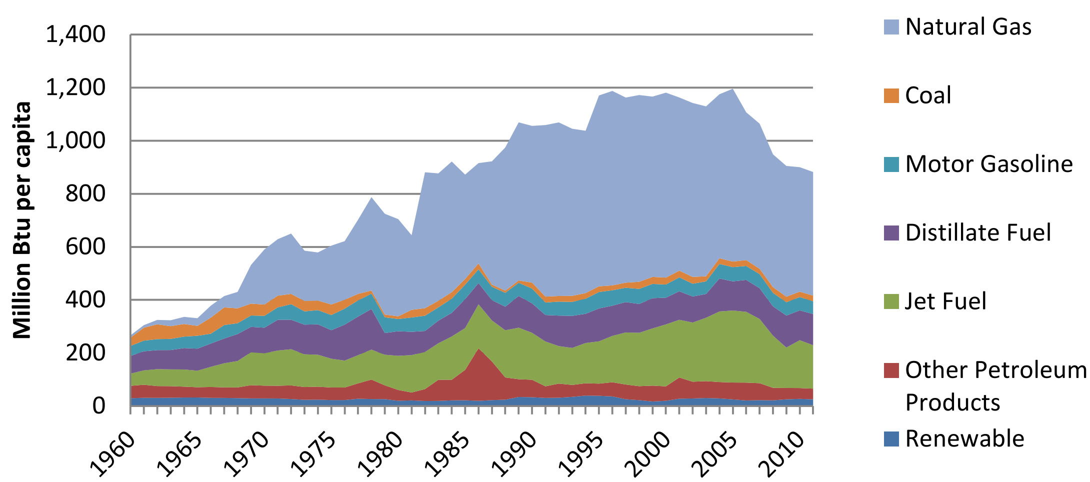
Figure 20. Alaska Energy Consumption by End-Use Sector, 2011



Source: Reproduced image from U.S. Energy Information Administration, State Energy Data System, and authors' calculations.

Natural gas became the predominant source of energy used in Alaska after oil and gas production began in Cook Inlet in the late 1960s. When oil and gas production began on the North Slope in the late 1970s, natural gas consumption by industrial users increased dramatically, because it is used to power North Slope industrial operations. The consumption of jet fuel increased with Anchorage International Airport's growing role as an international air cargo hub. Most other fuels—including fuel oil and motor gasoline—have held relatively stable shares of the total energy consumption per capita over time (Figure 21). But per capita consumption of coal has declined about 30%, with a smaller share of Alaskans using coal.

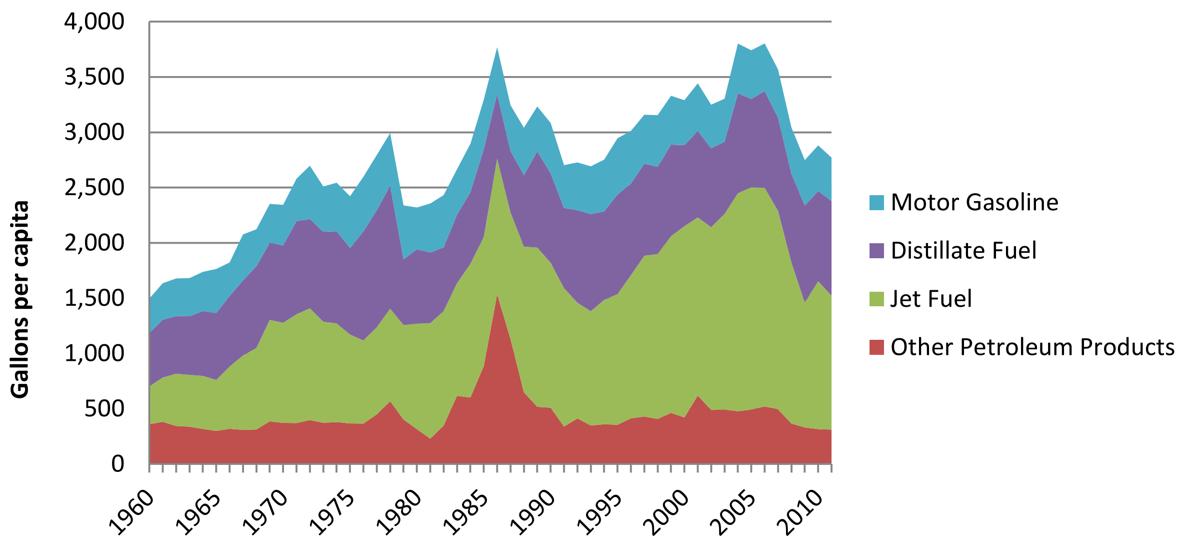
Figure 21. Energy Consumption per Capita in Alaska (all sectors), 1960-2011



Source: U.S. Energy Information Administration, State Energy Data System.

Figure 22 shows per capita consumption of petroleum products in Alaska since 1960. Jet fuel has increasingly become the fuel with the highest levels of consumption, driven by growth in numbers of international and cargo carriers refueling at Ted Stevens Anchorage International Airport. The Anchorage airport is among the top five in the world for cargo throughput, and it also serves the world's largest and busiest floatplane base. Per capita consumption of motor gasoline is up about 17% and distillate fuel consumption jumped 77% per capita from levels of the 1960s.

Figure 22. Per Capita Consumption of Petroleum Products in Alaska, 1960-2011



Note: The U.S. Energy Information Agency estimates of energy consumption include energy consumed during oil and gas extraction. Source: U.S. Energy Information Agency and authors' calculations.

Prices

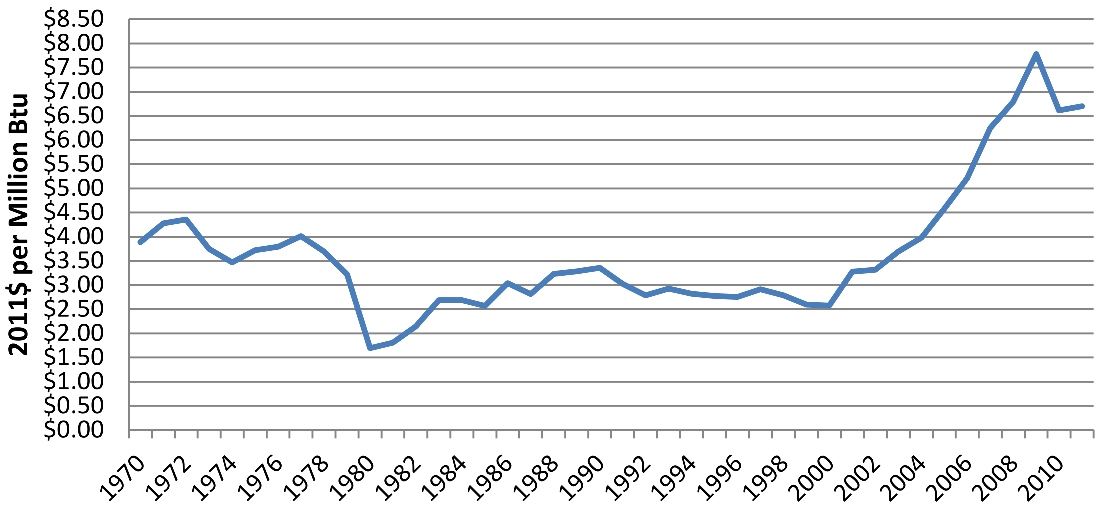
Natural gas and petroleum product prices are discussed in this section. Electricity prices are discussed in the Electric section of this report in pages 15 to 17.

After production of natural gas began in Cook Inlet, prices of that gas steadily decreased until about 2000, in real terms, (adjusted for the effects of inflation). After 2000, the downward trend reversed, and prices rapidly increased, almost doubling. In 2010, prices began to drop again.

Cook Inlet natural gas prices are loosely tied to Henry Hub prices (Figure 23).[26] It is important to note that the Cook Inlet natural gas market has no spot market; instead, prices are negotiated in contracts between a few natural gas producers and utilities. The Regulatory Commission of Alaska (RCA) reviews the contracts to ensure that the rates customers pay are fair and reasonable.

[26] Negotiated natural gas prices are often pegged to a basket of Lower 48 price indexes.

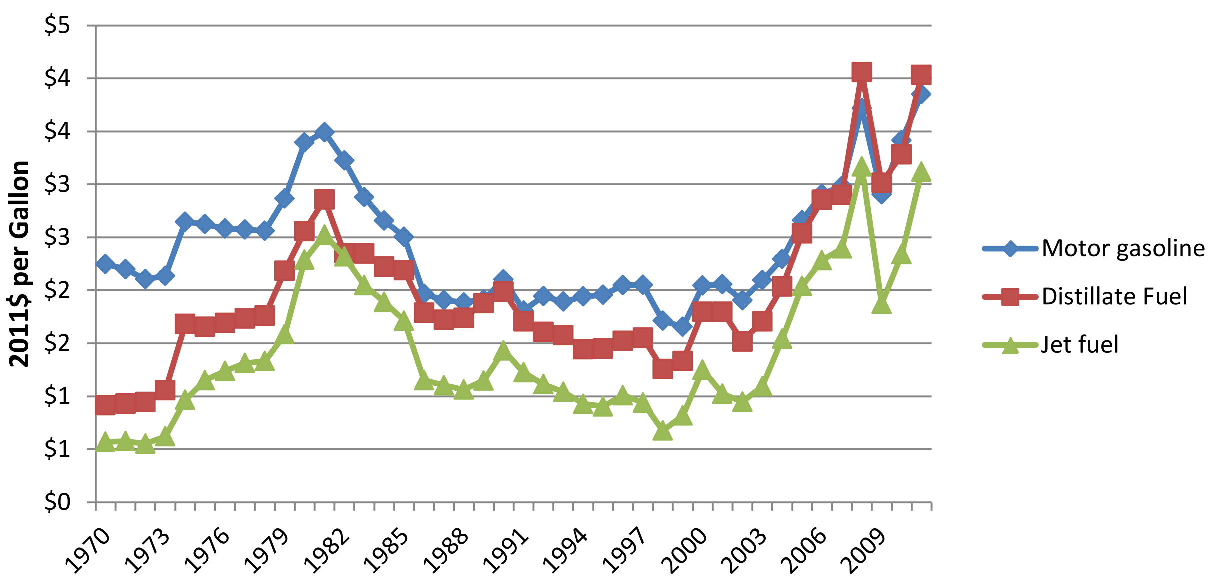
Figure 23. Average Price of Natural Gas for All Consumers in Alaska, 1970 – 2011, in $2011



Source: U.S. Energy Information Administration, State Energy Data System.
Note: Prices are weighted and exclude PCE assistance.

Prices of motor gasoline, distillate fuel, and jet fuel (again, adjusted for inflation) have also increased rapidly over the last decade—doubling for gasoline, more than doubling for distillate fuel oil, and tripling for jet fuel. After the 2008 recession, prices decreased significantly, but quickly increased to the pre-recession levels two years later (Figure 24).

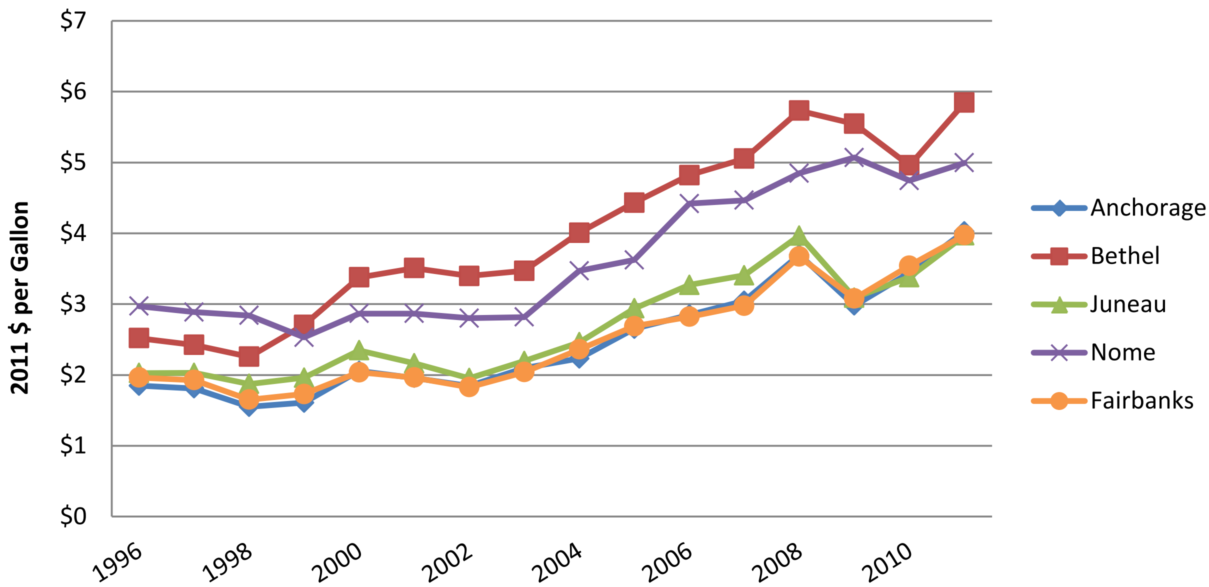
Figure 24. Average Price of Petroleum Products in Alaska, 1970-2011, $2011



Source: U.S. Energy Information Administration, State Energy Data System.

Though gasoline prices have risen sharply over the last decade, there are significant differences in the prices customers pay, depending on where they live; customers in urban areas or larger cities pay relatively lower prices. For example, in 2011 consumers in Bethel paid on average 50% more, and consumers in Nome on average 25% more, than consumers in Anchorage and Juneau (Figure 25).

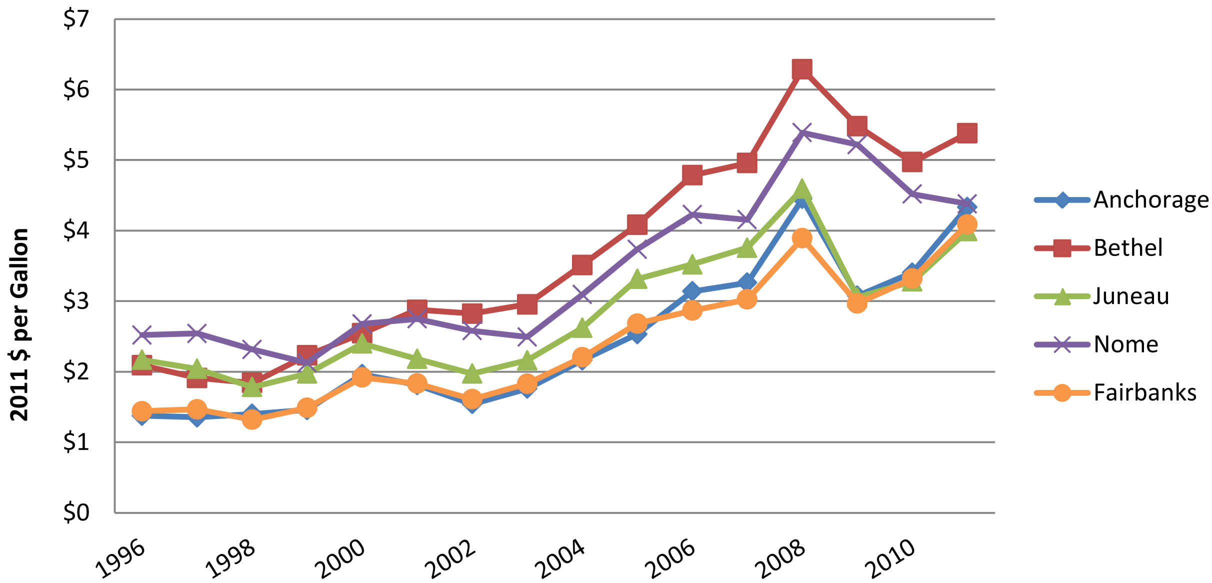
Figure 25. Price of a Gallon of Gasoline in Selected Alaska Communities, 1996-2011



Source: University of Alaska Fairbanks, Cooperative Extension Service, Alaska Food Cost Survey, and authors' calculations.

Most rural Alaska communities rely on heating oil for space heating. Similar to prices for gasoline, prices for heating oil have increased sharply since 1996. After the economic recession of 2008, heating oil prices decreased—but they are still much higher than they were a decade ago (Figure 26). These high prices put significant economic pressure on rural communities, and motivate strong interest in developing alternative sources of energy.

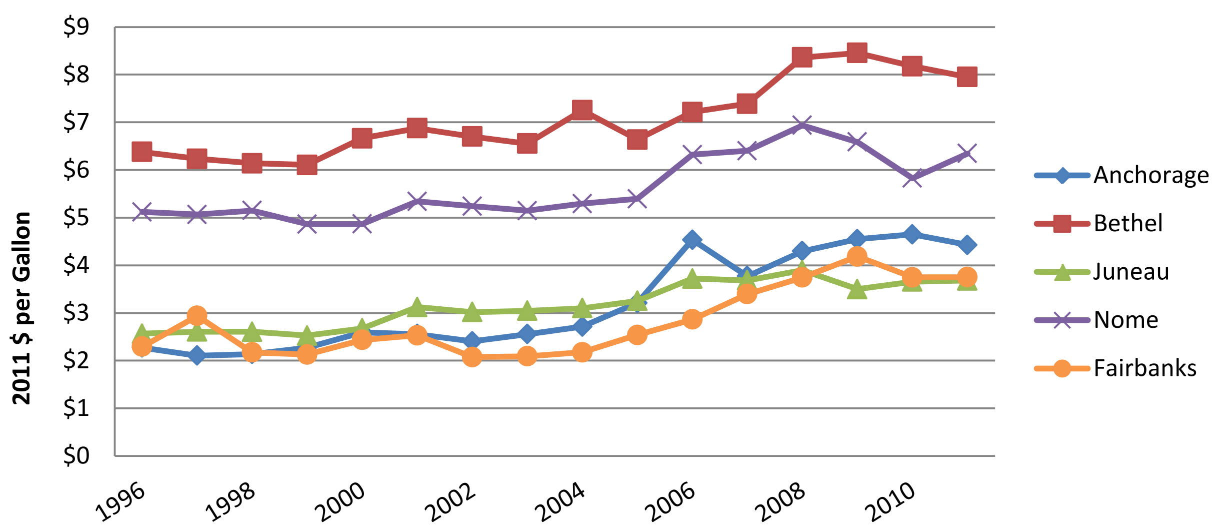
Figure 26. Average Price of Heating Oil in Selected Alaska Communities, 1996 – 2011



Source: University of Alaska Fairbanks, Cooperative Extension Service, Alaska Food Cost Survey, and authors' calculations.

Some rural communities also use propane gas for space heating and cooking. Although propane prices have also risen significantly over time, the increase has not been as sharp as that for heating oil (Figure 27).

Figure 27. Average Price of Propane in Selected Alaska Communities, 1996 – 2011



Source: University of Alaska Fairbanks, Cooperative Extension Service, Alaska Food Cost Survey and authors' calculations.

APPENDIX A. GLOSSARY OF TERMS[27]

Alaska Energy Authority (AEA): A public corporation of the state with a separate and independent legal existence with the mission to reduce the cost of energy in Alaska. http://www.akenergyauthority.org/

Auxiliary Generator: A generator at the electric plant site that provides power for the operation of the electrical generating equipment itself, including related demands such as plant lighting, during periods when the electric plant is not operating and power is unavailable from the grid. A black start generator used to start main central station generators is considered to be an auxiliary generator.

Backup (Standby) Generator: A generator that is used only for test purposes, or in the event of an emergency, such as a shortage of power needed to meet customer load requirements.

Barrel (bbl.): A unit of volume equal to 42 U.S. gallons.

Bituminous coal: A dense coal, usually black, sometimes dark brown, often with well-defined bands of bright and dull material, used primarily as fuel in steam-electric power generation, with substantial quantities also used for heat and power applications in manufacturing and to make coke. Bituminous coal is the most abundant coal in active U.S. mining regions. Its moisture content usually is less than 20%. The heat content of bituminous coal ranges from 21 to 30 million Btu per ton on a moist, mineral-matter-free basis. The heat content of bituminous coal consumed in the United States averages 24 million Btu per ton, on the as-received basis (i.e. containing both inherent moisture and mineral matter).

British Thermal Unit: The British thermal unit (BTU or Btu) is a traditional unit of energy equal to about 1.06 kilojoules. It is approximately the amount of energy needed to heat 1 pound (0.454 kg) of water1 °F (0.556 °C). It is used in the power, steam generation, heating and air conditioning industries. In North America, the term “Btu” is used to describe the heat value (energy content) of fuels, and also to describe the power of heating and cooling systems. When used as a unit of power, Btu per hour (Btu/h) is the correct unit, though this is often abbreviated to just “Btu”.

Capital Cost: The cost of field development, plant construction, and the equipment required for industry operations.

Climate Change: A term used to refer to all forms of climatic inconsistency, but especially to significant change from one prevailing climatic condition to another. In some cases, “climate change” has been used synonymously with the term “global warming”; scientists, however, tend to use the term in a wider sense inclusive of natural changes in climate, including climatic cooling.

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[27] U.S. Energy Information Administration glossary posted at www.eia.doe.gov/ plus multiple sources for additional Alaska-specific terms.

Coal: A readily combustible black or brownish-black rock whose composition, including inherent moisture, consists of more than 50% by weight and more than 70% by volume of carbonaceous material. It is formed from plant remains that have been compacted, hardened, chemically altered, and metamorphosed by heat and pressure over geologic time. It is estimated that Alaska holds about 15% of the world's coal resources, amounting to 170 billion identified short tons. Major coal provinces include Northern Alaska, the Nenana area, Cook Inlet – Matanuska Valley, the Alaska Peninsula, and in the Gulf of Alaska and the Bering River. Alaska coals exhibit low metallic trace elements, good ash-fusion characteristics, and low nitrogen content making them favorable for meeting environmental constraints on combustion in power plants.

Cogeneration system: A system using a common energy source to produce both electricity and thermal energy for other uses, resulting in increased fuel efficiency.

Combined Cycle: An electric generating technology in which electricity is produced from a gas turbine in combination with a steam turbine that uses otherwise lost heat exiting from the gas (combustion) turbine. The exiting heat is routed to a conventional boiler or to a heat recovery steam generator for utilization by a steam turbine in the production of electricity. This process increases the efficiency of the electric generating unit.

Combustion: Chemical oxidation accompanied by the generation of light and heat.

Commercial Sector: An energy-consuming sector that consists of service-providing facilities and equipment of businesses; Federal, State, and local governments; and other private and public organizations, such as religious, social, or fraternal groups. The commercial sector includes institutional living quarters. It also includes sewage treatment facilities. Common uses of energy associated with this sector include space heating, water heating, air conditioning, lighting, refrigeration, cooking, and running a wide variety of other equipment. Note: This sector includes generators that produce electricity and/or useful thermal output primarily to support the activities of the above-mentioned commercial establishments.

Consumer (energy): Any individually metered dwelling, building, establishment, or location.

Diesel #1: Also known as DF1 or Jet A. Diesel #1 is commonly used as a transportation and heating fuel throughout most of northern rural AK. Diesel #1 has a lower gel temperature than Diesel #2 which is sold as a transportation and heating fuel in warmer climates.

Diesel #2: Is commonly used throughout the US. In Alaska it is used for marine and highway diesel as well as heating fuel in warmer regions. Diesel #2 is preferred over #1 where it is warm enough as it has higher energy content and is typically cheaper.

Diesel Fuel: A fuel composed of distillates obtained in petroleum refining operation or blends of such distillates with residual oil used in motor vehicles. The boiling point and specific gravity are higher for diesel fuels than for gasoline.

Distillate Fuel Oil: A generic name for a refined petroleum product. It can refer to diesel, heating fuel or jet fuel.

Electricity: A form of energy characterized by the presence and motion of elementary charged particles generated by friction, induction, or chemical change.

Energy Balance: The difference between the total incoming and total outgoing energy. When the energy budget is balanced, the system neither gains nor loses energy.

Energy Information Agency (EIA): An independent agency within the U.S. Department of Energy that develops surveys, collects energy data, and analyzes and models energy issues. http://www.eia.doe.gov/

Exports: Shipments of goods from within the 50 States and the District of Columbia to U.S. possessions and territories or to foreign countries.

Fuel: Any material substance that can be consumed to supply heat, power, or mechanical energy. Included are petroleum, coal, and natural gas (the fossil fuels), and other consumable materials, such as uranium, biomass, and hydrogen.

Furnished without payment (power): The amount of electricity furnished by the electric utility without charge, such as a municipality under a franchise agreement or for public street and highway lighting. It does not include energy consumed by the utility.

Gallon: A volumetric measure equal to four quarts (231 cubic inches) used to measure fuel oil.

Gas: A non-solid, non-liquid combustible energy source that includes natural gas, coke-oven gas, blast-furnace gas, and refinery gas.

Grid: The layout of an electrical distribution system.

Gross Domestic Disposition: The total amount of energy available for sale in the domestic region, i.e. energy produced for sale in the domestic region in addition to energy imported for sale within the domestic region.

Gross Extraction: The total amount of fuel obtained or produced by a power production plant.

Gross Generation: The total amount of electric energy produced by generating units and measured at the generating terminal in kilowatt-hours (kWh) or megawatt-hours (MWh).

Heating Degree Days (HDD): A measure of how cold a location is over a period of time relative to a base temperature, most commonly specified as 65 degrees Fahrenheit. The measure is computed for each day by subtracting the average of the day's high and low temperatures from the base temperature (65 degrees), with negative values set equal to zero. Each day's heating degree days are summed to create a heating degree day measure for a specified reference period. Heating degree days are used in energy analysis as an indicator of space heating energy requirements or use.

Hydroelectric Power: The use of flowing water to produce electrical energy. Storage hydro, run-of-river hydro, wave, river in-stream, and tidal power are all forms of hydroelectric power.

Imports: Receipts of goods into the 50 States and the District of Columbia from U.S. possessions and territories or from foreign countries.

Industrial Sector: An energy-consuming sector that consists of all facilities and equipment used for producing, processing, or assembling goods. The industrial sector encompasses the following types of activity: manufacturing, agriculture, timber harvest and wood processing, fishing and fish processing, hunting, mining, oil and gas extraction, and construction. Overall energy use in this sector is largely for process heat and cooling and powering machinery, with lesser amounts used for facility heating, air conditioning, and lighting. Fossil fuels are also used as raw material inputs to manufactured products. Note: This sector includes generators that produce electricity and/or useful thermal output primarily to support the above-mentioned industrial activities.

Injections: Natural gas injected into storage reservoirs.

Installed Capacity: The maximum theoretical production output of a plant, based either on nameplate capacity or actual (practically determined) capacity.

Internal Combustion: The process where fuel is burned, or combusted, inside a cylinder or turbine, such as a diesel or jet engine, producing power directly as opposed to fuel burning externally, such as in a steam engine. The term internal combustion engine usually refers to an engine in which combustion is intermittent, such as the more familiar four-stroke and two-stroke piston engines. A second class of internal combustion engines uses continuous combustion: gas turbines, jet engines and most rocket engines.

Kilowatt-hour (kWh): A unit of energy equal to one kW applied for one hour; running a one kW hair dryer for one hour would dissipate one kWh of electrical energy as heat. Also, one kWh is equivalent to one thousand watt-hours.

Kilowatt (kW): One thousand watts of electricity (See Watt).

Load (Electric): Amount of electricity required to meet customer demand at any given time.

MCF: One thousand cubic feet.

Megawatt (MW): One million watts of electricity (See Watt).

Mining: An energy-consuming subsector of the industrial sector that consists of all facilities and equipment used to extract energy and mineral resources.

Nameplate Capacity: The maximum rated output of an electric power production unit (i.e. generator, prime mover) under specific conditions designated by the manufacturer. Capacity is usually indicated on a nameplate physically attached to the generator.

Natural Gas: Gas in place at the time that a reservoir was converted to use as an underground storage reservoir in contrast to injected gas volumes.

Net Capacity: The maximum load that an electrical apparatus (i.e. generating unit or station) can carry, not including use by the electrical apparatus.

Net Domestic Disposition: The total amount of energy produced in the domestic region that is available for sale within the domestic region, i.e. not including energy use by producers or energy exported for sale outside of the domestic region.

Net Extraction: The total amount of fuel obtained or produced by a power production plant, not including electric energy use by the plants.

Net Generation: The amount of gross generation not including the electrical energy consumed at the generating station(s) for station service or auxiliaries. Note: Electricity required for pumping at pumped-storage plants is regarded as electricity for station service and is deducted from gross generation.

Oil: A mixture of hydrocarbons usually existing in the liquid state in natural underground pools or reservoirs. Gas is often found in association with oil (See Petroleum).

O&M: Operations and maintenance

Other: The "other" category is defined as representing electricity consumers not elsewhere classified. This category includes public street and highway lighting service, public authority service to public authorities, railroad and railway service, and interdepartmental services.

Peak: The amount of electricity required to meet customer demand at its highest. The summer peak period begins June 1st and ends September 30th, and the winter peak period begins December 1st and ends March 31st.

Petroleum: A broadly defined class of liquid hydrocarbon mixtures. Included are crude oil, lease condensate, unfinished oils, refined products obtained from the processing of crude oil, and natural gas plant liquids. Note: Volumes of finished petroleum products include non-hydrocarbon compounds, such as additives and detergents, after they have been blended into the products.

Petroleum Products: Petroleum products are obtained from the processing of crude oil (including lease condensate), natural gas, and other hydrocarbon compounds. Petroleum products include unfinished oils, liquefied petroleum gases, pentanes plus, aviation gasoline, motor gasoline, naphtha-type jet fuel, kerosene-type jet fuel, kerosene, distillate fuel oil, residual fuel oil, petrochemical feedstocks, special naphthas, lubricants, waxes, petroleum coke, asphalt, road oil, still gas, and miscellaneous products

Plant: A term commonly used either as a synonym for an industrial establishment or a generating facility or to refer to a particular process within an establishment.

Power: The rate of producing, transferring, or using energy that is capable of doing work, most commonly associated with electricity. Power is measured in watts and often expressed in kilowatts (kW) or megawatts (MW).

Power Cost Equalization Program (PCE): Program administered by the Alaska Energy Authority under which participating utilities receive state funding to reduce the charge to consumers in rural areas where prices can be three to five times higher than prices in urban areas.

Prime Mover: The engine, turbine, water wheel, or similar machine that drives an electric generator; or, for reporting purposes, a device that converts energy to electricity directly (e.g. photovoltaic solar and fuel cells).

Prime Mover Code	Prime Mover Description (U.S. EIA)
ST………..	Steam Turbine, including nuclear, geothermal and solar steam (does not include combined cycle)
GT………..	Combustion (Gas) Turbine (includes jet engine design)
IC………..	Internal Combustion Engine (diesel, piston)
CA………..	Combined Cycle Steam Part
CT………..	Combined Cycle Combustion Turbine Part
CS………..	Combined Cycle Single Shaft (combustion turbine and steam turbine share a single generator)
CC………..	Combined Cycle - Total Unit

HY……….. Hydraulic Turbine (includes turbines associated with delivery of water by pipeline)
PS……….. Hydraulic Turbine – Reversible (pumped storage)
BT……….. Turbines used in a binary cycle such as geothermal
PV……….. Photovoltaic
WT……….. Wind Turbine
CE……….. Compressed Air Energy Storage
FC……….. Fuel Cell
OT……….. Other
NA……….. Unknown at this time (use only for plants/generators in planning stage)

Pro Forma: A Latin term means "for the sake of form," it describes a method of calculating financial results in order to emphasize either current or projected figures.

Purchased Capacity: The amount of energy and capacity available for purchase from outside the system.

Railbelt: The portion of Alaska that is near the Alaska Railroad, generally including Fairbanks, Anchorage, the communities between these two cities, and the Kenai Peninsula.

Refinery: An installation that manufactures finished petroleum products from crude oil, unfinished oils, natural gas liquids, other hydrocarbons, and oxygenates.

Re-injected: The forcing of gas under pressure into an oil reservoir in an attempt to increase recovery.

Renewable Energy Fund (REF): Program established by the Alaska State Legislature and administered by the Alaska Energy Authority to competitively award grants to qualified applicants for renewable energy projects.

Renewable Energy Resources: Energy resources that are naturally replenishing but flow-limited. They are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. Renewable energy resources include biomass, hydro, geothermal, solar, wind, ocean thermal, wave action, and tidal action.

Residential Sector: An energy-consuming sector that consists of living quarters for private households. Common uses of energy associated with this sector include space heating, water heating, air conditioning, lighting, refrigeration, cooking, and running a variety of other appliances. The residential sector excludes institutional living quarters.

Residual Fuel Oil: A general classification for the heavier oils that remain after the distillate fuel oils and lighter hydrocarbons are distilled away in refinery operations. It is used in steam-powered vessels in government service and inshore power plants, and can be issued for the production of electric power, space heating, vessel bunkering, and various industrial purposes.

Revenue (Electricity): The total amount of money received by an entity from sales of its products and/or services; gains from the sales or exchanges of assets, interest, and dividends earned on investments; and other increases in the owner's equity, except those arising from capital adjustments.

Short Ton: A unit of weight equal to 2,000 pounds.

Space Heating: The use of energy to generate heat for warmth in housing units using space-heating equipment. It does not include the use of energy to operate appliances (such as lights, televisions, and refrigerators) that give off heat as a byproduct.

Steam: Water in vapor form; used as the working fluid in steam turbines and some heating systems.

Transmission System (Electric): An interconnected group of electric transmission lines and associated equipment for moving or transferring electric energy in bulk between points of supply and points at which it is transformed for delivery over the distribution system lines to consumers, or is delivered to other electric systems.

Tonne (Ton): A unit of mass equal to 1,000 kilograms or 2,204.6 pounds, also known as a metric ton.

Total Disposition: The total amount of sold or transferred energy.

Turbine: A machine for generating rotary mechanical power from the energy of a moving force (such as water, hot gas, wind, or steam). Turbines convert the kinetic energy to mechanical energy through the principles of impulse and reaction, or a mixture of the two.

U.S. Department of Energy (DOE): Federal department that oversees programs, such as Wind Powering America, with the mission to advance national, economic, and energy security; promote innovation; and ensure environmental responsibility. http://www.energy.gov/

Watt (Electric): The electrical unit of power. The rate of energy transfer equivalent to one ampere of electric current flowing under a pressure of one volt at unity power factor.

Watt (Thermal): A unit of power in the metric system, expressed in terms of energy per second, equal to the work done at a rate of one joule per second.

Watt hour (Wh): The electrical energy unit of measure equal to one watt of power supplied to, or taken from, an electric circuit steadily for one hour.

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APPENDIX C. RCA UTILITY REGULATORY CODES SUMMARY

Regulatory Code	Summary Description	Simplified Category (ISER)
Commission Public Interest Exemption from 42.05.221 (42.05.711(d))	If it is found in the public interest, a utility may be exempted by the Regulatory Commission of Alaska from all regulation.	Not regulated
Commission Public Interest Exemption from all except certification (42.05.711(d))	If it is found in the public interest, a utility may be exempted from any of the following; installing individual meters for mobile homes and individual units in multi-unit buildings, providing efficient, continuous service, not having differences in service offered between localities or persons, filing tariff rates with the commission and pubic in a timely manner before changing rates, maintaining continuing property records in an instate office, being subject to the commission setting rates or the devaluation of property value, the requirement of having separate accounts from any other business, the requirement of maintaining instate account books and records and ensuring the commission can access them upon request. A utility may also be exempted from the provision which allows the commission to investigate its management practices. A utility may be exempted from paying a regulatory charge not more than 0.7% of annual revenue, and from the requirement to need to apply to discontinue services	Not regulated
Commission Public Interest Exemption from rate regulation but not service (42.05.711(d))	In this case the utility would be required to provide reasonably continuous service, but would not be subject to the commission potentially fixing rates.	Regulated, rate exemption
Cooperative passed 42.05.712 election (42.05.711(h))	A cooperative may elect to be exempt from regulation provided at least 15 percent of subscribers return ballots, subscribers receive 60 day notice of the election which uses impartial language, a list of all subscribers is provided to all subscribers who request one, the ballot uses language used in 42.05.712(g). The election may be called either by the utility's board of directors, or by a petition signed by 3 percent of subscribers, or members in excess of 5,000.	Not regulated

Regulatory Code	Summary Description	Simplified Category (ISER)
Customer election to terminate exemption from regulation (42.05.712(h))	An election to terminate exemption from regulation may be held in the same manner as an election to exempt a utility from regulation.	Regulated
Economically Regulated, no exemption (42.05 & 42.06)	A utility regulated under 42.05 is subject to the following; installing individual meters for mobile homes and individual units in multi-unit buildings, providing efficient, continuous service, providing the same service level to all localities and persons, filing tariff rates with the commission and pubic in a timely manner before changing rates, maintaining continuous property records in an instate office, being subject to the commission setting rates or the devaluation of property value, the requirement of having separate accounts from any other business, the requirement of maintaining instate account books and records and ensuring the commission can access them upon request. A utility may also be subject to a commission investigation of its management practices. A regulated utility also is required to pay the commission an annual regulatory charge which shall not exceed 0.7% of revenue, and to apply to the commission to discontinue any services.	Regulated
Electric/Telephone less than $50k revenues (42.05.711(e))	If an electric of telephone utility grosses less than $50k annually it is not subject to regulation by the commission.	Not regulated
Political Subdivision of the State (42.05.711(b))	Unless competing directly with another utility, utilities run by a political subdivision of the state is exempted from all regulation listed under the *Commission Public Interest Exemption from 42.05.221 (42.05.711(d))*, except for the requirement to pay a regulatory fee, and to ask the commission for permission to discontinue services.	Not regulated

Regulatory Code	Summary Description	Simplified Category (ISER)
Electric/Telephone with less than $500k revenues and passed 42.05.712 election (42.05.711(f))	If a utility with less than $500,000 in annual revenue passes an election under 42.05.712, the utility is exempt from all regulation with the exception of the following regulations. The utility is still required to obtain certification by the Regulatory Commission before providing services, and to pay an annual regulatory fee which shall not exceed 0.7% of annual revenue. Any such utility is also required to apply with the commission in order to discontinue service.	Not regulated
Political Subdivision of the State Competing w/ another utility (42.05.711(b)(2))	A political subdivision of the state competing with another utility is subject to all aspects of 42.05 including; installing individual meters for mobile homes and individual units in multi-unit buildings, providing efficient, continuous service, providing the same service level to all localities and persons, filing tariff rates with the commission and pubic in a timely manner before changing rates, maintaining continuous property records in an instate office, being subject to the commission setting rates or the devaluation of property value, the requirement of having separate accounts from any other business, the requirement of maintaining instate account books and records and ensuring the commission can access them upon request. A utility may also be subject to a commission investigation of its management practices. A regulated utility also is required to pay the commission an annual regulatory charge which shall not exceed 0.7% of revenue, and to apply to the commission to discontinue any services.	Regulated

APPENDIX D. DATA SOURCES FOR ELECTRIC ENERGY STATISTICS

Information on utility electricity capacity, generation, and other characteristics was gathered from reports filed with the U.S. Department of Energy's Energy Information Administration (EIA). For the preliminary report (dated November 2012), the Alaska Energy Authority directly collected copies of the EIA survey forms 860, 861, and 923 from a select number of utilities. Now that final EIA data files are available, we conducted a careful cross-check between preliminary data gathered by AEA and these final published data files. Additionally, we used data collected by the Alaska Energy Authority through the Power Cost Equalization program and a limited number of direct contacts with electric power producers. We also conducted a careful cross-check of the PCE program data. This report and accompanying tables present all final data.

All producers of electricity with installed capacity greater than one megawatt are required by law to report their operations to the federal government. Most utilities in Alaska fall below that installed capacity threshold.[28] Information for these smaller utilities came primarily from the PCE program.

In many parts of Alaska there is no utility-produced electricity available, and any activity using electricity requires self-generation. The number of such small installations (e.g. Point Baker, Port Protection, Telida) is quite large, though relatively small in terms of installed capacity and net generation. It would be a very expensive task to identify and contact individually each self-generator. As a result, total statewide estimates do not include self-generators and are therefore incomplete. In addition to small communities, there are industrial and military self-generators in Alaska, but few public data are available for these producers. Hence, data for industrial and military self-generators is included for those who report publically available data to the Energy Information Administration. The information presented in this report includes primarily certified public utilities for which public data are available.

It is important to note that this publication is meant to serve as a general reference and broad overview of electric power in Alaska. Because data come from a variety of sources that have imperfections, readers may find inconsistencies across tables. For example, Table 2.5b shows average rate per kilowatt-hour as calculated using reported revenue, sales, and customers, and Table 2.5c shows an imputed weighted average rate per kilowatt-hour as reported monthly by the utility to the PCE program. These two rates are sometimes slightly different.[29] Data in different tables may include different cases, or may be guided by slightly different concept definitions, depending on the data source. However, the authors

[28] Data for approximately 83% of utilities is from the PCE database. (For utilities that manage many isolated systems, such as the Alaska Village Electric Cooperative (AVEC) and Alaska Power and Telephone Company (AP&T), each isolated system is counted as a "utility.") But as this report shows, most generation and electricity and fuel use are in the urban centers, which are served by larger utilities that do report to EIA. Utilities such as AVEC and AP&T also report to EIA, though for some variables only aggregated data is reported. In those cases, PCE data provides community level information.

[29] This is only applicable to PCE communities. Communities for which the data source is EIA report the same calculated rate as in Table 2.5b.

believe the data presented provide a reasonable and valuable overview of electric power and energy across Alaska.

Energy Information Administration Surveys

The primary data source for the electric power statistics are the U.S. Department of Energy (DOE), Energy Information Administration (EIA) and the Alaska Energy Authority, Power Cost Equalization program data. Every utility and industrial (including military) electrical generating facility with a capacity greater than one megawatt is required to report their operating characteristics to the EIA annually, and in some instances, monthly. This information is compiled by the EIA and is available for every generating facility on their website: (http://www.eia.doe.gov/). The forms of interest to compile this publication are the EIA 860, 861 and 923. These are reporting forms for capacity, generation, sales and revenues.

Following the methodology established in 2010, we continue to use the EIA database with some modifications in order to publish this report more timely. Most utilities and industrial facilities are required by law to report to the federal government each year on their activities using the EIA forms; this information is then made available on the EIA website. This process causes a delay; the lag time for the availability of the federal data is approximately two years. However, it is redundant to collect the same information through a second questionnaire. Respondents are required by law to report to the EIA and this should make the response rate high. In order to expedite this process, the Alaska Energy Authority collected copies of the CY2011 EIA forms from a selective group of utilities, and created a reduced data set. After EIA final data files are published, a cross reference review of the data is done and a final report is produced.

Nonetheless, using EIA data poses some challenges because not all information reported in this publication is collected via the EIA forms. First, the smallest utilities with installed capacity less than one megawatt are not required to report to EIA and are not included in the EIA database. Second, not all Alaska generating facilities report as required by law.

These forms collect data at different levels of aggregation; for example some at the utility level only, while other data may be at the facility and/or generator level. This sometime causes differences in the underlying definition of the data making reconciliation of the information in the datasets within forms, and across the different forms sometimes difficult.

Alaska Energy Authority - Power Cost Equalization Program Data

To supplement missing data we used the database for the annual Power Cost Equalization Reports by the Alaska Energy Authority (AEA). Also, as needed, the Alaska Energy Authority and ISER supplemented these data sources by contacting utilities directly.

These data sources allowed us to collect information for almost all the utilities in the state without incurring the considerable cost of conducting a complete census of all producers. A few of the smallest utilities that were not either in the EIA database or the Power Cost Equalization database did not provide information for this report.

The 2011 Power Cost Equalization data provided data on the generation and sales (residential and commercial) of all utilities participating in the Power Cost Equalization program, including a breakdown by community for those utilities that operate in multiple communities, such as Alaska Village Electric Cooperative (AVEC) and Alaska Power and Telephone (AP&T). The EIA data for these utilities was in some cases reported only as a total across all communities, and we used these as control totals.

The PCE database contains information collected through AEA's PCE Utility Monthly Report which PCE participants must file. Utilities also report to the RCA annually for fuel cost adjustments. Reporting to both entities should be consistent; however, discrepancies are not unusual. These discrepancies may be due to high turnover in small utilities, poor reporting and limited staff to verify the utilities' self-reported data.

In addition, there are data (energy loss, use by facility and energy provided without charges) that is not included in the PCE report. Because of this, the values found in table 2.2a may not reflect a summation of all PCE communities as reported in the PCE report. Rather they reflect what was reported to the EIA directly as prepared by the utility itself. This same methodology was implemented in the sales and revenues tables (2.4a) when deemed appropriate. The intent is to create as comprehensive of a table as possible.

The summary information in the historical tables was calculated from the same sources mentioned above. Data from these sources was calculated and re-formatted where appropriate and consolidated into master data files from which all the tables in this report where built.
Inevitably the use of multiple data sources introduces some inconsistencies in reporting. Notwithstanding, we believe that the *Alaska Electric Power Statistics Preliminary* 2011 update report provides useful information on the state of electric power generation in Alaska.

APPENDIX E. REPORTING REQUIREMENTS

Energy Information Administration

Every utility facility with a capacity greater than one megawatt (MW) is required to report their operating characteristics to the US Department of Energy (DOE), Energy Information Administration (EIA) annually, and in some instances, monthly. This information is compiled by the EIA and is available for every generating facility on their website (http://www.eia.doe.gov/). Specific reporting requirements are determined by the Department of Energy but collected, assembled, and evaluated by the EIA according to the Federal Energy Administration Act of 1974. We obtained data for year 2011. Three EIA forms were used in this report:

- **EIA-860 Annual Electric Generator Report**. This report contains information on capacity and types of fuel used. It is completed by all existing plants and proposed (5-year plans) plants that: 1) have a total generator nameplate capacity (sum for all generators at a single site) of one megawatt or greater; and 2) where the plant is connected to the local or regional electric power grid and has the ability to draw power from the grid or deliver power to the grid.

- **EIA -860M Monthly Update to the Annual Electric Generator Report**. This report contains monthly updates to the EIA-860. It is completed by those who also completed EIA-860 and additionally indicated a proposed change in generator production within one month of the report period. The proposed change may be due to: 1) a new generator scheduled to start commercial operation; 2) an existing generator scheduled to retire from service; or 3) an existing generator with a proposed modification scheduled.

- **EIA-861 Annual Electric Power Industry Report**. This report contains information on peak production, net generation, sales, and revenues. It is completed by electric industry distributors including: electric utilities, wholesale power marketers (registered with the Federal Energy Regulatory Commission), energy service providers (registered with the Regulatory Commission of Alaska), and electric power producers.

- **EIA-923 Power Plant Operations Report**. This report contains information on electric power generation, fuel consumption, fossil fuel stocks, and fossil fuel cost and quality. It is completed by all electric power plants that: 1) have a total generator nameplate capacity (sum for generators at a single site) of one megawatt or greater; and 2) where the plant is connected to the local or regional electric power grid and has the ability to draw power from the grid or deliver power to the grid.

Power Cost Equalization Program and Regulatory Commission of Alaska

Participants of the Power Cost Equalization (PCE) program report to the Regulatory Commission of Alaska (RCA) for fuel and non-fuel cost adjustments to their rates. The RCA has authority to maintain accounts and records of public utilities that fall under its jurisdiction, under Alaska Statute 42.05.451. This responsibility allows the Regulatory Commission of Alaska to obtain information from regulated utilities. Additionally, all utilities that serve ten or more customers must obtain an operating certificate, which describes the authorized service area and scope of operations of the utility. The RCA will issue a certificate when it finds the utility to be fit, willing, and able to provide the service. The RCA maintains a list of both regulated and unregulated certified utilities. Utilities report annually to the RCA, and file a PCE Utility Monthly Report with AEA.