Buckland
Nunatchiaq

Native Village of Buckland:
907-494-2171
City of Buckland:
907-494-2121

Demographics –
Native Village Status: Federally Recognized Tribal Council
Alaska Native Name: Nunachiak
Population: 511
Avg. Household Size: 5.02
Median Household Income: $41,932

Access –
Barge Access: Seasonal
Runway Ownership: State
Runway Surface: Gravel
Runway 1: 3,200 ft x 75 ft
Runway 2: None

Climate –
Average Summer Temperature: 52 °F
Average Winter Temperature: -2 °F
Heating Degree Days: 15,751

Heat & Power Costs (2021) –
Cost of Diesel Fuel: $6.15 per gal
Cost of Gasoline: $6.15 per gal
Cost of Electricity: $0.47 per kWh
Cost of Electricity, after PCE: $0.31 per kWh

Tank Farm -
Ownership: Native Village, City, School, AKDOT
Total Capacity: 297,300 gal
Status/Year Built: Acceptable

Electric Utility –
City of Buckland

Power Demand (2020) –
Average Summer Load: 180 kW
Average Winter Load: 250 kW
Peak Summer Load: 260 kW
Peak Winter Load: 350 kW
Total Power Generated: 1,626,621 kWh

Power System –
Fuel Efficiency (2020): 11.16 kWh/gal diesel
Line Loss (2018): 11.5%

Number of Community Buildings on PCE (2020): 12
Community PCE kWh Use of Total Allowed (2020): 28% (119,987 kWh - used / 429,240 kWh – total allowed)

Power Generation Infrastructure –
Diesel Engines:

Manufacturer	Model	Capacity	Year Built
Caterpillar	3456	475 kW	2006
John Deere	6135	400 kW	2021
John Deere	6135	310 kW	2021

Wind Turbine(s):

Manufacturer	Model	Capacity	Year Built
Northern Power Systems	Northwind 100	100 kW	2013
Northern Power Systems	Northwind 100	100 kW	2013

Solar PV:

Installer	Inverter	Capacity	Year Built
BoxPower	SMA Tripower	45.99 kW	2019

(Additional 10.13 kW installed for water plant, behind the meter)

Battery Storage System:

Manufacturer	Model	Capacity	Year Built
SAFT	Intensium Mini-M	277 kW / 218 kWh	2019

Heat Recovery –
Facilities Served: City office, new WTP, old WTP/Washeteria
Opportunity to Expand Waste Heat: Yes

Water & Wastewater –
Ownership: City of Buckland
Water System: Circulation Loop(s)
Wastewater System: Gravity

Selected Projects –

EPA DERA Generator Replacement – *Expected 2022*

- Replacement of two generators, 2021
  - John Deere 6135, 400 kW
  - John Deere 6135, 310 kW
- EPA Diesel Emissions Reduction Act & City of Buckland
  - $484,923 awarded from EPA in 2020
  - $96,665 from City of Buckland Cost Share

Solar PV Array and Inverter – *Completed 2019*

- Installed 45.99 kW solar PV and inverter, 2019
  - Solar PV & foundations by BoxPower
- Displaces 2,900+ gal/year diesel fuel
- Contributed to 130+ hours of diesels-off in 2020
- DOE Office of Indian Energy
  - $1 million awarded from DOE in 2016
  - $1 million match funding from NANA
    - Award for Kotzebue, Buckland, & Deering

Battery Storage and Controls – *Completed 2019*

- Installed 277 kW/218 kWh battery storage and controls
  - Necessary to make solar PV array effective
- Integrated solar PV & battery storage with microgrid, 2019
- Contributed to 130+ hours of diesels-off in 2020
- USDA High Energy Cost Grant Program
  - $1.6 million awarded in 2016
    - Award for Buckland and Deering

Wind/Diesel Microgrid – *Completed 2015*

- Installed two Northwind 100 kW wind turbines, 2013
- Integrated wind turbines with microgrid, 2015
- Displaces 18,000+ gal/yr diesel fuel
- Contributed to 130+ hours of diesels-off in 2020
- AK Energy Authority Renewable Energy Fund, Round 1
  - $10.5 million awarded in 2009
    - Shared award for Noorvik, Buckland, and Deering

LED Streetlight Retrofit Borough-Wide – *Completed 2015*

- Installed 8 LED streetlights in Buckland
- 25-year community savings: ~$870,000 & ~330,000 gal diesel
- State of Alaska, Grants to Municipalities
  - Funding awarded 2014
  - $200,000 awarded to Northwest Arctic Borough

Water Plant Solar PV – *Completed 2015*

- 10.3 kW solar PV installed
- Average 18 kWh/day; still operational
- Coastal Impact Assistance Program (CIAP)
    - Funding awarded 2009
    - $84,078 awarded

Future Projects –

Overhaul Generator 1

- Generator 1 is currently non-functional
- Overhaul generator 1 to enhance reliability and capacity to run system in automatic
    - Use Village Improvement Funding that is already allocated

Energy Audits

- Conduct additional energy audits of community buildings
    - Water treatment plant, washeteria, health clinic, school, sewer building, lift stations, City offices, City shop, City storage, teacher housing, armory, IRA building, and Native store.
- Conduct additional energy audits of residential buildings
    - Elders' homes and pastor home
- Conduct operational energy audits
    - Water treatment plant
        - Adjust heat add set points, utilize recovered heat, utilize electric boiler
- Complete energy efficiency recommendations to reduce heating and operational costs

Community-Wide Residential LED Lighting Upgrade

- Upgrade all residential lighting fixtures to energy efficient LED lighting
    - Survey type and quantity of lighting fixtures in all homes
    - Apply for Village Improvement Fund support
    - Procure and install energy efficient lighting
        - Reduce residential electricity costs

LED Streetlight Retrofit

- Install 30 new LED streetlights
- Upgrade 25 existing streetlights to LEDs
- Apply for Village Improvement Fund support
    - Hire local labor to install

Solar PV, Wind Turbines, and Battery Storage

- Increase capacity of solar PV array and battery storage
- Install additional wind turbine
    - Explore opportunity to use KEA's extra Northwind 100 wind turbine

- Displace additional diesel fuel and increase hours of diesels-off
    - Reduce the cost of electricity
- Enhance resiliency of system

Distribution System Upgrade

- Assess system to identify sources of high line loss
    - Replace and upgrade aging infrastructure, as required
        - Transformers, wires, etc.
- Straighten power poles that are leaning severely

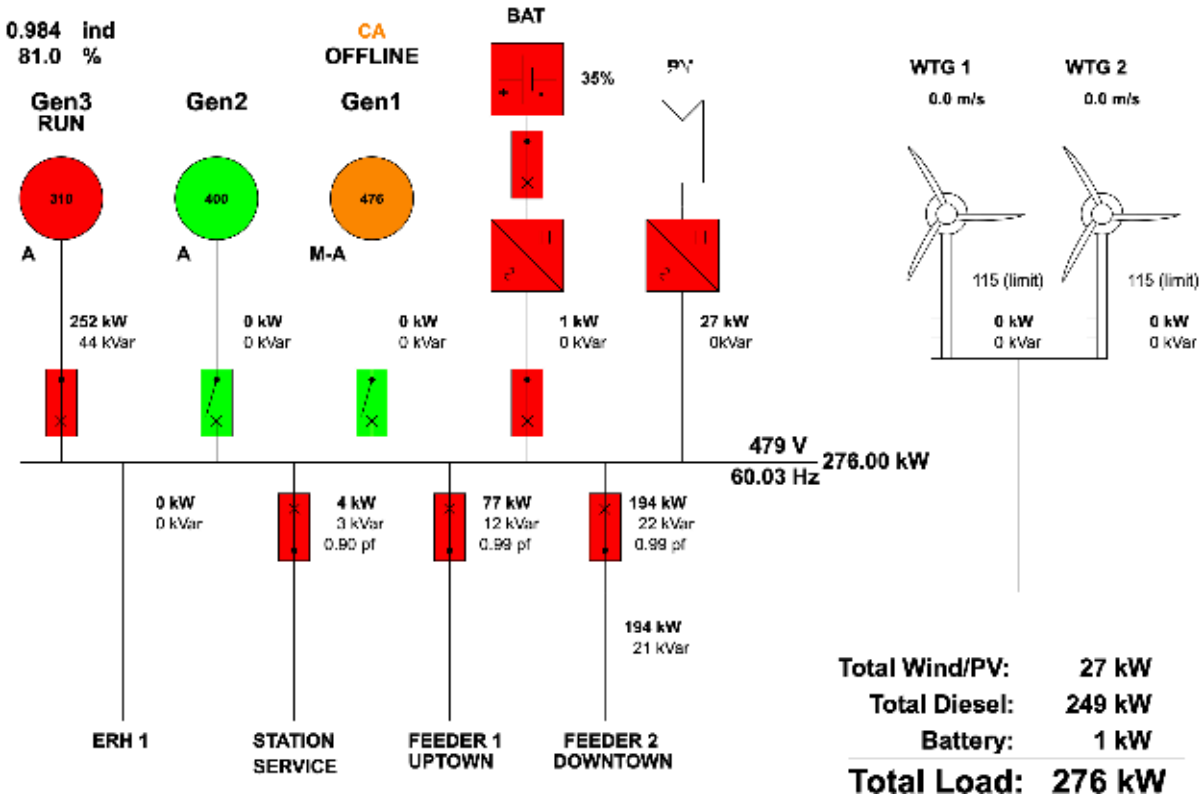
Energy Milestones –

- Achieved diesels-off operation – *July 20th, 2019*
- Installed first solar PV in Buckland – *Completed 2015*

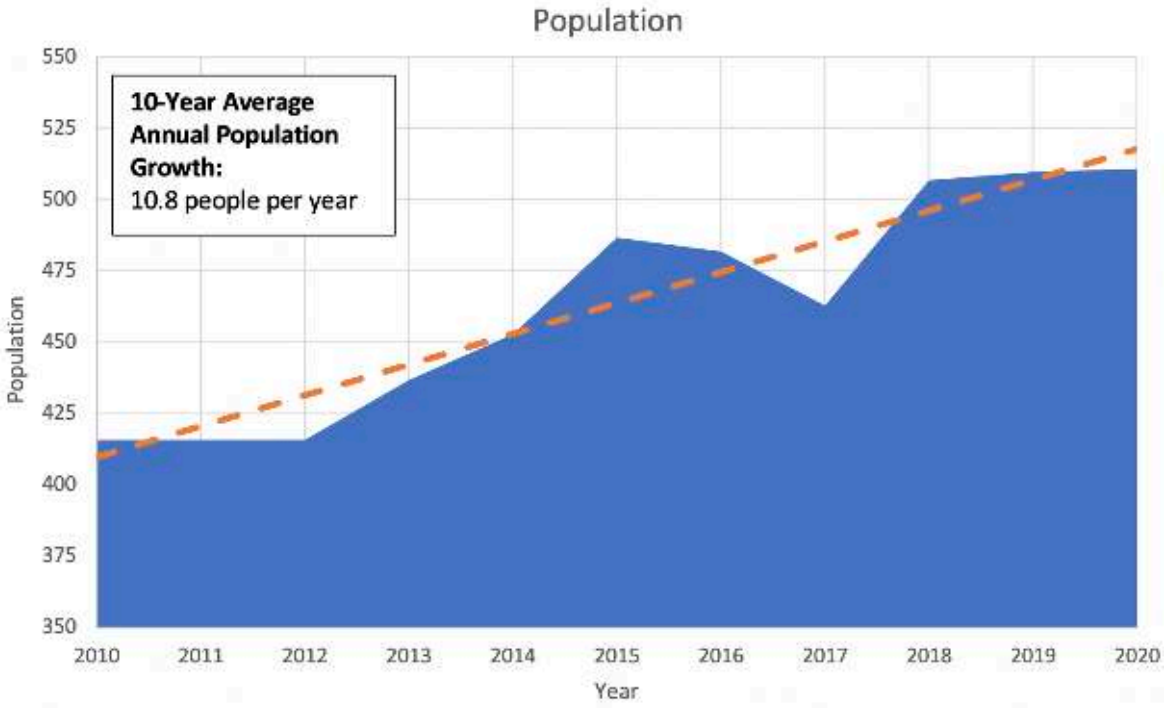
Community Goals –

- Reduce cost of residential space and water heating
    - Expand renewable energy microgrid
        - Solar PV, wind turbines, battery storage
    - Implement energy efficiency measures
    - Maintain and/or replace aging residential heating appliances
- Rebuild or replace diesel generator #1 to enhance reliability of power system
- Enhance energy efficiency of water and sewer systems
    - Repair and upgrade service lines to reduce frequency of freeze-ups
        - Dump Rd. sewer services freeze-up most frequently
- Create additional training opportunities for operators to enhance skills and understanding of microgrid
- Train back-up operator to expand the number of power system experts within the community
    - Provide relief for primary operator
    - Enhance reliability of power system
- Partner with Northwest Inupiat Housing Authority to implement policy changes to prioritize and invest in energy efficiency in newly constructed homes

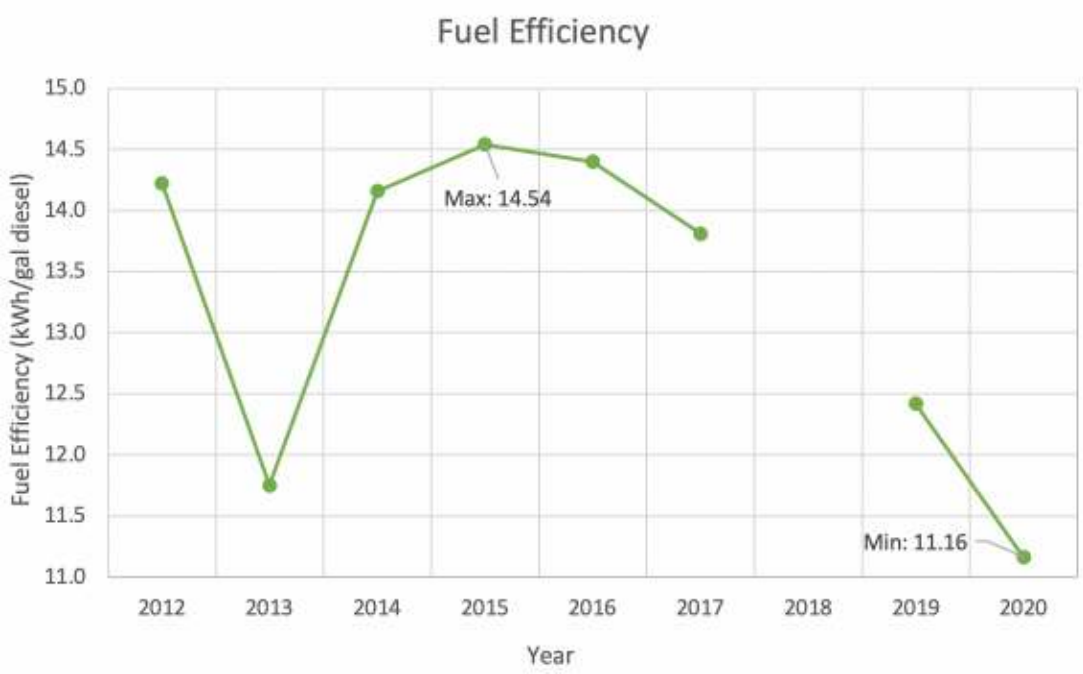
Microgrid System Schematic –



Energy System Trends –

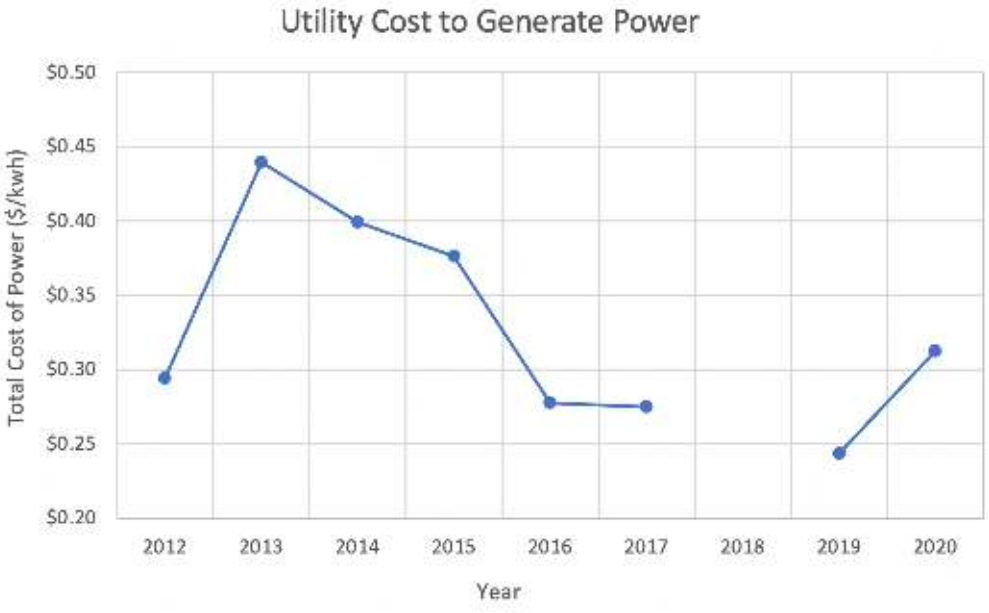


Dramatic changes in population impact the long-term community planning necessary to meet future power demand. The population in Buckland is not changing dramatically. Over the last ten years the population has increased an average of 2.6% each year.

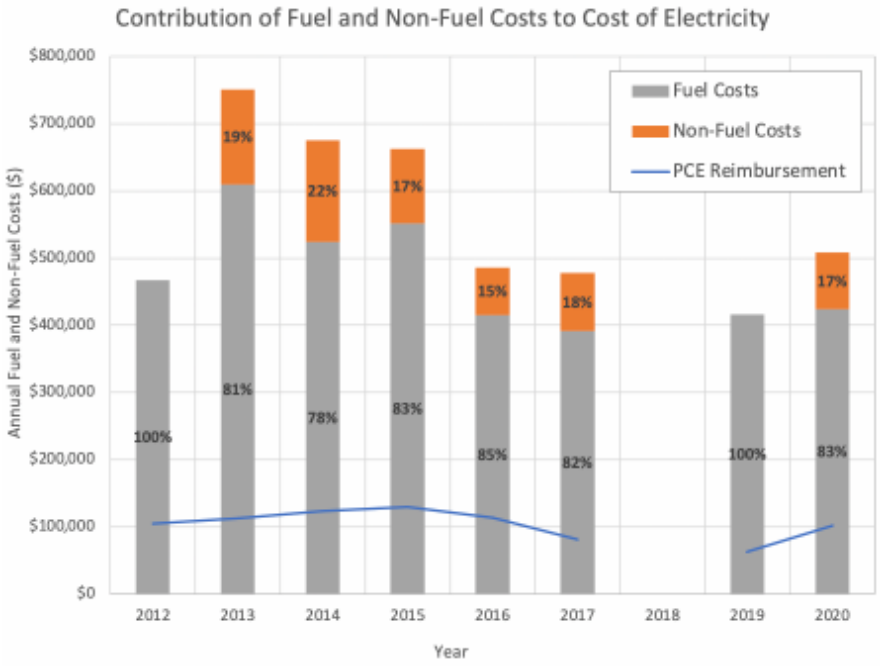


A higher fuel efficiency results in less diesel fuel use and a lower cost to generate power. A fuel efficiency below 12 kWh/gal is poor; a fuel efficiency above 14 kWh/gal is excellent. *From 2014 to 2017 the fuel efficiency in Buckland has been excellent, but in recent years it has been poor. Due to the method that is used to calculate this value in the PCE data, there are a variety of potential causes for this reduction in fuel efficiency. Further investigation is required to understand this decline in fuel efficiency. No data was available for 2018.*

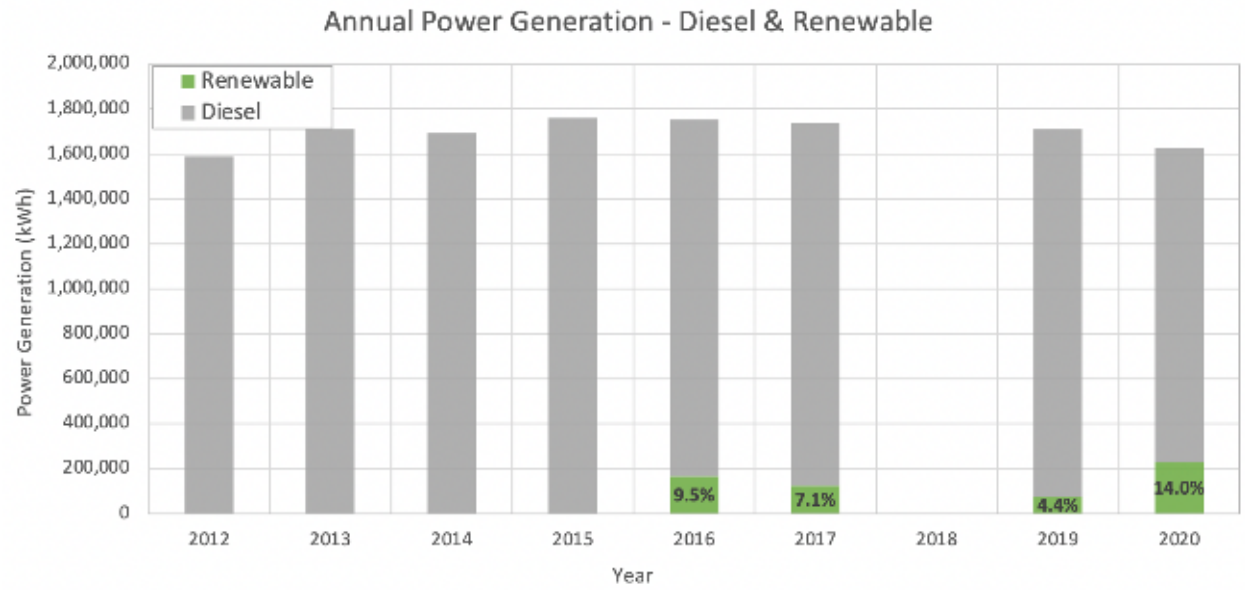
The maximum allowable line loss to maintain eligibility for PCE benefits is 12%. In Buckland, the line loss decreased steadily from 2012 to 2014, indicating the distribution system was in good condition and all power use is accounted for. Since then, the line loss has increased dramatically. Recent line loss values should be calculated and the system should be evaluated if high line loss persists. No data was available for 2019 and 2020.



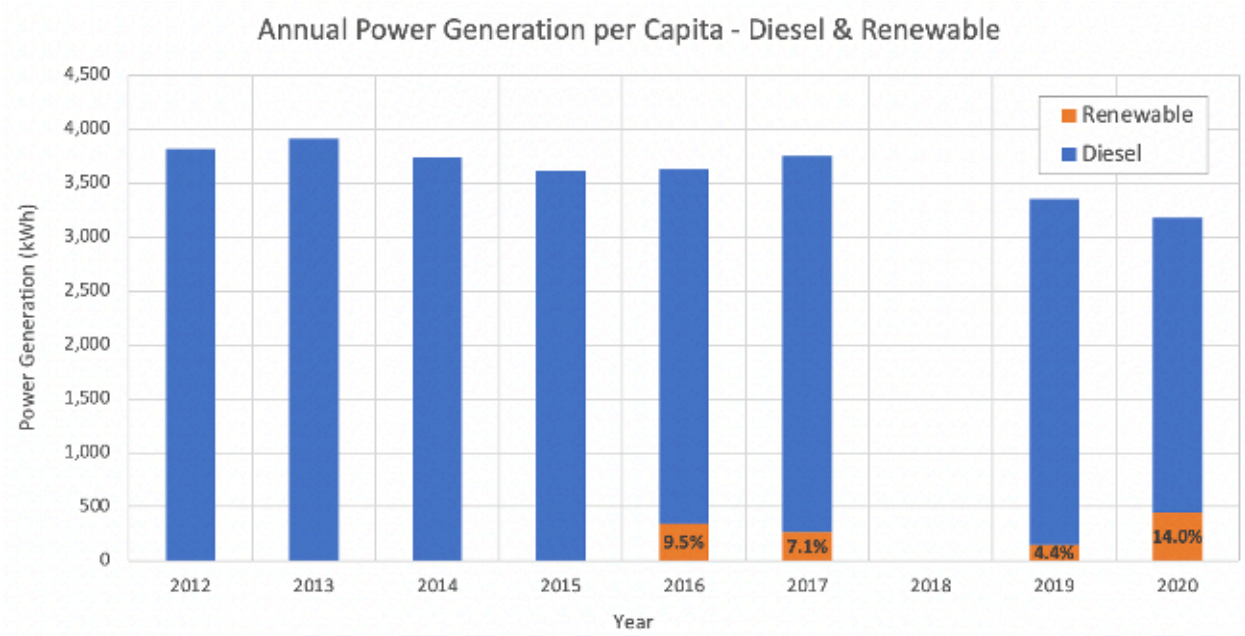
Over the long-term, a lower utility cost to generate power typically correlates with a lower cost of electricity for residents. The major factors that affect the cost to generate power are the cost of fuel, generator fuel efficiency, maintenance, and operations. Major system breakdowns may cause the cost to generate power to spike on a particular year, as will high fuel prices. In Buckland the cost to generate power has been trending lower each year since 2013, excluding the slight increase in 2020. Fuel savings from power generated by renewable energy sources are likely contributing to this reduction. No data was available for 2018.



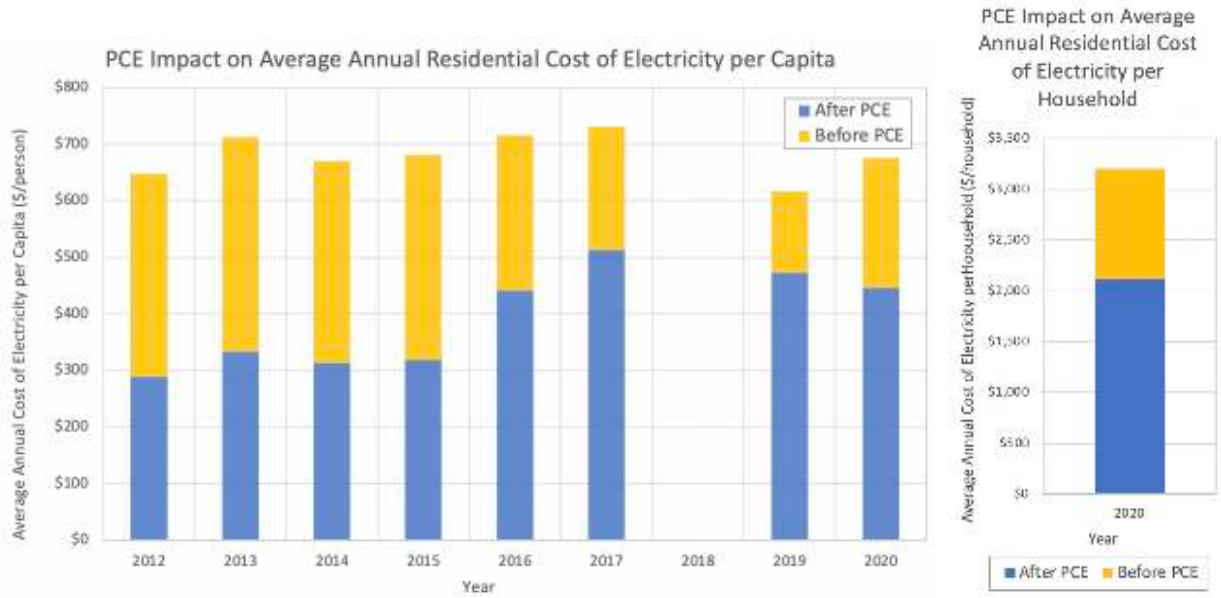
For many utilities, the non-fuel costs associated with generating power do not change dramatically each year. Fuel costs, on the other hand, are highly susceptible to annual fluctuations based on the global price of fuel, transportation costs, and the amount of power generated. PCE reimbursement is meant to offset the high fuel costs in rural Alaska. As the overall efficiency of the system increases, the PCE reimbursement offsets a larger portion of the total fuel costs. In Buckland, the reported portion of the costs spent on fuel is exceptionally high relative to other communities in the region. This is likely because in many of the other communities the Alaska Village Electric Cooperative (AVEC) owns and operates the local power plant. AVEC is able to buy fuel at a lower rate due to the volume of fuel they purchase for all the communities they serve. No data was available for 2018.



Renewable sources of power generation reduce diesel fuel use and can increase resiliency, in addition to offering many other benefits. The portion of power that is generated by renewable energy sources depends both on the capacity of the installed infrastructure as well as the performance of that infrastructure. In this way, the renewable energy generated may vary annually depending on the availability of the resource and availability of the equipment. In Buckland the portion of power generated by renewable energy sources has varied each year. No data was available for 2018.



In general, people choose to power more electric devices each year, so the power generation per capita is expected to increase over time. When power generation per capita instead decreases over time, it is often correlated with reductions in power consumption as a result of energy efficiency upgrades. Power generation is also affected by the weather and corresponding heating needs each year. In 2019 and 2020 there were significant reductions in power generation per capita. No data was available for 2018.



The PCE reimbursement reduces the residential cost of electricity by *a* different *amount* each year*. In communities where the main factor that affects the cost of power is the price of fuel, the PCE reimbursement will tend to levelize the residential cost of electricity from one year to the next. In Buckland, the residential cost of electricity per capita after PCE has varied dramatically over the last nine years from less than $300 per year to more than $500 per year. No data was available for 2018.*