Shungnak
Issingnak

Native Village of Shungnak:
907-437-2163
City of Shungnak:
907-437-2161
Alaska Village Electric Cooperative:
907-561-1818

Demographics –
Native Village Status: Federally Recognized Tribal Council
Alaska Native Name: Issingnak
Population: 274
Avg. Household Size: 5.1
Median Household Income: $40,833

Access –
Barge Access: Seasonal / None (depending on river water levels)
Runway Ownership: State
Runway Surface: Gravel
Runway 1: 4,001 ft x 60 ft
Runway 2: None

Climate –
Average Summer Temperature: 57 °F
Average Winter Temperature: -1 °F
Heating Degree Days: 15,780

Heat & Power Costs (2021) –
Cost of Diesel Fuel: $8.50 per gal
Cost of Gasoline: $8.50 per gal
Cost of Electricity: $0.67 per kWh
Cost of Electricity, after PCE: $0.25 per kWh

Tank Farm -
Ownership: City of Shungnak, Northwest Arctic Borough School District (NWABSD), AVEC, Native Store
Bulk Fuel Capacity:

Owner	Fuel	Capacity (gal)
City of Shungnak	Diesel	5,000
NWABSD	Diesel	40,800
AVEC	Diesel	116,300
Native Store	Gasoline	32,800
Native Store	Diesel	41,500

Condition: Deteriorating

Electric Utility –
Alaska Village Electric Cooperative

Power Demand (2020) –
**Values are approximate, based on Shungnak portion of total power generated*
Average Summer Load: 113 kW
Average Winter Load: 171 kW
Peak Summer Load: 124 kW
Peak Winter Load: 186 kW
Total Power Generated: 1,713,871 kWh
Total Power Purchased by Kobuk (via powerline connected to Shungnak): 650,370 kWh

Power System (2020) –
Efficiency: 13.49 kWh/gal
Line Loss: 4.2%
Number of Community Buildings on PCE: 9
Community PCE kWh Use of Total Allowed: 62% (142,919 kWh / 230,160 kWh)

Power Generation Infrastructure –
Diesel Engines:

Manufacturer	Model	Capacity
Caterpillar	3456	505 kW
Caterpillar	3406B	363 kW
Caterpillar	3456	505 kW

Wind Turbine(s): None
Solar PV:

Installer	Inverter	Capacity	Year Built
Alaska Native Renewable Industries	Solar Edge	223.6 kW bifacial	2021

**Installation located in Shungnak, 186.3 kW owned by Shungnak*
(Additional 7.5 kW installed for water plant, behind the meter)

Battery Storage System:

Component	Manuf.	Model	Capacity	Year Built
Battery	Blue Planet	Blue Ion 2.0	384 kWh	2021
Microgrid Controller	Ageto	ARC	-	2021
Converter	EPC	PD-250	250 kW	2021

Heat Recovery –
Facilities Served: Water Treatment Plant, City offices
Opportunity to Expand Waste Heat: Yes

Water & Wastewater –
Ownership: City of Shungnak
Water System: Circulating Loop(s)
Wastewater System: Gravity

Selected Projects –

Waste Heat Expansion – *Expected 2022*

- Expand to serve: clinic, cookhouse, VPSO
- AK Energy Authority Renewable Energy Fund, Round 13
    - Funding awarded 2021
    - $1.3 million awarded

Solar PV/Battery Storage Microgrid – *Completed 2021*

- Installed 223.5 kW Solar PV; 186.3 kW owned by Shungnak
- Installed 384 kWh Battery Storage System; all Shungnak-owned
- Estimated to displace 9,800+ gallons of diesel per year
- Developed Independent Power Producer agreement with AVEC
- USDA High Energy Cost Grant, Village Improvement Fund
    - $1.3M awarded from USDA in 2020
    - $489,000 awarded from VIF in 2020

LED Streetlight Retrofit Borough-Wide – *Completed 2015*

- Installed 10 LED streetlights in Shungnak
- 25-year community savings: ~$1.1M & ~420,000 gal diesel
- State of Alaska, Grants to Municipalities
    - Funding awarded 2014
    - $200,000 awarded to Northwest Arctic Borough

Water Plant Solar PV – *Completed 2016*

- 7.5 kW solar PV installed
- Average 17 kWh/day; still operational
- Coastal Impact Assistance Program (CIAP)
    - Funding awarded 2009
    - $ 58,513 awarded

Intertie: Shungnak & Kobuk – *Completed 1994*

- Electrically connect Shungnak and Kobuk
- Constructed 10 mi. of distribution line
    - Also supports telecommunication cables
- Substantial maintenance required in near future
- Owner: Alaska Energy Authority
    - Now for sale

Future Projects –

Wind Turbines

- Install MET tower to characterize wind resource
- Conduct feasibility study to evaluate opportunity for wind energy in Shungnak
- Identify and secure funding for design and construction

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

Residential Heat Trace Design Upgrade

- Survey residential heat trace infrastructure and operation
- Design and implement improved system to maintain water system functionality in winter
    - Reduce energy consumption and enhance reliability

Energy Scholarship

- Develop scholarship program to enhance local involvement and interest in local energy systems
    - Train scholarship recipients to be experts in local energy systems
    - Target local youth

Milestones –

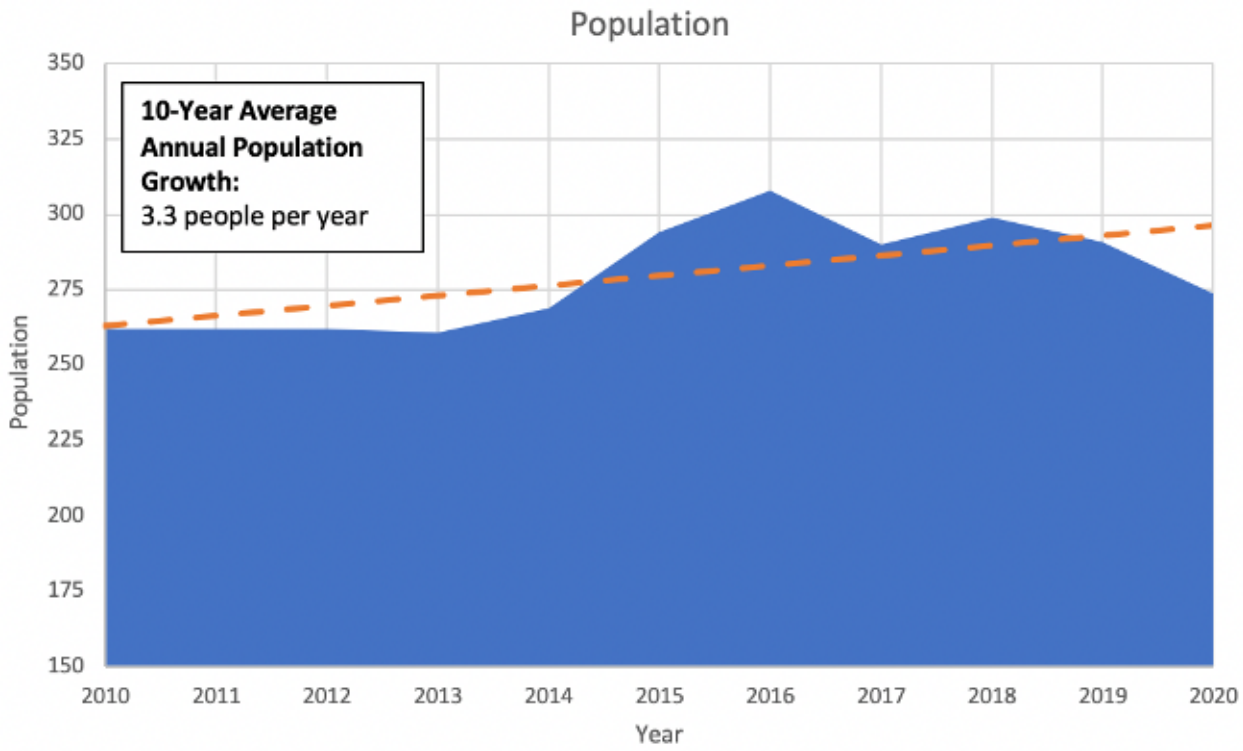
- Developed first Independent Power Producer agreement with AVEC – *Completed 2021*
- Installed first utility-scale solar PV in Shungnak, *Completed 2021*
- Installed first solar PV in Shungnak, *Completed 2016*

Community Goals –

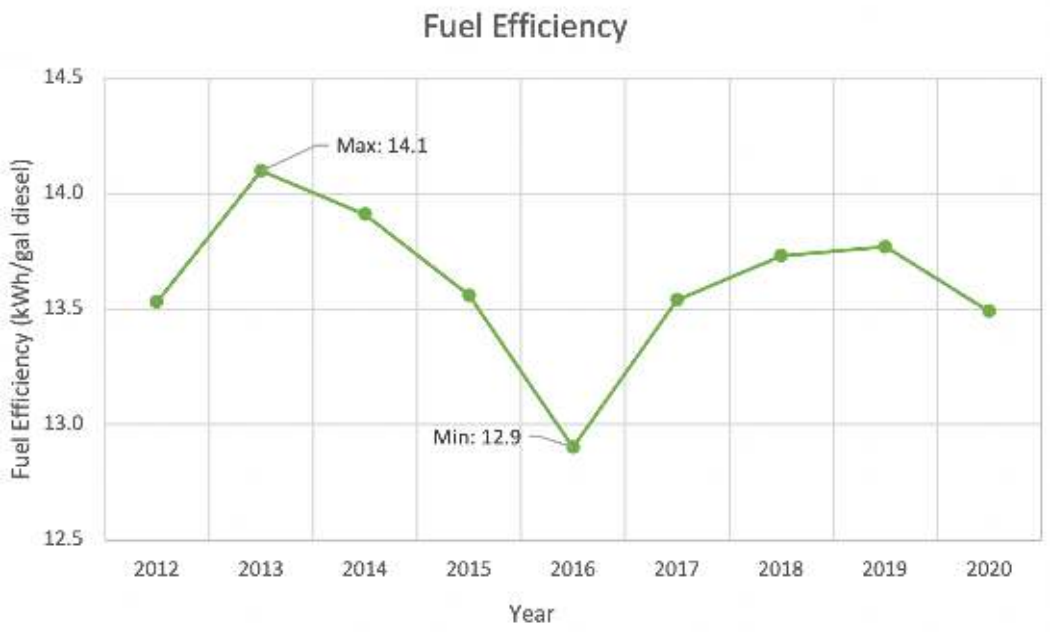
- Reduce cost of residential space and water heating
    - Install heat pumps in all homes
    - Expand renewable energy microgrid
    - Implement energy efficiency measures
    - Maintain and/or replace aging residential heating appliances
- Continue to optimize operation of bifacial solar installation
    - Explore methods of deicing panels in the spring
- Continue to monitor success of Independent Power Producer agreement and adjust as necessary
- Enhance energy efficiency of water and sewer systems
    - Reduce number of water and sewer freeze-ups
- Create additional training opportunities for operators to enhance skills and understanding of microgrid
- Explore regional opportunities for fuel cooperative with Ambler and Kobuk

    - Optimize fuel storage to reduce need for flown-in fuel
    - Consider cost savings if diesel use is reduced below margin where flown-in fuel is required
- Engage youth in community energy system
- Partner with Northwest Inupiat Housing Authority to implement policy changes to prioritize energy efficiency in newly constructed homes

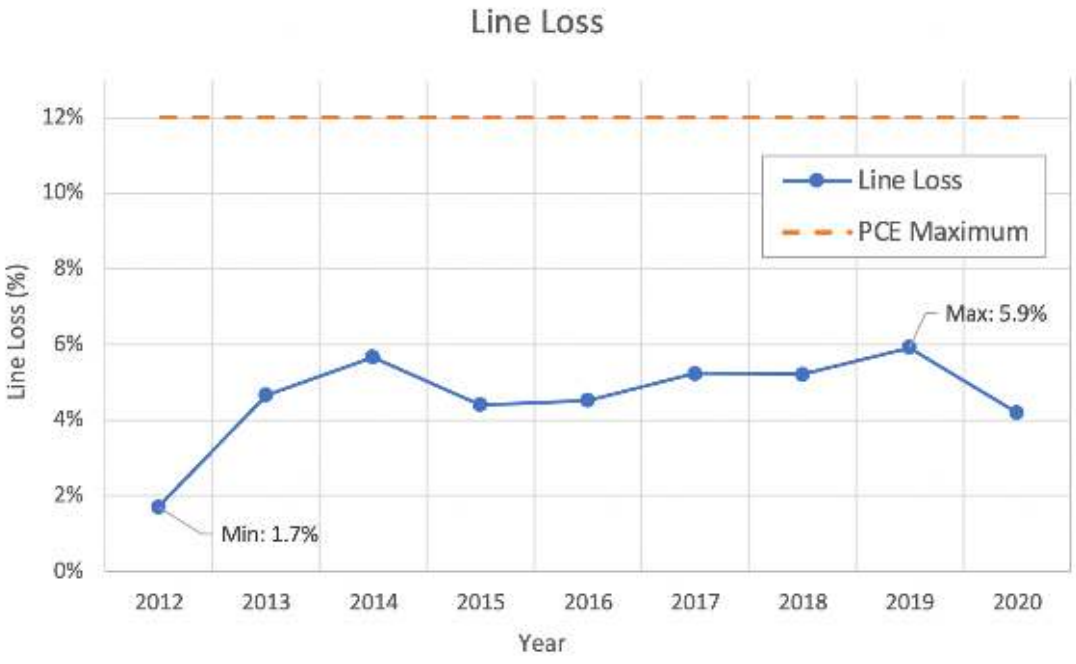
Energy System Trends –



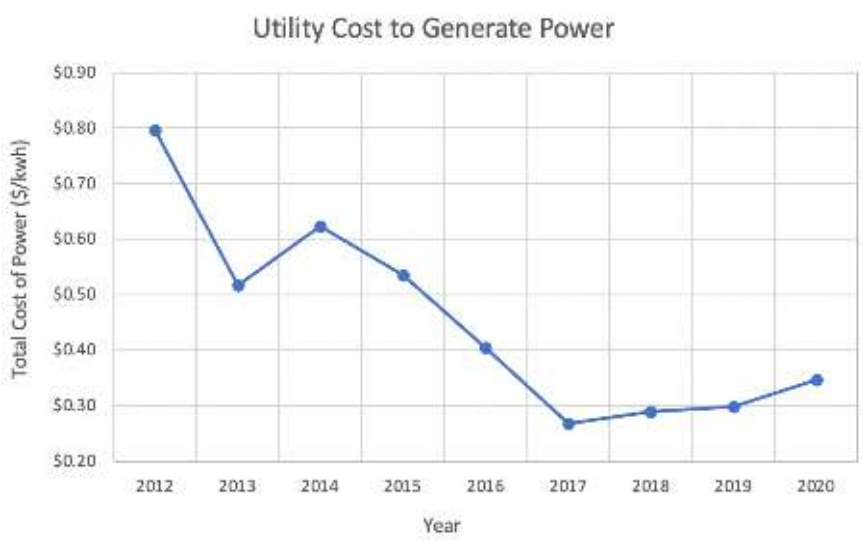
Dramatic changes in population impact the long-term community planning necessary to meet future power demand. The population in Shungnak is not changing dramatically. Over the last ten years the population has increased an average of 1.3% each year.



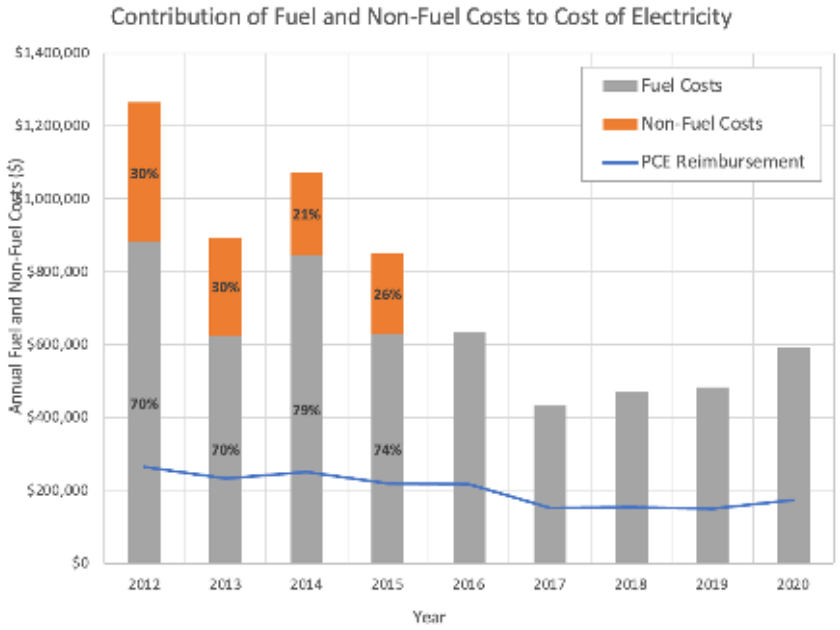
A higher fuel efficiency results in less diesel fuel use and a lower cost to generate power. A fuel efficiency below 12 kWh/gal is poor; a fuel efficiency above 14 kWh/gal is excellent. The fuel efficiency in Shungnak typically has been very good. In 2016 the fuel efficiency dipped below 13 kWh/gal, which is unusually low for Shungnak. The data for Shungnak includes the power generated for Kobuk. Kobuk is intertied to Shungnak and does not generate power except in the case of unplanned blackouts in Shungnak.



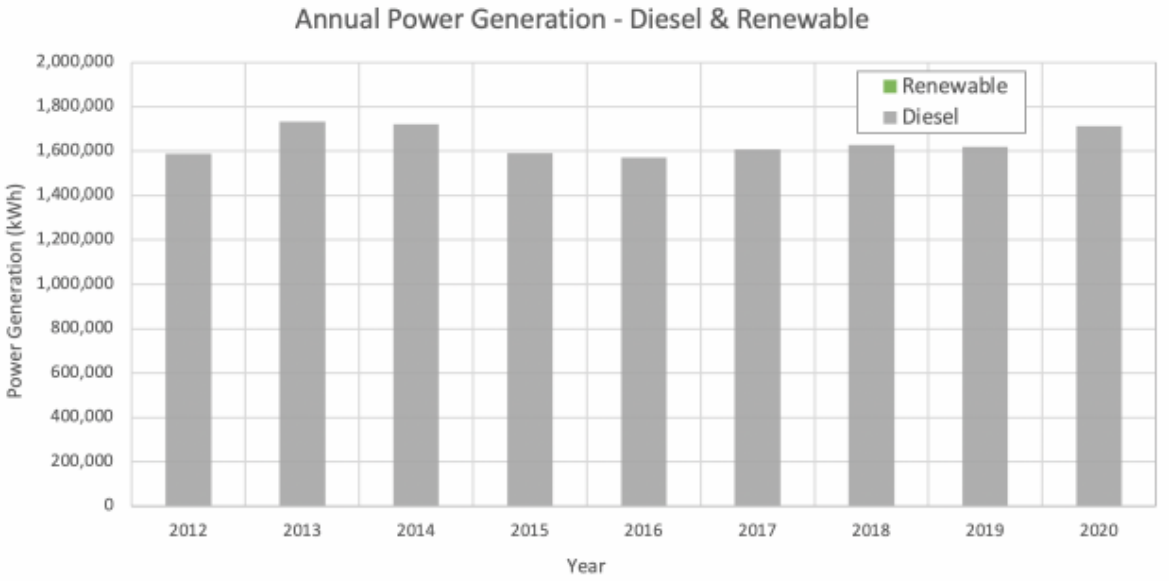
The maximum allowable line loss to maintain eligibility for PCE benefits is 12%. In Shungnak the line loss is very low and has been very low for the past nine years, indicating the distribution system is in good condition and all power use is accounted for. That said, the intertie from Shungnak to Kobuk will need substantial maintenance in the near future to maintain good working condition of the system. Many power poles are leaning dramatically and are at risk of catastrophic failure. The data for Shungnak includes the power generated for Kobuk. Kobuk is intertied to Shungnak and does not generate power except in the case of unplanned blackouts in Shungnak.



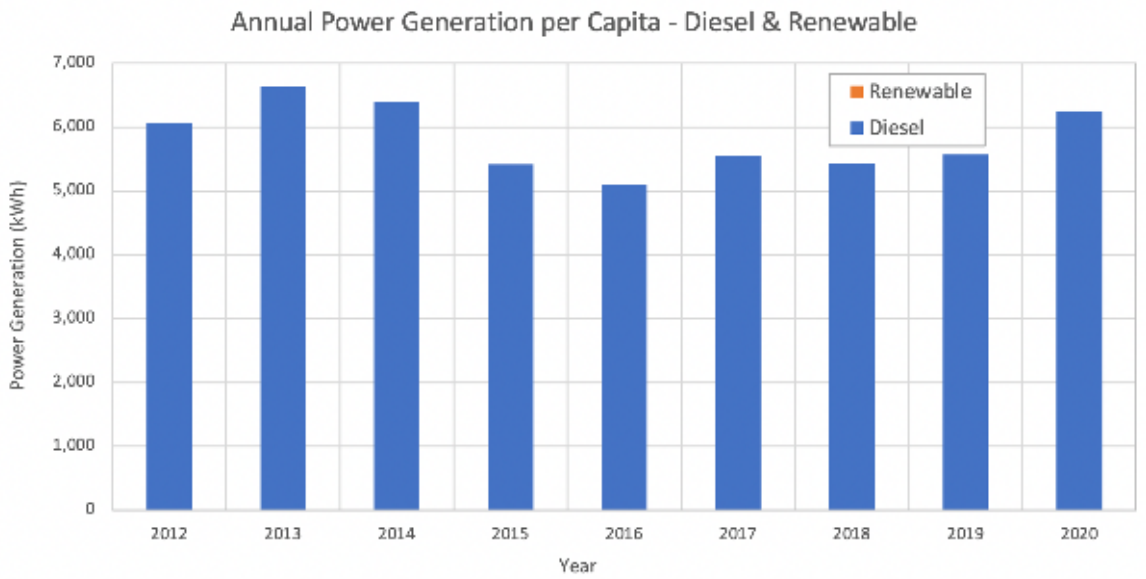
Over the long-term, a lower utility cost to generate power typically correlates with a lower cost of electricity for residents. The major factors that affect the cost to generate power are the cost of fuel, generator fuel efficiency, maintenance, and operations. Major system breakdowns may cause the cost to generate power to spike on a particular year, as will high fuel prices. In Shungnak the cost to generate power decreased from 2014 to 2015. The low costs to generate power from 2016 to 2020 are misleading as they do not include the cost of fuel, whereas the previous years do, as shown below. The data for Shungnak includes the power generated for Kobuk. Kobuk is intertied to Shungnak and does not generate power except in the case of unplanned blackouts in Shungnak.



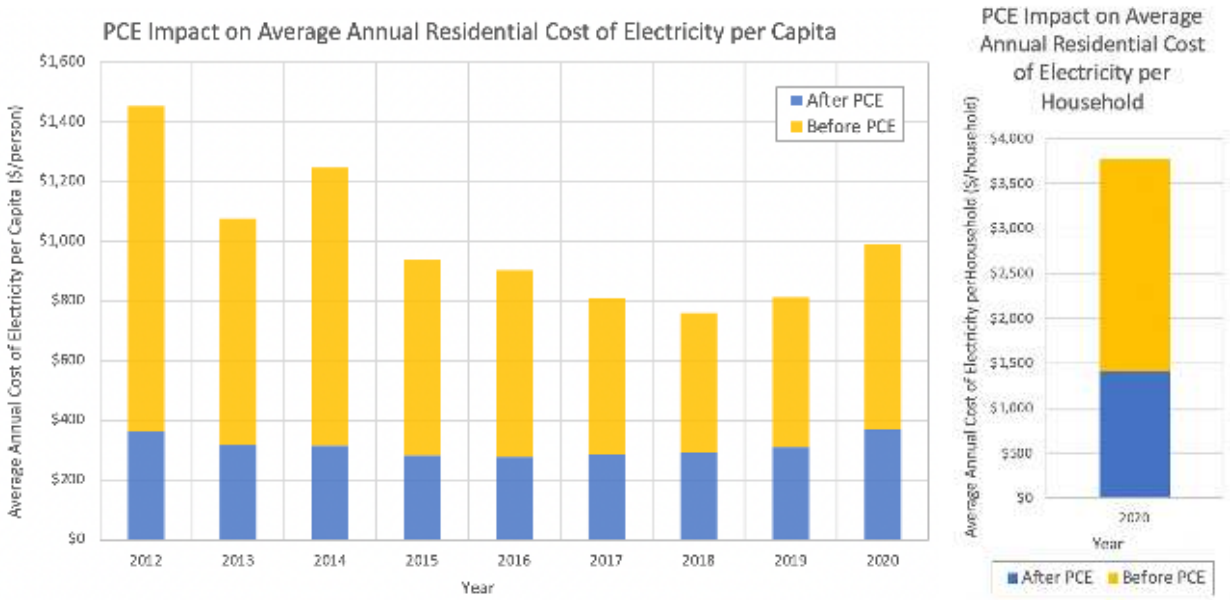
For many utilities, the non-fuel costs associated with generating power do not change dramatically each year. Fuel costs, on the other hand, are highly susceptible to annual fluctuations based on the global price of fuel, transportation costs, and the amount of power generated. PCE reimbursement is meant 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 Shungnak, no non-fuel costs were reported starting in 2016. This is because in 2016 AVEC started reporting fuel costs for all communities in a summarized report rather than individually for PCE reporting. In prior years, the reported portion of the costs spent on fuel is relatively low relative to other communities in the region.



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. There was no renewable power generation at the utility scale in Shungnak prior to 2021. All of the power was generated by diesel generators. The total power generated has fluctuated minimally year-to-year since 2012. The data for Shungnak includes the power generated for Kobuk. Kobuk is intertied to Shungnak and does not generate power except in the case of unplanned blackouts in Shungnak.



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. Power generation per capita in Shungnak has varied throughout the last nine years. The data for Shungnak includes the power generated for Kobuk. Kobuk is intertied to Shungnak and does not generate power except in the case of unplanned blackouts in Shungnak.



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. This is the case in Shungnak, where the residential cost of electricity per capita after PCE has remained steady for the last nine years between $250 and $400 per year. The data for Shungnak includes the power generated for Kobuk. Kobuk is intertied to Shungnak and does not generate power except in the case of unplanned blackouts in Shungnak.