

## Technical Appendix: GHG Reductions for the Lake and Peninsula School District

### GHG Reduction Estimate Method and Models/Tools Used:

#### Measure 1: Community Facilities Energy Efficiency – Schools and District Office

The Lake and Peninsula Borough (LPB) determined the potential energy savings for School District non-residential facilities, specifically the Lake and Peninsula School District's (LSPD) 13 K-12 School Facilities and the District's office building in King Salmon, Alaska, actual energy data from on site investigations by qualified personnel serves as the basis for analysis for potential reduction measures.

For the School Facilities, half of the schools had previously had energy audits completed in 2012. The audits established baseline energy usage, identified specific potential retrofits with specific electrical and fuel oil savings. While not all schools were audited, generally, the findings of each audit were similar. The average fuel and electrical reductions for each previously conducted school energy audit were averaged and then applied to each remaining unaudited school facility, adjusted based on the community size (in order to reflect relative school size and occupancy). This resulted in the project energy use reductions for each school facility.

The same process was completed for capital cost estimates, with previously conducted investment grade energy audits for several facilities serving as the basis for a population adjusted average for each unaudited school facilities. Capital costs were further adjusted based upon the lapsed time since the audits were completed in 2012. Capital cost estimates were increased by 35% to account for inflation over the past 12 years.

The energy audits conducted are dozens of pages long, the cover page to an audit is provided as a technical appendix; the LPSD will make all audits, and facility surveys available if requested.

#### Measure 2: Residential Energy Efficiency – Teacher Housing

Lake and Peninsula School District has 29 occupied teacher housing units providing housing for teachers across the 13 communities with Schools in the district. To determine the potential energy efficiency improvements possible for these facilities, the Lake and Peninsula Borough made assumptions regarding the potential energy use reductions based upon previous publicly available data.

Firstly, average household energy use across the Bristol Bay region data on average household energy use was determined from the Alaska Housing Finance Corporation's statewide 2018 Housing Report. The report tracks energy use in housing by region. All communities (with the exception of Newhalen) are powered by 100% diesel electric generators. To determine emissions impacts of electrical use, electrical usage was adjusted to gallons of diesel burned for power generation. This was accomplished using data from the Alaska Energy Authority 2022 PCE Report for each community utility. This report identifies diesel generation efficiency in a kilowatt hour per gallon format.

Once baseline energy usage per household was determined, the potential energy reductions from energy efficiency improvements was completed. Based upon data and assessments from the Alaska Housing Finance Corporation 2019 Weatherization Impacts report. This report identified that rural Alaska households can, on average, expect a 20% reduction in heating fuel requirements and a 10% reduction in

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electrical usage requirements after completing weatherization activities. These percentages were applied to the baseline energy usage estimates for each housing unit to establish expected energy savings from the proposed measure.

### Measure Implementation Assumptions:

#### Measure 1: Community Facilities Energy Efficiency – Schools and District Office

The 2019 AHFC Housing Weatherization report established an estimated useful life for energy efficiency retrofits of 20 years. The LPB assumed this useful life for retrofits would apply to community facilities as well.

Lake and Peninsula Borough assumed that it would take a year and a half to secure a qualified energy auditor to audit all facilities included in the project, and that implement retrofits would take two and a half years due to the remote nature of the project sites and a severely constrained and qualified workforce in Alaska and nationwide. The proposed implementation schedule was developed based upon the above assumptions.

Costs were based upon previously conducted energy audits and adjusted for inflation by 35% to reflect the 2012 dating of the original energy audits.

#### Measure 2: Residential Energy Efficiency – Teacher Housing

The 2019 AHFC Housing Weatherization report established an estimated useful life for energy efficiency retrofits of 20 years. The LPB assumed this useful life for retrofits would apply to community facilities as well.

Lake and Peninsula Borough assumed that it would take a year and a half to secure a qualified energy auditor to audit all facilities included in the project, and that implement retrofits would take two and a half years due to the remote nature of the project sites and a severely constrained and qualified workforce in Alaska and nationwide. The proposed implementation schedule was developed based upon the above assumptions.

Costs were based upon actual data for implementing energy efficiency retrofits for housing in rural Alaska identified in the AHFC 2019 Weatherization Impacts report. The report identified an average cost of \$30,000/unit. These prices were adjusted 20% to reflect inflation to 2025 prices after inflation.

### GHG Reduction Estimate Assumptions:

#### Measure 1: Community Facilities Energy Efficiency – Schools and District Office

The following Emissions factors for diesel were utilized using numbers from the [IPCC \(2013\). Climate Change 2013: The Physical Science Basis](#).

Units of Measure	Reduced Emissions - EPA Factors				
	CO2	NH4	N2O	NOx	Total
kg/gallon	10.21	0.41	0.08	0.00515	10.70515

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MT/gallon	0.010191	0.000409	0.000080	0.000005	0.010685721
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The above emissions reductions factors were applied to the total number of gallons of diesel fuel avoided from both reduced heating and indirectly through reduced electrical usage to determine emissions reductions estimates for each facility.

### Measure 2: Residential Energy Efficiency – Teacher Housing

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	CO2	NH4	N2O	NOx	Total
kg/gallon	10.21	0.41	0.08	0.00515	10.70515
MT/gallon	0.010191	0.000409	0.000080	0.000005	0.010685721

The above emissions reductions factors were applied to the total number of gallons of diesel fuel avoided from both reduced heating and indirectly through reduced electrical usage to determine emissions reductions estimates for each housing unit.

### **GHG Emissions Reduced:**

The below table identifies emissions reductions totals by measure using the above stated methodology to establish estimated annual emissions reductions.

Emissions Measures	Annual Reduced diesel (g)	Annual Reduced Emissions
<b>Measure 1: Community Facilities EE - Schools and District Office</b>	39,596	403
<b>Measure 2: Residential EE - Teacher Housing Units</b>	5,218	53
<b>Total</b>	<b>44,814</b>	<b>456</b>

The below table identifies emissions reductions totals by measure using the above stated methodology to establish estimated emissions reductions over the time period from 2025-2050.

Emissions Measures	Near Term - 2025-2030 GHG Reductions (MTCO2e)	Long Term - 2050 GHG Reductions (MTCO2e)	Total Emissions Reductions	Total Capital Cost	Capital Cost / Emissions Reductions (MT)
<b>Measure 1: Community Facilities EE - Schools and District Office</b>	1,212.00	6,868	8,080	\$4,078,037	\$ 504.71

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<b>Measure 2: Residential EE - Teacher Housing Units</b>	159.45	904	1,063	\$ 1,257,436	\$ 1,182.90
<b>Total</b>	<b>1,371.45</b>	<b>7,772</b>	<b>9,143</b>	<b>\$ 5,335,474</b>	<b>\$583.56</b>

### Key Data Sources:

- AEA FY2022 PCE Report – Utility Efficiency and Fuel Prices
- AHFC 2019 Weatherization Impacts Report – Residential EE energy use reductions potential, capital cost estimates
- AHFC 2018 Housing Assessment – Baseline Residential energy usage
- Previously Conducted Energy Audits

### Additional attachments:

1. AEA 2023 PCE Report Example Community
2. AHFC 2019 Weatherization Impacts Report Cover
3. 2018 AHFC Housing assessment Cover
4. Example Energy Audit Cover Page

# Chignik Lagoon PCE

Utility: CHIGNIK LAGOON POWER UTILITY

Reporting Period: 07/01/22 to 06/30/23



Community Population	72
Last Reported Month	June
No. of Monthly Payments Made	12
Residential Customers	67
Community Facility Customers	7
Other Customers (Non-PCE)	15

Fiscal Year PCE Payments \$112,501

## PCE Statistical Data

PCE Eligible kWh - Residential Customers	178,566	Average Annual PCE Payment per Eligible Customer	\$1,520
PCE Eligible kWh - Community Facility Customers	41,341	Average PCE Payment per Eligible kWh	\$0.51
Total PCE Eligible kWh	219,907	Last Reported Residential Rate Charged (based on 500 kWh)	\$0.90
Average Monthly PCE Eligible kWh per Residential Customer	222	Last Reported PCE Level (per kWh)	\$0.62
Average Monthly PCE Eligible kWh per Community Facility Customer	492	Effective Residential Rate (per kWh)	\$0.28
Average Monthly PCE Eligible Community Facility kWh per Person	48	PCE Eligible kWh vs Total kWh Sold	52.3%

## Additional Statistical Data Reported by Community\*

Generated and Purchased kWh		Generation Costs	
Diesel kWh Generated	326,734	Fuel Used (Gallons)	26,744
Non-Diesel kWh Generated	148,899	Fuel Cost	\$135,340
Purchased kWh	0	Average Price of Fuel	\$5.06
Total Purchased & Generated	475,633	Fuel Cost per kWh sold	\$0.32
		Annual Non-Fuel Expenses	\$111,449
		Non-Fuel Expense per kWh Sold	\$0.26
		Total Expense per kWh Sold	\$0.59

Consumed and Sold kWh		Efficiency and Line Loss	
Residential kWh Sold	232,651	Consumed vs Generated (kWh Sold vs Generated-Purchased)	88.4%
Community Facility kWh Sold	41,341	Line Loss (%)	4.8%
Other kWh Sold (Non-PCE)	146,633	Fuel Efficiency (kWh per Gallon of Diesel)	12.22
Total kWh Sold	420,625	PH Consumption as % of Generation	6.7%
Powerhouse (PH) Consumption kWh	32,010		
Total kWh Sold & PH Consumption	452,635		

## Comments

\*The data contained in this report is primarily based on information submitted by the utility with their monthly PCE reports. Changes to the reported data and/or significant anomalies have been noted in the comments.

# Weatherization Program IMPACTS REPORT

Oil prices spiked in 2007 and 2008, peaking at \$145.31 per barrel on July 3, 2008.<sup>1</sup> While this meant significant additional revenue for the State of Alaska, it also put a large energy cost burden on households, especially in communities where oil is the primary heating fuel and electricity is produced by diesel-fired generators. Alaska's cold climate leads to significantly higher energy use for home heating, with the average single-family home using approximately twice the energy per year as the average home in other "cold" climate regions of the U.S.<sup>2</sup> This high energy consumption and reliance on fuel oil leads to a higher energy cost burden for households throughout the state, particularly in rural regions where energy spending was as much as four times higher than the national average even with the relatively low oil prices of 2016.<sup>3</sup>

In response to this increased energy cost burden on households, the State of Alaska initially gave relief to Alaskans through a direct payment to everyone who was registered to receive a dividend in 2007. The Alaska Legislature provided longer-term relief to residents in 2008 by providing \$300 million in funding to expand the Alaska Housing Finance Corporation's (AHFC) Weatherization Assistance program and establish the Home Energy Rebate program. Success of the programs led to additional funding from the legislature for AHFC, totaling \$579 million from fiscal years 2008 to 2018.<sup>4</sup>

AHFC was directed to use these funds to meet the legislative intent of the programs. During testimony, legislative sponsors indicated program intent for home energy efficiency programs were to reduce

## KEY OBJECTIVES

- Reduce residential energy use
- Reduce energy costs
- Create jobs and stimulate the construction industry
- Improve home comfort and durability
- Reduce greenhouse gas and particulate matter emissions
- Improve quality of home life and alleviate home residents hardship

home energy bills, create jobs, and increase affordability of home heating and electricity.<sup>5</sup> To that end, AHFC administrators outlined six primary program objectives including reduce residential energy use, reduce energy costs, create jobs and stimulate the construction industry, improve home comfort and durability, reduce greenhouse gas and particulate matter emissions, and improve quality of home life and alleviate home resident hardship.<sup>6</sup>

This report evaluates the impacts of the Weatherization program on Alaska, focusing on the progress made between 2008 and early 2018 in each objective outlined in the legislative intent.

## Program Description

The goal of the Weatherization program is "to increase the energy efficiency of dwellings owned

1. Cushing, OK spot price from U.S. Energy Information Administration. Data available at: [https://www.eia.gov/dnav/pet/pet\\_pri\\_spt\\_s1\\_d.htm](https://www.eia.gov/dnav/pet/pet_pri_spt_s1_d.htm)

2. Madden, D., Wiltse, N. 2018 Alaska Housing Assessment. CCHRC for Alaska Housing Finance Corporation. 2018. Available at: <https://www.ahfc.us/efficiency/research-information-center/alaska-housing-assessment/2018-housing-assessment>

3. Ibid.

4. In nominal dollars

5. Alaska State Senate Finance Committee testimony (2008, March 12). Retrieved on January 25, 2019: [www.legis.state.ak.us/pdf/25/M/SFIN2008-03-121457.PDF](http://www.legis.state.ak.us/pdf/25/M/SFIN2008-03-121457.PDF)

6. Personal communication with Research and Rural Development Staff, AHFC, 10/30/2018.

**2018 Alaska Housing Assessment**  
**Statewide Housing Summary**  
**January 17, 2018**

# ENERGY AUDIT REPORT

Nondalton School

1000 School Road

Nondalton, Alaska 99640

AkWarm ID No. BBNC-5NN-CAEC-01



Submitted by:

Central Alaska Engineering Company  
Contact: Jerry P. Herring, P.E., C.E.A.  
32215 Lakefront Drive  
Soldotna, Alaska 99669  
Phone (907) 260-5311  
[akengineer@starband.net](mailto:akengineer@starband.net)

June 27, 2012

**Central Alaska**   
ENGINEERING COMPANY



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