Kotzebue
Qikiqtagruk

Native Village of Kotzebue:
907-442-3467
City of Kotzebue:
907-442-3401
Kikiktagruk Inupiat Corp.:
907-442-3165
Kotzebue Electric Association:
907-442-3491

Demographics –
Native Village Status: Federally Recognized Tribal Council
Alaska Native Name: Qikiqtagruk
Population: 3121
Avg. Household Size: 3.44
Median Household Income: $88,047

Access –
Barge Access: Seasonal
Runway Ownership: State
Runway Surface: Asphalt
Runway 1: 5,300 ft x 150 ft
Runway 2: 3,876 ft x 90 ft

Climate –
Average Summer Temperature: 51 °F
Average Winter Temperature: 0 °F
Heating Degree Days: 16,531

Heat & Power Costs (2021) –
Cost of Diesel Fuel: $5.87 per gal
Cost of Gasoline: $5.88 per gal
Cost of Electricity: $0.40 per kWh
Cost of Electricity, after PCE: $0.22 per kWh

Tank Farm -
Ownership: Kotzebue Electric Association (KEA) (Vitus – leasing a portion), Crowley
Bulk Fuel Capacity:

Owner	Fuel	Capacity (gal)
KEA	Diesel	2,150,000
Vitus	ULSD1	650,000 (leased from KEA)
Vitus	Gasoline	300,000 (owned by Vitus)
Crowley	Diesel Gasoline ULSD AV100LL Jet A	6,132,000

Condition: Deteriorating

Electric Utility –
Kotzebue Electric Association (KEA)

Power Demand (2020) –
Average Load: 2.5 MW
Peak Load: 3.4 MW
Total Power Generated: 19, 919,319 kWh

Power System (2020) –
Fuel Efficiency: 14.78 kWh/gal diesel
Line Loss: 3.1%
Number of Community Buildings on PCE: 26
Community PCE kWh Use of Total Allowed: 62% (1,632,934 kWh / 2,621,640 kWh)

Power Generation Infrastructure –
Diesel Engines:

Manufacturer	Model	Capacity
Caterpillar	3516	1135 kW
Caterpillar	C27	725 kW
EMD	8-710	1440 kW
EMD	16-710	2865 kW
EMD	16-710	2865 kW
EMD	20-710	3010 kW

Wind Turbine(s):

Manuf.	Model	Capacity	Qty	Status	Year Built
EWT	DW 54-900	900 kW	2	Functional	2012
Vestas	V15	65 kW	1	Needs Repair	2005
Northern Power Systems	Northwind 100	100 kW	1	Needs Repair	2000
AOC	15/50	66 kW	15	Needs Repair	1997 - 2005

Grid Stabilization:

Component	Manuf.	Model	Capacity	Year Built
STATCOM	ABB	PCS100	1MVAr	2012

Solar PV:

Installer	Inverter	Capacity	Year Built
Alaska Native Renewable Industries	Solar Edge	576 kW bifacial	2020

(*Additional 20 kW installed for water plant, behind the meter)*

Battery Storage System:

Component	Manuf.	Model	Capacity	Year Built
Battery	SAFT	IM-20	950 kWh	2015
Converter	ABB	PCS100	1,225 kW	2015
Microgrid Controller	EPS	Demand Control	-	2005

Electric Boiler:

Owner	Capacity	Year Installed
Maniilaq Health Center	450 kW	2014
National Park Service	108 kW	2022

Heat Recovery –
Facilities Served: Circulating water main – heat added in power plant to raise temp from 38°F to 50°F in winter months.
Opportunity to Expand Waste Heat: Yes

Water & Wastewater –
Ownership: City of Kotzebue
Water System: Piped; New water treatment plant – construction expected to conclude in fall 2022
Wastewater System: Piped

Selected Projects –

Battery Storage System Design – *Expected 2022*

- Design for ~4 MW/MWh battery storage system
- Design to integrate battery storage with microgrid to achieve diesels-off operation
- Alaska Energy Authority – REF 13; Kotzebue Electric Association
  - Grant awarded 2020
  - $325,000 awarded from AEA
  - $100,000 cost share from KEA

National Park Service Wind-To-Heat – *Expected 2022*

- Installed 108 kW electric boiler
- Excess wind energy powers NPS's electric boiler
- Finalizing agreement to buy excess wind power

Solar PV Array and Battery – *Completed 2020*

- Installed 576 kW bifacial solar PV and inverters
  - Average daily production: 1794 kWh/day
- Installed 950 kWh/1,130 kW battery storage system
- DOE; Village Improvement Fund; Kotzebue Electric Assoc.
  - Grant awarded 2019
  - $600,000 awarded from USDA
  - $600,000 awarded from VIF
  - $600,000 cost share from KEA

Biomass Feasibility Study – *Completed 2017*

- Evaluated opportunity to generate power from solid waste
  - Displace 30,000+ gallons of diesel fuel annually
  - Divert 300 tons of waste from landfill annually
- Determined to be a financially and technically viable project

Grid Stabilization Technology Upgrade – *Completed 2012*

- Installed ABB PCS 100 STATCOM 1MVAr
- Enhances microgrid stabilization
  - Increases power factor on genset during high-renewables operation

LED Streetlight Retrofit Borough-Wide – *Completed 2015*

- Installed 275 LED streetlights in Kotzebue
- 25-year community savings: ~$30M & ~11.6M gal diesel
- State of Alaska, Grants to Municipalities
  - Funding awarded 2014
  - $200,000 awarded to Northwest Arctic Borough

Water Plant Solar PV – *Completed 2015*

- 21.06 kW solar PV installed
- Average 40.1 kWh/day; still operational
- Coastal Impact Assistance Program (CIAP)
  - Funding awarded 2009
  - $168,156 awarded

Wind/Diesel Microgrid Expansion – *Completed 2012*

- Installed two EWT 900 kW wind turbines
- Integrated wind turbines with microgrid
- Installed 450 kW electric boiler at hospital, 2014
  - Developed agreement for Maniilaq buy excess wind power
- AK Energy Authority Renewable Energy Fund, Rounds 1 & 3
  - Grants awarded 2008 & 2010
  - $8 million awarded total

Wind/Diesel Microgrid – *Completed 2005*

- Installed 15 AOC 66 kW wind turbines
- Installed 1 Vestas V15 65 kW wind turbine
- Installed 1 Northwind 100 kW wind turbine
- Integrated wind turbines with microgrid
- First successful cold temperature wind-diesel integration in US
- US Department of Energy
  - $4 million awarded in 1996

Future Projects –

Battery Storage

- Increase battery energy storage and inverter power capacity
- Funding secured for design work from Renewable Energy Fund, Round 13
    - Install an additional 4-8 MWh of battery storage and approximately 4 MW of inverter power capacity
- Need to secure procurement and installation funding

Solar PV

- Increase capacity of solar PV array
- Applied for Renewable Energy Fund, Round 14
    - Install an additional 500 – 600 kW of solar PV
    - Reuse infrastructure from old turbines (15 AOC's, maybe 1 Vestas)

Wind Turbines

- Expand wind energy with two additional turbines
    - 1,000 kW EWT turbines
- Funding secured for design work from Village Improvement Fund
- Need to secure construction funding

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

Milestones –

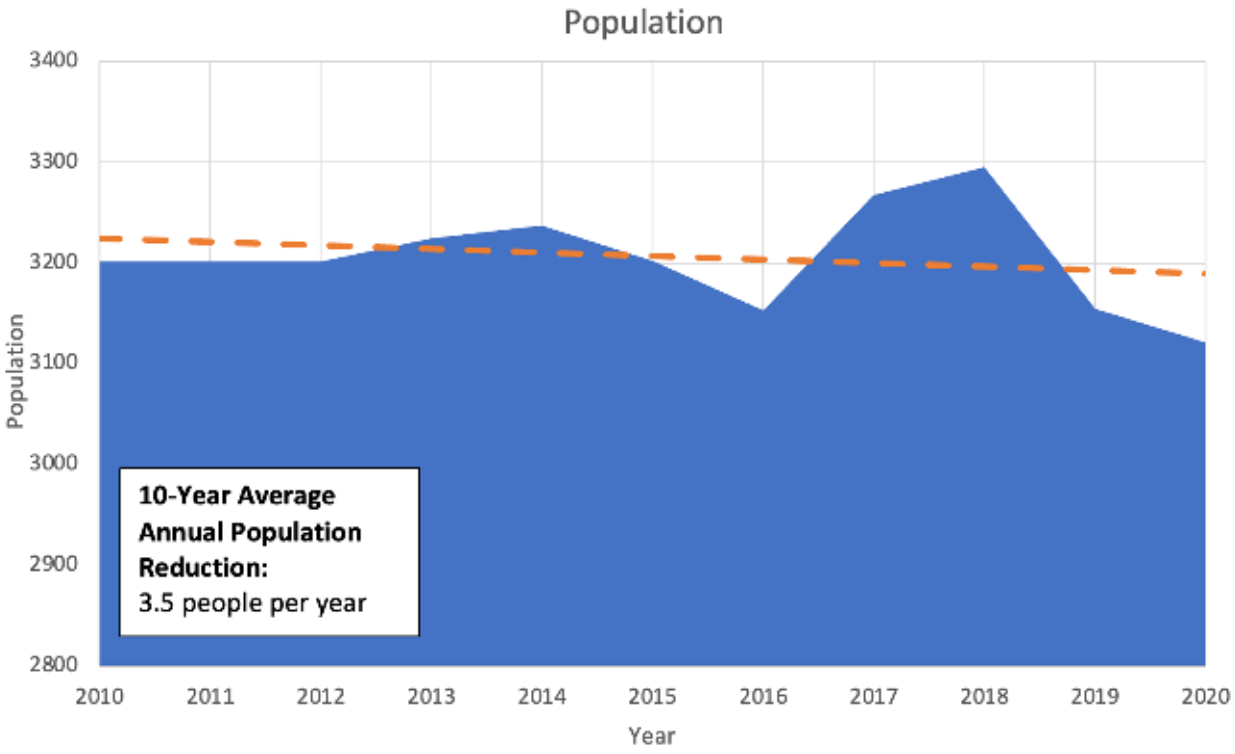
- Installed largest solar PV array in rural Alaska – *Completed 2020*
- Installed first solar PV in Kotzebue – *Completed 2015*
- First utility-scale wind in the Arctic – *Completed 1997*

Community Goals –

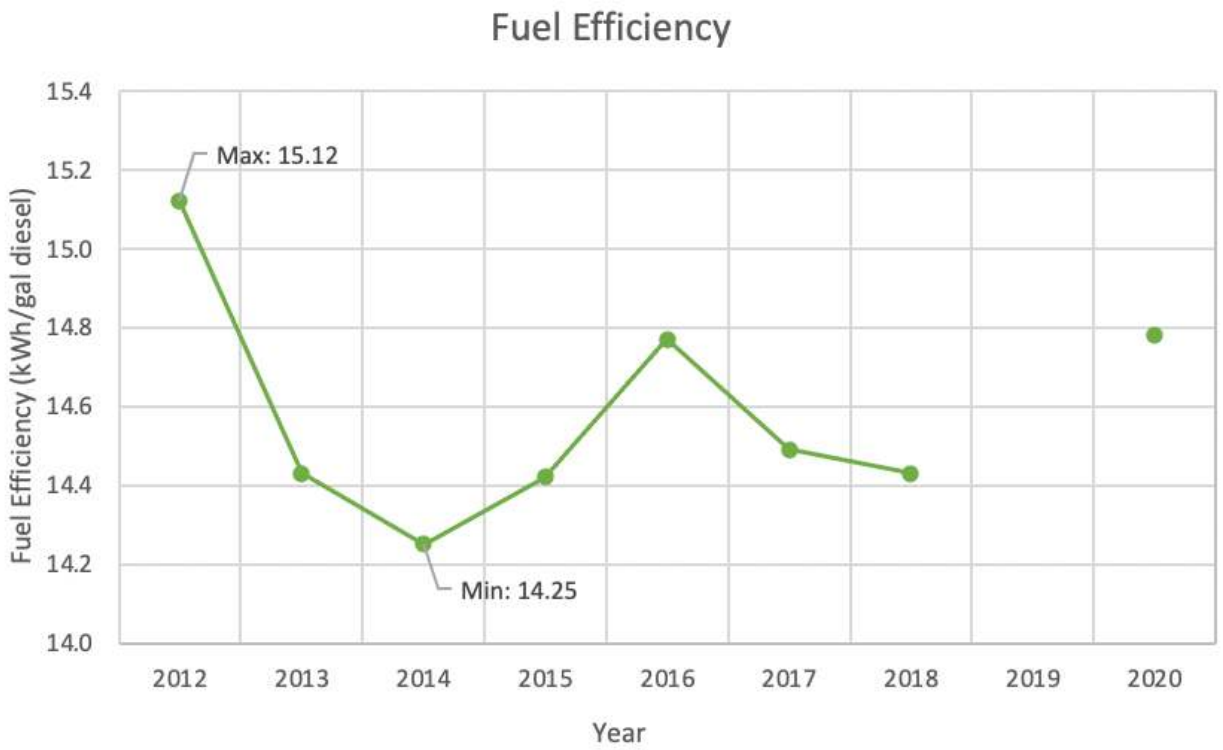
- Reduce cost of residential space and water heating
    - Construct bulk fuel storage owned by City/Tribe
    - Expand renewable energy microgrid
        - Explore opportunities for dispatching excess wind for residential and commercial heating
            - Electric heating and/or heat pumps
    - Implement energy efficiency measures for residential and commercial buildings
    - Maintain and/or replace aging residential heating appliances
- Achieve diesels off operation after installation of additional battery storage
- Optimize diesel genset operation through installation of additional renewable energy generation sources and community-scale energy storage

    - Reduce wind curtailment
    - Reduce restrictions on use of smallest diesel generator
- Continue to optimize operation of bifacial solar installation to maximize energy generation
- Partner with NANA to organize electricians, mechanics, and additional technical expertise to serve the region
    - Utilize Kotzebue as a hub to offer trainings and service mobile equipment
- Explore opportunities to develop Cape Blossom Port to site additional wind turbines
- Enhance Native Village of Kotzebue, Kikiktagruk Inupiat Corp., and City of Kotzebue level of interest and involvement in Kotzebue's energy systems and energy efficiency opportunities
    - Further support reductions in the residential cost of energy for heat and electricity
    - Enhance community resilience

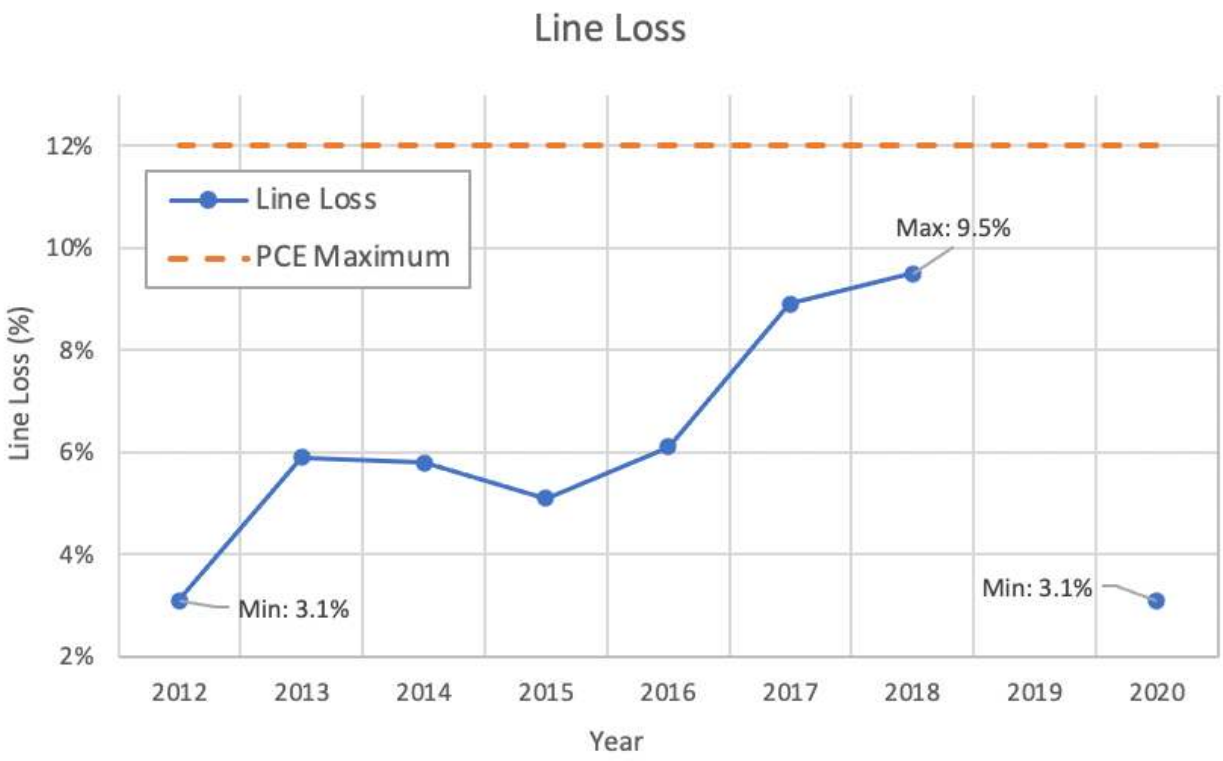
Energy System Trends –



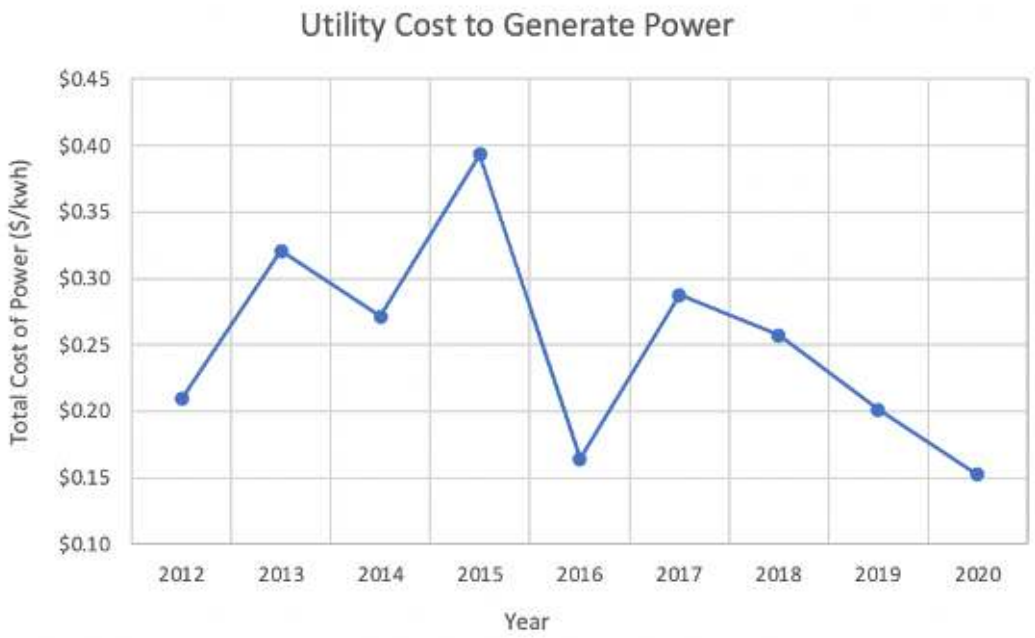
Dramatic changes in population impact the long-term community planning necessary to meet future power demand. The population in Kotzebue has fluctuated year-to-year. Over the last ten years the population has decreased an average of 0.1% each year.



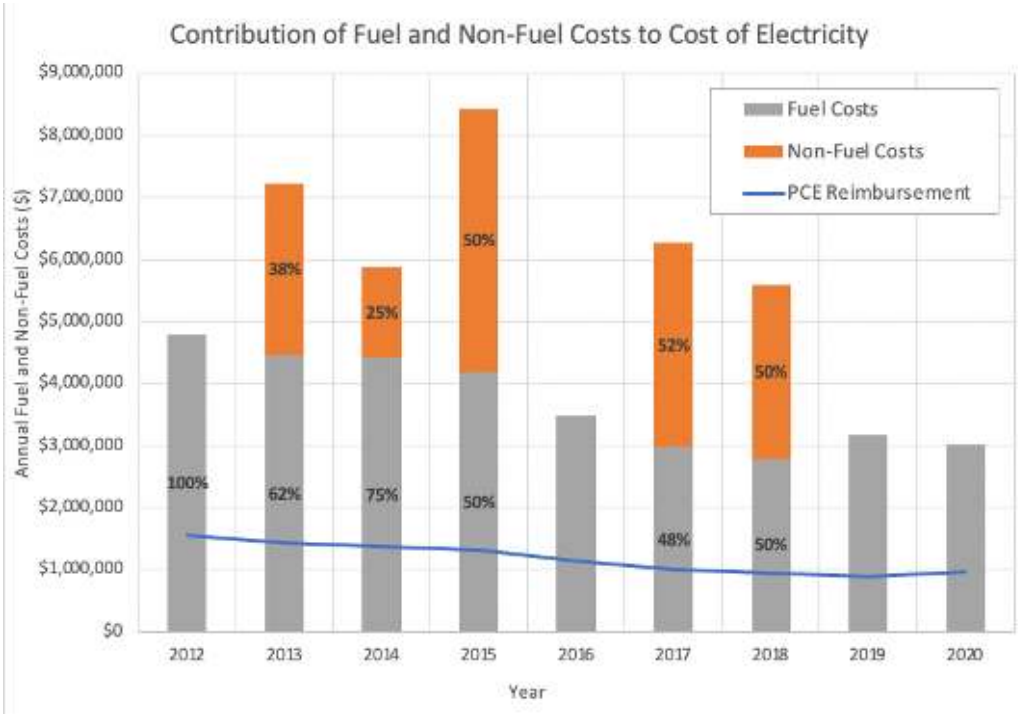
A higher fuel efficiency results in less diesel fuel use and a lower cost to generate power. A fuel efficiency below 12 kWh/gal is poor; a fuel efficiency above 14 kWh/gal is excellent. The fuel efficiency in Kotzebue has been excellent with values that are typically greater than 14 kWh/gal. No data was available for 2019.



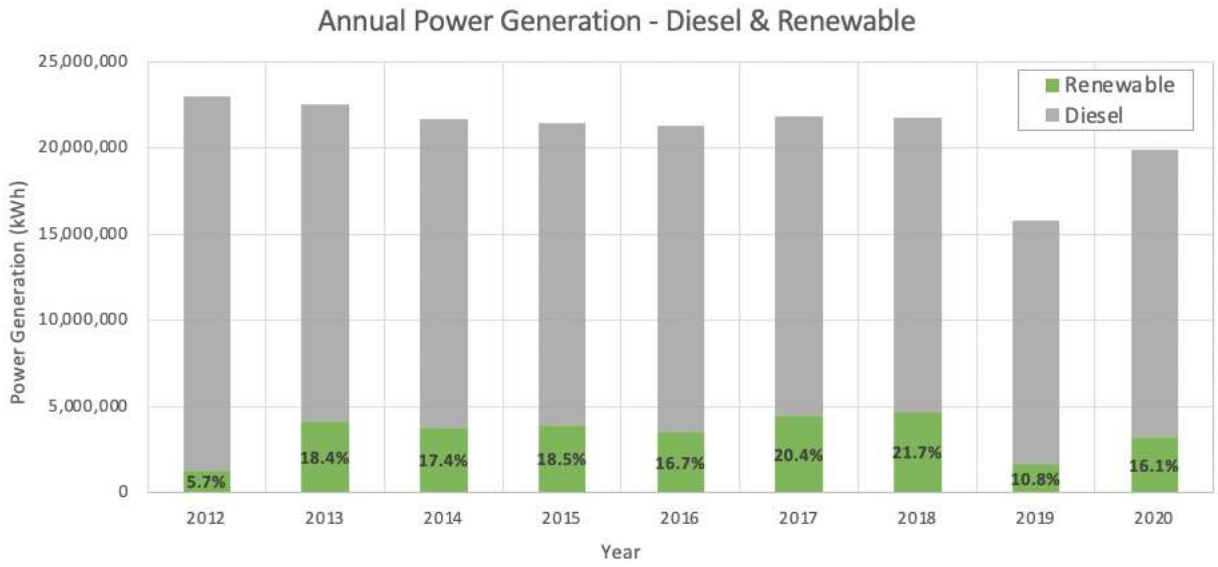
The maximum allowable line loss to maintain eligibility for PCE benefits is 12%. In Kotzebue, the line loss increased steadily from 2012 to 2018. In 2020 the line loss decreased dramatically. It is unclear what caused this dramatic reduction in line loss. No data was available for 2019.



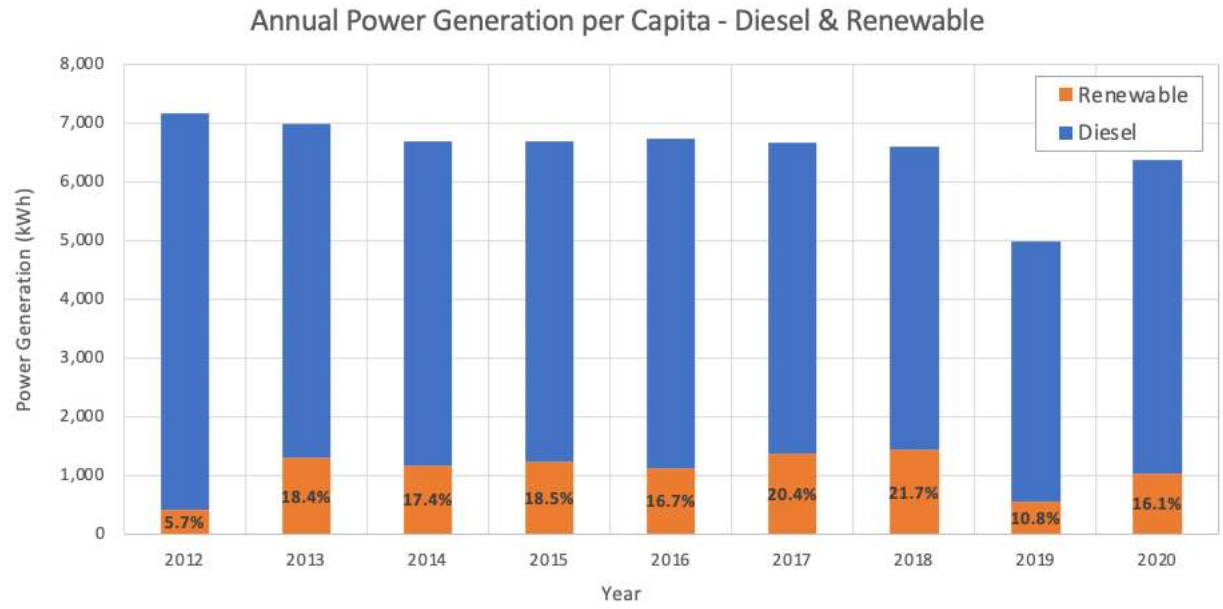
Over the long-term, a lower utility cost to generate power typically correlates with a lower cost of electricity for residents. The major factors that affect the cost to generate power are the cost of fuel, generator fuel efficiency, maintenance, and operations. Major system breakdowns may cause the cost to generate power to spike on a particular year, as will high fuel prices. In Kotzebue the cost to generate power has fluctuated substantially over the last nine years, but it has decreased in 2017 and 2018 and it is now at a very low value relative to other communities in the region and across the state. In 2016, 2019, and 2020 the cost to generate power does not include the non-fuel costs (as shown below) and therefore underestimates the actual cost to generate power. This is due to a PCE reporting error.



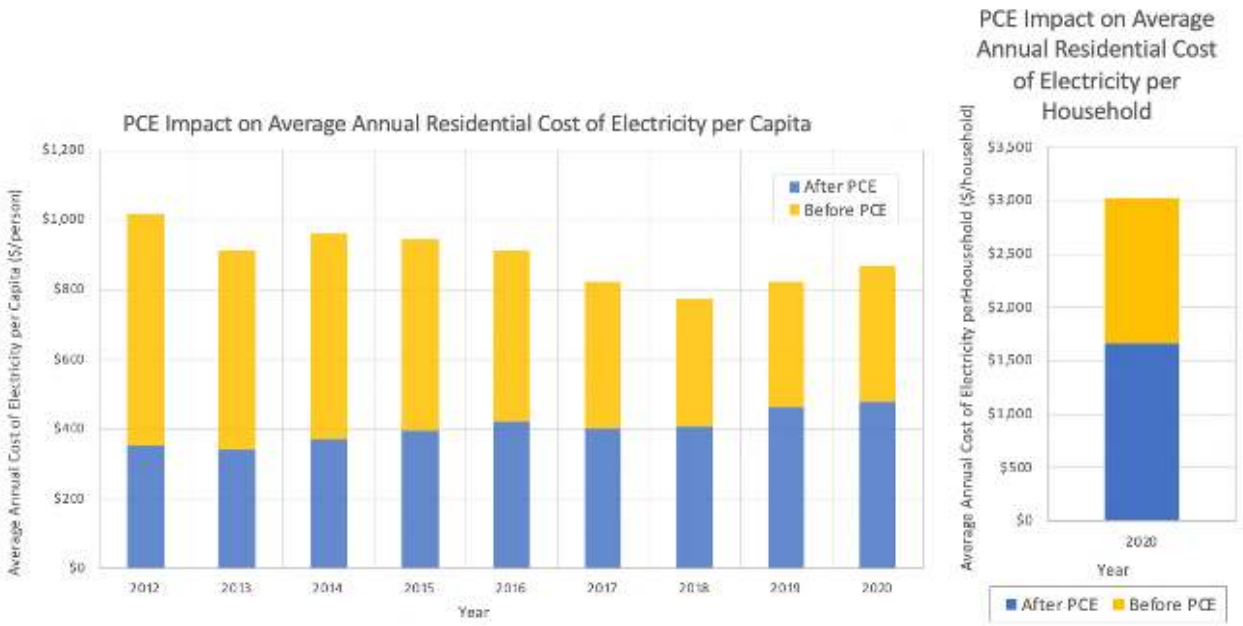
For many utilities, the non-fuel costs associated with generating power do not change dramatically each year. Fuel costs, on the other hand, are highly susceptible to annual fluctuations based on the global price of fuel, transportation costs, and the amount of power generated. PCE reimbursement is meant 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 Kotzebue, the reported non-fuel costs fluctuate dramatically year-to-year. It should be verified this is not a calculation error. The fuel costs have decreased dramatically since 2012 and have steadied in the last four years.



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 Kotzebue the portion of power generated by renewable energy sources grew dramatically in 2013 and modestly in 2017. In 2019 and 2020 the renewable energy generation decreased substantially, likely indicating downtime of renewable infrastructure.



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 Kotzebue was exceptionally steady from 2014 to 2018, with slightly higher values preceding this interval and slightly lower values in recent years. In 2019 there were significant reductions in power generation per capita. It should be verified this is not a calculation error.



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 Kotzebue, the residential cost of electricity per capita after PCE has increased over the last nine years, while the cost before PCE has decreased. This reduction in PCE funding primarily reflects the increasing price of electricity on the Railbelt—which is used to calculate PCE reimbursement levels statewide—not a reduction in PCE rate due to KEA operations.