



# 2024 Alaska Electricity Trends Report

An Analysis of Electricity in Alaska, Data Years 2011-2021

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# Chapter 1.

## Introduction

An Analysis of Electricity in Alaska, Data Years 2011-2021

### Welcome

This report summarizes electricity data gathered from federal, state, and utility sources. It provides an overview of electricity capacity, generation, consumption, and price trends from 2011 to 2021. A comprehensive report highlighting these trends has not been produced for the state of Alaska since 2013's *Alaska Energy Statistics Report*.

This web book is designed as 'best available' document for the 2011-2021 energy trends data and reports. This website will be updated when updates to the underlying 2011-2021 data or fixes become available. Future year trends reports will be tackled in a different context and reporting structure.

Please explore the data using the chapter navigation links in the left sidebar and the section navigation links in the right sidebar.

### 1.1. How to Cite

#### APA:

Alaska Center for Energy and Power. (2024). Alaska Energy Trends Report. Retrieved August 06, 2024, from <https://acep-uaf.github.io/aetr-web-book-2024/report2024.pdf>

#### BibLaTeX:

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@online{aetr_web_book_2024,
  author = {{Alaska Center for Energy and Power}},
  title = {{2024 Alaska Electricity Trends Report}},
  year = 2024,
  url = {https://acep-uaf.github.io/aetr-web-book-2024/},
  urldate = {2024-08-01}
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## **Executive Summary**

The objective of this work is to provide regulators, legislators, and other energy stakeholders with a holistic look at recent trends in electrical generation. The first impetus for this report is a lack of combined reporting on electricity generation across the state that extends to federally and non-federally regulated electric utilities (most of Alaska's electric utilities do not meet the minimum threshold for federal reporting requirements). The second impetus for this report is to aid in decision-making processes surrounding Alaska's energy future.

With uncertainty in natural gas sources on the Railbelt, technological advancements in generation technology, and improvements in the affordability of technologies, understanding trends in the state's capacity, generation, consumption, and prices is vital to more informed decision-making.

In this report, we present data collected from federal, state, and local sources supplemented by correspondence with utilities. We show trends for capacity, generation, consumption, and prices. The capacity and generation trends include data from 2011 to 2021, and the consumption and prices trends are data limited to 2019. More information on sources and methods are provided in the subsequent sections throughout the report. This report uses data visualizations as the primary mode for presenting the trends. To accommodate this presentation style, we present trends as simplified regions of the state as opposed to the Alaska Energy Authority energy regions.

We emphasize that this report is designed to provide factual information to the best of our ability without providing recommendations or in-depth analysis. However, context is provided for more impactful trends.

## **Key Takeaways**

### **1.1.1. Capacity**

- Generation capacity on average increased across all of Alaska from 2011 to 2021.
- The state saw large increases in renewable energy capacity, storage, and on-demand peaking units.

### **1.1.2. Generation**

- Net generation has remained relatively stable
- The Coastal region generated more power from wind and hydro, but less from oil in 2021 than in 2011.
- The Railbelt region generated more power from wind, hydro, coal, and solar, but less from oil and gas in 2021 than in 2011.
- The Rural Remote region generated more power from wind and solar, but less from oil and hydro in 2021 than in 2011.
- We have seen significant increases in the usage of utility-scale battery storage.

### **1.1.3. Consumption**

- Electricity consumption overall has fallen for all customer classes, with residential customers seeing the most reductions.
- The number of customer accounts have continued to increase throughout the state.
- Per capita consumption for the residential sector is highest in the Coastal region and lowest in the Rural Remote region.

#### **1.1.4. Prices**

- Residential electricity rates increased on average across Alaska after adjusting for inflation, the PCE subsidy, and population weighting.
- The region that experienced the least residential rate increase was the Coastal region with a 6% increase.
- The region experiencing the highest residential rate increase was the Railbelt with a 26% increase.
- Commercial and Other customers in the Coastal and Rural Remote regions saw rate decreases where Commercial customers in the Railbelt region saw price increases of about 15%.
- PCE subsidies continue to dampen residential prices in the Coastal and Rural Remote regions.

## **Chapter 2.**

### **Methods**

Data Sources, Region Definitions, and Description of the PCE Program

#### **2.1. Data Sources**

The data in this report was collected from a variety of sources that are listed below. Most electric utilities throughout the state are not required to submit annual reports to the federal government due to their size and/or number of customers. Therefore, our data sources encompass federal, state, commercial, and local filings as well as direct communications with utilities and state program managers. Each section of the report pulls data from a variety of these sources. The data was downloaded directly from the original sources and concatenated to develop a dataset for this report. In some cases, a single observation is derived from multiple sources due to reporting limitations.

Below are relevant sources of data for the report.

##### **2.1.1. Federal**

- Energy Information Administration
  - [EIA-860](#)
  - [EIA-861](#)
  - [EIA-923](#)
- Federal Energy Regulatory Commission
  - [Form 1](#)

##### **2.1.2. State**

- Alaska Energy Authority
  - [Power Cost Equalization Program Utility Monthly Reports](#)
- Regulatory Authority of Alaska
  - [Annual filings](#)

##### **2.1.3. Direct Communications**

- Alaska Energy Authority
  - Hydro/Wind Program Managers
  - Village and Powerhouse Assessments
- Electric Utilities

#### **2.1.4. Commercial Sources**

- Intelligent Energy Systems

#### **2.1.5. Compilation**

Neil McMahon, first at AEA and then at DOWL, an Alaska engineering firm, did the preliminary compilation of data and developed the Excel workbooks that support this report. This step involved careful cross-referencing of assets between the various data sources and error checking by domain experts. At this point, aggregate calculations were created to match the tables found in previous *Alaska Energy Statistics Reports*. Data in this report were derived from those workbooks exported to CSV files; the original workbooks are available via a GitHub repo [ak-energy-statistics-2011\\_2021](#).

### **2.2. Regional Summaries**

For the purpose of energy planning, AEA has defined [eleven energy regions](#) for the State of Alaska. Previous versions of the *Alaska Electric Energy Statistics* reports presented data summarized by those regions. In order to provide visualizations that are easier to understand, we have condensed these eleven regions into three major energy regions: Coastal, Railbelt, and Rural Remote. Figure 2.1 shows the diagrammatic relationship between these two classification systems. Figure 2.2 and Figure 2.3 displays this relationship cartographically.

We note that the Coastal and Rural Remote regions include mixtures of Power Cost Equalization (PCE) and non-PCE eligible communities. The Coastal region includes Copper River/Chugach and incorporates all communities served by Copper Valley Electric Association. PCE communities are largely dependent on diesel generation.

### **2.3. Power Cost Equalization (PCE)**

Alaska is famous for wide expanses of rugged terrain. Towns are often extremely distant from one another, or are separated by inaccessible mountains and glaciers. The utility landscape of Alaska resembles a sea of islands, very different from the interconnected grids of the contiguous United States.

In total, Alaska contains over 100 separate utilities, many of which serve a single, small community. Most rely on diesel generators connected to huge fuel tanks, which receive a barge shipment of fuel in the summer that must last through the winter. If the town runs out of fuel during winter months, additional fuel has to be flown in at extreme expense. Predictably, electricity in these remote towns is extremely expensive.

Some rural towns pay 3 to 5 times the rates of urban Alaska. Urban Alaska has greatly benefited from large state-subsidized energy projects, such as the Bradley Lake Hydroelectric Project, the Four Dam Pool Projects, and the Alaska Intertie. In an effort to confer similar benefits to rural Alaska, the state of Alaska developed the Power Cost Equalization Program (PCE).

The PCE program reimburses rural utilities for credits that have been provided to eligible customers. Eligibility is limited to residential customers and community facilities. The subsidy applies to the first 750 kWh per month of residential consumption. Community facilities are subsidized up to the first 70 kWh per month per resident. The program is administered by the Regulatory Commission of Alaska (RCA) and the Alaska Energy Authority (AEA).

Please visit the Alaska Energy Authority [PCE webpage](#) for more information about the Power Cost Equalization program.

Figure 2.1.: Schematic Relationship between Energy Regions as defined by AEA and ACEP

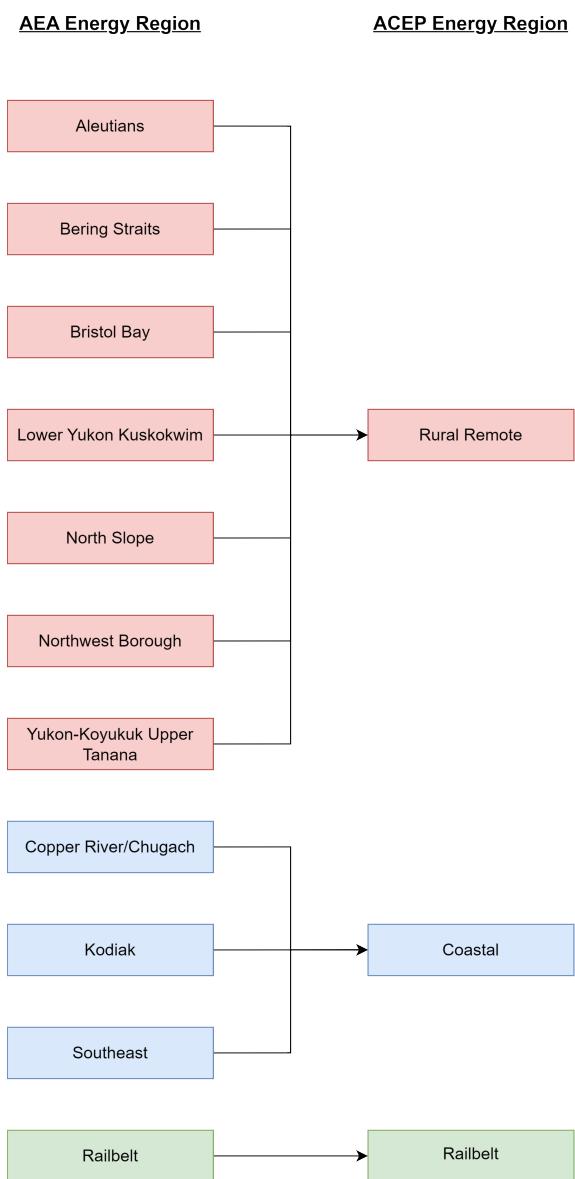


Figure 2.2.: AEA Regions Map

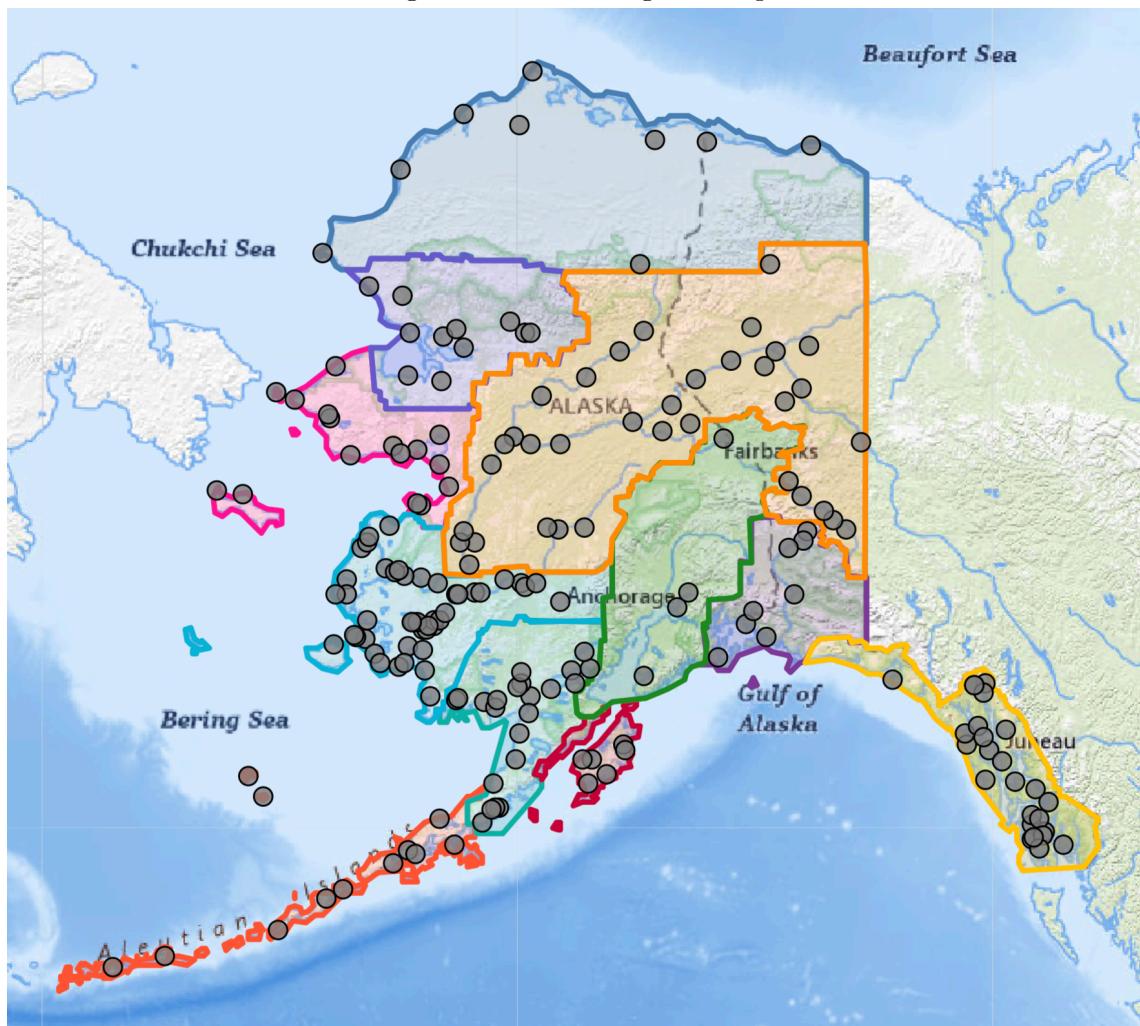
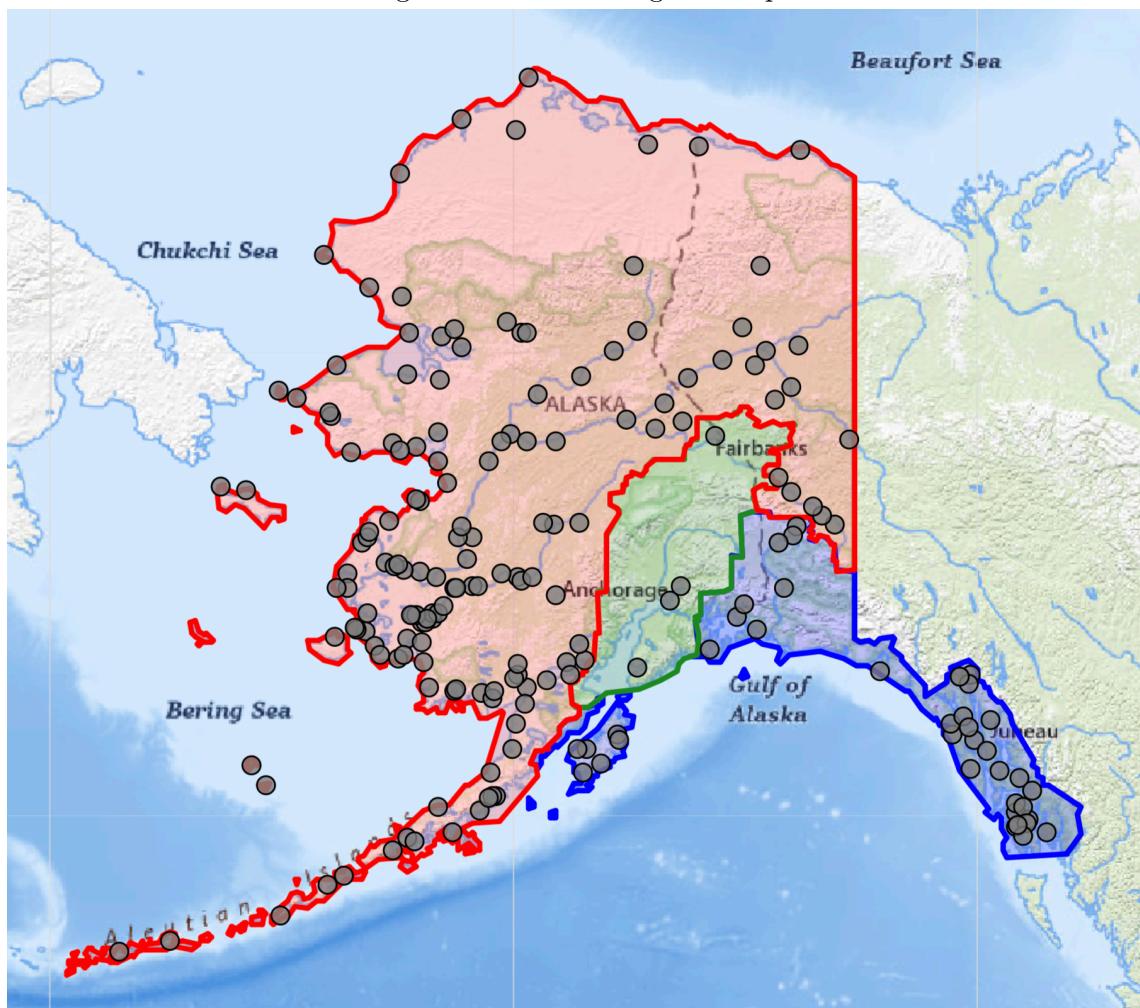


Figure 2.3.: ACEP Regions Map



## **2.4. Feedback Regarding Potential Errors**

Since these data come from multiple sources, there is potential for errors in its compilation. An integral part of this effort is the creation of a high quality dataset that can constructively contribute to future work. Therefore, any discrepancies or noted errors should be reported using email or GitHub issues via the links in the right hand navigation menu of every page. Alternatively, direct contact information for members of the DCM team is listed in Section [D.2](#).

## Chapter 3.

### Installed Capacity

Total Installed Capacity by Certified Utilities in Alaska, 2011-2021

#### 3.1. General Overview

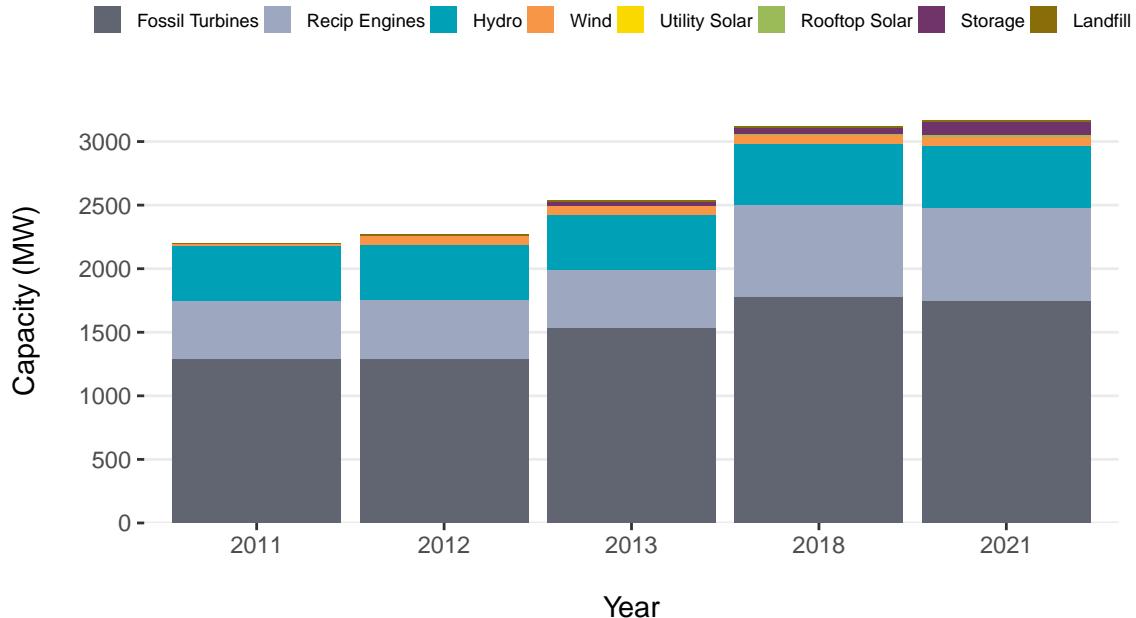
Generation capacity represents the maximum amount of electricity that can be generated at any given time dependent on certain conditions. The combination of generation sources is often referred to as the capacity mix. Changes in the capacity mix over time reflect decisions to build and retire generators. These decisions are a result of shifting costs, technological innovations, the normal aging of the generation fleet, and/or stakeholder policies. Due to data limitations, we show capacity levels for calendar years 2011-2013, 2018, and 2021. While we cannot observe year-to-year trends, there are enough years of data to visualize capacity trends from 2011 to 2021.

We begin this section by showcasing the increases in total capacity across the state. In 2011, it is estimated that the total statewide electricity generation capacity was 2,197 MW. We estimate that this has increased to approximately 3,163 MW in 2021 based on best available data. This represents an increase of 966 MW, or 44 percent increase since 2011. To illustrate this example, we show a stacked area chart in Figure 3.1 that showcases growth over time for various technologies.<sup>1</sup>

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<sup>1</sup>The EIA-923 data used for net generation was supplemented with FERC Form No. 1 data to account for missing statistics for the Southcentral Power Project. Please visit [the patch notes to learn more about our methodology and findings](#).

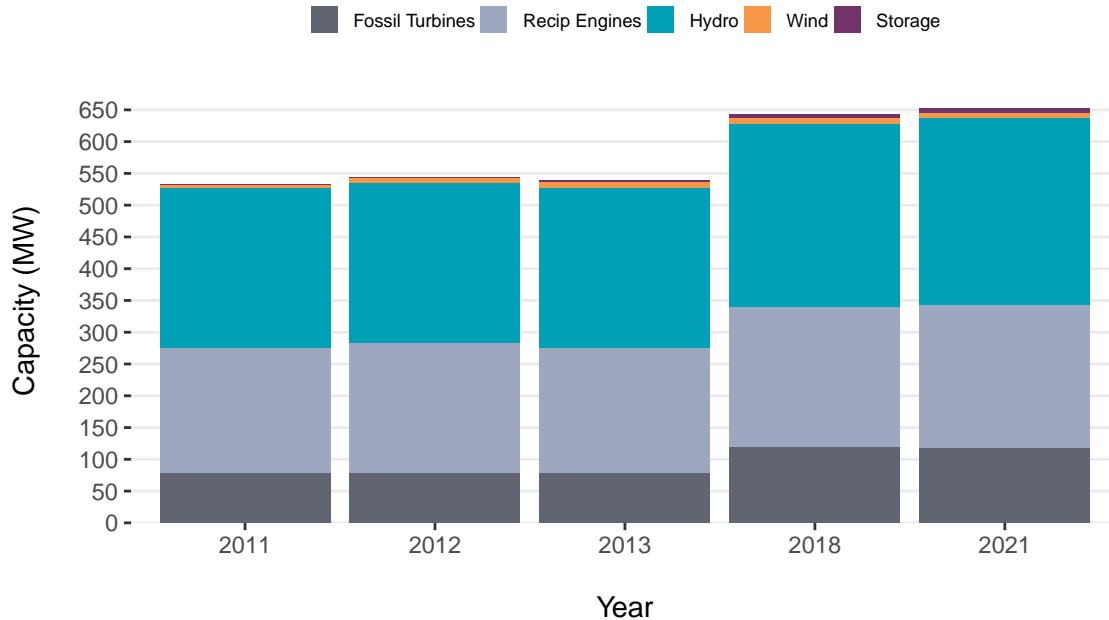
Figure 3.1.: Capacity Changes, Statewide



### 3.2. Coastal

For the coastal region, we observe a 121.2 MW increase in generation capacity (an increase of approximately 22.8 percent) between 2011 and 2021. Figure 3.2 shows the change in total installed capacity for each prime mover in the coastal region. This region saw additions of 38.9 MW of fossil turbines, and 28.9 MW of reciprocating engines. The remaining increases were renewable and storage capacity which we look at in more depth in Figure 3.3.

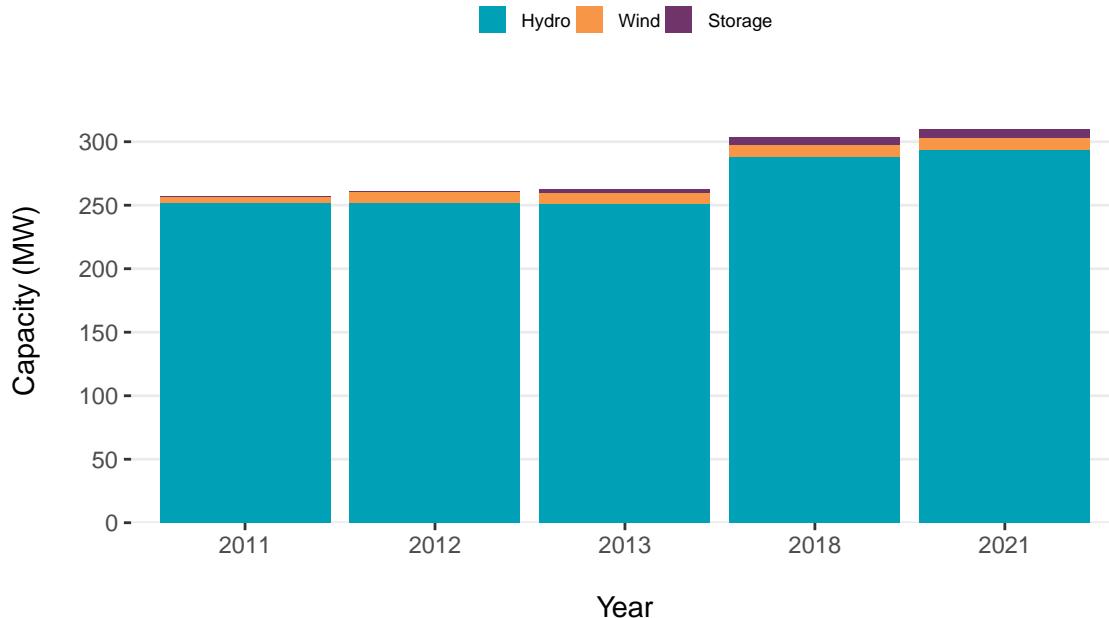
Figure 3.2.: Coastal Region Capacity



## Coastal Renewables

Across the 53.45 MW of added renewable and storage capacity , hydropower accounted for the bulk of the capacity additions with 41.95 MW. Storage capacity increased by 7 MW and wind generation capacity increased by 4.5 MW. Between 2013 and 2018, significant hydropower additions were made in the Southeast (19.4 MW), Kodiak (11.3 MW), and the Copper-River/Chugach (6.5 MW) AEA energy regions.

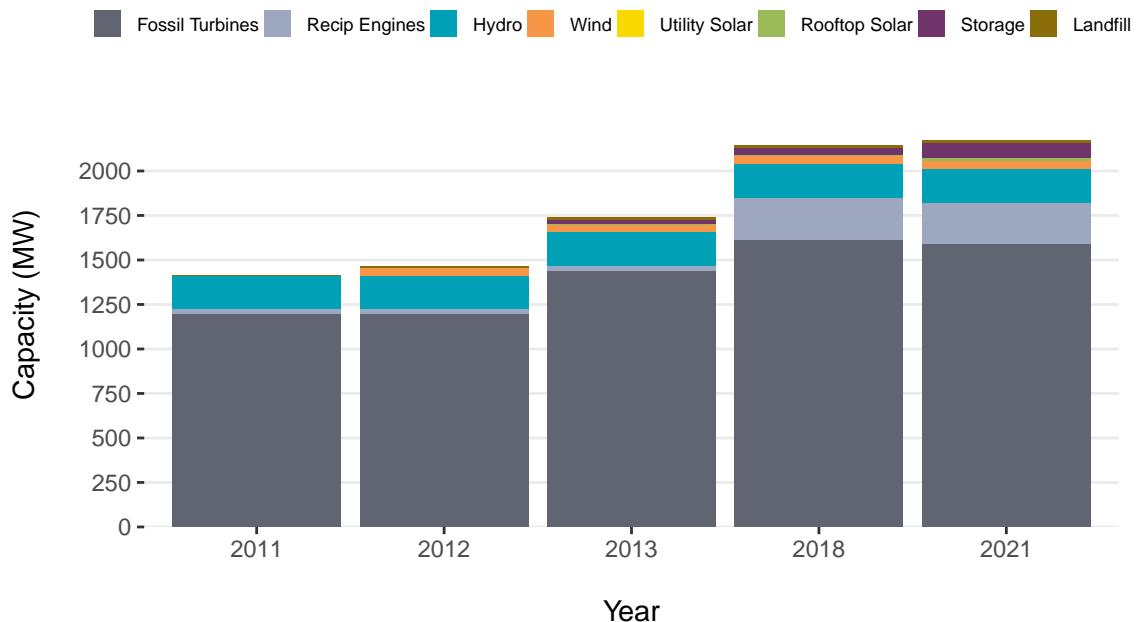
Figure 3.3.: Coastal Region Renewable Capacity



### 3.3. Railbelt

For the Railbelt region, capacity additions were dominated by more-efficient fossil fuel generating units and new battery storage. These additions are visualized in Figure 3.4. There were 761.9 MW of capacity additions between 2011 and 2021. The Railbelt region saw 207.3 MW of reciprocating engine additions and 390.2 MW of fossil fuel turbines. The remaining capacity additions were renewables and storage and are shown in Figure 3.5.

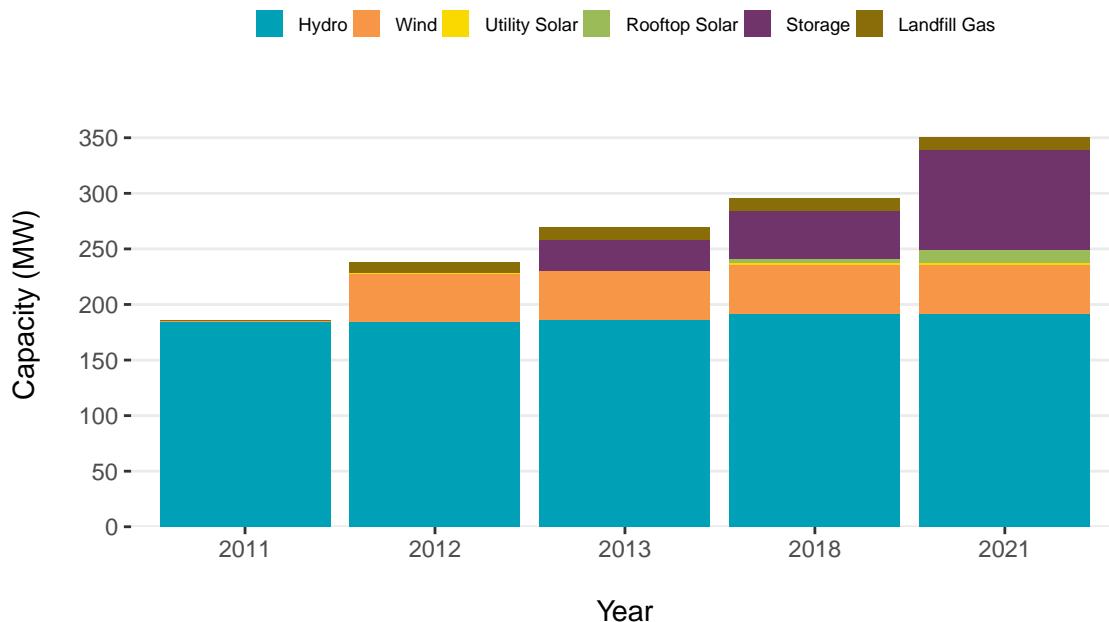
Figure 3.4.: Railbelt Region Capacity



## Railbelt Renewables

Total renewable and storage capacity in the Railbelt region increased by 164.41 MW. Notable additions included the commercial commissioning of the 18 MW Fire Island Wind site in September 2012 and the 25 MW Eva Creek Wind site in October 2012. Significant investments in storage capacity have also been made. Since 2011, 89.5 MW of storage, 43.49 MW of wind, 7.09 MW of hydro, 1.9 MW of utility solar, 10.93 MW of rooftop – also known as “behind-the-meter” – solar, and 11.5 MW of landfill gas have been added.

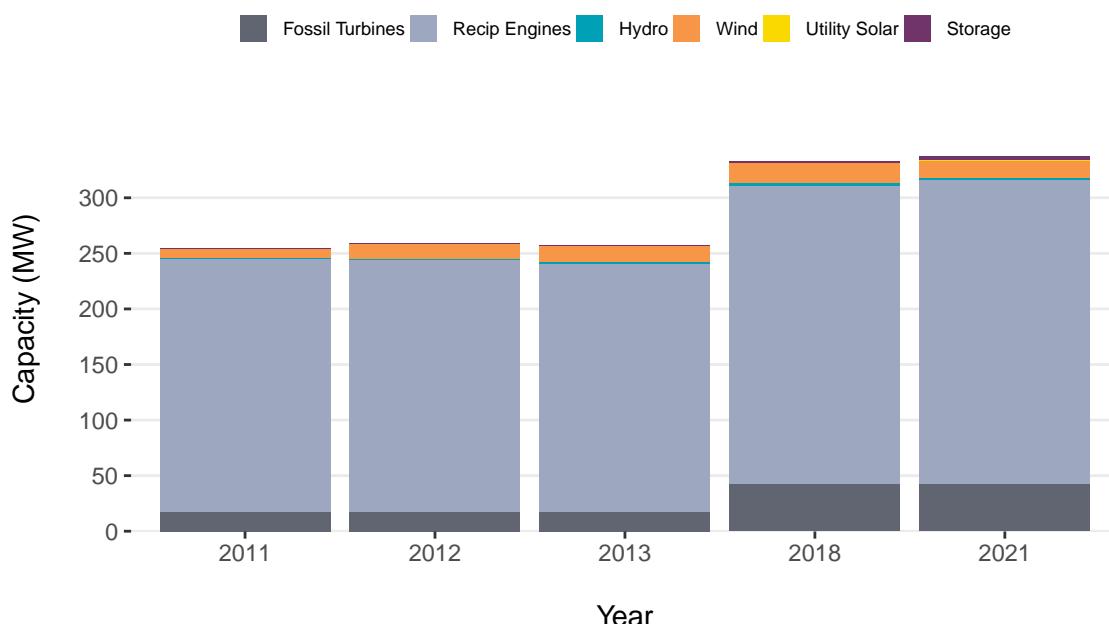
Figure 3.5.: Railbelt Region Renewable Capacity



### 3.4. Rural Remote

The rural remote region saw an increase of 83.1 MW in capacity (a 32.63% increase) (Figure 3.6). Most of the increases in capacity were fossil fuel turbines (25.4 MW added on the North Slope) and reciprocating engines (45.65 MW). Renewable capacity is explored in further detail in the Figure 3.7.

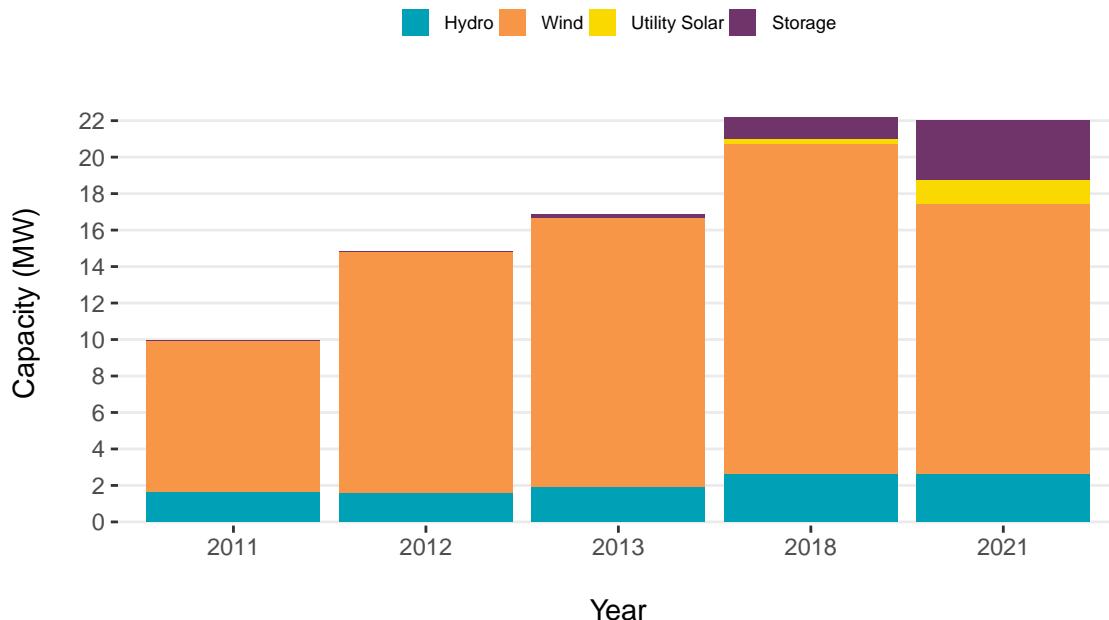
Figure 3.6.: Rural Remote Region Capacity



## Rural Remote Renewables

This region saw an absolute increase of 12.05 MW of renewable capacity between 2011 to 2021. Over this time period, hydropower generation resources increased by 0.99 MW, wind increased by 6.51 MW, utility-scale solar increased by 1.31 MW and storage increased by 3.25 MW. Between 2018 and 2021, 2 MW of wind was retired in the Bering Straits energy region, 1.2 MW in Kotzebue, and 0.2 MW in the Aleutians, explaining the reduction in wind capacity between the calendar years.

Figure 3.7.: Rural Remote Region Renewable Capacity



## Chapter 4.

### Net/Gross Generation

Generation by Fuel Type in Alaska, 2011-2021

#### 4.1. General Overview

This section outlines the trends in generation by fuel type for each region. Generation in our context has two separate definitions. Data collected through the Energy Information Administration (EIA) records “net” generation, which excludes electricity use for power plant operations.<sup>1</sup> However, data collected from the Alaska Energy Authority’s (AEA) Power Cost Equalization (PCE) program is presented as “gross” generation, which does not make this exclusion.<sup>2</sup>

Figure 4.1 provides a visual representation of yearly electricity generation for the Coastal, Railbelt, and Rural Remote regions. All regions produced a relatively consistent amount of electricity between 2011 and 2021. Across this time period, the Railbelt generated an average of 5,109 GWh, the Coastal region generated an average of 1,131 GWh, and the Rural Remote region generated an average of 509 GWh. Between 2011 and 2021, the average yearly growth rate for generation was 1.62% in the Coastal region, -0.82% in the Railbelt region, and 2.43% in Rural Remote communities.<sup>3</sup> The Coastal and Rural Remote trends are in line with improvements in rural electrification, as well as modest population growth. Of the regions, the Railbelt is the only one that consistently saw decreases in generation across the years. Total statewide generation increased at an average annual growth rate of -0.18%.

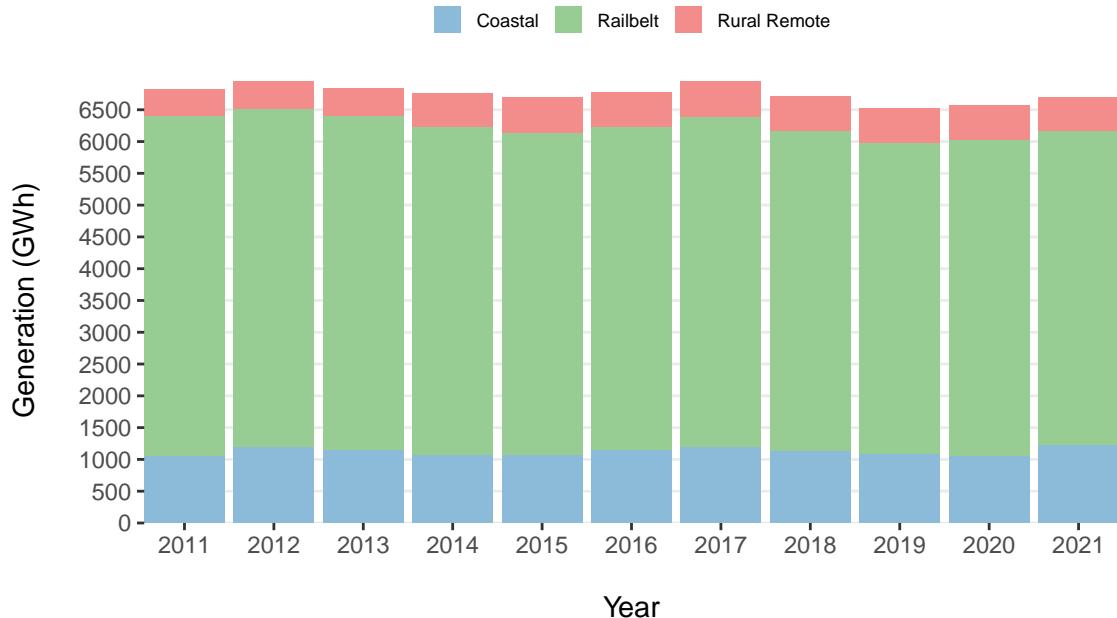
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<sup>1</sup>The EIA-923 data used for net generation was supplemented with FERC Form No. 1 data to account for missing statistics for the Southcentral Power Project. Please visit [the patch notes to learn more about our methodology and findings](#).

<sup>2</sup>The PCE data do show powerhouse consumption as a separate data item, which would allow for the computation of “net generation” in PCE communities. However, we have continued to report generation in PCE communities as the gross amount in order to be consistent with previous Alaska Energy Statistics Reports.

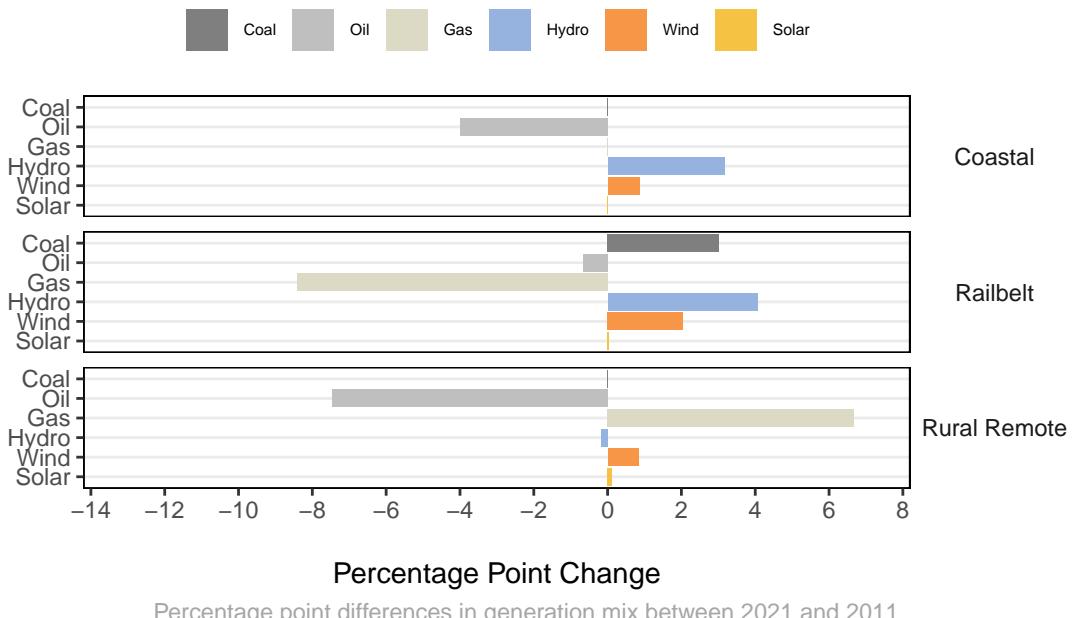
<sup>3</sup>Calculated with the compound average growth rate:  $CAGR = \left( \left( \frac{gen_{2021}}{gen_{2011}} \right)^{\frac{1}{2021-2011}} - 1 \right)$

Figure 4.1.: Electricity Generation by Region



While generation did not change significantly during the observed time period, the resources from which generation occurred, did. Figure 4.2 shows how the mix of generation fuels changed between 2011 and 2021.<sup>4</sup>

Figure 4.2.: Regional Changes in Net Generation



<sup>4</sup>Oil consists of generators whose primary fuel source is diesel/distillate, naphtha, or jet fuel. Gas consists of natural or landfill gas. Hydro refers to conventional hydroelectric turbines. Wind and solar are both utility-scale (excluding behind-the-meter solar). Storage is not included in these calculations.

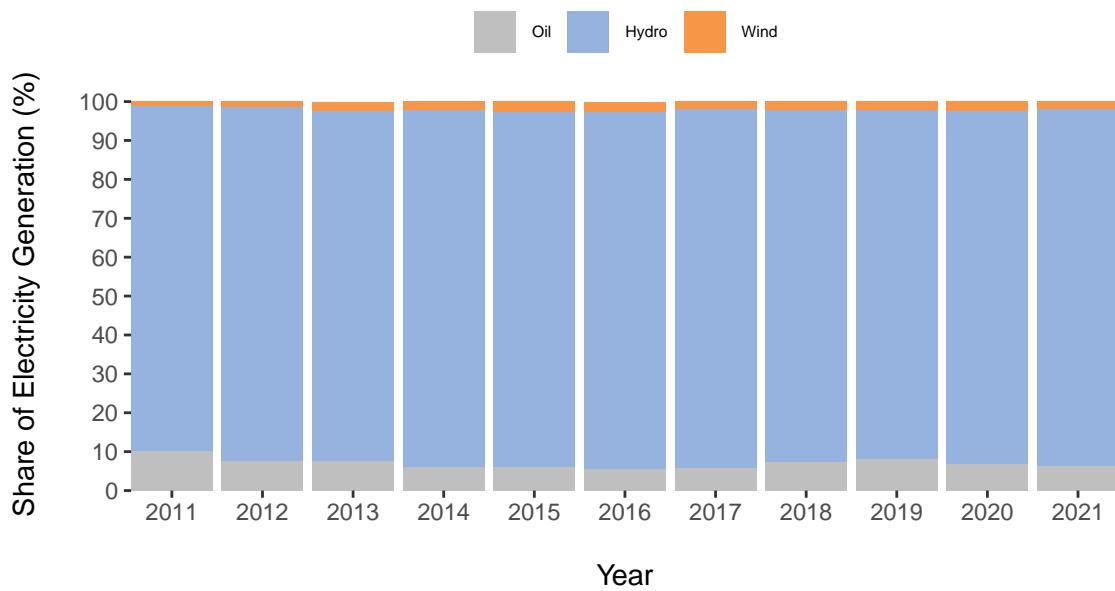
We show that for these resources, the Coastal region displaced oil generation with hydro and wind generation. The Railbelt displaced gas and oil generation with coal, hydro, and solar generation. Finally, the Rural Remote region of the state displaced coal and a small amount of hydro with gas, solar, and wind generation.

This figure does not include trends in storage or the other category. Storage net generation is always negative due to the efficiency of current battery systems where more energy is sent to storage than can be recovered. The “other” category was not included in this figure as net generation was zero in 2011 and 2021 (but not throughout the series, which we show in the subsequent sections).

## 4.2. Coastal

In 2011, the Coastal region generated 89% of its electricity from hydro, 10% from oil, and the remainder from wind.<sup>5</sup> In 2021, the region generated 92% of electricity from hydro, 6% from oil, and 2% from wind. In addition, storage played a role in generation, albeit the net result is negative due to efficiencies. Figure 4.3 shows how this generation mix has changed over the years.

Figure 4.3.: Share of Net Generation by Fuel Type, Coastal Region



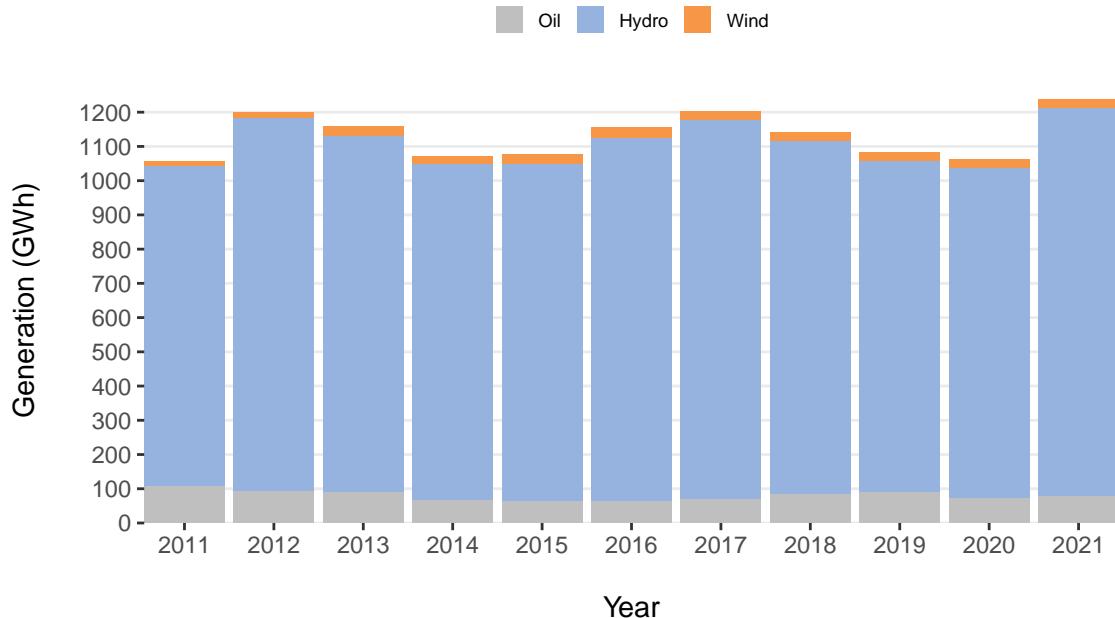
Note: Storage is not included here since net generation is negative.

Generation grew at an average annual growth rate of 1.62% from 2011 to 2021. Figure 4.4 highlights the yearly trends in generation by fuel source.

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<sup>5</sup>Net generation from storage facilities are not included in these calculations.

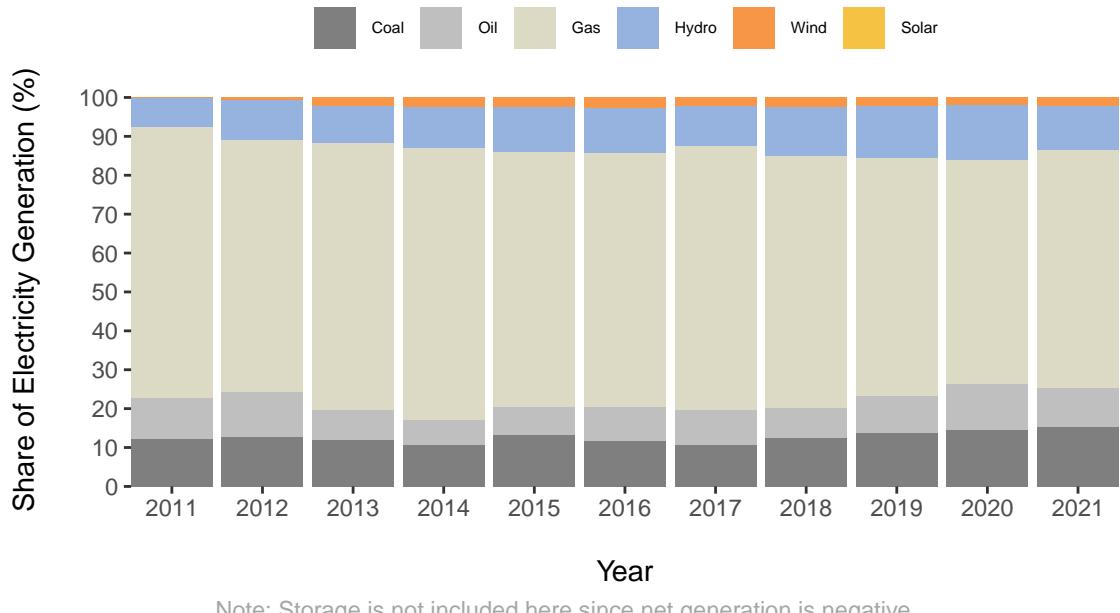
Figure 4.4.: Electricity Generation, Coastal Region



### 4.3. Railbelt

Railbelt generation has seen notable changes in how it generates electricity between 2011 and 2021. In 2011, the Railbelt region generated 70% of electricity from gas, 12% from coal, 7% from hydro, and 10% from oil. Additionally, a small amount of wind generation was present. In 2021, the region generated 61% of electricity from gas, 15% from coal, 12% from hydro, 10% from oil, and 2% from wind. Additionally, a small amount of solar generation was present. In addition, storage played a role in generation, albeit the net result is negative due to non-perfect efficiencies. Figure 4.5 shows how this generation mix has changed over the years.

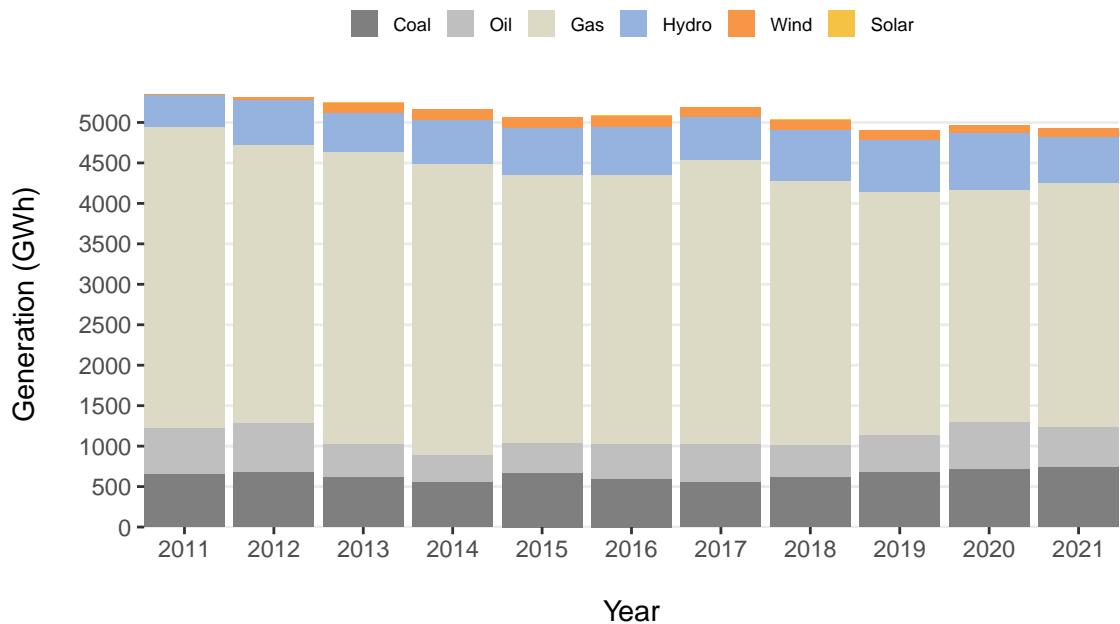
Figure 4.5.: Share of Net Generation by Fuel Type, Railbelt Region



Note: Storage is not included here since net generation is negative.

Generation from 2011 to 2021 saw an average annual growth rate of -0.82%. Figure 4.6 highlights the yearly trends in generation by fuel source.

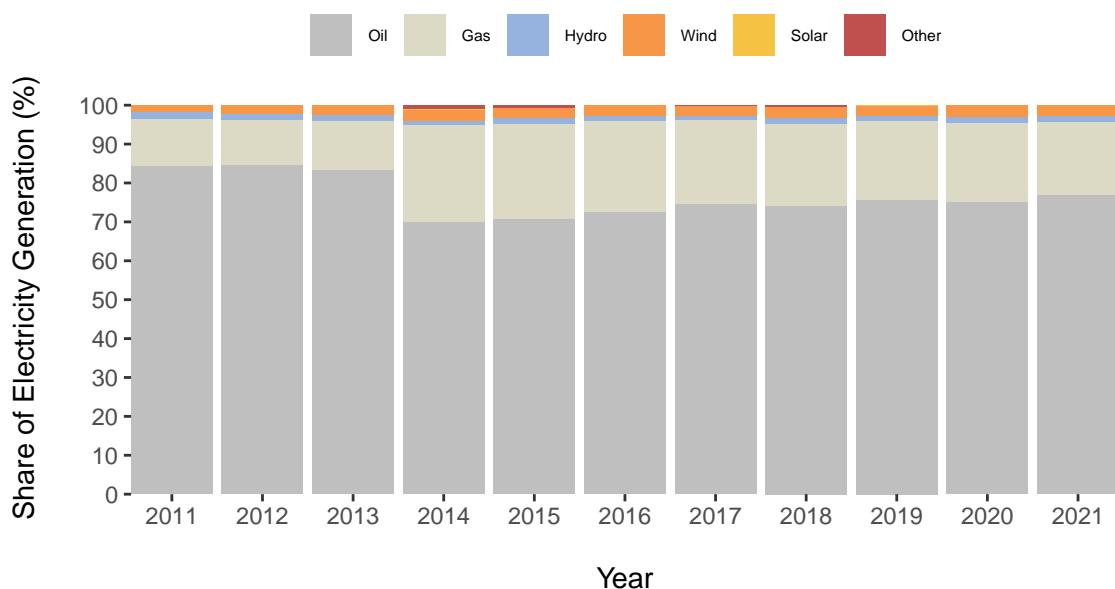
Figure 4.6.: Electricity Generation, Railbelt Region



#### 4.4. Rural Remote

The Rural Remote region has seen notable changes between 2011 and 2021 in how it generates electricity. In 2011, the region generated 84% of electricity from oil, 12% from gas, 2% from hydro, and 2% from wind. In 2021, the region generated 77% of electricity from oil (mostly diesel), 19% from gas, 1% from hydro, and 3% from wind. Additionally, a small amount of solar generation was present. Figure 4.7 shows how this generation mix has changed over the years.

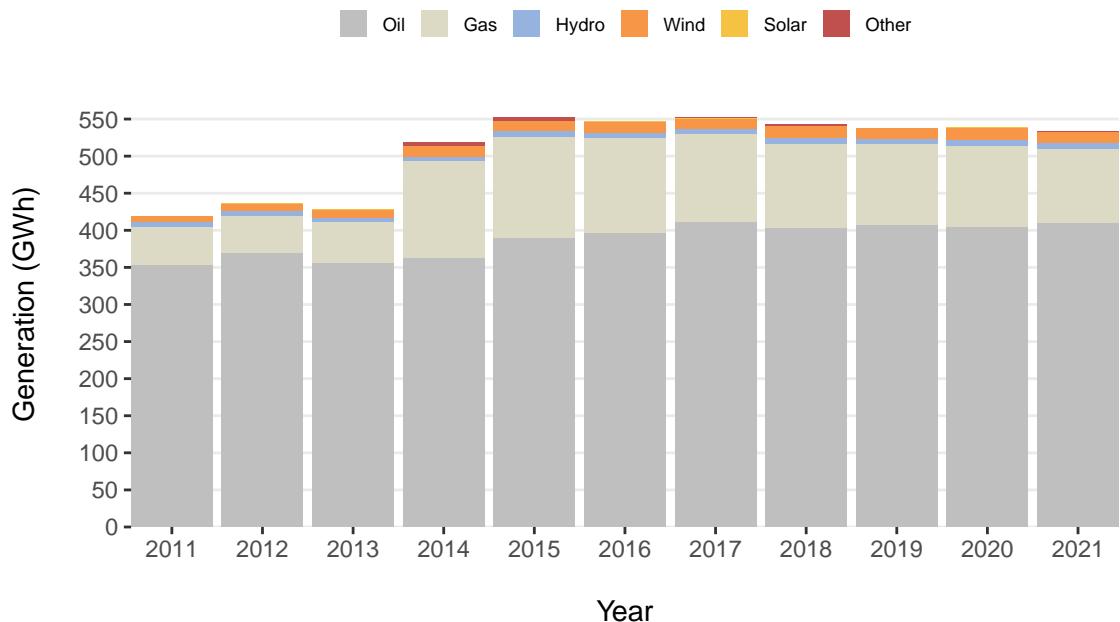
Figure 4.7.: Share of Net Generation by Fuel Type, Rural Remote Region



Note: Storage is not included here since net generation is negative.

Generation from 2011 to 2021 saw an average annual growth rate of 2.43%. Figure 4.8 highlights the yearly trends in generation by fuel source. From 2013 to 2014, a large increase in gas generation is observed due to operations on the North Slope - specifically in the Barrow Utilities & Electric Cooperative, Inc. (BUECI), Deadhorse, and Nuiqsut service regions.

Figure 4.8.: Electricity Generation, Rural Remote Region



## **Chapter 5.**

### **Consumption and Sales**

Electricity Sales in Alaska, 2011-2019

#### **5.1. General Overview**

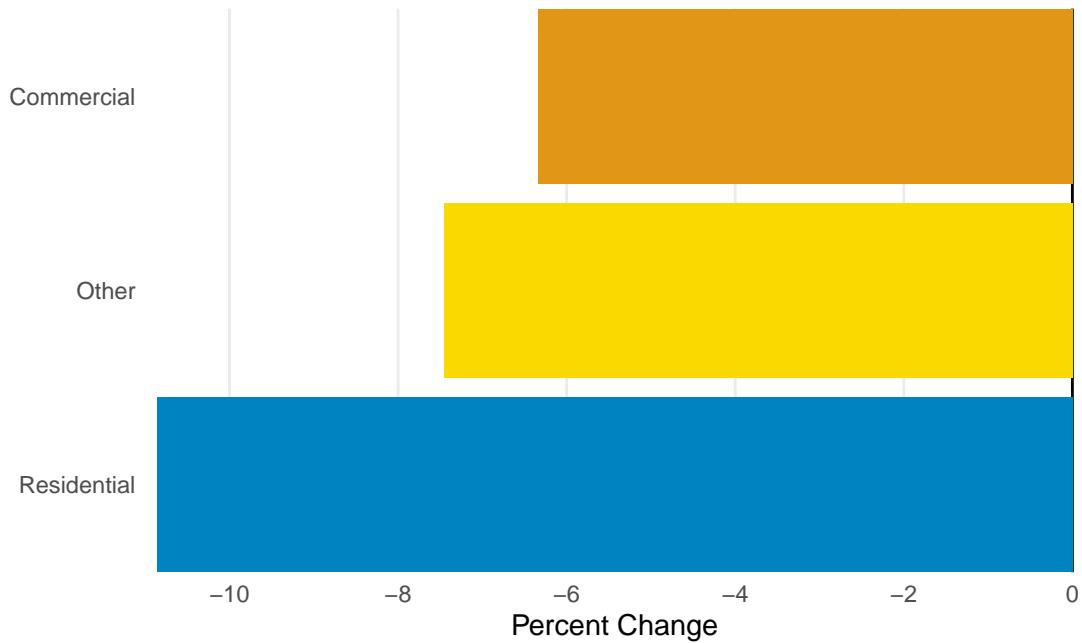
The data presented in this section is from calendar years 2011 to 2019. More recent data has been omitted due to issues with data completeness and validity.

Across the state, electricity sales (herein referred to as consumption), has fallen when comparing the 2011 and 2019 calendar years. To visualize this trend, we look at the percentage changes from 2011 to 2019 in electricity consumption by customer class (Figure 5.1). We highlight the following customer class definitions:

- **Residential:** Residential electric customers
- **Commercial:** Commercial electric customers
- **Other:** For EIA reported data, the Other group includes industrial and transportation customers. For PCE reported data, it includes community and government accounts. No industrial accounts were reported in the PCE data.

Statewide electricity consumption growth for the residential sector was -10.86% from 2,141 GWh in 2011 to 1,909 GWh in 2019. The commercial sector growth was -6.34% from 2,758 GWh in 2011 to 2,583 GWh in 2019. Finally, Statewide electricity consumption growth for the ‘Other’ customer class was -7.46% from 1,378 GWh in 2011 to 1,275 GWh in 2019.

Figure 5.1.: Change in Sales by Customer Class, Statewide, from 2011 to 2019



We also examine the change in the number of customer accounts across the state. The total number of customer accounts in the state increased 6.15% from approximately 326,402 to 346,476. We plot the percentage increases in customer accounts by category in Figure 5.2. Residential accounts across the state increased 5.22% from approximately 275,473 to 289,843. The number of commercial accounts across the state increased 11.77% from 46,411 to 51,875. Finally, the number of other accounts across the state has increased 14.87% from approximately 4,518 to 5,190.

Figure 5.2.: Change in Customer Accounts by Class, Statewide, from 2011 to 2019

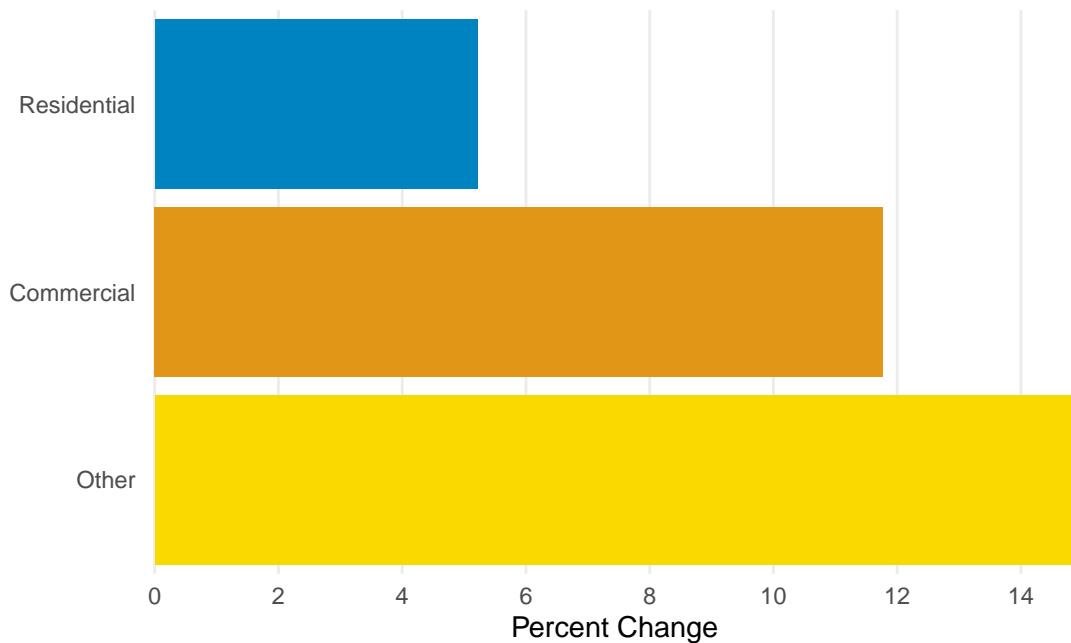
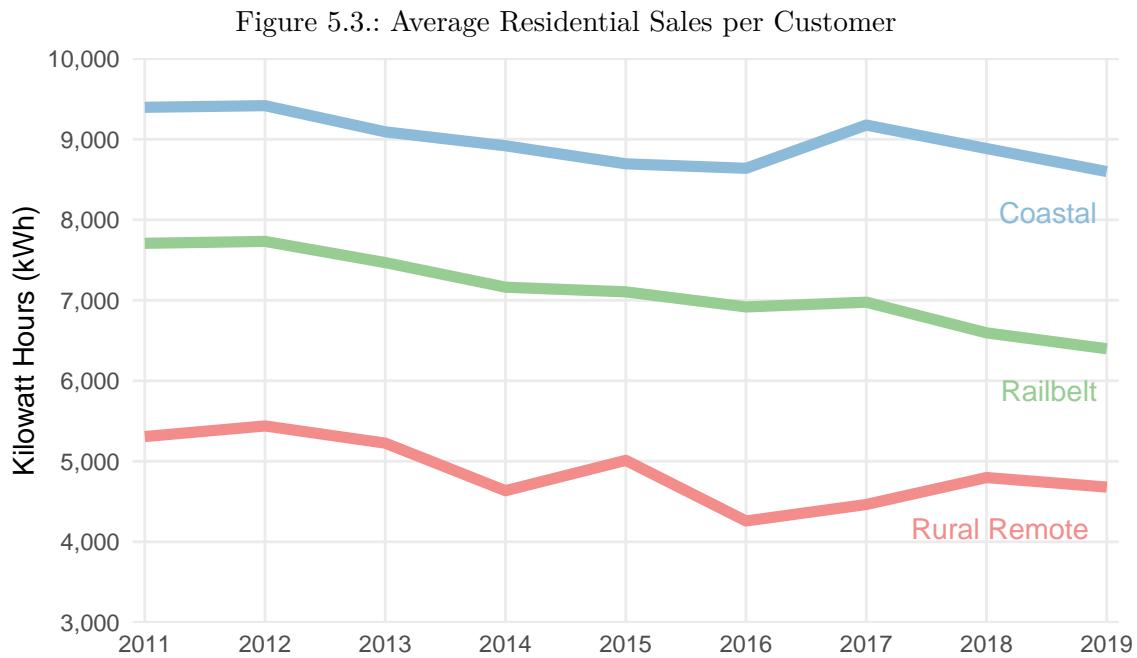


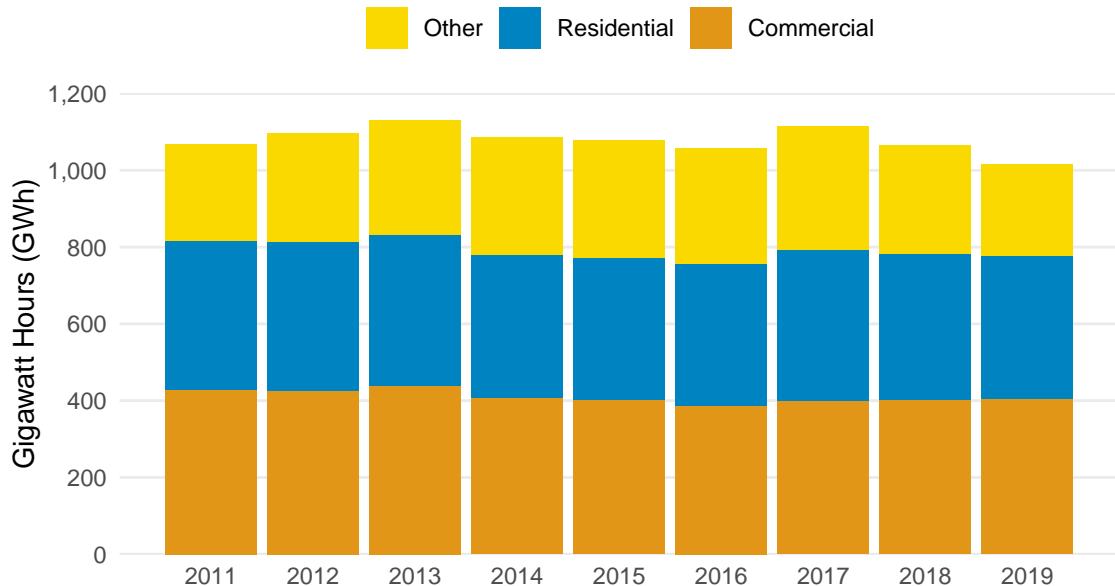
Figure 5.3 shows the average annual electricity consumption for each of the regions. The Coastal region led the state in consumption per capita, with an average of 8,980 kWh per customer per year. This was followed by the Railbelt region with 7,118 kWh per capita and the Rural Remote region with 4,868 kWh per capita. Overall, each region has seen reductions in consumption per capita, which may reflect improvements in energy efficient technologies and energy efficiency/conservation behaviors.



## 5.2. Coastal

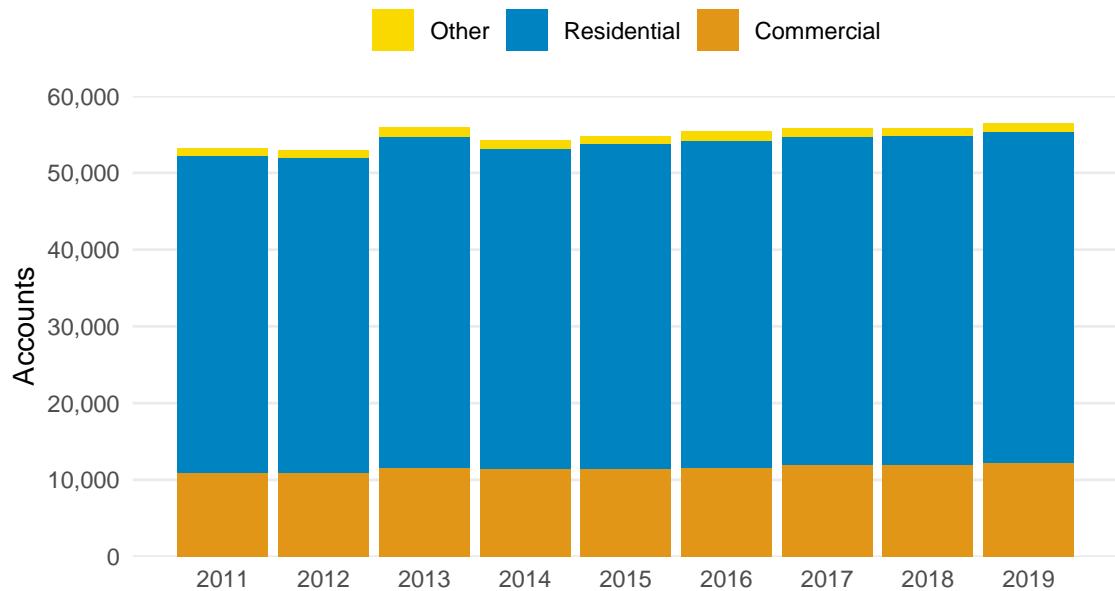
To estimate the average yearly growth rate in each customer class, we calculate the cumulative compound average growth rate (CAGR). From 2011 to 2019, the coastal region saw an average yearly growth rate of -0.56% for residential sales, -0.63% for commercial sales, and -0.76% for all other sales. Figure 5.4 shows these sales in GWh for each year.

Figure 5.4.: Delivered Electricity by Customer Class, Coastal Region



While customer sales fell overall, customer accounts in the Coastal region increased for all customer classes. Figure 5.5 shows the trend in customer accounts by class for the Coastal region. The average yearly growth rate in customer accounts was 0.55% for the residential class, 1.43% for the commercial class, and 0.73% for the other class.

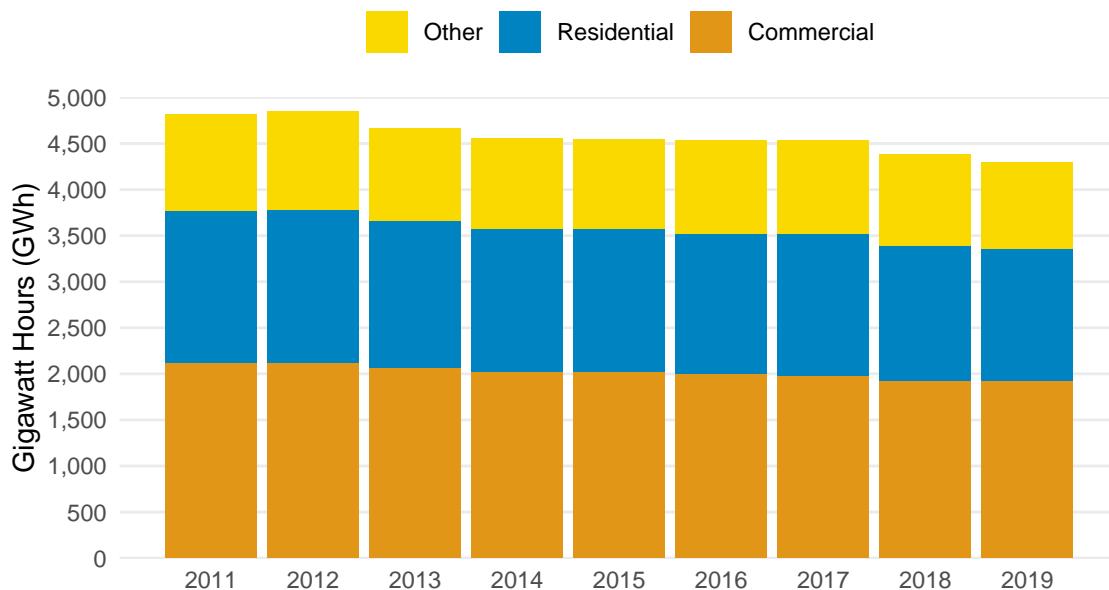
Figure 5.5.: Number of Customer Accounts, Coastal region



### 5.3. Railbelt

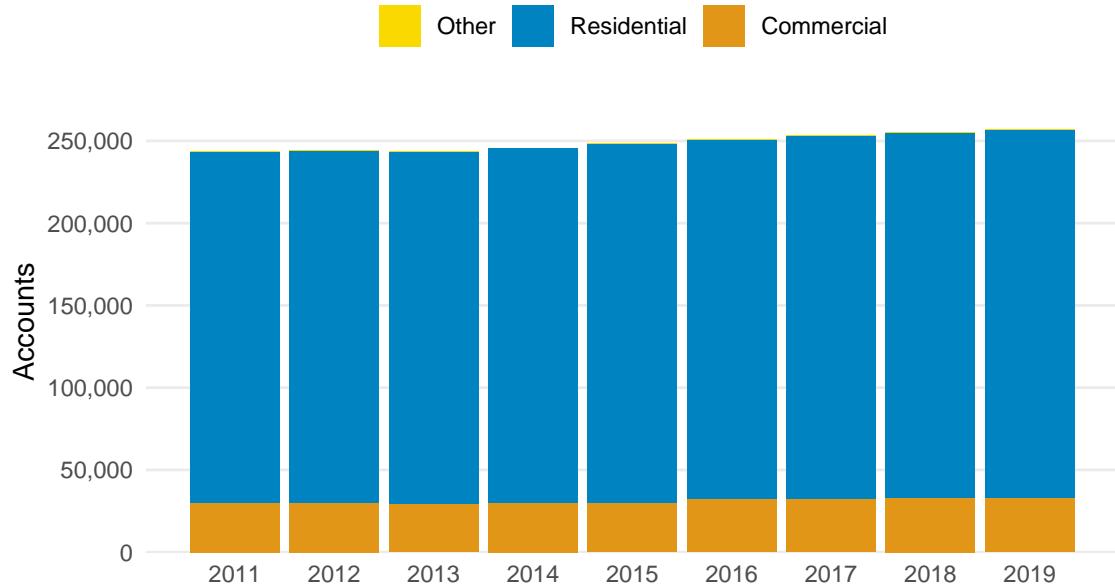
From 2011 to 2019, the Railbelt region saw an average yearly growth rate of -1.71% for residential sales, -1.27% for commercial sales, and -1.31% for all other sales. Figure 5.6 shows these sales in GWh for each year.

Figure 5.6.: Delivered Electricity by Customer Class, Railbelt Region



The trends in the number of customer accounts by class are visualized in Figure 5.7. The average yearly growth rate in customer accounts on the Railbelt was 0.6% for the residential class, 1.37% for the commercial class, and -1.64% for the other class.

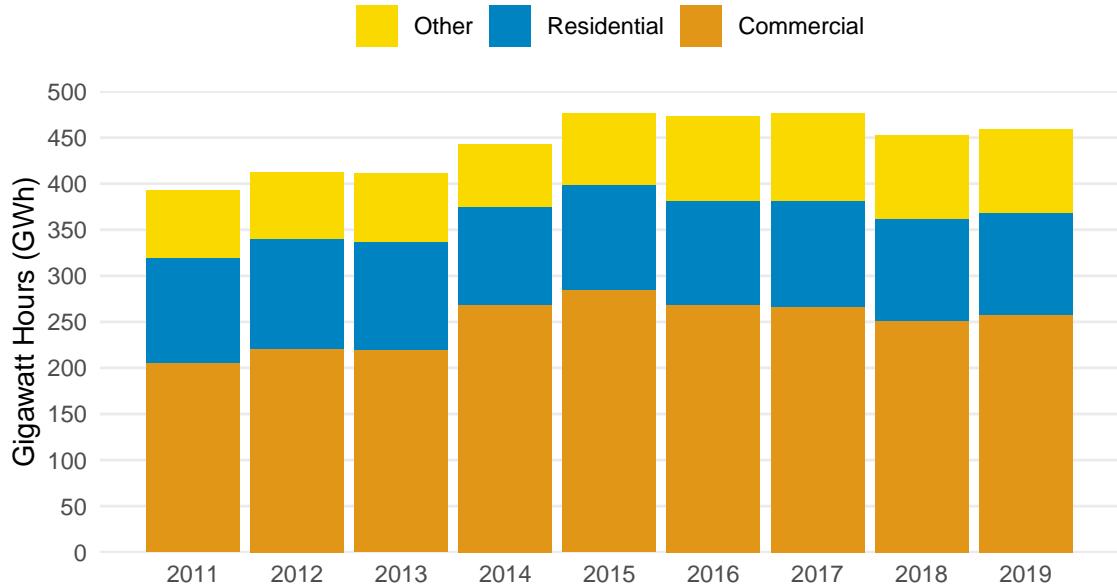
Figure 5.7.: Number of Customer Accounts, Railbelt Region



#### 5.4. Rural Remote

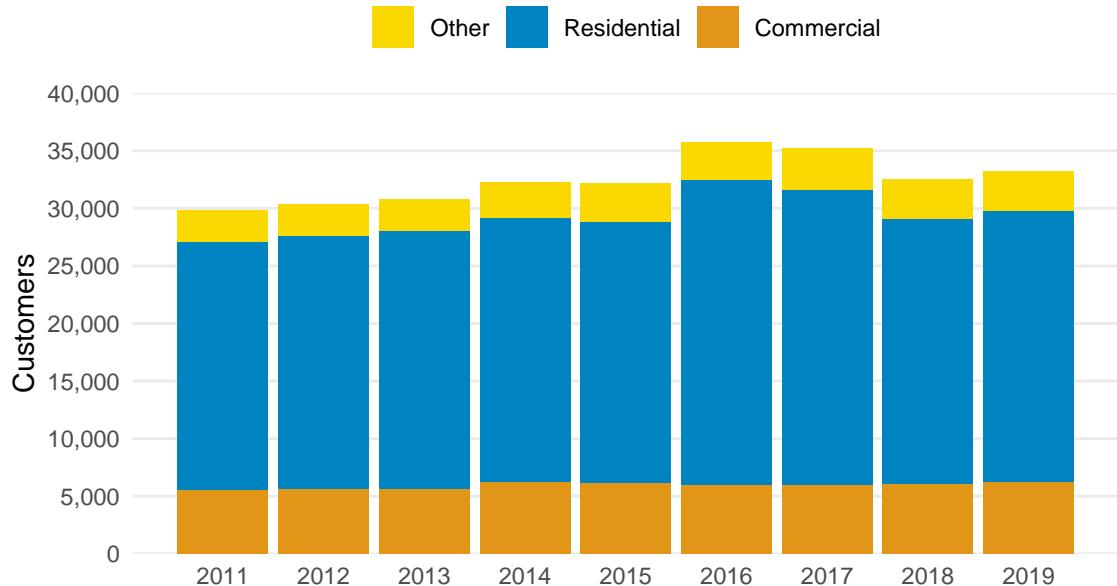
From 2011 to 2019, the Rural Remote region saw an average yearly growth rate of -0.43% for residential sales, 2.88% for commercial sales, and 2.7% for all other sales. Positive growth rates for the commercial and other customer classes are unique to the rural remote energy region as all other regions saw average yearly declines in sales. Figure 5.8 shows these sales in GWh for each year.

Figure 5.8.: Delivered Electricity by Customer Class, Rural Remote Region



The trends in the number of customer accounts by class are visualized in Figure 5.9. The average yearly growth rate in customer accounts in the Rural Remote region was 1.14% for the residential class, 1.52% for the commercial class, and 2.79% for the other class.

Figure 5.9.: Number of Customer Accounts, Railbelt Region



## **Chapter 6.**

### **Price of Electricity**

Electricity Prices for the Residential, Commercial, and Industrial Customer Classes, 2011-2019

#### **6.1. General Overview**

Utilities in Alaska serve multiple customers, namely residential, commercial, industrial, government/municipal, and community customer classes. Each customer class experiences a different set of costs such as per kWh charge as well as monthly customer charges. In this section, we aim to highlight trends in electricity prices for the residential, commercial, and other customer classes across the Coastal, Railbelt, and Rural Remote regions. We again restrict the data years in this section to 2011 to 2019 due to concerns with data validity for 2020-21.

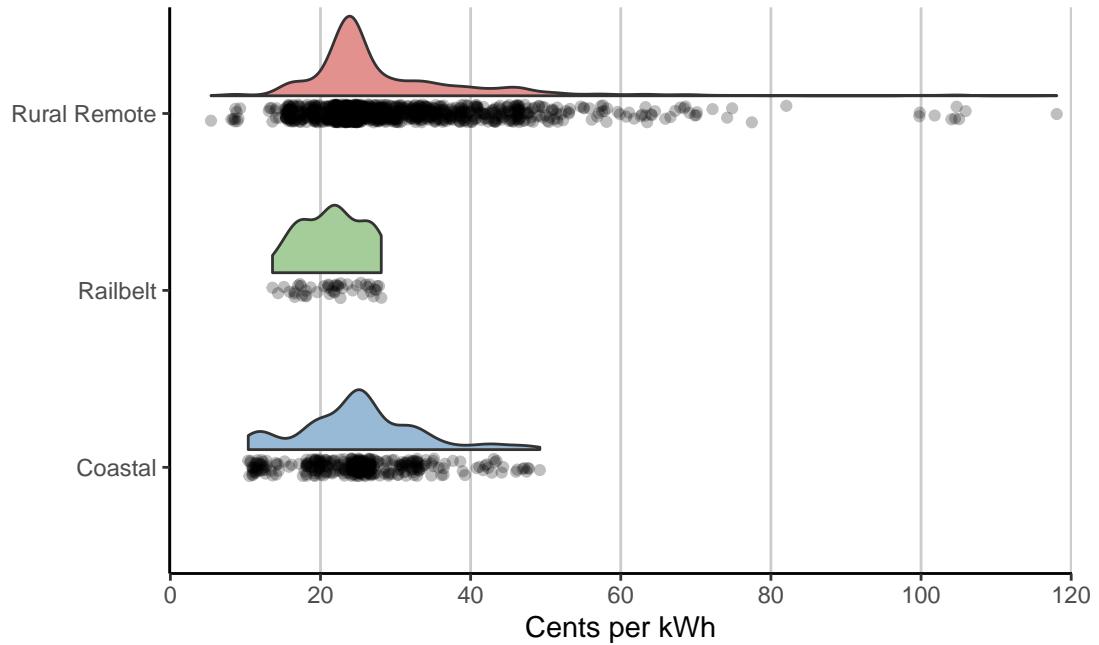
In rural areas, many communities are eligible to participate in the PCE program (described in Section 2.3). It is important to note that the prices presented here reflect the post-PCE adjustment and are annualized averages based on the calendar year. Yearly average effective rates listed here reflect the calendar year and not the fiscal year, which will make them different from those reported in the AEA's annual reports. We also note that for PCE communities, the rates are reported in the original data. For data sourced from the EIA, rates were calculated by dividing total revenue by total kWh sold in each customer class - this may overestimate the rate as this would include revenue from customer charges.

Note that all prices in this section have been adjusted for inflation over time to 2021 dollars using the Bureau of Labor Statistics (BLS) Consumer Price Index (CPI) for all items in urban Alaska (BLS CUUSA427SA0). To our knowledge, there is no CPI that properly accounts for price changes over time in rural Alaska. However, the general trend shows that customer account-weighted prices have been relatively stagnant across all regions of the state.

##### **6.1.1. Regional Overview**

Below are three raincloud plots to show the distribution of prices across the three customer classes. Figure 6.1 shows Residential prices, Figure 6.2 shows Commercial prices, and Figure 6.3 shows prices for Other customers. Each dot on the graphs represents the average annual price of a community for a single year in the range. For this report, data is displayed for 9 years, 2011-2019, therefore each community will render 9 points on the plot. Communities are grouped by the three regions, and the colored half-violin above the dots shows distributions of the prices.

Figure 6.1.: Residential Sector Prices, 2011-2019



Most notably, the dramatic effects of the PCE subsidy can be seen by comparing the price distribution of the residential customer class against the price distribution of the commercial/other customer classes in the Rural Remote and Coastal regions.

Figure 6.2.: Commercial Sector Prices, 2011-2019

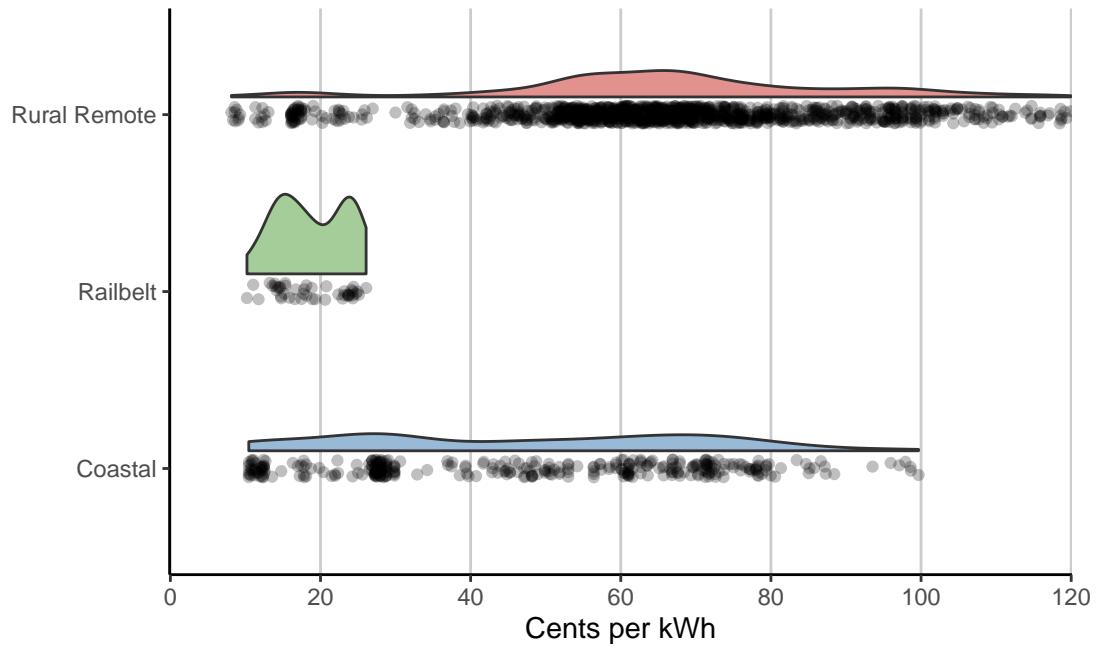
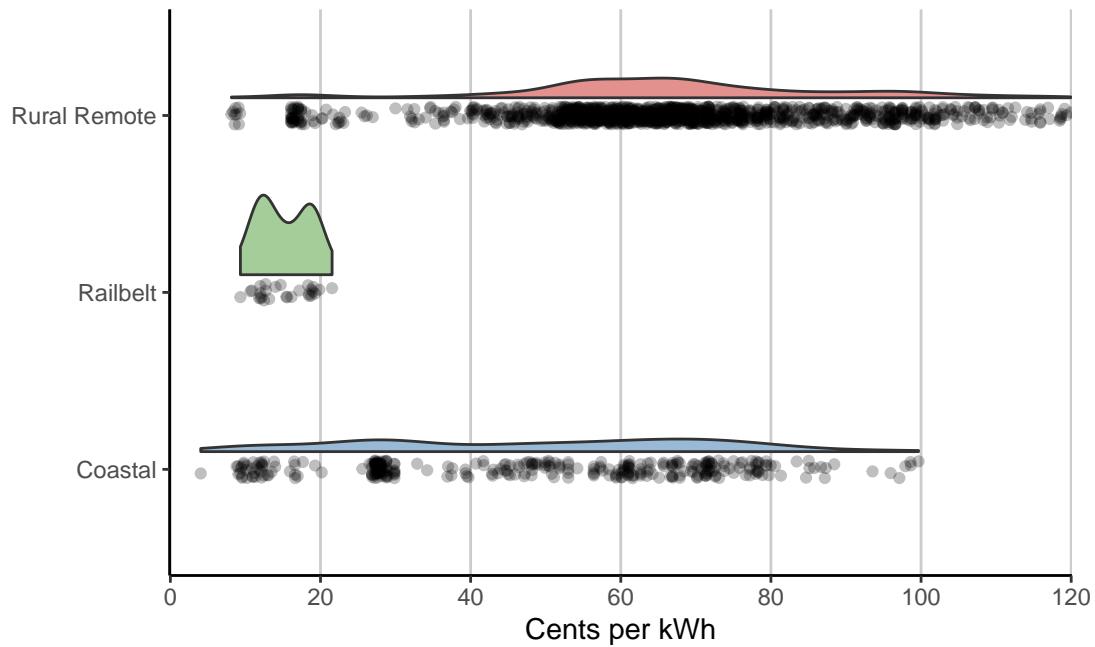


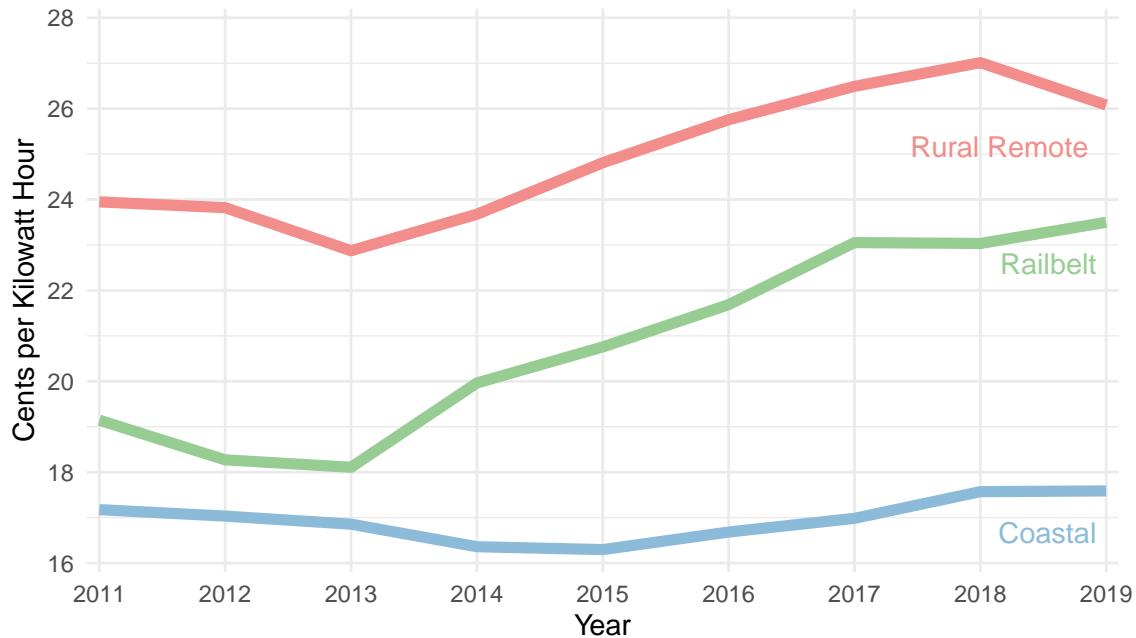
Figure 6.3.: Other Sector Prices, 2011-2019



### 6.1.2. Regional Averages

Due to the wide range of electricity prices in Alaska, it is difficult to accurately summarize the data. Because of this, we determined that averages were best calculated using a customer account weighted average. Population is roughly correlated to price, with small communities experiencing higher rates than larger communities. The average number of customer accounts for the year was used to calculate the weighted arithmetic mean price for each year and region. Figure 6.4 is a graph of residential customer prices over time after weighting for the number of customer accounts.

Figure 6.4.: Residential Price Over Time



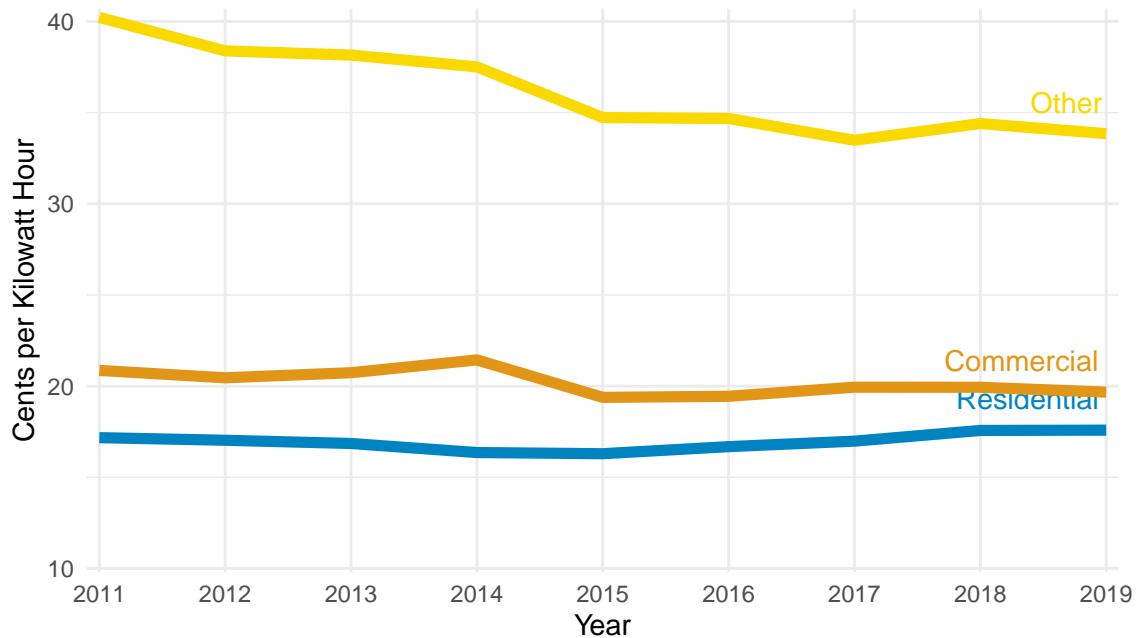
## 6.2. Coastal

Figure 6.5 shows the average price of electricity in the Coastal region for each customer class and year. Between 2011 and 2019, the region experienced decreasing prices for Commercial and Other customers, while Residential customers have seen a slight increase in price.

The average real price (in 2021 dollars) of electricity for Residential customers in the Coastal region rose 2% from 17.18 cents/kWh in 2011 to 17.59 cents/kWh in 2019. The average price of electricity for Commercial customers in the Coastal region fell -6% from 20.86 cents/kWh in 2011 to 19.67 cents/kWh in 2019. Finally, the average price of electricity for Other customers in the Coastal region fell -16% from 40.22 cents/kWh in 2011 to 33.85 cents/kWh in 2019.

Residential customers in the Coastal region saw increases in the price of electricity while commercial and other customers saw decreases. However, the residential customer class continues to pay the lowest per kWh in the region due to a combination of low prices in high population areas and PCE subsidies in eligible communities.

Figure 6.5.: Sector Price Over Time, Coastal Region



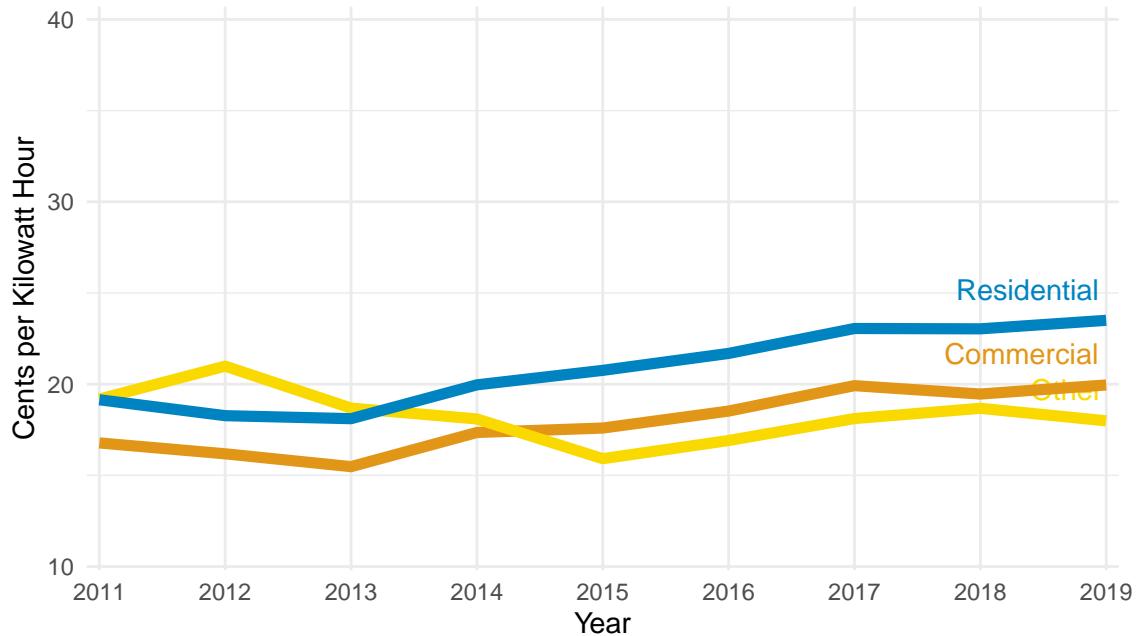
### 6.3. Railbelt

Figure 6.6 shows the average price of electricity in the Railbelt region for each customer class and each year of the report. Between 2011 and 2019, Other customers saw a large decrease in price, followed by a gradual increase. Residential and Commercial customers experienced slight decreases in price until 2013 when prices reversed and rose dramatically.

The average real price of electricity for Residential customers in the Railbelt rose 23% from 19.14 cents/kWh in 2011 to 23.5 cents/kWh in 2019. The average price of electricity for Commercial customers in the Railbelt rose 19% from 16.78 cents/kWh in 2011 to 19.96 cents/kWh in 2019. Finally, the average price of electricity for Other customers in the Railbelt fell -6% from 19.18 cents/kWh in 2011 to 17.99 cents/kWh in 2019.

This region differs significantly from the Coastal and Rural Remote regions in that residential customers pay more for electricity than the Commercial or Other customer classes.

Figure 6.6.: Sector Price Over Time, Railbelt Region

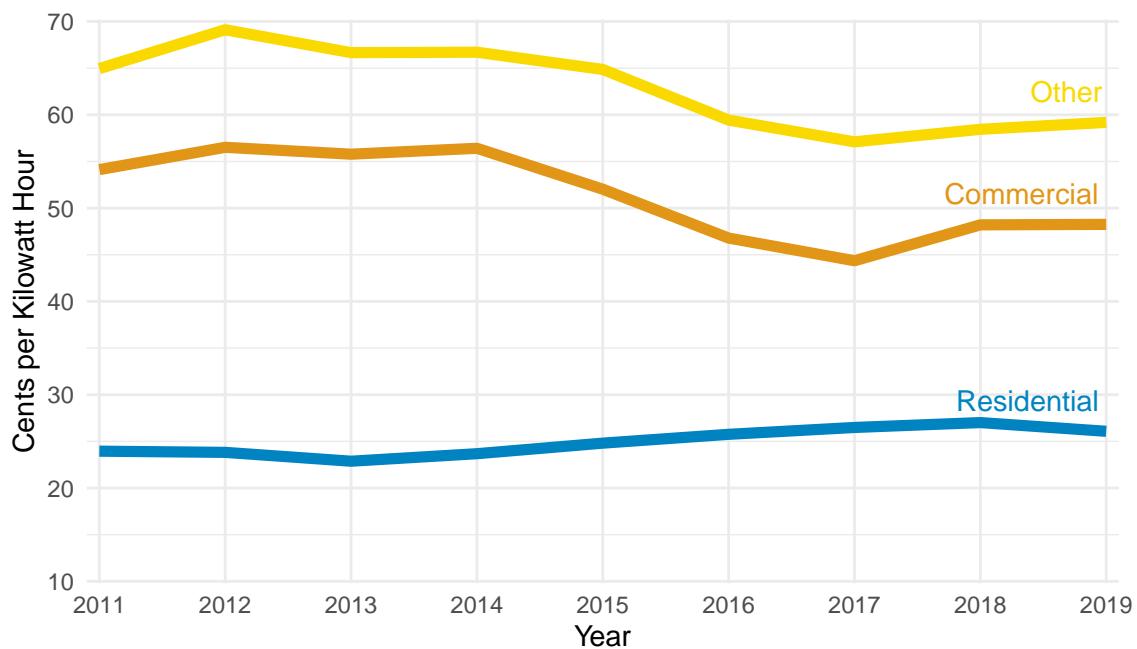


## 6.4. Rural Remote

Figure 6.7 shows the average price of electricity in the Rural Remote region for each customer class and year of the report. Between 2011 and 2019, Residential customers experienced a gradual increase in rates, while Commercial and Other customers experienced a gradual decrease in rates.

The average price of electricity for the Residential customers in the Rural Remote region rose 9% from 23.95 cents/kWh in 2011 to 26.08 cents/kWh in 2019. The average price of electricity for Commercial customers in the Rural Remote region fell -11% from 54.12 cents/kWh in 2011 to 48.26 cents/kWh in 2019. Finally, the average price of electricity for Other customers in the Rural Remote region fell -9% from 64.96 cents/kWh in 2011 to 59.19 cents/kWh in 2019.

Figure 6.7.: Sector Price Over Time, Rural Remote Region



# **Chapter 7.**

## **Conclusions**

### Description of Results and Conclusions

From 2011 to 2019/21, there have been significant developments in the electricity generation landscape in Alaska. In this report, we highlight trends across installed capacity, net/gross generation, consumption by customer class, and price per kWh. There are several key takeaways from each of these areas that we reiterate in this conclusion.

#### **7.0.1. Capacity**

There has been continued development in the installation and availability of electric generation capacity (Section 3.1) across the state. Throughout every region, installed capacity increased. Of particular note are the installation of peaking and/or backup engines, renewable energy facilities (hydro, wind, and solar expansions), and storage. If trends continue, we can expect to see further increases in resilience and reliability-focused capacity.

#### **7.0.2. Generation**

Net/gross generation (Section 4.1) throughout the state remained relatively stable across observed years with each region having notable trends. In the Coastal region, we observed more hydroelectric and wind generation on average in 2021 than in 2011. This was coupled with reductions in generation from oil-based units. On the Railbelt, we observed more generation from wind, hydroelectric, coal, and solar resources in 2021 than in 2011. This was coupled with less oil and natural gas generation. Finally, in the Rural Remote region, we observed more generation from wind and solar resources in 2021 than in 2011. We also note the increase in use of utility-scale battery storage throughout the state.

#### **7.0.3. Consumption**

Electricity consumption (Section 5.1) throughout the state fell on average. The residential customer class saw the largest reductions, while the number of customer accounts increased across all categories. We also note that the Rural Remote region saw increases in consumption for the commercial and industrial customer classes. Finally, we observed that the Coastal region had the highest per capita consumption for residential customers, followed by the Railbelt and then the Rural Remote regions.

#### **7.0.4. Prices**

Electricity prices (Section 6.1) across the state were variable but trended upward. After adjusting for inflation, PCE subsidies, and including a population weight, the average residential electricity price across the state increased. The largest residential rate increases from 2011 to 2019 were observed in the Railbelt region (26%), and the smallest were observed in the Coastal region (6%). Throughout the Coastal and Rural Remote regions, commercial and other customer classes saw rate decreases. Rate decreases were also observed on the Railbelt for commercial customers. We also observed that PCE subsidies were paramount to mitigating the cost of electricity for residential and community customers in the Rural Remote and Coastal regions.

### **7.1. Future Plans**

The results of this trends report highlight the direction that installed capacity, net/gross generation, consumption, and prices took from 2011-2019/21. We emphasize the importance of continuing to collate electricity data from federal, state, regional, and local sources so that it may be analyzed on a more consistent basis. Our hope is to continue producing trends reports with updated data to better inform the public and decision makers regarding Alaska's energy future.

## **Chapter 8.**

### **Data Portal**

Download the Data Used in the Report's Figures

#### **8.1. Data Overview**

The data used in this web-book is derived from federal, state, commercial, and local sources, as well as direct communications with utilities and state program managers. More information about data sources can be found on the web book version of this report at:

<https://acep-uaf.github.io/aetr-web-book-2024/methods.html>

#### **8.2. Download Individual Tables**

To download the data itself, please visit this report's corresponding web-book at:

<https://acep-uaf.github.io/aetr-web-book-2024/data.html>

## Appendix A.

### About this Report

Description of the 2024 Alaska Electricity Trends Report Web Book

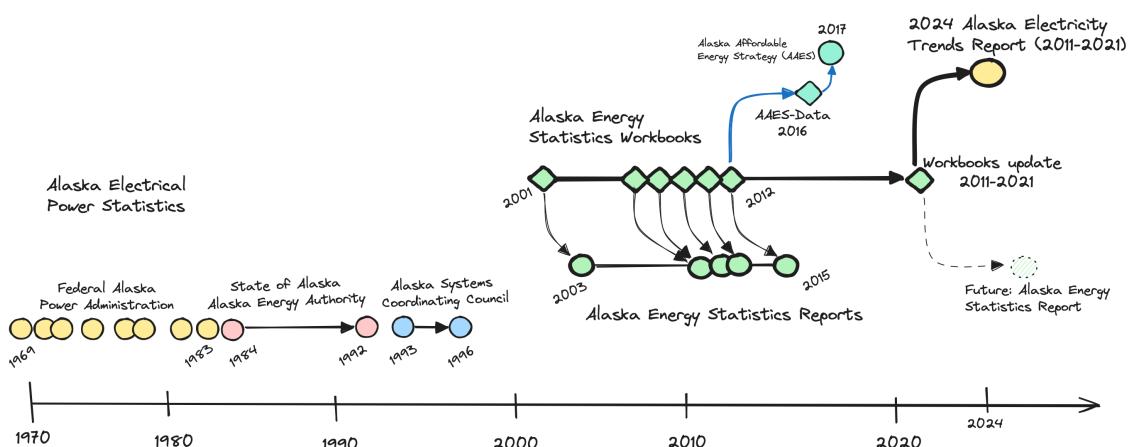
#### A.1. General Overview

This Alaska Electrical Trends Report (AETR) Web Book has been produced by the Alaska Center for Energy and Power (ACEP) at the University of Alaska Fairbanks (UAF). It is designed to be interactive and dynamically updated when new data becomes available.

Throughout the years, several agencies have prepared and published reports and data compilations on energy use in Alaska. AETR is complementary to those prior reports, but is not presented in a comparable format.

#### A.2. Historical Timeline of Prior Reports

Figure A.1.: Timeline of Energy Reports



Starting in 1969, the first Electric Power Trends report was published by the Alaska Power Administration. During this time, the Alaska Power Administration was a federal agency housed within the U.S. Department of the Interior. Their first publication was known as the “First Annual Report” and covered data from the 1968 fiscal year. However, this became the “Alaska Electric Power Statistics Report” in 1971 and examined data from the 1960-1969 data years. The APA continued to produce intermittent reports until 1983 when the State of Alaska established the Alaska Power Authority (APA), which later became the Alaska Energy Authority (AEA).

Under state direction, the APA/AEA continued to publish intermittent reports on electric power statistics until their final publication in 1992 which covered data years 1960 to 1991. To address the reporting gap, the Alaska Systems Coordinating Council in collaboration with the State of Alaska,

Department of Community and Regional Affairs, Division of Energy continued generating reports until 1996 with their final report covering data years 1960 to 1995. Finally, the University of Alaska Anchorage, Institute of Social and Economic Research produced several reports with their last covering 1960 to 2012. Since then, there have been no electric power statistical reports.

The Table A.1 provides a summary of this timeline. This report serves to supplement the reporting gap in electric power statistics for the State of Alaska.

Table A.1.: Historical Timeline of Reports

Year Published	Institution	Data Coverage
1971 to 1983	Alaska Power Administration	1960 to 1982
1984 to 1988	Alaska Power Authority	1960 to 1987
1989 to 1992	Alaska Energy Authority	1960 to 1991
1992 to 1996	Alaska Systems Coordinating Council; State of Alaska	1960 to 1995
2003, 2011 to 2015	University of Alaska Anchorage, Institute of Social and Economic Research	1960 to 2012

For a table of links to these historic reports, please refer to Table B.1.

### A.3. Technical Details

The book is formatted using [Quarto](#), an open-source scientific and technical publishing system. The template was developed by the Openscapes project, as part of their [Quarto Website Tutorial](#).

The markdown files that make up the book reside in the [aetr-web-book](#) GitHub repository. The generation process is publicly accessible. Errors in the document can be flagged using GitHub issues where they can be tracked and addressed by the DCM team.

The book also integrates R code for data processing and figure generation. When data files are updated, manually triggering the Quarto render will update the figures automatically.

## Appendix B.

### Historical Electric Power Statistics Reports

Links to Previous Reports, Data Years 1960-2012

#### B.1. Historical Electric Power Reports

For an overall description of previous reports that have examined electric power trends in Alaska, please see Section A.2. Below is an exhaustive list of links to these reports over time. Notably, we omit reports that include projections such as the State of Alaska Energy Reports/Plans.

Table B.1.: Links to Historical Reports

Year	Data Year	Authoring Institution	Publication Title	Type	Persistent Links
1969	1968	United States Department of the Interior, Alaska Power Administration	First Annual Report	Report	<a href="#">First Annual Report</a>
1971	1960-Calendar	United States Department of the Interior, Alaska Power Administration	Alaska Electric Power Statistics 1960 - 1969	Report	<a href="#">Alaska Electric Power Statistics 1960 - 1969</a>
1972	1960-Calendar	United States Department of the Interior, Alaska Power Administration	Alaska Electric Power Statistics 1960 - 1970	Report	<a href="#">Alaska Electric Power Statistics 1960 - 1970</a>
1974	1960-Calendar	United States Department of the Interior, Alaska Power Administration	Alaska Electric Power Statistics 1960 - 1973	Report	<a href="#">Alaska Electric Power Statistics 1960 - 1973</a>
1976	1960-Calendar	United States Department of the Interior, Alaska Power Administration	Alaska Electric Power Statistics 1960 - 1975	Report	<a href="#">Alaska Electric Power Statistics 1960 - 1975</a>
1977	1960-Calendar	United States Department of the Interior, Alaska Power Administration	Alaska Electric Power Statistics 1960 - 1976	Report	<a href="#">Alaska Electric Power Statistics 1960 - 1976</a>
1981	1960-Calendar	United States Department of Energy, Alaska Power Administration	Alaska Electric Power Statistics 1960 - 1980	Report	<a href="#">Alaska Electric Power Statistics 1960 - 1980</a>

Data					
Publication Year	Years	Type	Authoring Institution	Publication Title	Type
Year					Persistent Links
1983	1960-Calend	United States		Alaska Electric Power Statistics 1960 - 1982	Report <a href="#">Alaska Electric Power Statistics 1960 - 1982</a>
	1982	Department of Energy, Alaska Power Administration		Electric Power Statistics 1960 - 1982	
1984	1960-Calend	State of Alaska, Alaska Power Authority		Alaska Electric Power Statistics 1960 - 1983	Report <a href="#">Alaska Electric Power Statistics 1960 - 1983</a>
	1983			Electric Power Statistics 1960 - 1983	
1985	1960-Calend	State of Alaska, Alaska Power Authority		Alaska Electric Power Statistics 1960 - 1984	Report <a href="#">Alaska Electric Power Statistics 1960 - 1984</a>
	1984			Electric Power Statistics 1960 - 1984	
1986	1960-Calend	State of Alaska, Alaska Power Authority		Alaska Electric Power Statistics 1960 - 1985	Report <a href="#">Alaska Electric Power Statistics 1960 - 1985</a>
	1985			Electric Power Statistics 1960 - 1985	
1987	1960-Calend	State of Alaska, Alaska Power Authority		Alaska Electric Power Statistics 1960 - 1986	Report <a href="#">Alaska Electric Power Statistics 1960 - 1986</a>
	1986			Electric Power Statistics 1960 - 1986	
1988	1960-Calend	State of Alaska, Alaska Power Authority		Alaska Electric Power Statistics 1960 - 1987	Report <a href="#">Alaska Electric Power Statistics 1960 - 1987</a>
	1987			Electric Power Statistics 1960 - 1987	
1989	1960-Calend	State of Alaska, Alaska Energy Authority		Alaska Electric Power Statistics 1960 - 1988	Report <a href="#">Alaska Electric Power Statistics 1960 - 1988</a>
	1988			Electric Power Statistics 1960 - 1988	
1990	1960-Calend	State of Alaska, Alaska Energy Authority		Alaska Electric Power Statistics 1960 - 1989	Report <a href="#">Alaska Electric Power Statistics 1960 - 1989</a>
	1989			Electric Power Statistics 1960 - 1989	
1991	1960-Calend	State of Alaska, Alaska Energy Authority		Alaska Electric Power Statistics 1960 - 1990	Report <a href="#">Alaska Electric Power Statistics 1960 - 1990</a>
	1990			Electric Power Statistics 1960 - 1990	
1992	1960-Calend	State of Alaska, Alaska Energy Authority		Alaska Electric Power Statistics 1960 - 1991	Report <a href="#">Alaska Electric Power Statistics 1960 - 1991</a>
	1991			Electric Power Statistics 1960 - 1991	
1993	1960-Calend	Alaska Systems Coordinating Council; State of Alaska, Department of Community and Regional Affairs, Division of Energy		Alaska Electric Power Statistics 1960 - 1992	Report <a href="#">Alaska Electric Power Statistics 1960 - 1992</a>
	1992			Electric Power Statistics 1960 - 1992	
1994	1960-Calend	Alaska Systems Coordinating Council; State of Alaska, Department of Community and Regional Affairs, Division of Energy		Alaska Electric Power Statistics 1960 - 1993	Report <a href="#">Alaska Electric Power Statistics 1960 - 1993</a>
	1993			Electric Power Statistics 1960 - 1993	

Data						
Publication Year	Data Year	Type	Authoring Institution	Publication Title	Type	Persistent Links
Year	Years	Type	Authoring Institution	Title	Type	Persistent Links
1995	1960-Calendar	Alaska Systems	Alaska	Electric Power Statistics 1960 - 1994	Report	<a href="#">Alaska Electric Power Statistics 1960 - 1994</a>
	1994	Coordinating Council; State of Alaska, Department of Community and Regional Affairs, Division of Energy	Electric Power Statistics 1960 - 1994			
1996	1960-Calendar	Alaska Systems	Alaska	Electric Power Statistics 1960 - 1995	Report	<a href="#">Alaska Electric Power Statistics 1960 - 1995</a>
	1995	Coordinating Council; State of Alaska, Department of Community and Regional Affairs, Division of Energy	Electric Power Statistics 1960 - 1995			
2003	1960-Calendar	University of Alaska Anchorage, Institute of Social and Economic Research	Alaska	Electric Power Statistics (with Alaska Energy Balance) 1960 - 2001	Report	<a href="#">Alaska Electric Power Statistics (with Alaska Energy Balance) 1960 - 2001</a>
	2001	(with Alaska Energy Balance) 1960 - 2001				
2011	1960-Calendar	University of Alaska Anchorage, Institute of Social and Economic Research	Alaska Energy Statistics 1960 - 2008	Report	<a href="#">Alaska Energy Statistics 1960 - 2008</a>	
	2008		Ex-cell			
2011	1960-Calendar	University of Alaska Anchorage, Institute of Social and Economic Research	Alaska Energy Statistics 1960 - 2009	Report	<a href="#">Alaska Energy Statistics 1960 - 2009</a>	
	2009		Ex-cell			
2012	1960-Calendar	University of Alaska Anchorage, Institute of Social and Economic Research	Alaska Energy Statistics 1960 - 2010 Final Report	Report	<a href="#">Alaska Energy Statistics 1960 - 2010 Final Report</a>	
	2010		Ex-cell			
2013	1960-Calendar	University of Alaska Anchorage, Institute of Social and Economic Research	Alaska Energy Statistics 1960 - 2011 Final Report	Report	<a href="#">Alaska Energy Statistics 1960 - 2011 Final Report</a>	
	2011		Ex-cell			
2015	2012 Calendar	State of Alaska, Alaska Energy Authority	2012 Alaska Energy Statistics Final Report	Report	<a href="#">2012 Alaska Energy Statistics Final Report</a>	

## **Appendix C.**

### **Acronym Definitions**

Acronyms Commonly used in the Report

#### **C.1. Acronyms**

These abbreviations are used throughout this report

- ACEP: Alaska Center for Energy and Power, UAF
- AEA: Alaska Energy Authority
- BUECI: Barrow Utilities & Electric Cooperative, Inc.
- DCM: the Data and Cyberinfrastructure Management team at ACEP, UAF
- PCE: Power Cost Equalization
- EIA: Energy Information Administration
- ETI: Energy Transitions Initiative, ACEP
- FERC: Federal Energy Regulatory Commission
- CAGR: Compound Annual Growth Rate
- kW: Kilowatt
- kWh: Kilowatt-hour
- MW: Megawatt
- MWh: Megawatt-hour
- GW: Gigawatts
- GWh: Gigawatt-hour
- UAF: University of Alaska Fairbanks

## Appendix D.

### Acknowledgements and Roles

About the Team that Created the 2024 Alaska Electricity Trends Report

#### D.1. Acknowledgements

##### D.1.1. Funding

Funding support for this team was provided by leveraging support from multiple partners that include:

- Office of Naval Research's ([ONR](#)) Alaska Regional Collaboration for Technology Innovation and Commercialization ([ARCTIC](#)) program (award #N00014-19-1-2235)
- [Denali Commission](#) - Alaska Energy Project Partnerships (award #1659)
- State of Alaska

Note: Any opinions, findings, conclusions, or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the funding supporters.

##### D.1.2. Partners

- Alaska Center for Energy and Power ([ACEP](#)) at the University of Alaska Fairbanks ([UAF](#))
- Institute of Social and Economic Research ([ISER](#)) at the University of Alaska Anchorage ([UAA](#))
- Alaska Energy Authority ([AEA](#))
- DOWL Engineering ([DOWL](#))

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#### D.2. Credits and Roles

The Alaska Electrical Trends web book has been produced by the Alaska Center for Energy and Power ([ACEP](#)) at the University of Alaska Fairbanks ([UAF](#)). It is a collaboration between data scientists, researchers, and policy experts. Roles here are described by [Contributor Roles Taxonomy \(CRediT\)](#).

- [Jesse Kaczmarski1](#)
  - Roles: data curation, formal analysis, project administration, software, validation, visualization, writing – original draft

- [Ian MacDougall](#)<sup>1</sup>
  - Roles: data curation, formal analysis, software, validation, visualization, writing – original draft
- [Steve Colt](#)<sup>2</sup>
  - Roles: data curation, formal analysis, investigation, validation, writing – review & editing
- [Elizabeth \(Liz\) Dobbins](#)<sup>1</sup>
  - Roles: software, project administration, resources, supervision, writing – review & editing
- Neil McMahon<sup>3</sup>
  - Roles: data curation, investigation, validation
- [Sara Fisher-Goad](#)<sup>4</sup>
  - Roles: conceptualization, validation, writing – review & editing
- [Brittany Smart](#)<sup>2</sup>
  - Roles: project administration, writing – review & editing
- [Dayne Broderson](#)<sup>1</sup>
  - Roles: conceptualization, funding acquisition
- [Gwen Holdmann](#)<sup>2</sup>
  - Roles: conceptualization, funding acquisition
- [Shivani Mathur](#)<sup>2</sup>
  - Roles: validation, writing – review & editing
- [Erika Boice](#)<sup>2</sup>
  - Roles: writing – review & editing

#### D.2.1. Affiliations

ACEP's Data and Cyberinfrastructure Management (DCM) Team includes software developers, mathematicians, spatial analysts, economists, open science enthusiasts, and experts in information security and the deployment of computer infrastructure. ACEP's Energy Transition Initiative (ETI) is a group of experts that respond quickly to informational requests about Alaska energy. These teams together maintain a reliable pathway for data from collection to distribution.